BYTE

the small systems journal

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GAME PLAN 1982

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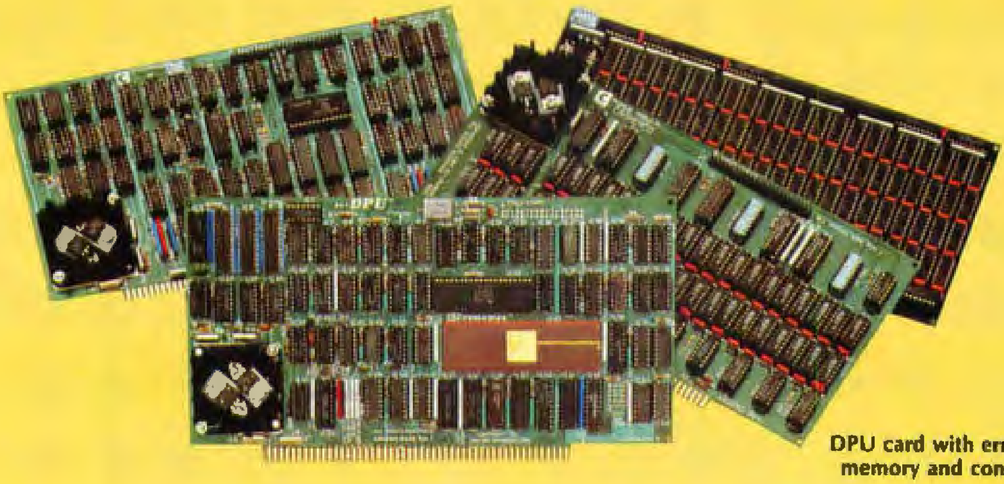

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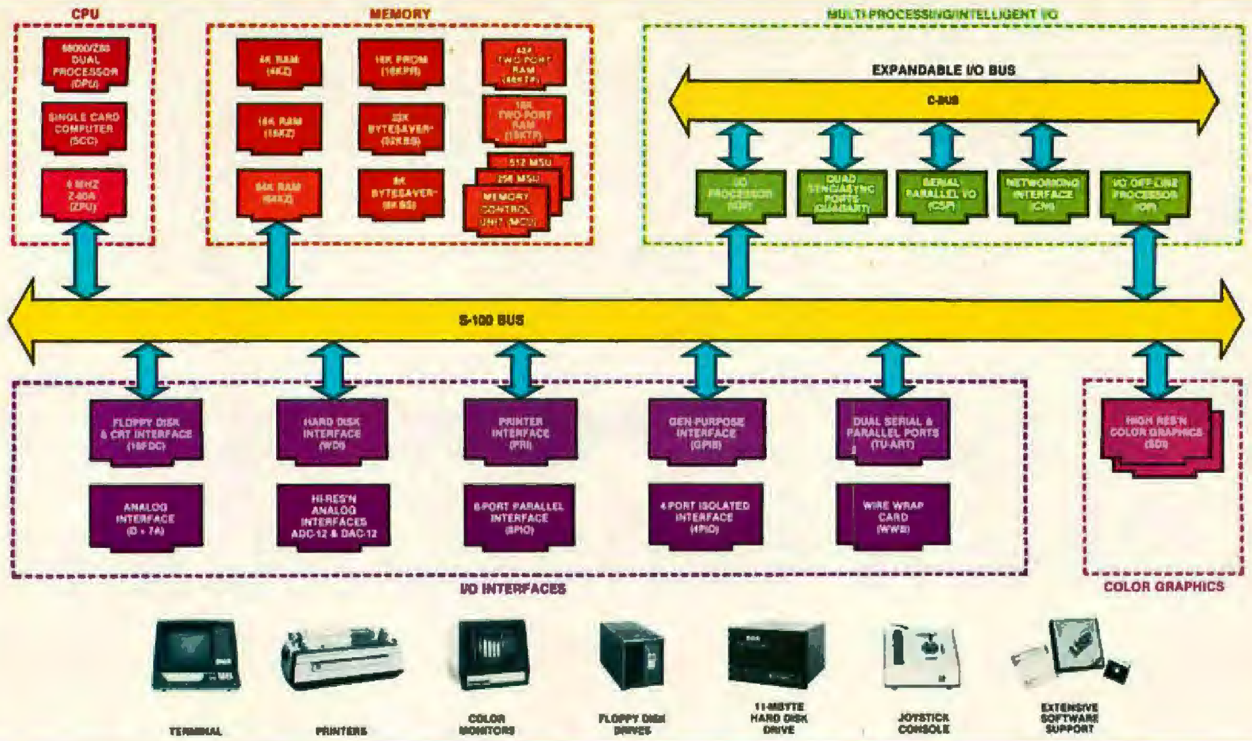

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In This Issue

Video games are taking the country by storm. They provide thousands of youngsters and adults alike with hours of exciting play. Their attraction forms a complex web of challenge, high-speed action, and intrigue. Video games offer a temporary alternative to workaday problems and worries. And, as Robert Tinney's cover suggests, they transport you into another world. Swiftly moving out of the arcades and into the homes, video games for microcomputers have grown into a booming industry of their own. In keeping with this national game wave and the playful spirit of the holiday season, we have put together a section devoted exclusively to games (see page 83). Game Plan 1982 includes "The Coinless Arcade—Rediscovered" by Pamela Clark and Gregg Williams; reviews of four games in BYTE's new Game Grid; the first- and second-place Game Contest Winners, "Cosmic Conquest" by Alan Sartori-Angus and "Charge!" by C. Anthony Ray, respectively; an article by Chris Crawford of Atari on "Design Techniques and Ideals for Computer Games," a quiz called "Board to Death" that will test your skill in recognizing printed-circuit boards; and more. We have our first annual update of the BYTE Cumulative Index. We present the second part of Steve Ciarcia's three-part article "Build the Circuit Cellar MPX-16 Computer System." Gregg Williams describes "Lotus Development Corporation's 1-2-3." And we have Jerry Pournelle's User's Column plus our regular features and reviews.

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Editorial

The Play's the Thing

Pamela Clark, Technical Editor

Each year, we mark December's arrival by the visions of toys and games that fill store windows, newspaper ads, television screens, and, of course, children's heads. And each year, many of us remain aloof, choosing instead to concentrate our energies on work. At least that was the case until 1982.

This year, not only the children are thinking about games, reading about games, talking about games, buying games, and even playing games. Prime-time television documentaries focus on the game invasion and its origins. Communities around the country picket arcade parlors in an attempt to keep the young from electronic clutches. Video-game commercials appear almost as frequently as pitches for laundry detergent. Games magazines fill the racks at supermarkets. Will 1982 be remembered as the Year the Games Got Us?

What's the Attraction?

Accompanying this newfound passion for arcade games is the inevitable quest to understand their fascination. Theories abound: games provide tension release, an escape from reality, and a techno-mystical high, to name a few. In addition to sounding vaguely like claims for snake oil, these explanations ignore the fundamental relationship of people and play. As John Huzinga writes in *Homo Ludens* (man as the player), "We play and know that we play, so we must be more than rational beings, for play is irrational."

Play, of course, is nothing new. Throughout history people have played games, sometimes with great abandon but more often furtively, as if playing is something we shouldn't admit we do, much less enjoy. Perhaps this very ambivalence has relegated the activity to the young. Most adults have done little more than smile wistfully at youth's antics before resuming more serious activities. The microcomputer, however, gives play an aura of respectability and therefore makes games playing an acceptable adult pastime.

Suitable for Gaming

Although the microcomputer can do many things, it is uniquely suited to game playing. For many of us, it represents a mature approach to play in the privacy of our homes. A variety of skill levels, a large selection of games, and the ability to be programmed to a vow of silence make the machine a perfect play companion. It spares us the dilemma of finding worthy opponents and the anguish of having our pet strategies revealed to friends and relatives. And because we play in private, no one need ever discover our secret passion.

For better or for worse, many of us equate a fondness for arcade games with a craven longing for the *National Enquirer*—a weakness we shouldn't admit to in polite company. But that attitude is changing. Those of us who want to game without shame may soon find strength in numbers. As more people own microcomputers, the ranks of game players multiply. In fact, playing games could become a worldwide pastime. After all, if robots do all the work, we'll need *something* to do.

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Editorial

The Game's the Same

In 1982, few games broke new ground in either design or format. Regrettably, the trend toward uniformity may continue to be characteristic of computer gaming. There are two primary reasons for this: commercial marketing trends and the design imbalance of most games.

The microcomputer game industry is subject to the same forces that shape other industries, the primary one being to make money. If the public really likes an idea, it is milked for all it's worth, and numerous clones of a different color soon crowd the shelves. That is, until the public stops buying or something better comes along. Companies who believe that microcomputer games are the hula hoop of the 1980s only want to play Quick Profit. And when companies measure their success by quarters (both the calendar and coin variety), designing innovative games is low on the list of priorities.

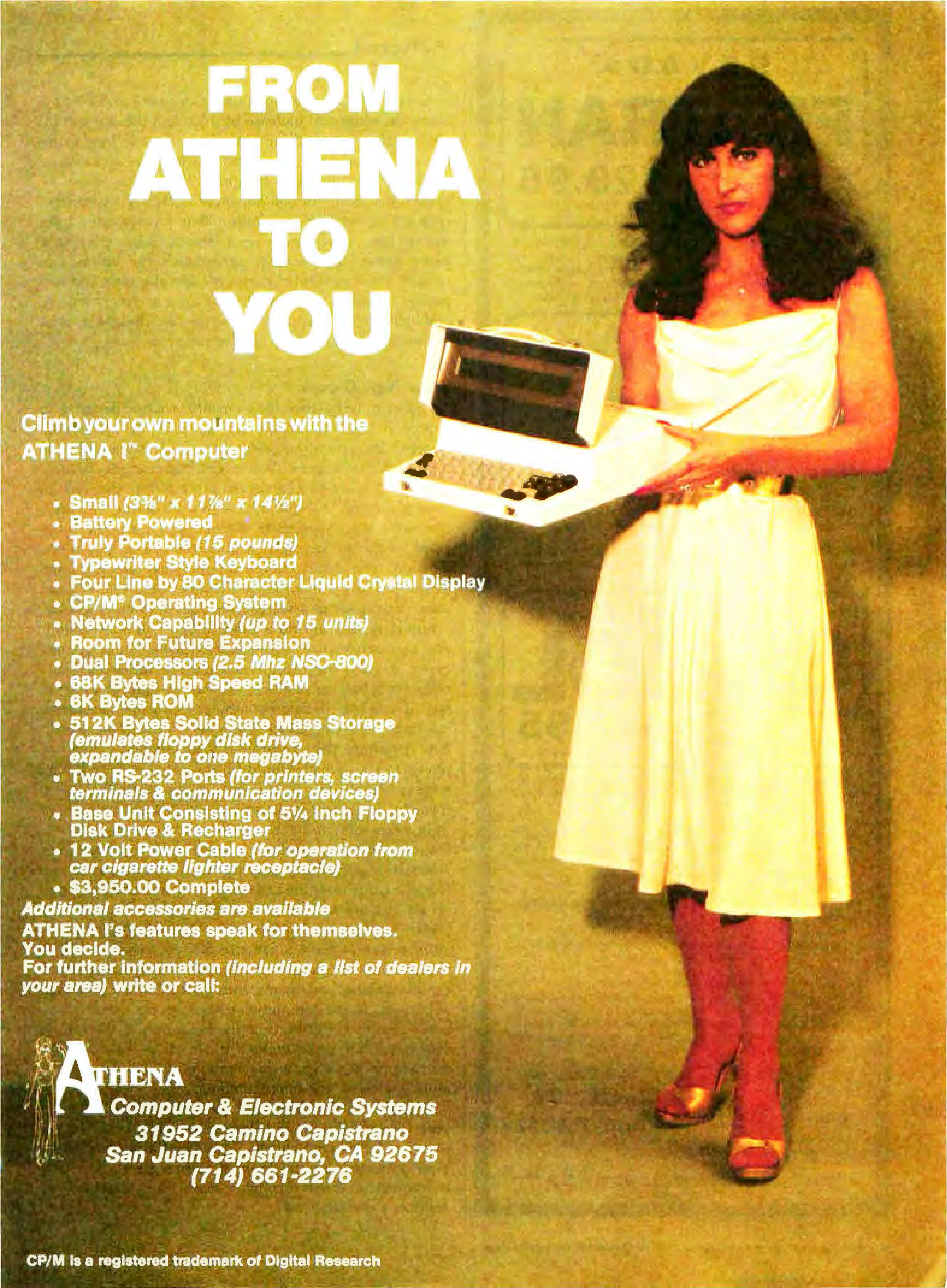
Microcomputer games are now part of the mammoth entertainment industry that focuses on your play time and how much you will spend on it. Companies view games in terms of their knock-off potential, the same trend that affects television and movies. Look at *Raiders of the Lost Ark*, *Tales of the Gold Monkey*, and *Pitfall*—the movie, the TV show, and the game.

Ironically, in industry's rush to respond to demand, the original creative concept always seems to get copied rather than improved. Just as the birth of the microcomputer spawned a seemingly endless succession of similar machines, the instant popularity of video games will beget generations of imitative software. While the industry isn't totally saturated with look-alikes, this year has seen more money poured into promotion and advertising than into developing new and innovative games.

The Limits of Game Design

The second reason for uniformity, the design imbalance of games, has to do with the background of computer game designers. Most of the current designers acquired their computer skills before they began tinkering with games. Their games still reflect that orientation; they make the game fit the machine. Thus the microcomputer severely limits game design. Ideally, a computer game is composed of the same elements as any other game: the players' roles, the setting, and the plot (the sequence of events and their consequences). For believable roles, designers apply an extensive knowledge of behavior. For engaging settings, they draw on their imagination and experience. By combining these elements with a suitable plot, a designer can create a particular mood.

Unfortunately, in many computer games, some elements are not as well developed as others. Because the plot can easily be reduced to a series of numbers and instructions, it is well suited to the microcomputer . Thus most computer game designers manipulate the plot rather than the roles or setting. Consider the following sequence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of events: if Player A fires the laser pistol and hits the alien, the score will increase by 1000 and the sky will fill with swarms of attacking spaceships. (Quick: how many of you have already translated this into the appropriate code?) Programming a computer to keep a record of events and generate consequences is clearly easier than creating a complex integration that incorporates roles and settings. If you experience déjà vu while playing a video game, it's because, underneath the colors and sounds, most computer games are just the same old formulas. Creating games with a balance of roles, setting, and plot may require the skills of designers who discovered games before computers.

Brave New Games

One way to balance the elements of game design is to approach the microcomputer as part of an overall system, incorporating videodiscs and holography to create your own game. You might, for example, become the hero of a life-size battlefield projected on the walls of your playroom. All you'd have to do is select the videodisc with the appropriate scenery and push the holography function key. When you tired of battling in one location, you could choose another: capture the Eiffel Tower in Paris, run with the Cossacks on a vast Tibetan plain, or engage in a warp-drive duel in another galaxy.

Similarly, if you find a game design you really enjoy, you can personalize it; descending aliens could become gypsy moths, next-door neighbors, ring-around-the-collar, or whatever nemesis you want to blast away at. In fact, if you use the microcomputer as a game-generating machine, you can create your very own game world. First determine the size of your visual display, from one screen to six—which would fill the room with pulsating scenery. Route the sound through strategically located speakers and select your setting—30,000 BC, a couple of light-years down the road, or anywhere in between. Decide whether your player image will be a projection of yourself or a symbolic playing token you create. If you like, the game machine can compute your handicap based on an algorithm of your previous experience and your present mental and physical condition. After a few moments you'd have a game to call your own.

The computer's ability to communicate means that you can even share your game with a worldwide contingent of players. As we communicate through play, microcomputer gaming could become the Esperanto of the future. The possibilities are endless if we strive to make the microcomputer a game machine instead of just making more games for the microcomputer.

Where does that leave us? This hasn't been a banner year for innovation, but during 1982 lots of us finally went public playing games. That event alone may have more influence on the look of future games than any technological breakthrough, marketing strategy, or designer's revelation. ■

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From INFOWORLD magazine, August 16, 1982

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Logo Draws Enthusiastic Responses

Congratulations on the August 1982 BYTE theme issue describing Logo, a most interesting language and computer-based learning environment.

Daniel Watt's excellent article, "Logo in the Schools" (page 116), as well as others in that issue, states that the Logo environment improves a student's learning ability. But from the research presented in BYTE, it is not clear that Logo, per se, is really the panacea its enthusiastic sponsors claim it to be.

Many factors influence a student's ability to learn and a teacher's ability to evaluate student performance. Increased training of the teachers, increased time spent individually with students, greater availability of modern equipment, special-interest group meetings after school and on weekends, and the special recognition that a child gets for being part of the study may have had a greater impact than that of Logo.

That the student knows that he or she is participating in a study can skew the test results tremendously. This problem was demonstrated long ago in psychological research and is known as the "Hawthorne effect."

The Edinburgh study (page 117) showed that the quantitative improvement in mathematical skills was small, while the teachers *perceived* the students to have better reasoning abilities. In this case, it appears that the outcome of the test was influenced by what the teachers expected to find.

If teachers *think* that Logo-based education is good for the students, then they will tend to find mostly positive results. Nicknamed the "Rosenthal effect," this problem has also been called a self-fulfilling prophecy.

The notion of a self-fulfilling prophecy applies to students as well. Children branded as "below average" often perform at a low level because they lack the confidence to succeed. When they are specially selected for a research study, they are labeled as someone unique. That label, in turn, becomes a self-fulfilling prophecy, giving them the impetus to succeed because someone *expects* them to.

The solution is to conduct a double-blind experiment. The person who evaluates student ability should have no knowledge whatsoever of the experimental conditions applied to the student groups.

Education is a *system* with many subparts; Logo is only one part of that system and is merely the *catalyst* for all the other factors. Logo solves the problems associated with the computer (e.g., Logo is highly interactive and more user-friendly than previous systems). But Logo research projects seem to ignore all other influential forces.

When Logo systems go into the field, will classes be small enough for individual instruction? How many teachers will be given additional instruction and training in the use of Logo? Will funding be provided for teachers to supervise after-hours special-interest groups? Will schools really have enough machines to make Logo use meaningful? (Even if Apple donates a computer to every school, one computer per school doesn't provide much machine time for each student.)

Like the researchers, I also believe that the use of Logo systems will have a positive effect on learning ability. But more thorough research than that reviewed in BYTE must be done before we Logo-ize all of our schools.

Edward Mitchell, Software Development Engineer
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I read with interest the Logo articles in the August BYTE. I would, however, like to make two observations. First, the claim that modern program-language designers advocate the use of data typing in order to (1) discourage the use of a single variable for various purposes (see page 174 of Brian Harvey's "Why Logo?") and (2) to simplify the work of a compiler (see page 88 of "Harold Abelson's "A Beginner's Guide to Logo") are not quite accurate.

It is true that these goals can be attained by typing variables and declaring all variables used; however, the major gain is that the *information required for a precise understanding of a program from its text* is made available. A data type is a set of values and a group of operations; a variable is a named object declared to be of some type. A variable can have as value any element of the set of values of its declared type, and the operations of that type are the only ones that may be applied to the variable. Thus, the declaration

```
var i: integer
```

in Pascal supplies the following information: the program will be using a variable named "i," the values it may take on are in the range −maxint to +maxint, and the only operations that may be applied to "i" are the arithmetic, comparison, and evaluation operations defined for integers in the Pascal-language definition. The gain is less in automatic compiler checking than in the increase of human understandability of a program.

This brings up my second point about Logo: it appears to be an excellent tool for the sorts of exploratory learning for which it was intended. In my opinion, however, it is totally inadequate as a medium for the development of certifiable product software which efficiently uses the resources of a machine to perform a computational task. In particular, the system does not lend itself to the development of *large* software systems by a group of software engineers; note that this is precisely the situation in which complete accurate information about the structure of the software and its functional and performance properties must be available to personnel other than the original developer. I suspect that Logo vendors would not want to develop, modify, and maintain the Logo processor software (interpreter, editor, I/O routines, etc.) *in Logo*. The development and maintenance of software products should be an engineering rather than an experimental enterprise; Logo was designed for experimental rather than engineering use.

Bill Wood
St. Louis Park, MN 55426

I would like to make a few comments on Daniel Watt's article "Logo in the Schools." It only reinforces my belief that schools are *not* the best place to educate children.

Several points brought forth in Watt's discussion of the Brookline Logo project (page 120) deserve special emphasis. "The surprising success of students with learning disabilities. . ." seems a contradiction. One wonders if "learning disability" is not an educator's term to describe a teaching *inability*. Information presented in a way acceptable to each individual child will virtually eliminate this national epidemic—learning disability.

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The Brookline project rejected standardized tests to measure the stated goal "to observe and document what [the children] actually learned." To me, this means that tests may be designed to evaluate the system (e.g., an educator's preplanned objectives) and not to determine a child's knowledge. One should think about this very carefully.

Watt said that a "limitation of the project was that it required an extremely sensitive and knowledgeable teacher, with a great deal of time to consider the needs of each student." To me, this is the ultimate limitation of *all* schools.

A final comment directed at Watt's conclusion. He said that "teachers need to understand the value of exploratory learning and student interaction." It seems to me that professional educators have been promoting just the opposite because, with student/teacher ratios of 30 and more, rigid discipline is mandatory. Watt should have said that "teachers need to unlearn their own training to limit individuality and interstudent communications." Paraphrasing the Computer in the Schools project coordinator, maybe practicing this will "turn kids on" and provide further "striking changes in kids' relationships to schools and learning."

Please continue the efforts to present a wide variety of information in BYTE so that those of us who choose to educate our children at home may learn. I found the August issue particularly supportive of my endeavor.

James O. Mayor
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Damascus, MD 20872

I agree with Mr. Mayor that many of the points raised in my article, "Logo in the Schools," could be taken as criticism of prevailing classroom practices. I am delighted that he found the August issue helpful in supporting his decision to educate his children at home. On the other hand, millions of children who are in schools are also entitled to experience the kinds of benefits that a Logo learning experience can offer. I believe that Logo can help schools broaden and deepen the kinds of learning experiences that they offer and that our schools will be more likely to do so if the issues highlighted by Mr. Mayor are clearly faced and understood by educators who choose to use Logo in their classrooms. . . . **D. W.**

What a pleasure it was to devour the August 1982 BYTE from cover to cover! Logo is becoming a significant part of our "computer culture," and BYTE's outstanding treatment of its many aspects and levels of subtlety certainly affirms that fact. I especially appreciated the articles by Daniel Watt ("Logo in the Schools," page 116) and Cynthia Solomon ("Introducing Logo to Children," page 196). From these articles, the average reader can get an excellent overview of the tremendous practical potential for Logo in our classrooms.

The National Logo Exchange, a newsletter for Logo teachers, is dedicated to facilitating the exchange of successful Logo teaching tips, techniques, and strategies among teachers using Logo in their classrooms. As editor, I applaud BYTE's efforts to educate the general public to Logo, and I look forward to the effects of the August issue being felt in many school board meetings across the country.

Again, thank you for the efforts on behalf of Logo. The children of today will benefit from the August BYTE for many years.

Tom Lough, Editor
The National Logo Exchange
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Charlottesville, VA 22905

Excellent edition—August 1982. The articles on Logo were very good. As an educator who has been using Logo for several months with children of a variety of ages (2nd to 10th grades) and with a variety of results, I thoroughly enjoyed the issue (I wanted to write to compliment BYTE even before I finished the last article).

I would also like to comment on Chris Morgan's editorial "Keeping Our Technological Edge." While I echo Mr. Morgan's thoughts about providing a greater chance for children to learn computing skills by making hardware available through tax breaks, I would like to point out what many consider a more serious problem: the dramatic shortage of qualified teachers of math and science. The reason for this shortage is clear: salary. A beginning programmer earns more than one and a half times the salary of a beginning teacher. Further, there is little job security in teaching. The National Science Teachers Association found that 50.2% of the teachers assigned to math and science classes last year had inadequate backgrounds. And the problem is getting worse. A recent article in the *New York Times* pointed out that during the last decade production of secondary school teachers has declined 78% in math and 64% in science.

Although numerous solutions have been proposed, including getting industry involved on various levels, the main thrust will have to come from a commitment to education on a national basis. We are dangerously close to falling behind Japan, West Germany, and the Soviet Union in technological fields, and we will certainly fall behind if we continue to follow this path of cutting back for today and sacrificing our future.

Again, I applaud BYTE on the August issue and for its awareness of the problems that are evolving.

John Reynolds, Computer Coordinator
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New York, NY 10021

More on Logo

I have just returned from buying two additional copies of the special Logo issue of BYTE. These will remain our references, as have some other issues of BYTE.

BYTE's consulting editor, Phil Lemmons, concluded his "Logo Update" by citing the lack of hardware to teach Logo (page 334). In the YPLA (Young People's Logo Association) we have faced that problem by devising methods of teaching turtle geometry off the computer. Most certainly we don't ignore the computer. Rather, we take the geometric concepts carried out on the screen and place them into real-life situations with which young people can very easily relate. Thus, when they get their turn at the keyboard, they can use that precious time to better advantage.

Our program is quite simple. We use body geometry, arts and crafts projects, graph paper, cut-outs made from screen-dumped programs, worksheets, activities with Big Trak, and other devices to help provide a visual reference to the educational concepts presented by the turtle.

Also, Gregg Williams in his comparative article on the implementations of Logo overlooked what I have found to be

a very important undocumented TI Logo command. (See "Logo for the Apple II, the TI-99/4A, and the TRS-80 Color Computer," page 230.) To the best of my knowledge, *Turtle News* is the only publication to fully describe the JOY1 and JOY2 commands. These are extremely useful for inputting numerical code to the computer.

I have enjoyed working with cerebral-palsied patients using adapted joysticks as the input devices. And the ease with which Logo can be learned, coupled with its efficiency as a general-purpose language, make it very well suited for teaching these people what can be done with the computer.

Given the confidence quickly gained through Logo, these people can, will, and do gain the confidence to go on and learn what they need to do to become productive citizens. All they need is someone to show them that they can indeed do it.

Again, thanks for a marvelous issue. It will become a most permanent and useful part of our library.

James H. Muller, President
Young Peoples' Logo Association
1208 Hillside Dr.
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Congratulations on the August issue devoted to Logo. I can hardly imagine a better job of covering both the language and the culture. I have one complaint, however, concerning Gregg Williams's otherwise top-notch article comparing four different versions of Logo. (See "Logo for the Apple II, the TI-99/4A, and the TRS-80 Color Computer," page 230.)

His contrast between the relatively black box, user-proof character of Apple Logo and the relatively greater user access to the Terrapin/Krell version is right on the mark. But does it follow that "Apple Logo is better for situations involving nontechnical users and. . .Terrapin Logo is oriented more toward the sophisticated programmer"? I suppose that depends on one's image of the typical new user of Logo.

For the past few months, I have been giving workshops for educators interested in learning about Logo. As a group, these are overwhelmingly nontechnical users. Nevertheless, given a choice between Apple Logo and Terrapin Logo, they consistently express a preference for the Terrapin version (after overcoming some initial bias in favor of the Apple name).

The single difference that most accounts for this preference is one factor that wasn't even mentioned explicitly in the article: what the user can do with pictures in the two systems. Although it is possible to get a printer copy of the graphics screen in Apple Logo, one must "crash" Logo to do so. In Terrapin/Krell Logo, the user may save and read pictures from files that are accessible not only from within Logo but also within Apple DOS. As a result, for example, one can create and save pictures using public-domain Applesoft-based utilities and then use them freely from inside Logo programs.

To a teacher just getting started with a new language, this kind of compatibility across systems has a powerful appeal. So does a tutorial manual (from Terrapin) that is both "geared for the novice" and "does a very good job of introducing some advanced Logo concepts." Teachers also appreciate the tutorial demonstration programs and the shape-editing utility from MIT and the text-editing utilities from Terrapin. By contrast, as Mr. Williams states, "Apple Logo's greatest strength is its advanced programming commands." The applications for these commands are, of course, over the heads of the teachers in my introductory workshops.

Except for that, I could find nothing in the whole issue that didn't make sense to me. Thanks for a superb job.

David Greene
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Palo Alto, CA 94303

Thanks for pointing out a difference between the two systems that is obviously important to a large body of users. When I made those comments on Apple and Terrapin Logo, I was thinking of Apple Logo's BURY and STARTUP-file features (for the benefit of nontechnical users, Terrapin Logo doesn't have these) and Terrapin's tracing and assembler features (to be used by the advanced user; Apple Logo doesn't have these). But your evaluation is equally valid—and I certainly won't argue with experience gained in the field. Thanks for writing. . . . G. W.

The August 1982 BYTE devoted to the Logo language was very interesting, but all the writers missed the existence of the hidden (and dare I say subversive) message "RESIST THE DRAFT," which is to be found on sector 8, track 8, of Apple Logo. With this product going into so

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many of our schools, it seems that Apple Computer is making an early start on 1984.

Dr. John S. Kallend
011 Life Sciences Building
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Everyone Can Know the Real Chips

As Steve Ciarcia pointed out in his article "Everyone Can Know the Real Time," National Semiconductor's MM58167A real-time clock chip greatly simplifies the implementation of a time-of-day clock. (See the May 1982 BYTE, page 34.) However, the chip is manufactured using an extremely slow CMOS (complementary metal-oxide semiconductor) process that can cause designers some unforeseen problems. Most notably, chip access can take up to 1 microsecond, necessitating the use, in some systems, of the ready line (RDY/pin 4) to force the processor into extra wait states until data is valid.

On the positive side, while the manufacturer seems to indicate that interrupts faster than 10 Hz are not possible, in fact interrupts at speeds over 500 Hz can be implemented. This involves using the alarm-clock function and incrementing the setting by values as small as 2 microseconds after each interrupt in software. Again, the slow CMOS process keeps the user from programming faster interrupts due to the long propagation delays in the 48-bit comparator. Within a year, National plans to release a new version of the chip using a higher-speed CMOS process that should eliminate the access problem and allow interrupts at rates up to 1 kHz. The MM58167A (and other chips by Motorola and Oki) will certainly increase the use of time-of-day clocks in small systems.

Bob Rumer
Beckman Instruments Inc.
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A Reasonable Request

Can we *please* quit squabbling over which operating system is the best, or at least set up some ground rules for comparisons? I am very tired of the watermelon versus kumquat comparisons of Unix and CP/M that have been raging in BYTE this year. (See "Unix Feedback," August 1982 BYTE, page 20.)

To begin with, there are many different types of operating systems, including:

- single-user systems such as CP/M and RT-11
- real-time systems such as RSX-11M
- timesharing systems such as Unix, VMS, RSTS, and MP/M

It is a waste of time to fight over members of different groups. The only thing that really matters is if you are using an operating system that is suited to the task at hand. This can be illustrated quite well with Digital Equipment Corporation's PDP series of computers. At least four choices of operating systems are available

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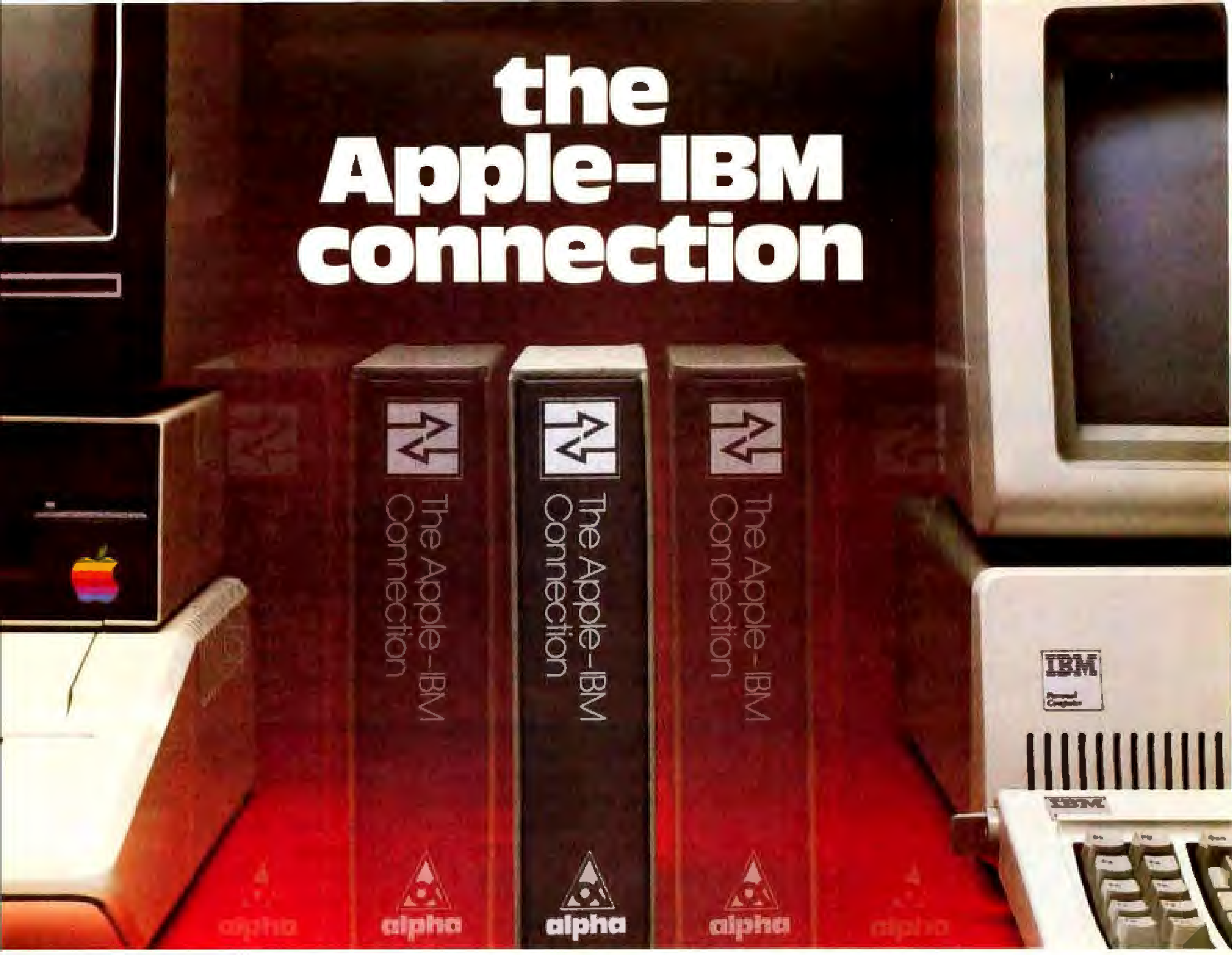

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for it: RT-11, RSX-11M, RSTS, and Unix. For various tasks and under different conditions, any one may be the better choice. On a single machine, I have, at various times, used RT-11 to run diagnostics, RSX-11M to run a statistical package that required it, and Unix for all in-house daily processing. If I ever encountered a package that ran under RSTS, I would be glad to try to accommodate that system too.

As a matter of interest, my machine can handle one user under RT-11, about four under RSX-11M, and about ten under Unix. Because CP/M is a near double of RT-11 for 8-bit machines, the folly of direct comparisons is obvious.

If you let them, operating systems can become religions instead of tools to get your job done. More than enough religious fanatics are battling in the world today; we don't need a holy war over Unix and CP/M. If you are happy with your operating system, that is fine. But don't blind yourself to the fact that some tasks (perhaps even yours) might be much easier to perform in another environment. It is one thing to be locked into a system because of a large investment in time and money and quite another to use the fact that *you are locked in* to promote antiquated and low-powered systems onto new machines.

Tom Slezak, Computer Scientist
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Bug in FORTRAN-80 Goes Uncorrected

I have been putting Microsoft FORTRAN-80 to quite heavy use for more than four years and have been very satisfied with its general performance. Because Microsoft is regarded as a leader in microcomputer software, one might expect it to have a reasonable approach to handling bug reports. It does not, as the following example illustrates.

About three years ago, a bug appeared in FORTRAN-80 in which it failed to correctly repeat group format specifications. (For those interested in the specifics, FORTRAN-80 will not correctly perform the READ on page 153 of Harry Katzan Jr.'s *FORTRAN 77* [New York: Van Nostrand Reinhold, 1978]. The structure is common to both '66 and '77 FORTRAN.) I reported the bug at that time, and Microsoft acknowledged its presence. When I bought the next update, the bug had not been fixed. I reported it again, this time being assured that no one had reported it before (I had reported it previously, myself!). Again, when I bought the next update, the bug was still there.

After three years and several more repeats of the above, I sent a certified letter to the president of Microsoft that outlined my experience to him and asked him for a clear statement of Microsoft's intentions. What I got was an endorsement of the following: "Microsoft has no intention of fixing the bug in FORTRAN-80 regarding FORMAT re-use."

Having been in the business for many years, I can understand a certain degree of aloofness when dealing with the user, but Microsoft advertises FORTRAN-80 to be in compliance with the "full ANSI Standard FORTRAN X3.9-1966 except the COMPLEX data type." It is not, and Microsoft has known for some three years now that it is not.

David Dunthorn
CF Systems
908 West Outer Dr.
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Why worry? The compiler was developed by Microsoft and is supported by IBM. With names like that behind the product, it must be pretty good . . . *right?*

Wrong. During my evaluation, I encountered one problem after another, ranging from disappointing omissions to outright bugs. In my opinion, this product is fundamentally unusable.

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FOR EPSON PRINTERS, Microbuffer is $159 in either an 8K serial or a 16K parallel version. The serial buffer supports both hardware handshaking and XON-XOFF software handshaking at baud rates up to 19,200. Both interfaces are compatible with Epson commands including Graftrax-80 and Graftrax-80+.

ALL OTHER COMPUTER/PRINTER COMBINATIONS are served by the in-line, stand-alone Microbuffers. (Pictured here, twice actual size.)

Both serial and parallel versions are expandable up to 256K. The serial stand-alone will support different input and output baud rates and handshake protocol. The 32K model starts at $299, $349 for 64K, and 64K add-ons (for up to a total of 256K) are just $179.

SIMPLE TO INSTALL.

Microbuffer II is slot-independent. It will fit directly inside the Apple II in any slot except zero.

Microbuffer for your Epson mounts easily in the existing auxiliary slot directly inside the Epson printer.

The stand-alone Microbuffer is installed in-line between virtually any printer and any computer.

MICROBUFFER FROM PRACTICAL PERIPHERALS.

When you think of how much time Microbuffer will save, can you afford to *not* have one?

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Circle 378 on inquiry card.

Suppose you declare a character variable CHARACTER *64 LINE and then READ into LINE with a simple "A" format. If you do not supply 64 characters of input, the program terminates with fatal error number 1252: "Not enough input to satisfy IOlist. . ." This means you have to type the trailing blanks when entering input from the keyboard. It also means that you can't write a program to read a text file one line at a time. The I/O package does not provide the trailing blanks that conventional compilers do.

Now suppose, to compensate for this problem, you add error detection and recovery logic to your program using a READ statement of the form READ(*,10,ERR=50) LINE. The first time you enter a line which is too short, the program transfers to the specified error statement (50). However, the system can't seem to forget that it detected an error, so every subsequent attempt to READ results in an immediate transfer back to the error statement without reading a thing!

Well, instead of using a formatted READ, how about using a "list directed" (sometimes called "free format") READ? Sorry to say, that feature is not provided. The IBM Personal Computer FORTRAN conforms only to the Subset FORTRAN 77 standard, and the subset does not include list-directed I/O. Never mind the fact that this is a personal computer language that will most often be used interactively . . . you still have to count your spaces!

The ANSI (American National Standards Institute) standard for FORTRAN notes that the subset language is intended to make a minimum demand on storage requirements, particularly during execution. Implementing only the subset sure didn't minimize the size of this version. You have to have 128K bytes to run the compiler. Even at that, it requires two floppy disks to hold the compiler and a third one to hold the linker and library.

Memory used during execution is just as bad. A 12-line program with no arrays that does nothing more than READ from the keyboard and WRITE to the display requires 32,655 bytes of memory. (For comparison, I ran the same program on a Digital Equipment Corporation PDP-11/70 under RSTS/E and F77—a full implementation of the language—and it required only 18,048 bytes.) Add to this the 12K bytes of DOS and you find that it takes more than 44K of memory to run a trivial program. The executable file on

disk (which you must create) is 35,200 bytes long—more than 20 percent of the capacity of a single-sided disk.

The memory usage is due to a large (apparently monolithic) run-time library. So what do you get with the library? It's hard to tell: the library's contents are not documented. It appears that you get standard FORTRAN intrinsic functions and I/O support and nothing else. No mention is made of the library routines to get the date or time, or to control cursor position and video attributes such as color and intensity; you have to write your own in assembly language. And no tools are provided for library maintenance. For example, there is no way to build a single library consisting of both FORTRAN and assembly-language subroutines.

What about speed? This is a compiler that produces machine language that is optimized for the 8088 processor. If you avoid the use of library subroutines, you can achieve speeds up to 4 times faster than a similar program using interpreted BASIC. But the mathematical library is terribly slow. A program that sums the square roots of the numbers from 1 to 1000 takes 38 seconds using this FORTRAN; the same process using interpreted BASIC takes only 11 seconds! Incredible . . . the people who wrote the FORTRAN math library apparently didn't take advantage of the much faster routines already in read-only memory for BASIC.

The list goes on, but you should see the light by now. My advice to anyone considering the purchase of a FORTRAN compiler for the IBM Personal Computer is simple: don't buy version 1.00 of this product.

T. M. Putnam
157 Ivy Hill Dr.
West Lafayette, IN 47906

User's Column Fan

Like Karim Alim, we too have enjoyed Jerry Pournelle's User's Column. (See "What's the Story, Jerry?", August 1982 BYTE, page 30.) Perhaps because we also read Dr. Pournelle's science fiction, we are not surprised to learn that he is on speaking terms with Arthur C. Clarke, Larry Niven, and Isaac Asimov. In any field, top professionals tend to know each other.

Jerry Pournelle uses his equipment professionally. Therefore, he can justify owning more of it than I can. Because of this, and because he knows people in the field, he can risk trying it out sooner than I can. Good. When I am ready to buy more equipment, I will review his experiences. And if in the meantime, he's told Bill Godbout his troubles, what I get may be all the better.

As a result of Jerry's reviews, we have picked up Ashton-Tate's dBase II and Oasis Systems' The Word and have been very pleased with them. If Jerry has written software that scratches an itch we share with him, we are willing to pay him for it.

We also had a systems engineer guide us in our selection of components for our system. The result is an S-100 system that has run for nearly two years with a minimum of problems. The engineer has been working with Compupro equipment for some time now. He says that the Godbout people have been most responsive to his questions and complaints. In fact, he would love to upgrade our system with all Godbout boards.

Maybe very few people can duplicate all of what Jerry Pournelle is doing with computers, but there are a lot of us who aspire to some of it.

Laura H. Wise
611 Fourth Place SW
Washington, DC 20024

Seeing Double

The August 1982 BYTE illustrated the latest application for publishers: the "Article Generator." What a delightful sense of irony BYTE has, using it to generate identical articles on the subject of program generators in both BYTE (see George Stewart's "Program Generator," page 38) and the September issue of *Popular Computing* (see page 112).

Charles H. Porter
14226 95th Ave. NE
Bothell, WA 98011

Several readers, Mr. Porter included, wrote to complain about our simultaneous publication of George Stewart's arti-

The Best Made Better

When we unveiled our CompuStar™ multi-user terminal system just over a year ago, we thought we had created the most powerful, lowest-priced multi-user computer we would ever manufacture. We were wrong. Today, we've made our best even better!

Our newly redesigned CompuStar™ boasts the same performance statistics that made its predecessor such an overnight success, plus a host of exciting *new* features. CompuStar users now get the added benefits of dual character set capability, an expanded library of visual attributes including reverse video, underlining and below-the-line descenders, an enhanced disk operating system and Microsoft¹ BASIC — all at no extra cost! And single-user systems now start at as little as $2995.

There are four types of CompuStar™ workstations (called Video Processing Units or VPU's) that can be connected into a variety of central disk systems with 10 to 96 megabytes of multi-user storage.

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Inside our new CompuStar you'll find a level of design sophistication that's destined to establish a new standard for the industry. A series of easy-to-service modular components has been engineered to yield the most impressive reliability figures we've ever seen. But CompuStar users are not only thrilled with our system's performance (and the miserly few dollars they spent to get it), they also have the peace of mind of knowing that Intertec's comprehensive customer protection and field service programs will insure their total after-the-sale satisfaction.

For more information on what just may be the last multi-user microcomputer you'll ever (have to) buy, ask your dealer today about our all new CompuStar™ system. Or, contact us at the number and address below. We'll gladly explain how we've made our best . . . even better!

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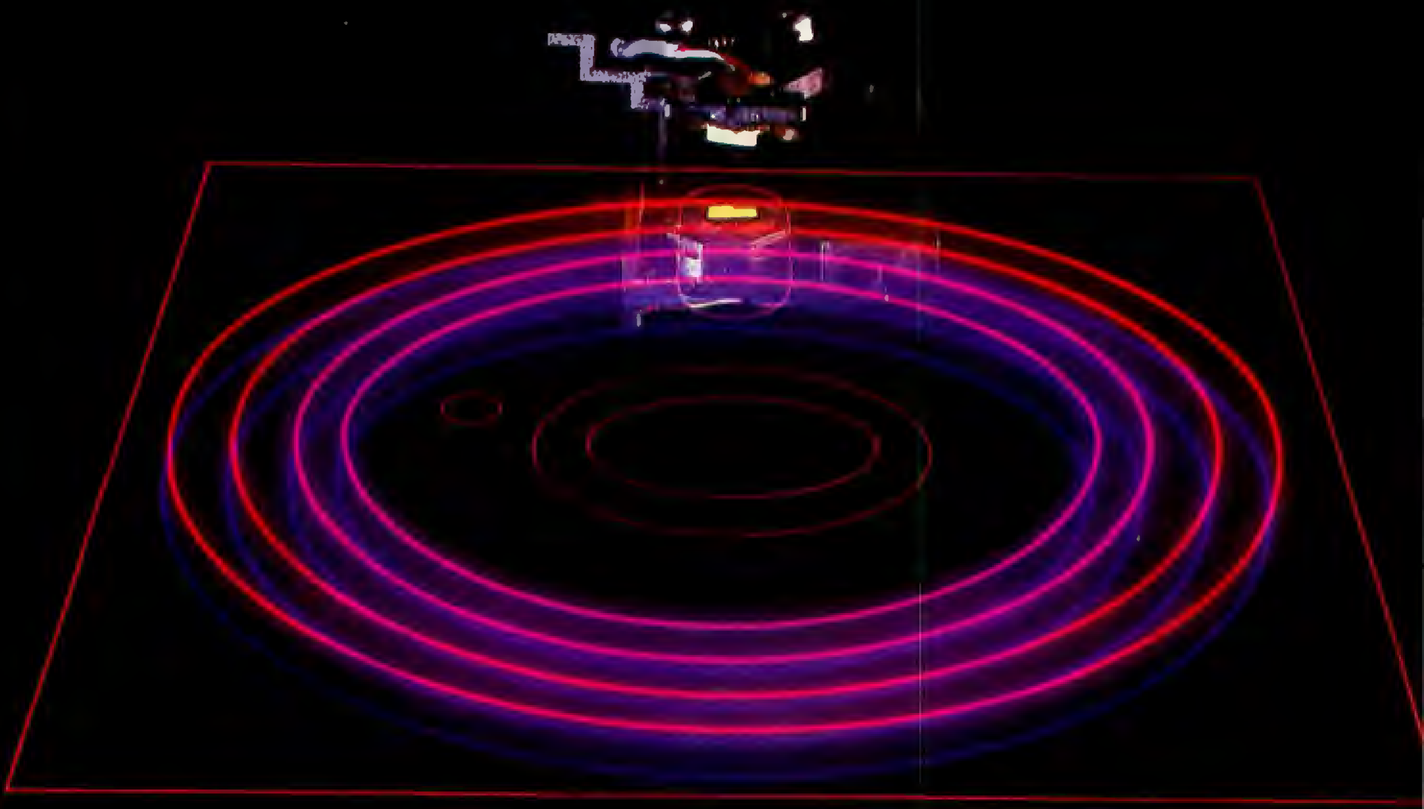
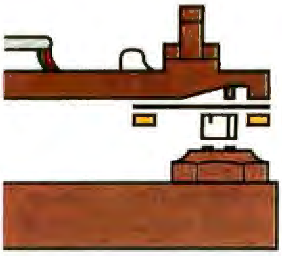
Rana's disk drive was twice as good as Apple's with one head.



Now we have two.

We added another head so you won't have to buy another disk.

That's the beauty of a double sided head. A floppy disk which allows you to read and write on both sides. For more storage, for more information, for keeping larger records, and for improved performance of your system. That's what our new Elite Two and Elite Three offers. It's the first double headed Apple® compatible disk drive in the industry. And of course, the technology is from Rana. We're the company who gave you 163K bytes of storage with our Elite One, a 14% increase over Apple's. And now with our high tech double sided heads, our Elite Two and Three offers you two to four times more storage than Apple's. That's really taking a byte out of the competition.



Rana's double sided heads give Apple II superior disk performance power than second generation personal computers such as IBM's.

We put our heads together to give you a superior disk drive.

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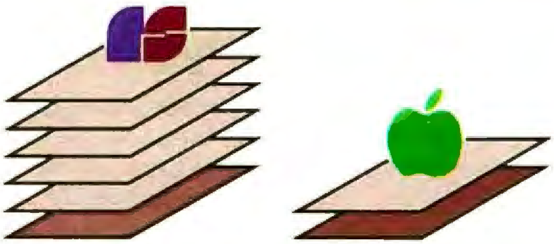
The Elite Two offers an impressive 326K bytes and 40 tracks on each side. This drive is making a real hit with users who need extra storage, but don't require top-of-the-line capacity. Costwise, it takes 2½ Apple drives to equal the performance of our Elite Two. And twice as many diskettes. Leave it to Rana to produce the most cost efficient disk drive in the world.

We've always had the guts to be a leader.

Our double sided head may be an industry first for Apple computers, but nobody was surprised.

They've come to expect it from us. Because Rana has always been a leader. We were the first with a write protect feature, increased capacity,



Your word processor stores 5 times as many pages of text on an Elite Three diskette as the cost ineffective Apple.

and accurate head positioning. A first with attractive styling, faster access time, and the convenience of storing a lot more pages on far fewer diskettes. We were first to bring high technology to a higher level of quality.

So ask for an Elite One, Two, or Three. Because when it comes to disk drives, nobody uses their head like Rana.

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cle, "Program Generators" in BYTE and Popular Computing. *It was done intentionally. We reprinted the article in* Popular Computing *because George had done such an excellent job of reporting on program generators that we wanted to get the word out to* Popular Computing's *readers, too. . . .* C. M.

The Power of Print Strikes Again

The July 1982 BYTE contained an excellent review of Joseph Weizenbaum's book *Computer Power and Human Reason* (page 402).

More than three years ago, I saw this book in a store and passed it by after looking at a few pages. But Nancy Robertson's review prompted me to buy it and read it from cover to cover. I learned a lot.

Mr. Weizenbaum has put wisdom and knowledge together in a field where hype and pseudoscience dominate. If the editors of BYTE could do an entire issue on this book, it would be a great public service.

John B. Palmer
POB 23
Boonville, CA 95415

Setting the Record Straight

We were dismayed by the inaccuracies contained in an advertisement that appeared in the August 1982 BYTE and by the false impressions it may have left among readers. The advertised product was I-Protect, a shield which purports to protect VDT (video-display terminal) operators from "the equivalent of a chest X-ray every 12 days." To support the erroneous claim that VDT operators are exposed to significant X-ray emissions, and thus need such protection, the advertisement misinterprets VDT radiation studies that were performed by the FDA (Food and Drug Administration) and NIOSH (National Institute for Occupational Safety and Health).

For the sake of readers who may have been misled by the advertisement, let us set the record straight.

Measurements performed under normal VDT operating conditions by the FDA and NIOSH have *never* shown X-ray emissions significantly above the natural background radiation to which we are all exposed. In order for our laboratories to produce any higher levels of X-radiation, they had to resort to extreme conditions, including maximum misadjustments of both user and service controls, excessive line voltages, and intentionally induced component failure—conditions which in some cases led to illegible video displays and permanent damage to the units.

Based on our measurements of ionizing and nonionizing radiation, we do not believe that VDTs should pose a radiation risk to those who operate them. We are concerned that people who read the I-Protect advertisement may have been led to believe otherwise.

John C. Villforth, Director
Bureau of Radiological Health
Department of Health & Human Services
Food and Drug Administration
Rockville, MD 20857

Pournelle Taken to Task

In Jerry Pournelle's July 1982 BYTE User's Column, he discusses what he terms overpriced documentation. (See "Ada, MINCE, CP/M Utilities, Overpriced Documentation, and Analiza II," page 290.) It is common knowledge that most of the hardware and software documentation allied to currently available microcomputer products is of a depressingly low standard. Few suppliers seem to appreciate that the majority of end-users have nowhere near enough knowledge to make immediate and confident use of their hard-copy guides and manuals. It is unfortunate that documentation continues to be viewed by many machine and program producers as an evil necessity, and one can only hope that an increasingly competitive marketplace will result in higher overall standards.

However, I must take Jerry Pournelle to task over his comments on the cost of documentation. Actual printing costs comprise a very small proportion of the total cost of writing, editing, typesetting, reproducing, packaging, and distributing hard-copy publications. Assuming that the cost of employing qualified staff to write technical copy together with the appropriate overheads is included in the price of the software (and this is not always the case), the following considerations pertain:

1. Processing an order. This includes postage, packing, subsequent dispatch,

MORE BYTES PER DOLLAR*

It's true! The AVT-2 personal computer - fully Apple™ compatible - gives you more bytes per dollar than the market leader.

Check the Specs . . .

- Basic 64 K byte RAM memory upward expandable in 256 K byte cards to a maximum of four cards giving 1 M byte potential.
- 6502 Central microprocessor.
- 16 K byte ROM memory.
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- Composite B/W video output.
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- 40 col. x 24 line character display in B/W or color system.
- B/W graphic display 280 x 192 or 280 x 160 with 4 text lines.
- 16 Color graphic display 40 x 48 or 40 x 40 with 4 text lines.
- 6 Color graphic display 280 x 192 or 280 x 160 with 4 text lines.
- Full-feature detached keyboard with 65 keys and cursor steering.
- Seven Apple™ compatible slots for plug-in peripherals.
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- Double 5¼ inch floppy disk drives, optional.
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*** The AVT-2 has a basic 64 K memory compared to 48 K of standard Apple II™.**
To find out how much cheaper the AVT-2 is, write or telex for a personal quote: AVT Trading A.G., Chamerstrasse 50, CH 6300 Zug, Switzerland. Telex 865267 GSAG.

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AVT comp 2

and, possibly, the preparation of an invoice, for which a realistic commercial charge would be between $5 and $20.

2. Stocking and storing. To avoid delays in servicing an order, a busy organization will have to print a substantial number of documents and store them at some cost.
3. Revision and amendment. The nature of products related to computing implies frequent changes due to improvements, modifications, and corrections. Thus, stocks of documentation will have to be scrapped periodically. Typesetting is not often used for reasons of speed; it is far quicker to modify hard copy using a word-processor that can look very professional when litho-printed.

Let us hope that the technology in which we are so interested and which causes us to read BYTE will overcome, through the advent of inexpensive digital typesetters, laser and ink-jet printing, FAX, and high-speed communications, some of these practical difficulties. Let us hope that the suppliers improve *their* communications!

C. J. Clifton, Head, Computer Products
Design Engineering Software Centre
Engineering Sciences Data Unit Ltd.
251-259 Regent St.
London, W1R 7AD, England

Something Went Wrong

Jerry Pournelle's July 1982 BYTE User's Column contained two errors with regard to Digital Research products that I would like to correct. ("See Ada, MINCE, CP/M Utilities, Overpriced Documentation, and Analiza II," page 290.)

The article listed two different prices for Digital Research's symbolic instruction debugger SID: $195 and $295. Mr. Pournelle later commented that although it was an excellent product, the price was a bit high. The actual price of SID is only $75.

The article also listed CP/M at $180, when the actual price is $150.

Also, our Japanese representatives, Microsoftware Associates, have notified us that BYTE listed its old address, telephone, and Telex numbers in a recent article. The new location, telephone, and Telex number are:

Microsoftware Associates
6th Floor A. Y. Building
3-2-2, Kitaayama, Minato-Ku
Tokyo 107, Japan
tel: 03-497-0381
Telex: 2427080

Patricia Lucas, Public Relations Manager
Digital Research
POB 579
Pacific Grove, CA 93950

A Satisfied Customer

About a year and a half ago, I first entered a personal computer store. I was ignorant of and mystified by the very word computer. I was intimidated by the seemingly nebulous array of the various brands of microcomputers, peripherals, and software.

But for previously having acquired shrewdness in the marketplace the hard way, I would have been easy prey for less scrupulous dealers and sales personnel. But I knew that I did not know enough to even begin to make intelligent choices about what, for me, is a major purchase—one with which I must live for a long, long time.

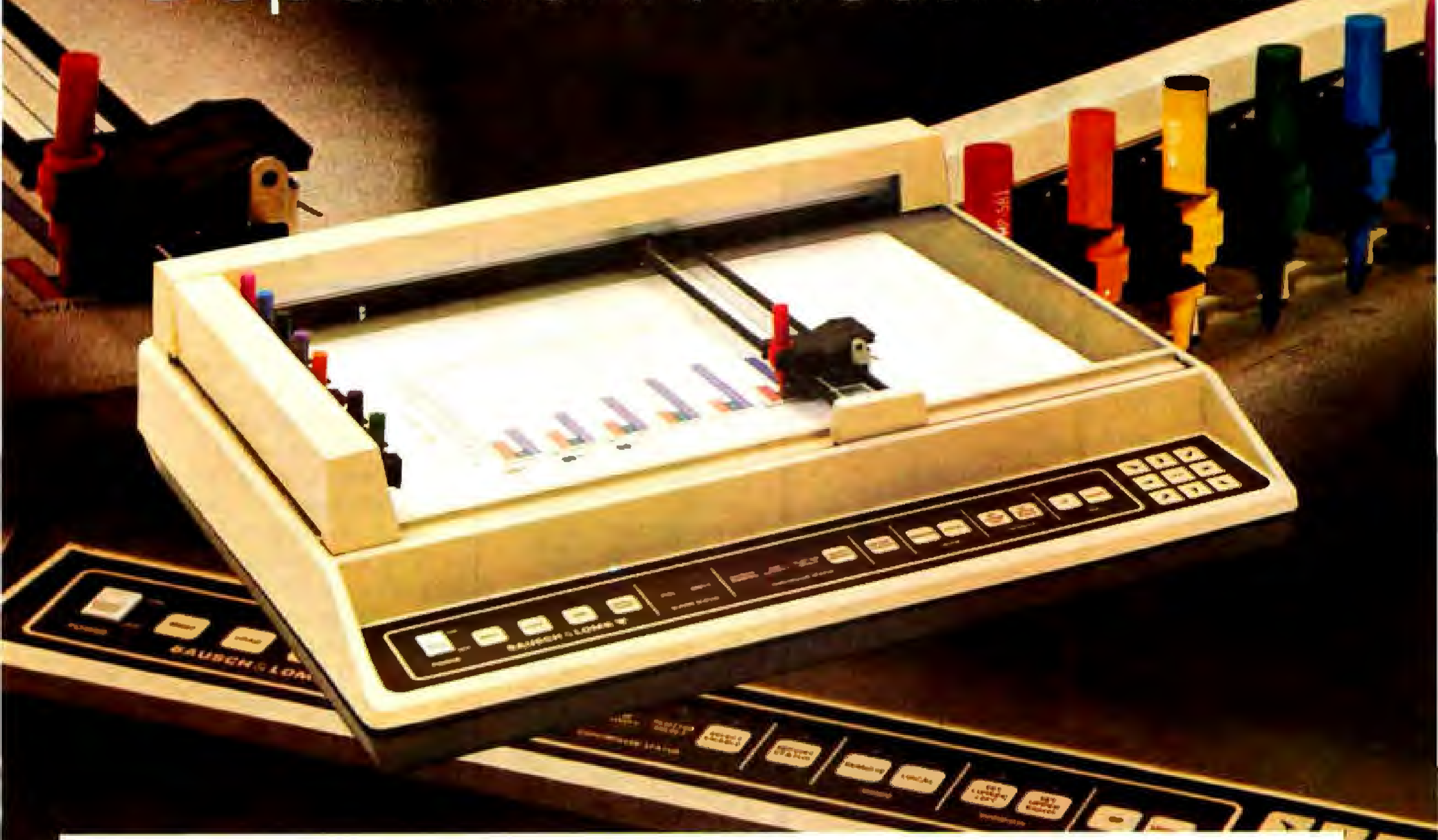
I approached the marketplace eager to learn everything I could about microcomputers. I avidly read various literature and BYTE magazine. I availed myself of the University of Minnesota's public service Microcomputer Helpline (call (612) DR MICRO). And I sought considerable clarification from numerous dealers.

In the marketplace, however, I experienced a number of possibly manipulative ploys: I was misled with incomplete information, I was intentionally misadvised, and (because I did not present the instant sale), perhaps the most irksome to me, I frequently experienced the cold shoulder from impatient or greedy sales personnel.

The manager and staff of only one computer store showed me the consistent patience and constant willingness to take the time to help educate me. They never misadvised me, nor have I ever felt manipulated by them. They have been customer-friendly even if this meant foregoing the sale of any item if a competitor's product was in my best interest. These days, that kind of ethics means more to me than money.

Perhaps, as was at issue in BYTE magazine several months ago, Computerland does ask somewhat more for products than some, especially mail-order competition. But if my very rewarding association

A Complete Graphics Department For Just $1995



Realize day-in and day-out solid performance from a quiet and capable desktop plotter. It's true. For only $1995* the Houston Instrument HIPLØT™ DMP-29 will provide you with world-class multi-color hard copy graphics, and deliver a level of quality and performance that you would expect in a plotter costing three times as much.

It's a hard worker. The DMP-29 goes about its job with amazing speed and precision. Unbeatable resolution and repeatability are yours in both 8½" x 11" and 11" x 17" formats, and 8-pen capability assures you of fast attention-free flexibility when multi-color output is required. High pen speed combined with an addressable resolution of 0.001" assures fast, accurate and stepless traces.

It's friendly. You can call 21 different functions directly from the front-panel membrane keyboard. It's tolerant too. The DMP-29 will modestly protect itself from user errors, as when attempting to place a pen in an already occupied stall.

And it's smart. An extensive set of firmware routines makes life easier for the user. A small sampling of the built-in talent inherent in the DMP-29 includes character generation, circle, arc and elipse synthesis, line type variations, viewport/windowing, clipping and scaling.

For more information on the hard working, friendly and smart DMP-29 plotter, contact Houston Instrument, P.O. Box 15720, Austin, Texas 78761. (512) 835-0900. For rush literature requests, outside Texas call toll free 1-800-531-5205. In Europe, contact Houston Instrument, Rochesterlaan 6, 8240 Gistel, Belgium. Telephone 059/27-74-45.

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Circle 60 for literature.

Circle 61 to have representative call.

4P005

of the past is any measure, the staff at Computerland of Downtown Minneapolis is well worth the investment.

Larry E. Johnson
Building 9, Room 225
Minnesota Veterans Home
Minnehaha Ave. and East 51st St.
Minneapolis, MN 55417

Bug Fix

I use Wordstar with an IDS (Integral Data Systems) Prism 80 printer. Until recently, I could not print subscripts or superscripts. After many long-distance phone calls and letters to IDS, Micropro, and everyone else I could think of, I found the solution to be a simple matter of changing 8 bytes in Wordstar.

Specifically, to get superscript capability, you must change ROLUP: through ROLUP:+3 to 3, 1B, 19, and 19 (hexadecimal), respectively. To get subscript capability, you must change ROLDOW: through ROLDOW:+3 to 3, 1B, 14, and 14 (hexadecimal), respectively. I hope this information saves some readers the time and money I invested.

Leo J. Scanlon
7708 East Allen Dr.
Inverness, FL 32650

Shedding Light on Battery-Powered Displays

I read with interest Chris Morgan's editorial "The Briefcase Computer Market Heats Up" (July 1982 BYTE, page 6). On page 7, he states that "electroluminescent (EL) displays consume a lot of power—so much that they cannot be battery operated as can LCDs [liquid-crystal displays]."

EL-display technology is the most power-efficient of all the emitting technologies, except for CRTs (cathode-ray tubes). We at Aerojet have developed an EL display for a battery-operated portable terminal. This work has been under the sponsorship of the Army (ERADCOM). The display is being installed in the Digital Message Device terminal manufactured by Magnavox. The terminal will be evaluated in the U. S. Army's TACFIRE system.

LCDs are inherently the lowest power-consuming display technology ever conceived by man. However, they are not matrix-addressable in large panels of 320

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Coming Soon—Internal Hard Disk for Mod III
Floppy Disk III kits for Mod III include p.s. controller & cables
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Inc—Galactic Empire Trader Revolution—available separately $17.00 ea
Acorn Software—
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Resident Cache Buffer Hard Disk Storage	5M/10M	—	?
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MP/M 86	Yes	—	?
OASIS-16	Yes	—	?
XENIX	Soon	—	?
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Expansion Memory	Yes	Yes	?
Z-80 CP/M 80 Board	Yes	—	?
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*For comparison purposes, typical professional configurations consist of 16-Bit 8088 Processor, 128K RAM with Parity, Dual 320K 5-inch Floppies, DMA and Interrupt Controller, Dual RS-232 Serial Ports, Centronics Parallel Port and Dumb Computer Terminal or Equivalent.

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*As advertised in BYTE Magazine, August 1982.

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columns by 192 rows or more. Additional power must be consumed to make them matrix-addressable, such as thermal addressing. When provided with thermal addressing, LCDs consume more power than EL displays.

Larry E. Tannas Jr., Engineering Manager
Thin Film Device Laboratory
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Actually, just about any electrical or electronic device can be run by batteries. The question is, would the batteries be too bulky for use with a portable computer? I've heard from a number of companies who are working on that very problem. Many thanks to Mr. Tannas and the other readers who noted that electroluminescent displays can indeed be run by batteries. . . . C. M.

Sorry, Wrong Number

A pin number is incorrect in "MPI Disk Drives Meet IBM" in the September 1982 BYTE Letters (page 20). When following the procedure to use MPI B51 drives in the IBM Personal Computer, reference to pin 34 should be to pin 32, Side Select. Also, pins 7 and 8 (head load connecting to motor) can be jumper-connected on the shunt socket of the MPI drives instead of pins 1 and 14 (head load connecting to drive select). Either way will work.

Kim B. Lignell
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Adventures Paid Off

In response to Hans Strasburger's request in the August 1982 BYTE (page 32) for "real" adventures like the original, we, too, were starved for adventure after getting 350 points. So we wrote our own and now offer three additional adventure-type programs. A Remarkable Experience is a cave-exploration game with passwords to unravel, unique locations to investigate, new treasures to find, and unusual actions to take. A Galactic Experience is a space-exploration adventure with a murder mystery to analyze and a planet to save (by far our largest and most complex adventure). A Physical Experience is another space adventure where the user, Captain Player, must reverse the experiments of a group of scientists, prevent a supernova, and save the universe.

These are assembly-language programs with playing styles similar to the original Adventure; the computer recognizes and responds to one- or two-word sentences of four or five letters each. They are available in HDOS for Heath/Zenith computers and for standard 8-inch CP/M version 2.2 or higher. Further information can be obtained by writing to the address below.

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BYTE's Bits

Intel and Microsoft Ink Xenix Pact

Intel Corporation and Microsoft have signed an agreement making the Xenix operating system available for Intel's iAPX 86 microprocessor family. Under the terms of the agreement, Xenix for the iAPX family will be marketed by Intel. Intel began shipping the first iAPXs running Xenix in July. The company also announced plans to have the iAPX 286 outfitted with the operating system by the first half of 1983, which will make Unix-derived software available for 8086 system users.

Xenix is Microsoft's fully licensed 16-bit microprocessor adaptation of Bell Laboratories' Unix version 7 operating system.

Quarterly Calls for Papers

The editors of *The Journal of Computers Reading & Language Arts* have issued a call for papers dealing with the interdisciplinary theme of computers and their relationship to the reading and language arts. Papers or requests for information should be sent to George H. Block, *Journal of Computers Reading & Language Arts*, POB 13039, Oakland, CA 94661. ■


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Build the Circuit Cellar MPX-16 Computer System
Part 2

A continued description of an 8088-based system that shares its principles of operation with the IBM Personal Computer.

Steve Ciarcia
POB 582
Glastonbury, CT 06033

This article is the second of three describing the design and operation of my most ambitious construction project to date: the Circuit Cellar MPX-16 computer system. I've written these articles with the intent of giving you a grasp of the basic functional parts of a complicated piece of electronic equipment and how these parts work together.

Because the MPX-16 is somewhat more complex than the projects I normally write about, I've had to simplify the presentation of many details to fit them into the magazine, but if you're interested in building an MPX-16, you can get all the details you need from the *MPX-16 Technical Reference and User's Manual*, which comes with the printed-circuit board available from The Micromint (see the text box on page 78). This book includes timing diagrams and listings of the MPX-16's special software.

Last month I presented an overview of the system and a discussion of the coprocessors and bus structures. This month, I'd like to continue by explaining memory, interrupts, the expansion bus, and I/O (input/output) decoding. But first, here's a recap of the MPX-16's features.

System Features

The Circuit Cellar MPX-16 computer system fundamentally consists of a single 9- by 12-inch five-layer printed-circuit board (containing 120 integrated-circuit packages), to which various peripheral devices are attached. It has nine expansion slots and is completely compatible with the I/O-expansion bus of the IBM Personal Computer.

The MPX-16 uses the Intel 8088 microprocessor and the optional 8087 numeric coprocessor; the main circuit board has room for 256K bytes of user memory and contains two serial and three parallel I/O ports, a floppy-disk controller, and EPROMs (erasable programmable read-only memories) containing the BIOS (basic I/O system) module of Digital Research's CP/M-86 16-bit disk operating system. The MPX-16 can be readily expanded to provide a full 1 megabyte of user memory and several megabytes of hard-disk mass storage. A more detailed list of characteristics appears in table 1.

The MPX-16 was initially designed to run CP/M-86, but eventually Microsoft's MS-DOS operating system will be available for it, making it possible to run most software written for the IBM Personal Computer on the MPX-16, except software that uses unique features of the IBM PC. The principal difference is this: with the present BIOS, the MPX-16 communicates with the user through a serially interfaced display terminal instead of a memory-mapped video display. (You could theoretically install an IBM Color Graphics Display Adapter and a serial IBM-type keyboard for exact hardware emulation.)

The MPX-16 is well suited for use as a low-cost 8088-based computer for integration into a complete hardware/software package, chiefly because it combines so many functions on a single printed-circuit board. Putting together the hardware of a complete system, you need only add a power supply, a serial video-display or printing terminal, and one floppy-disk drive (either 5¼- or

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2. optional Intel 8087 math coprocessor
3. onboard space for four 64K-byte banks of dynamic RAM for a total of up to 256K bytes, with parity generation and error detection
4. sockets for up to 64K bytes of JEDEC 24- or 28-pin standard ROM or EPROM devices
5. two RS-232C serial I/O ports
6. two 8-bit general-purpose parallel I/O ports with handshaking control lines
7. one Centronics-compatible parallel printer port
8. four programmable timers (one for a real-time clock, two for data rates, one for memory-refresh requests)
9. four independent DMA (direct memory access) channels
10. sixteen levels of vectored, prioritized interrupt control
11. single- or double-density floppy-disk controller for controlling up to four 5¼-inch or 8-inch single- or double-sided drives
12. five 62-pin I/O-expansion-channel connectors (hardware compatible with the IBM Personal Computer) with space for four more
13. five-layer 9- by 12-inch printed-circuit board
14. BIOS for CP/M-86 in EPROM

Table 1: *Major characteristics of the MPX-16 computer system.*

Start Address			
Decimal	Hexadecimal	Bank	Function
0	00000	0	64K to 256K bytes of R/W
64K	10000	1	memory on system
128K	20000	2	board
192K	30000	3	
256K	40000	4	
320K	50000	5	up to 704K bytes of
384K	60000	6	expansion memory in
448K	70000	7	I/O channel
512K	80000	8	
576K	90000	9	
640K	A0000	10	
704K	B0000	11	
768K	C0000	12	
832K	D0000	13	
896K	E0000	14	
960K	F0000	R	64K bytes of system ROM/EPROM

Figure 1: *Map of memory-address-space allocation in the MPX-16, in 64K-byte increments.*

8-inch). Turn on the power, insert a CP/M-86 disk, and go. And by the time you read this, an enclosure for the circuit board should be available. Many applications need nothing more.

System Memory

The stars of the show in November's article were the Intel 8088 microprocessor and the 8087 numeric processor extension (NPX), with supporting roles played by the Intel 8284 clock generator/driver, the 8288 bus controller, and the 8237A-5 DMA (direct memory access) controller. This month we look at some less glamorous but equally necessary components, starting with a type of component so prosaic as to be called a commodity by the semiconductor industry: the memory.

The MPX-16 system circuit board contains both read-only and read/write memory. In addition to the possible 64K bytes of ROM, the MPX-16 circuit board contains sockets for up to 256K 9-bit words (an 8-bit byte plus a parity bit) of dynamic RAM (random-access read/write memory). Furthermore, to augment the onboard memory, as much as 704K bytes of expansion RAM or ROM can be added in the I/O-expansion slots using readily available memory-expansion boards such as the Quadram Quadboard or the Seattle Computer RAM-Plus card. A memory map of the 8088's 1-megabyte (1,048,576-byte) address space in 64K-byte increments is shown in figure 1. Two of the five sections of the schematic diagram are included in this article; section 2 appears as figure 2 on pages 48, 49, and 50; section 3 as figure 3 on pages 52, 53, and 54. A table of integrated circuits, giving their type, location, and power connections, appears on pages 56 and 60 as table 2.

ROM Configuration

Four integrated-circuit sockets, designated IC82 through IC85 in section 3 of the schematic diagram, are provided for holding ROM (read-only memory) chips, which most often are EPROM devices. These four JEDEC- (Joint Electron Device Engineering Council) standard 28-pin sockets can contain several sizes of EPROMs, any of the various "byte-wide" (8-bit word size) devices such as the 2716 (16K bits or 2K bytes), the 2732 (4K bytes), the 2764 (8K bytes) or the 27128 (16K bytes). EPROMs with 24-pin packages, such as the 2716s and 2732s, are plugged into the lower 24 pins of the sockets, with certain jumper connections set accordingly.

For proper operation, the MPX-16 circuit board must contain a ROM or EPROM device in the highest address space (socket IC85) and a bank of RAM in the lowest address space because the 8088 processor fetches its first instruction after a power-up reset from location hexadecimal FFFF0 (usually a jump instruction branching to an initialization routine) and uses interrupt vectors in the range hexadecimal 00000 to 003FF.

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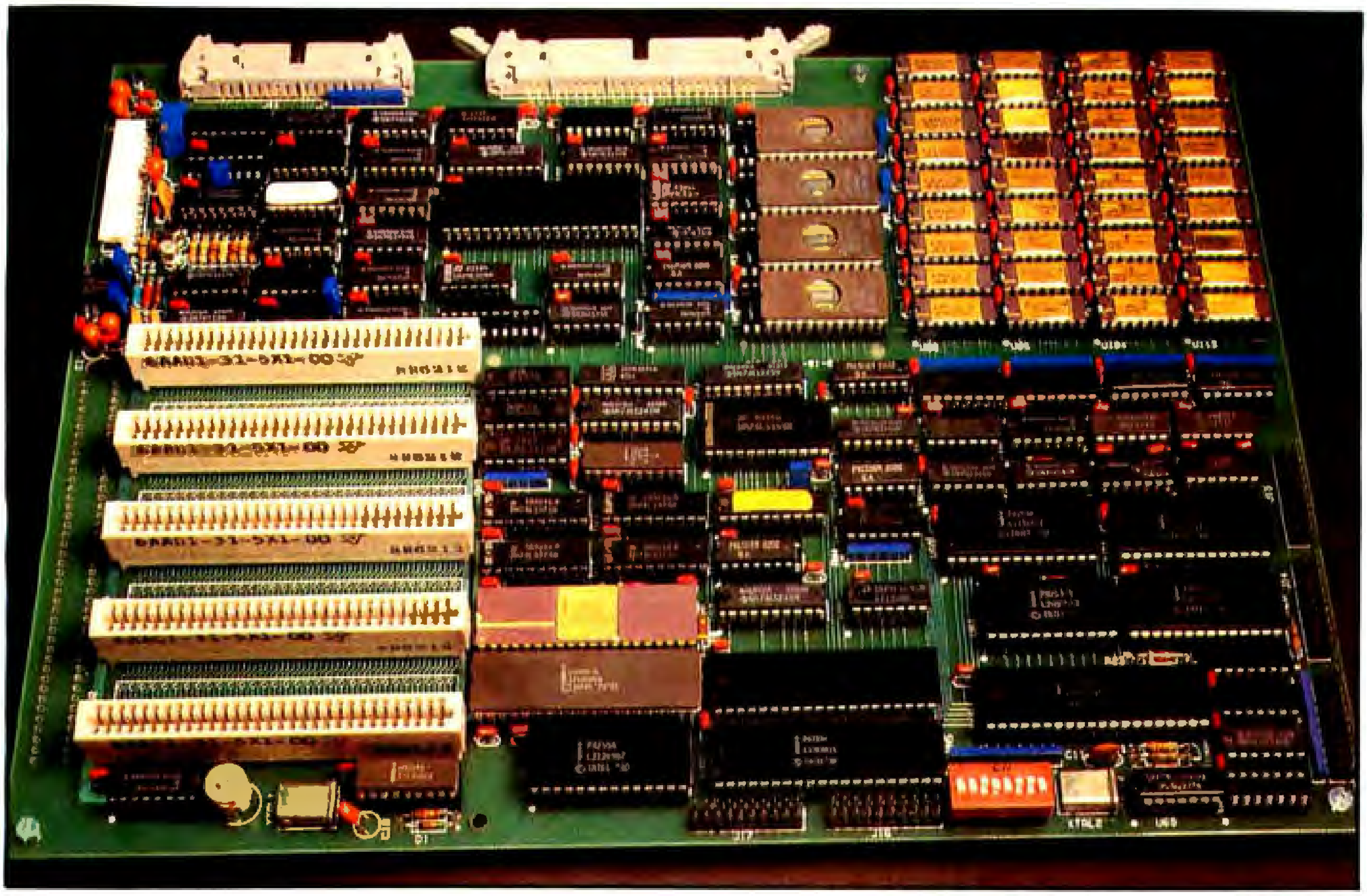

Photo 1: *The Circuit Cellar MPX-16 single-board computer system, which uses the latest technology to provide lots of low-cost computing power. The five-layer printed-circuit board contains 120 integrated circuits including most common peripheral-device interfaces; furthermore, any peripheral-device card intended for use with the IBM Personal Computer can be plugged into one of the I/O-expansion slots. There are nine slot positions, but only five sockets are installed initially.*

The capacity of the ROMs (or EPROMs) used on the system board must be compatible with the configuration of onboard jumpers JP1 through JP6 and with the program stored in the 32-word by 8-bit address-decoding PROM (programmable ROM) device IC45, an HM7603. The PROM program and jumper arrangements supplied with the system board are intended for type-2732 EPROMs. A different decoding PROM is needed for other memory-device types so that the four ROM sockets may be decoded into a contiguous address space in each case. (A PROM-programming table is included in the MPX-16 documentation.) The ROM-decoding logic and memory organization are respectively shown in sections 2 and 3 of the schematic diagrams.

Memory chips are less glamorous than microprocessors, but just as necessary.

The ROM-address-space-decoding logic for the system board is enabled whenever all three high-order system address bits, SYSA17 through SYSA19, are high, causing the output of a NAND gate (IC30) to go low. If five PROM-address bits SYSA11 through SYSA15 or SYSA12 through SYSA16 (depending on the jumper configuration) address one of the programmed locations, the selected ROM-chip-enable line (one of $\overline{\text{PROMSEL0}}$ through $\overline{\text{PROMSEL3}}$) is also driven low, selecting that memory device. The $\overline{\text{ROMSEL}}$ signal at IC28 pin 5 (a two-input OR gate in section 2) also enables a wait-state-generation circuit if jumper JP7 is connected. After one of the $\overline{\text{PROMSEL}x}$ lines has been driven active-low, a $\overline{\text{SYSMEMRD}}$ (system memory read, active-low) signal from the system bus master will initiate the memory-read cycle and generate a single wait state if JP7 is connected. Valid data from the ROMs is available on the data bus after $\overline{\text{SYSMEMRD}}$ goes low.

Normally, the MPX-16 requires ROM or EPROM devices with an access time of 350 ns (nanoseconds) or faster. The optional wait-state feature afforded through JP7 allows use of slower ROM devices with 450-ns access times. If faster devices are used, then JP7 should not be installed and the MPX-16 can operate with no wait states.

The EPROMs on the standard MPX-16 system board contain a power-on self-test routine and I/O drivers, including the CP/M-86 BIOS

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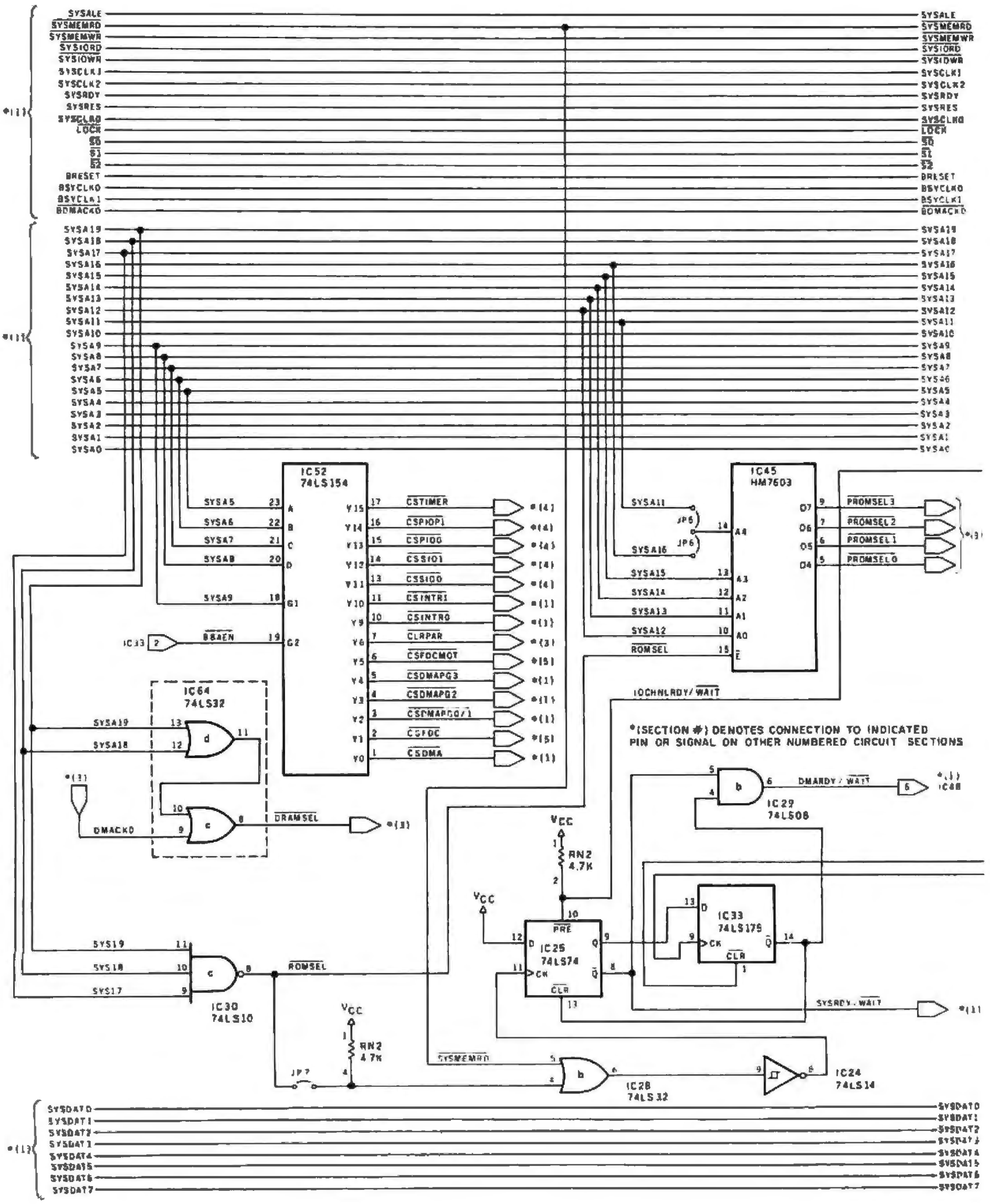
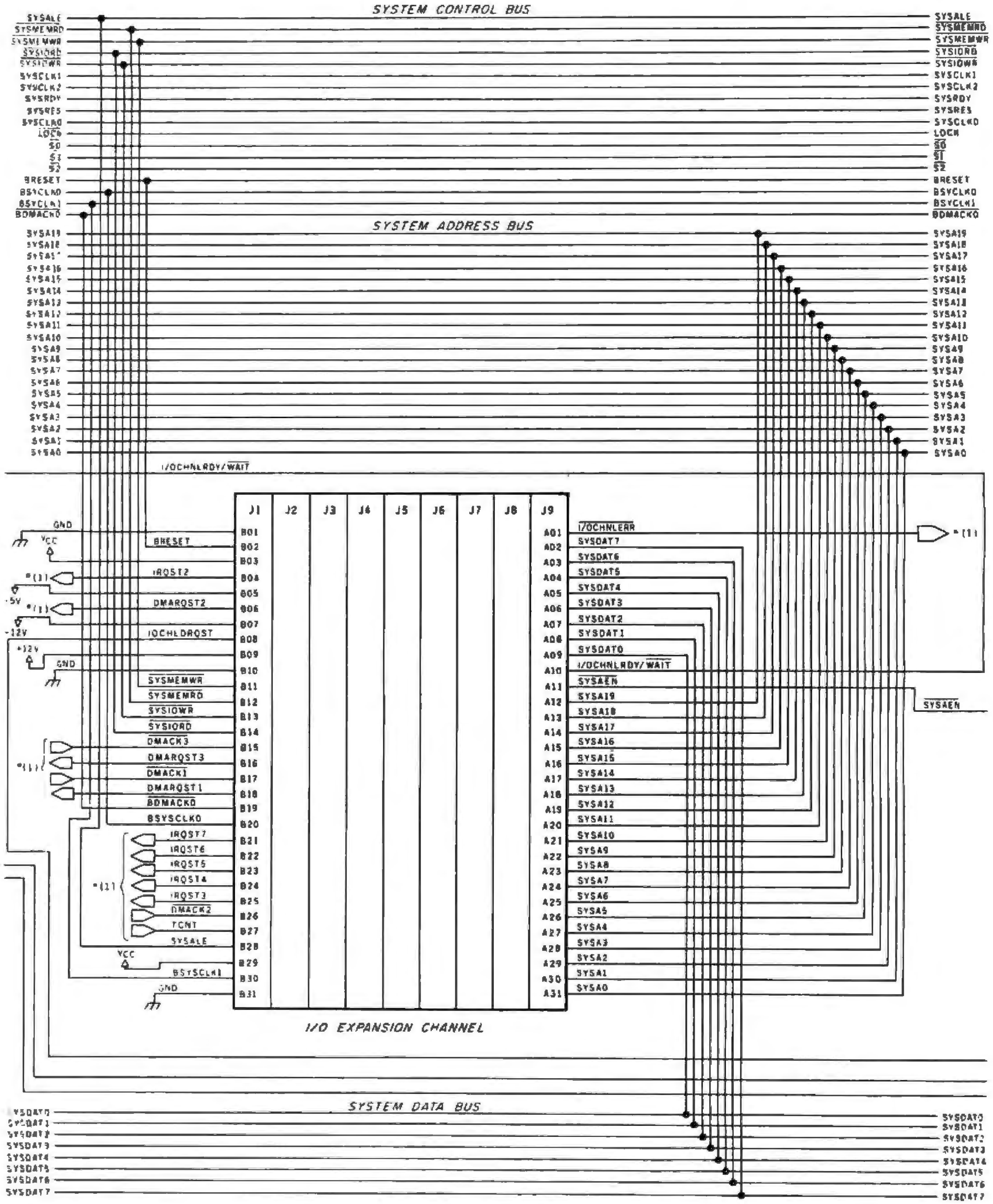


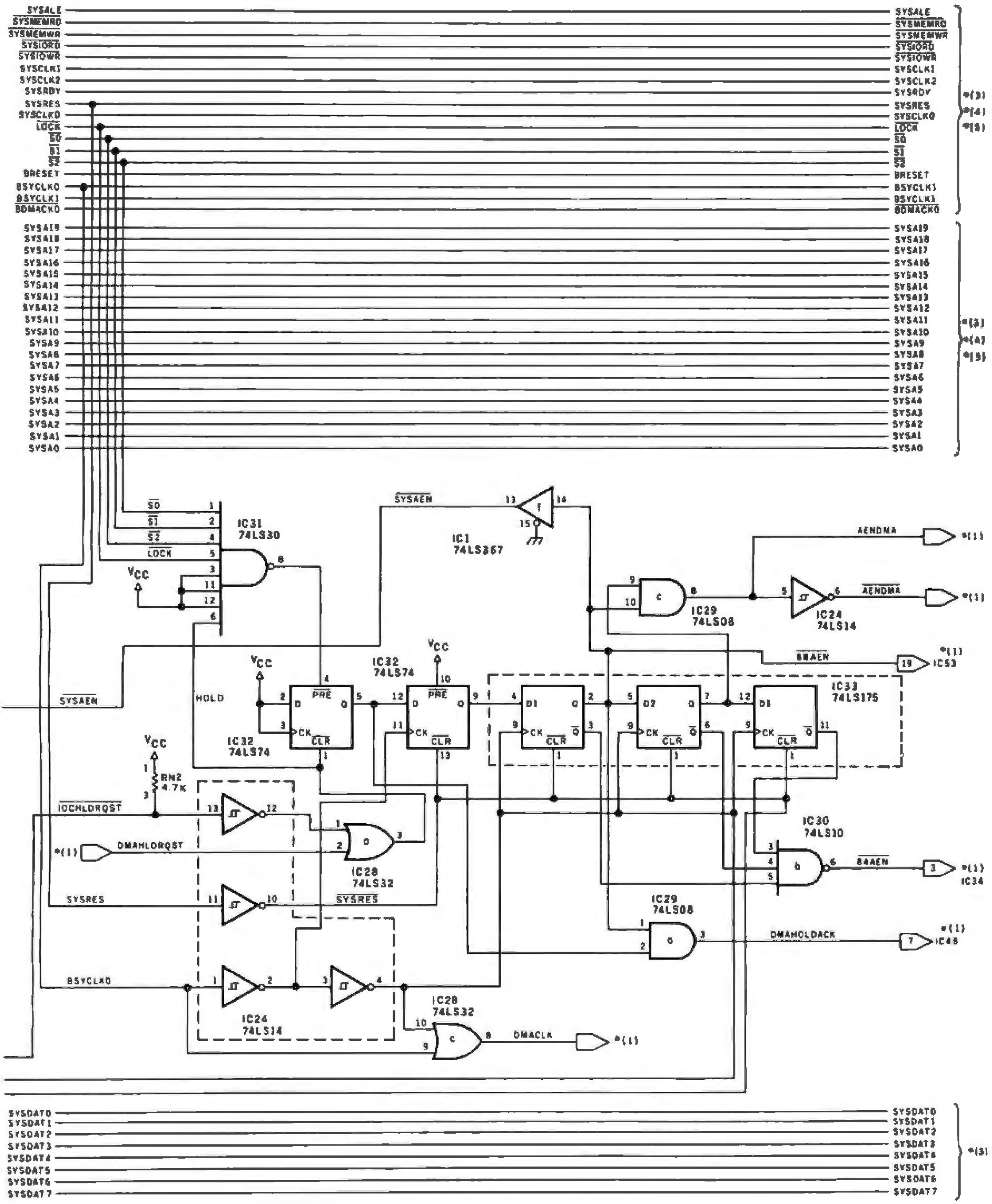
Figure 2: *Section 2 of the schematic diagram of the MPX-16 computer's main circuit board. (Section 1 was printed in last month's article; section 3 appears here in figure 3; sections 4 and 5 will appear in next month's article.) The notation *(n) indicates that a given signal line connects to a component or another line shown in schematic section n.*

A table of all the MPX-16's integrated circuits appears as table 2 on pages 56 and 60, giving each device's number, type, sec-



tion/figure location, and power connections. Connections to the I/O-expansion-channel slots are of course made to each individual slot. Possible substitutes for the HM7603 are the 74S288, the 82S123, and the AM27S09, although it's best to use the HM7603. *(The diagram is continued on page 50.)*

Figure 2: *Continued from page 49.*

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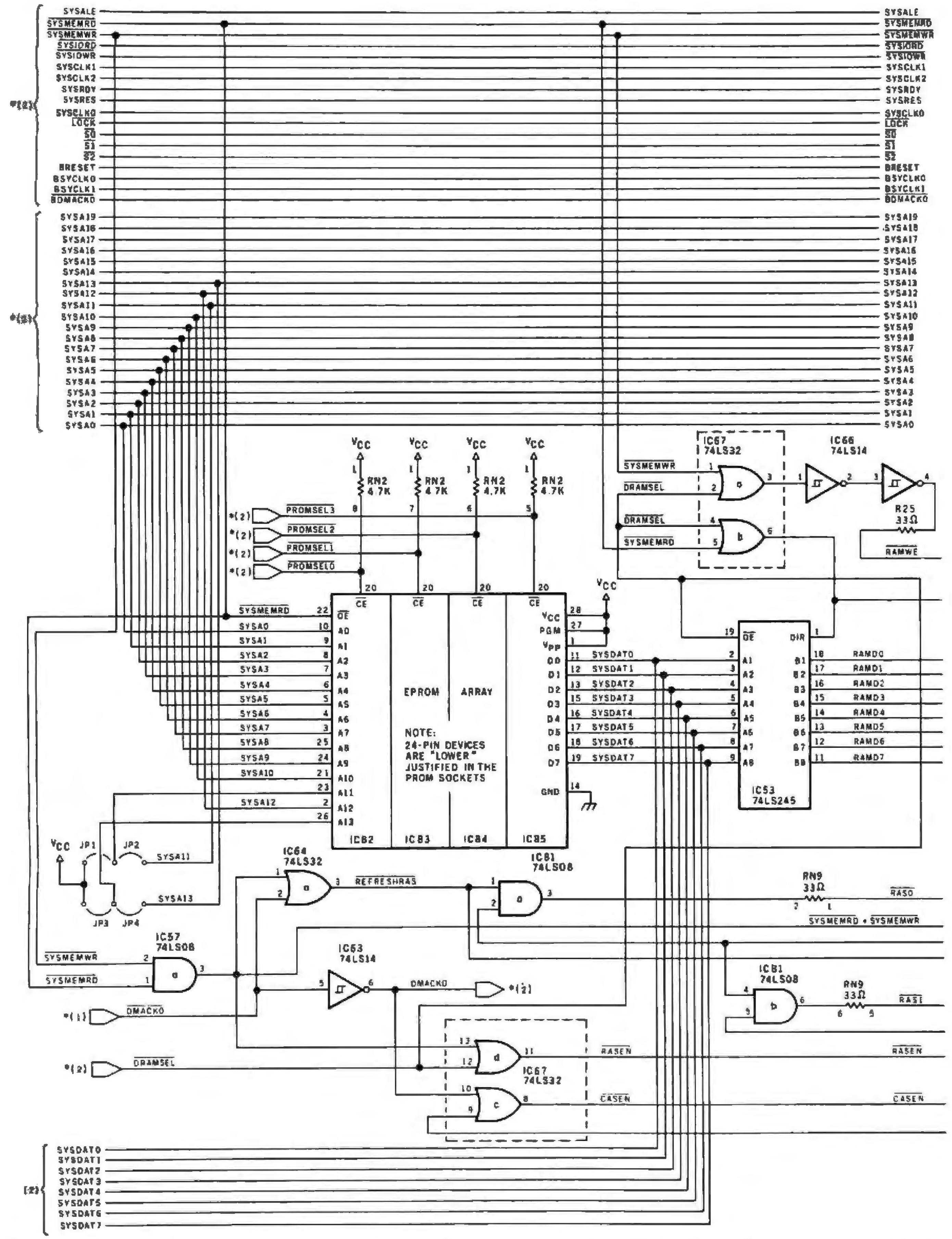
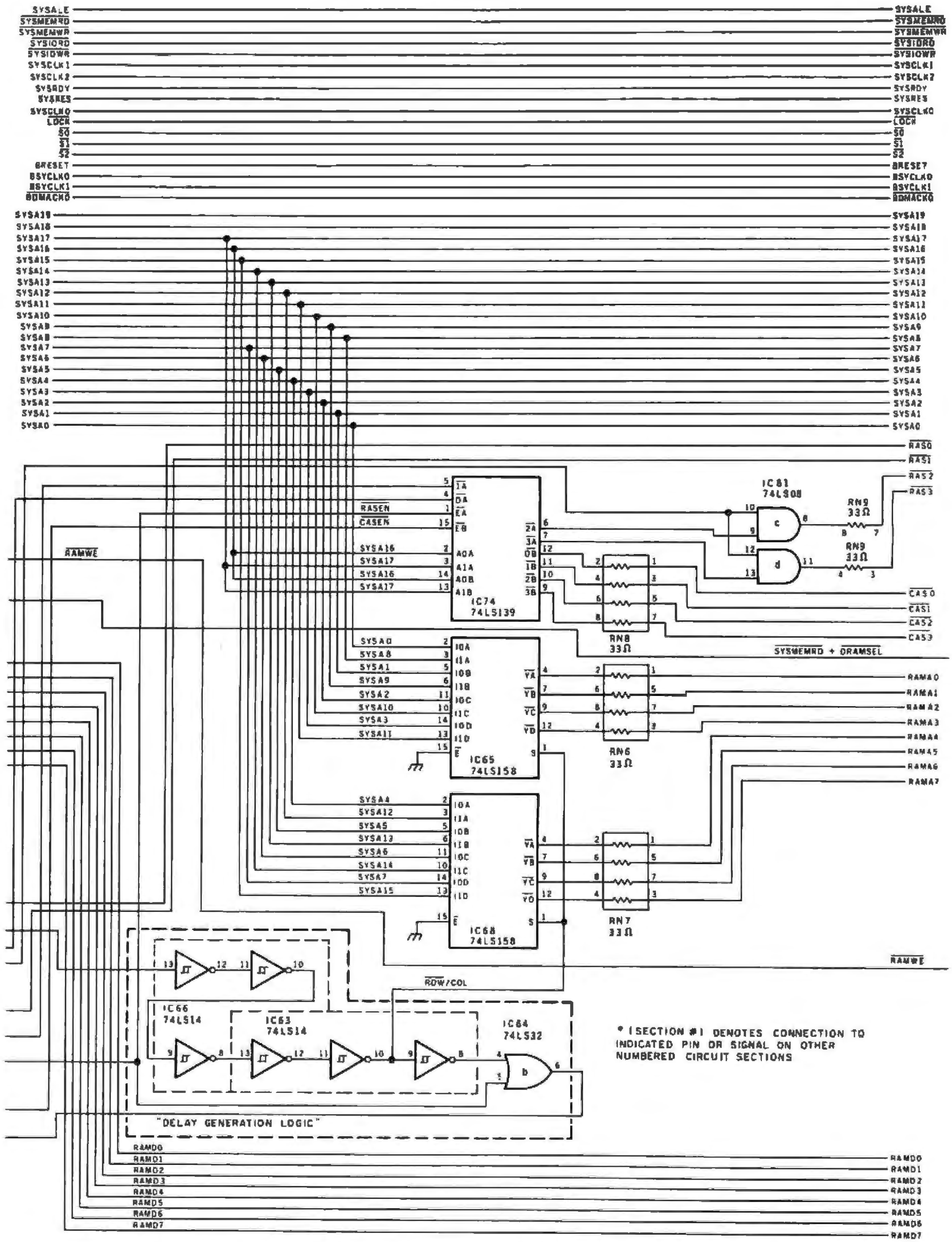


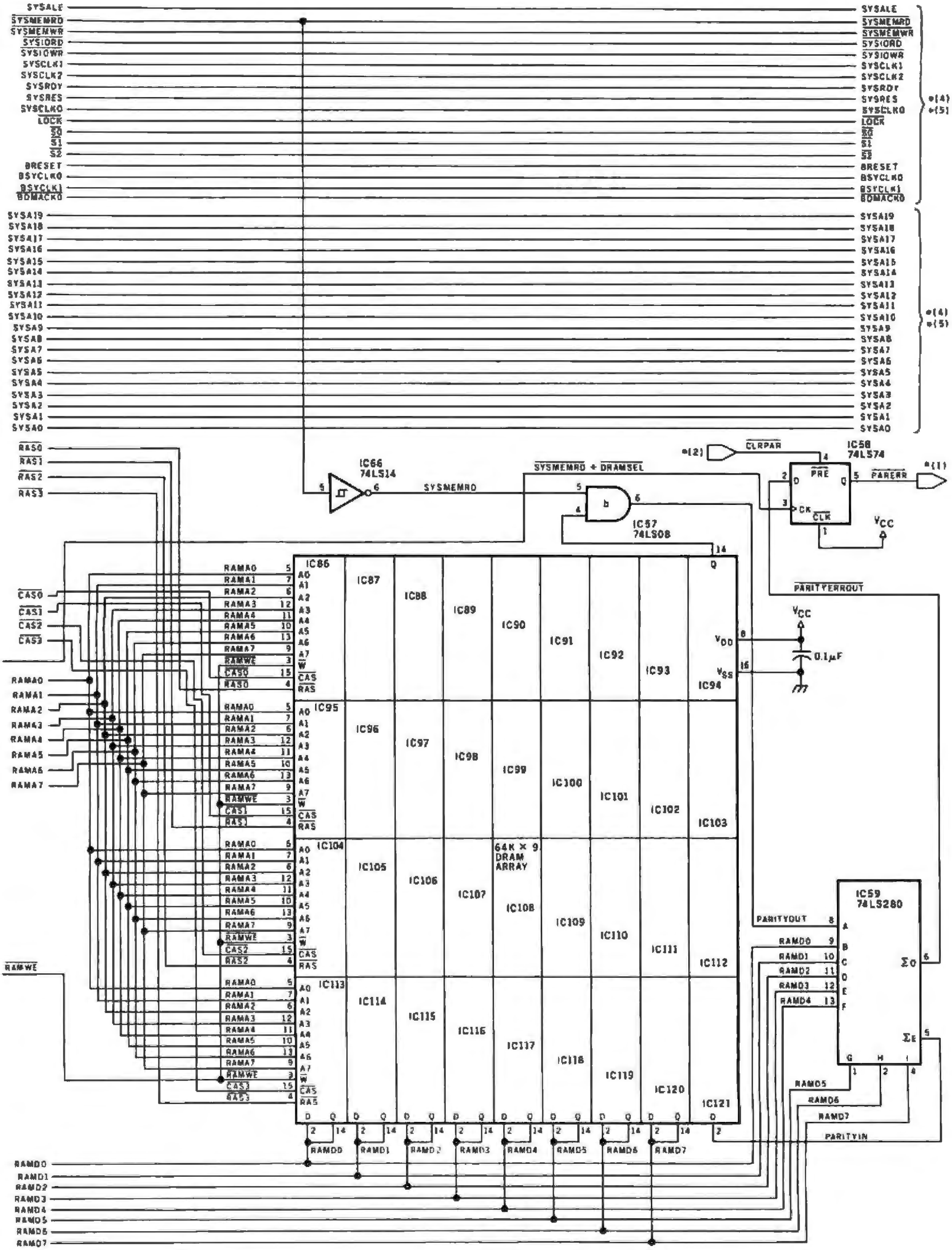
Figure 3: *Section 3 of the schematic diagram of the MPX-16 computer's main circuit board. The notation *(n) indicates that a given signal line connects to a component or another line shown in schematic section n.*

Connections shown on the edges of the dynamic-memory array on page 54 are of course made to each individual chip. Bypass



capacitors, not shown, should be installed adjacent to most integrated circuits between +5 V and ground. A table of all the MPX-16's integrated circuits appears as table 2 on pages 56 and 60, giving each device's number, type, section/figure location, and power connections. *(The diagram is continued on page 54.)*

Figure 3: *Continued from page 53.*



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VR1	LM7905	5 (3-2)	(voltage regulator)			3
IC1	74LS367	1 (1-3b), 2 (2-2)	16	8		
IC2	74LS123	5 (3-2)	16	8		
IC3	74LS157	5 (3-2)	16	8		
IC4	74LS124	5 (3-2)	16	8		
IC5	74LS175	5 (3-2)	16	8		
IC6	74LS173	5 (3-2)	16	8		
IC7	74LS393	5 (3-2)	14	7		
IC8	74LS10	5 (3-2)	14	7		
IC9	74LS74	5 (3-2)	14	7		
IC10	M1116-8M	5 (3-2)	14	7		
IC11	74LS153	5 (3-2)	16	8		
IC12	74LS14	5 (3-2)	14	7		
IC13	74LS74	5 (3-2)	14	7		
IC14	74LS74	5 (3-2)	14	7		
IC15	74LS74	5 (3-2)	14	7		
IC16	74LS74	5 (3-2)	14	7		
IC17	74LS175	5 (3-2)	16	8		
IC18	7406	5 (3-2)	14	7		
IC19	spare socket					
IC20	74LS04	1 (1-3ab), 5 (3-2)	14	7		
IC21	8272	5 (3-2)	40	20		
IC22	74LS240	5 (3-2)	20	10		
IC23	7407	5 (3-2)	14	7		
IC24	74LS14	2 (2-2)	14	7		
IC25	74LS74	2 (2-2)	14	7		
IC26	74LS139	5 (3-2)	16	8		
IC27	7407	5 (3-2)	14	7		
IC28	74LS32	2 (2-2), 4 (3-1)	14	7		
IC29	74LS08	2 (2-2)	14	7		
IC30	74LS10	1 (1-3a), 2 (2-2)	14	7		
IC31	74LS30	2 (2-2)	14	7		
IC32	74LS74	2 (2-2)	14	7		
IC33	74LS175	2 (2-2)	16	8		
IC34	8284A	1 (1-3a)	18	9		
IC35	8259A	1 (1-3a)	28	14		
IC36	8088	1 (1-3a)	40	1,20		
IC37	8087 (option)	1 (1-3a)	40	1,20		
IC38	74LS373	1 (1-3a)	20	10		
IC39	74LS373	1 (1-3b)	20	10		
IC40	74LS173	1 (1-3b)	16	8		
IC41	74LS173	1 (1-3b)	16	8		
IC42	74LS173	1 (1-3b)	16	8		
IC43	74LS245	1 (1-3a)	20	10		
IC44	74LS373	1 (1-3a)	20	10		
IC45	HM7603-5	2 (2-2)	16	8		
IC46	74LS245	1 (1-3a)	20	10		
IC47	8155H-2	4 (3-1)	40	20		

Table 2: *Integrated circuits in the MPX-16. Here are shown each device's number, type, section/figure location, and power connections.*

The location of each chip in the five-part schematic diagram is listed by schematic section; the characters in parentheses show in which article the section appeared and which figure the device appears in. Some integrated circuits containing multiple gates appear in more than one schematic section. *(The table is continued on page 60.)*

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IC48	8237A-5	1 (1-3b)	31	20		
IC49	74LS245	1 (1-3a)	20	10		
IC50	74LS373	1 (1-3a)	20	10		
IC51	8288	1 (1-3a)	20	10		
IC52	74LS154	2 (2-2)	24	12		
IC53	74LS245	3 (2-3)	20	10		
IC54	74LS243	1 (1-3b)	14	7		
IC55	74LS08	1 (1-3ab), 5 (3-2)	14	7		
IC56	74LS32	1 (1-3a)	14	7		
IC57	74LS08	3 (2-3)	14	7		
IC58	74LS74	3 (2-3), 4 (3-1)	14	7		
IC59	74LS280	3 (2-3)	14	7		
IC60	8255A-5	4 (3-1)	26	7		
IC61	8253-5	4 (3-1)	24	12		
IC62	8259A	1 (1-3a)	28	14		
IC63	74LS14	1 (1-3a), 3 (2-3)	14	7		
IC64	74LS32	2 (2-2), 3 (2-3)	14	7		
IC65	74LS158	3 (2-3)	16	8		
IC66	74LS14	3 (2-3)	14	7		
IC67	74LS32	3 (2-3)	14	7		
IC68	74LS158	3 (2-3)	16	8		
IC69	74LS393	4 (3-1)	14	7		
IC70	8251A	4 (3-1)	26	4		
IC71	8251A	4 (3-1)	26	4		
IC72	1489	4 (3-1)	14	7		
IC73	1489	4 (3-1)	14	7		
IC74	74LS139	3 (2-3)	16	8		
IC75	74LS00	1 (1-3b)	14	7		
IC76	74LS14	4 (3-1)	14	7		
IC77	7407	4 (3-1)	14	7		
IC78	7407	4 (3-1)	14	7		
IC79	1488	4 (3-1)		7	14	1
IC80	1488	4 (3-1)		7	14	1
IC81	74LS08	3 (2-3)	14	7		
IC82	EPROM	3 (2-3)	28,1*	14		
IC83	EPROM	3 (2-3)	28,1*	14		
IC84	EPROM	3 (2-3)	28,1*	14		
IC85	EPROM	3 (2-3)	28,1*	14		
IC86	4164	3 (2-3)	8	16		
↓	↓	↓	↓	↓		
IC121	4164	3 (2-3)	8	16		

* depends on type of EPROM used

Table 2: *Continued from page 56.*

and a floppy-disk bootstrap-loader routine.

RAM Configuration

The onboard user-programmable memory of the MPX-16 consists of one to four 64K-byte banks of nine type-4164 64K-bit dynamic RAM devices. Within the 8088 processor's 1-megabyte address space, the MPX-16 must have at least the lowest 64K-byte bank of RAM (bank 0) installed from hexadecimal addresses 00000 to 0FFFF so that interrupt-routine pointers can reside in the locations from hexadecimal 00000 to 003FF. The RAM chips are required to have an access time of no more than 200 ns and a cycle time of 335 ns. Single-bit parity generation and

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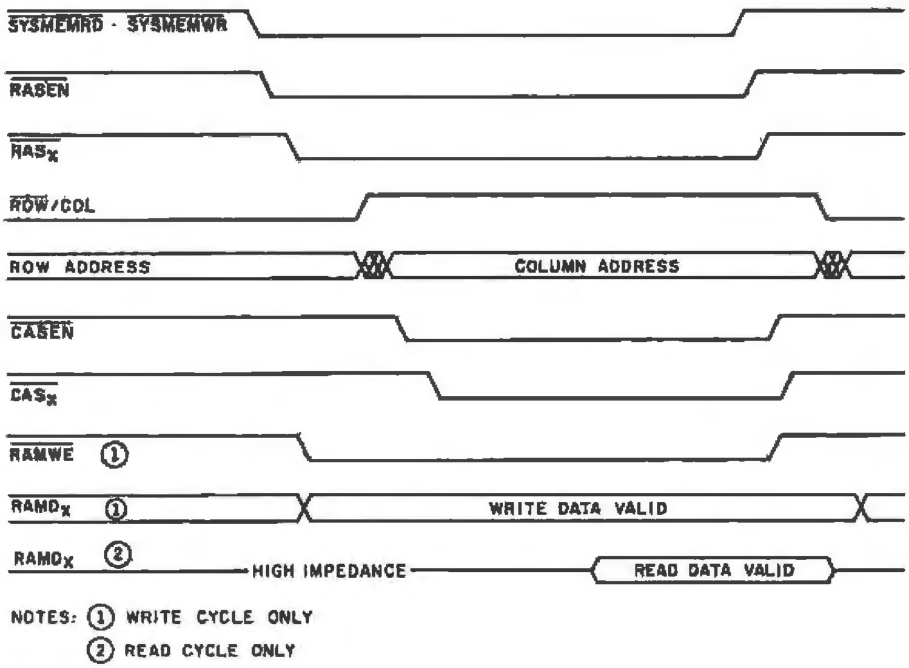

Figure 4: *Timing diagram for the memory operation of the MPX-16.*

error detection are provided for all of the 256K-byte onboard memory.

The RAM address-decoding logic is shown in section 2 of the schematic diagram (figure 2), and the read/write control logic, address multiplexers, RAM array organization, and parity-generation/error-detection logic are shown in section 3 (figure 3). The onboard RAM address space is selected when two conditions are met: the two high-order address bits SYSA18 and SYSA19 are both low and a memory-refresh cycle is not in progress (shown by DMACK0, the DMA-channel-0-acknowledge signal, being low). Because of this decoding scheme and the fact that the MPX-16 power-on self-test routine automatically clears memory and determines its size, the full 256K bytes of onboard RAM should be installed before you put in additional RAM in the I/O-expansion slots.

Dynamic Memory Refresh

Because dynamic RAM devices are used for the MPX-16's programmable memory, a memory-refresh circuit is necessary to prevent data stored in them from being lost. The 64K-bit dynamic RAMs require that all 256 rows be addressed every 4 ms (milliseconds) to maintain the integrity of the data (the columns need not be individually addressed); one row must be addressed for refreshing approximately every 15 μs (microseconds). To eliminate having a separate bus-arbitration circuit for this purpose, memory refresh is carried out by executing a DMA (direct memory access) read cycle in a "RAS-only" manner—that is, using only the row-address-strobe inputs of the memory chips. Because refresh is controlled by the DMA circuit, there can never be a conflict between the refresh operation and the processor's memory references.

The DMACK0 signal goes active-low to indicate to the rest of the system that a refresh cycle is in progress. This signal disables the RAM-decoding circuitry, prevents the generation of a CAS (column-address strobe) signal, and enables the REFRESHRAS input at IC64 pin 2 (in section 3, figure 3). When the system bus master, the 8237A DMA controller (IC48 in section 1, printed last month), drives the SYSMEMRD or SYSMEMWR (system memory write) line low, the output at IC 64 pin 3 also goes low. This causes the outputs of the four two-input gates (sections of IC81: positive AND gates used as negative ORs), whose other input comes from IC74, to go low. These outputs form the RAS inputs for each of the four RAM banks. (The 33-ohm series resistors in the RAS control lines are there to reduce ringing on the lines, which might latch a new row address during the middle of the memory cycle.) The DMA controller is set up by the system-initialization software to automatically increment the address counter after each refresh-memory cycle.

Memory Operation

A diagram of typical timing cycles for normal memory-read and write operations is shown in figure 4. For either type of memory cycle, the read/write-control logic is enabled when the DRAMSEL signal is low, indicating that two conditions have both been fulfilled: a valid address (lower than hexadecimal C0000) has been latched on the system bus and the DMACK0 signal (from IC63, pin 6) is low (indicating that a refresh cycle is not in progress).

A memory cycle is initiated when the output of an AND gate (IC57 pin 3 in section 3) goes low, indicating that either the SYSMEMRD or the SYSMEMWR control signal has been driven low by the system bus master. The RASEN (RAS enable) signal at IC67 pin 11, produced from the output of IC57 ORed with DRAMSEL, enables the 1-of-4 (2- to 4-line) decoder IC74 to select one of the four lines RAS0, RAS1, RAS2, or RAS3 (row-address-input enable for each of the four banks—which one is selected depends on the logic levels of the SYSA16 and SYSA17 address lines) and sets up the row address on the multiplexed memory-address lines RAMA0 through RAMA7. A chain of Schmitt-trigger inverter sections, IC63 and IC66, delays the active-low output from IC57 pin 3 by five gate-delay periods, holding the row-address condition until the type-4164 memory chips have had sufficient time to latch the address bits.

When the ROW/COL signal goes high (column addressing active), the

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multiplexers change the contents of RAMA0 through RAMA7 to the column address derived from the system-address-bus lines SYSA8 through SYSA15. The $\overline{\text{CASEN}}$ signal enables the B outputs of the 1-of-4 decoder IC74, which drives the CAS-control line for one of the memory banks.

The data-input and data-output lines of each RAM chip are tied together onto a common bidirectional memory-data line. The entire RAM array is isolated from the system data bus by bus transceiver IC53, which is enabled by the $\overline{\text{DRAMSEL}}$ signal during nonrefresh memory cycles, allowing data to pass between the RAM array and the system data bus.

The direction of data flow is controlled by the output of IC67 pin 6, a logical OR of $\overline{\text{DRAMSEL}}$ and $\overline{\text{SYSMEMRD}}$. During memory-read cycles, this signal is low, causing the data on the memory data bus to be transferred to the system data bus. During memory-write cycles, the direction signal is high and the data flow is from the system data bus to the memory data bus.

Parity Checking

Until the introduction of the IBM Personal Computer, memory with parity checking was rare in personal computers but had been used for years in larger computers. IBM did well to copy this feature of larger machines, since the constant decreases in memory prices have made it more and more cost-effective. The MPX-16 also incorporates parity memory for increased system reliability and user confidence. Parity generation and checking in the MPX-16 are provided by a 74LS280 parity generator (IC59) and a type-D flip-flop (IC58), shown in figure 3 on page 54.

During a memory-write cycle, the PARITYOUT signal presented to pin 8 of IC59 is low, because the output of IC57 (an AND gate) is disabled by the low state of the active-high SYSMEMRD signal. The parity bit computed by IC59 from the eight RAM data lines is written into the parity-bit memory chip (the ninth one of each bank) for the bank being addressed.

When a memory-read cycle occurs, the output of IC57 is enabled, and the parity bit that was previously written for each byte is routed to IC59 and used to check for an error in the parity value. When the rising edge of the signal from IC67 pin 6 ($\overline{\text{DRAMSEL}}$ OR $\overline{\text{SYSMEMRD}}$) is detected by the flip-flop IC58, it latches parity value.

When no parity error is present, the odd-parity output (Σ O) of the 74LS280 will be a logic high state. When an error does occur, the odd-parity output will be low. The $\overline{\text{PARERR}}$ signal from IC58 is sent to the NMI (nonmaskable interrupt) logic and will remain set until the next memory-read cycle for which no parity error occurs, or until the flip-flop is preset by a low state on the $\overline{\text{CLRPAR}}$ (clear parity) line, IC58

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pin 4. Software called through the interrupt vector then notifies the user of a memory error.

Interrupt Advantages

The versatility of any computer system is enhanced if its processing can be interrupted by outside events so that it doesn't have to continually keep track of what is going on in the outside world. The MPX-16 supports an interrupt system with 16 levels of interrupt priority, for a high degree of versatility in dealing with the external environment.

Perhaps the major advantage to using interrupts is the increase in throughput resulting from their use in handling the system I/O functions. Instead of the processor's spending a great deal of time checking to see if I/O devices are ready to transfer data or waiting for them to be ready, in an interrupt-driven system the processor can continue executing its application program, only suspending execution to attend to an I/O device when the device signals that it is actually ready for data transfer.

Although it can be tougher to debug, interrupt-driven software is generally more compact and efficient than that which must explicitly check I/O devices by polling or waiting. But we don't have space here to discuss the software aspects at length.

MPX-16 Interrupt Logic

The interrupt structure of an 8088-based system revolves around an interrupt-vector lookup table located low in system memory from location hexadecimal 00000 through 003FF. Each interrupt vector in the table consists of 4 bytes that point to the address of an interrupt-service routine. Up to 256 interrupt vectors, numbered from decimal 0 to 255, can be used to specify starting addresses of interrupt routines anywhere in the 8088's 1-megabyte address space. Each of the interrupt vectors is assigned an interrupt-type number that points to its location in the lookup table. The type number multiplied by 4 equals the offset of the vector from location 00000.

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Repeat function key	Yes	Yes	No
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Load/Save buffers on disk	Yes	No	No
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nonmaskable-interrupt (NMI) input at pin 17 of the 8088 microprocessor, IC36. This signal is an internally synchronized edge-triggered input which causes a predefined "type-2" interrupt that "vectors" (passes control) to the location identified by the eighth position in the table. Although the 8088's NMI input is not directly maskable by software, the MPX-16 contains extra hardware that can mask the interrupt signal before it gets to the 8088, given proper setup by the software. The NMI input is used to report system memory-parity errors and errors from the I/O-channel expansion slots.

The next 15 levels of interrupts are implemented by two Intel 8259A programmable interrupt controllers (PICs), IC35 and IC62 in section 1 of the schematic diagram, which was printed in last month's article. One of the programmable interrupt controllers, IC35, serves as the master and resides on the multiplexed local bus shared with the processors. The other, IC62, is a slave device to IC35 and resides on the system bus. The master/slave configuration is set up during the initialization process by software.

All of the peripheral devices residing on the system board, such as the serial and parallel I/O-port controllers, are supported by interrupt-request lines on the 8259A PICs. Interrupt requests from the PICs drive the INTR input of the 8088 (pin 18). This signal is a level-triggered input that can be internally masked by a software instruction. Interrupts requested by the INTR input do not have predefined vector types as does the nonmaskable interrupt. In the case of the 8259A PIC, a consecutive block of eight interrupt types, one for each of the eight interrupt-request input pins, is programmed into the device by the system software as part of the initialization process when the power is turned on.

Handling Interrupts

When an interrupt signal is received on the 8088's INTR pin, the processor enters an interrupt-acknowledge cycle that is used to determine the interrupt type. First the processor preserves what it was doing when interrupted: the state of the machine is saved by pushing the contents of the flag register, code-segment register, and instruction pointer onto the stack. In addition, the interrupt flag is cleared, disabling further interrupts from occurring until the processor is ready for them. (If nested interrupts are desired, the interrupt-service routine must re-enable the processor to receive interrupts, while ensuring that the most crucial tasks are not delayed until too late. The programming is not easy.)

In the next step, the 8288 bus controller (IC51) issues two interrupt-acknowledge pulses on the $\overline{INTA}$ line. The first pulse signals the 8259A PICs that the interrupt request is being granted. When the second $\overline{INTA}$ pulse is issued, the 8-bit code for the interrupt type is placed onto the data bus. The value of the interrupt type is multiplied by 4 (simply by being shifted left 2 places) to determine the

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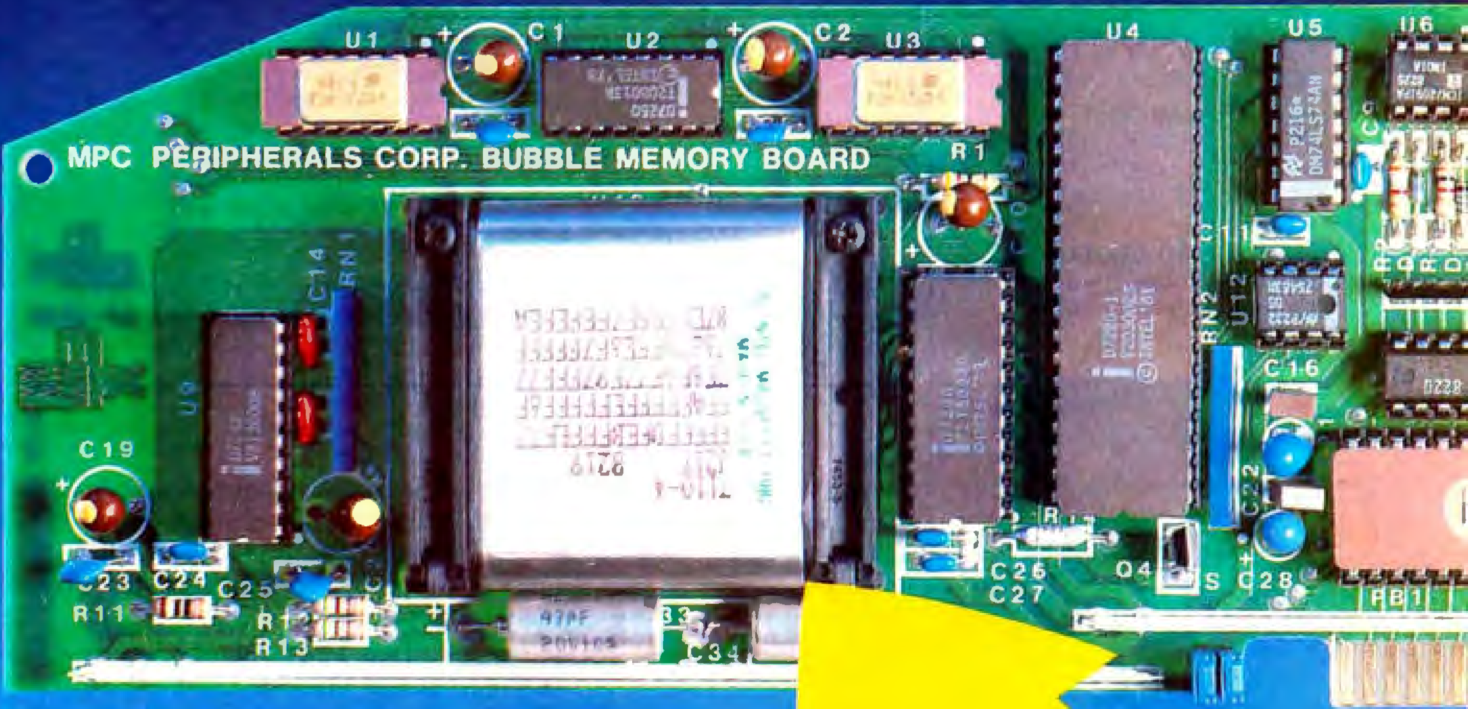

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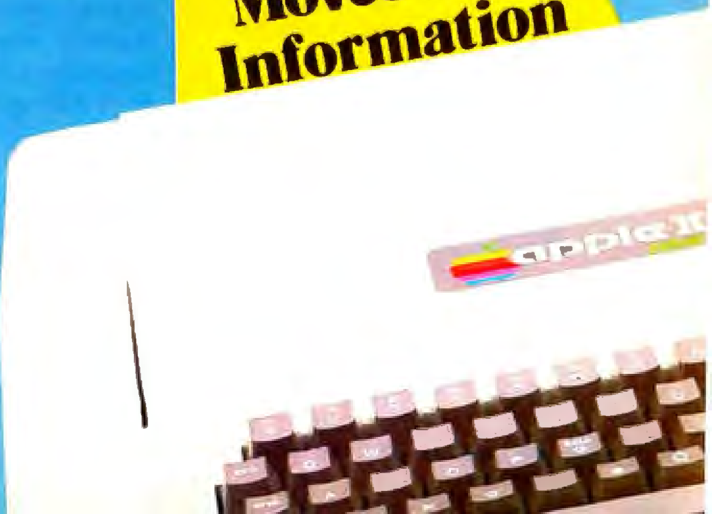

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1	master	TIMEINTR	real-time clock
2	slave	SIO0RXRDY	serial-channel-A receive ready
3	slave	SIO1RXRDY	serial-channel-B receive ready
4	slave	SIO0TXRDY	serial-channel-A transmit ready
5	slave	SIO1TXRDY	serial-channel-B transmit ready
6	slave	PRINTRDY	printer-port ready
7	slave	FDCINT	floppy-disk-controller interrupt
8	slave	NPXINT	numeric-processor-extension (8087) interrupt
9	slave	PIOINT	parallel-I/O-port interrupt
10	master	IRQST2	I/O-channel interrupt
11	master	IRQST3	I/O-channel interrupt
12	master	IRQST4	I/O-channel interrupt
13	master	IRQST5	I/O-channel interrupt
14	master	IRQST6	I/O-channel interrupt
15	master	IRQST7	I/O-channel interrupt

Table 3: *Interrupt signals in the MPX-16, listed in order of priority. Priority-0 errors go through the 8088's NMI input, while the rest go through either the master or the slave 8259A interrupt controller.*

address of the interrupt vector. Program control is then transferred to the address contained in the 4 bytes of the interrupt vector. Note that the first 2 bytes are used as the new instruction pointer (lower 16 bits of the address) and the second 2 bytes are used to form the new code-segment register (upper 16 bits). When the interrupt-service routine has completed execution, control is returned to the main program via an IRET instruction, which pops the original flag and address information off the stack into the active registers. The main program then resumes execution where it left off, with the interrupts reenabled.

Interrupt Priorities

The organization of the system-board interrupt-priority scheme is shown in table 3. The highest priority hardware interrupt, as we've seen, is the NMI, which is caused by memory-parity or I/O-channel errors. The highest priority maskable interrupt is from the IR0 input of the master 8259A PIC, which is generated by the real-time clock. The next eight interrupts in priority come from peripheral devices attached to the slave 8259A PIC, which is in turn attached to the IR1 input of the master 8259A. The last six interrupts come from the I/O-expansion-channel connectors. These interrupts drive the IR2 through IR7 inputs of the master 8259A.

Two other points concerning the 8259A PICs should be noted. Although a priority has been assigned to each interrupt-request input of the 8259A PICs, these can be changed by the system software. In addition, the 8259A PICs can even be used to implement a polled I/O system. (These devices provide considerable flexibility for handling I/O servicing at a relatively low hardware cost.) And finally, all of the interrupt-service routines in the MPX-16 system can be be invoked via a software-interrupt instruction that specifies the interrupt type. This can be useful in starting an I/O device and in debugging the interrupt routines.

I/O-Expansion Channels

The MPX-16 system board supports an I/O-expansion channel that represents an extension of the system bus. Peripheral devices are connected through several 62-pin card-edge connectors like those used by peripherals designed for the IBM Personal Computer. The MPX-16 computer system

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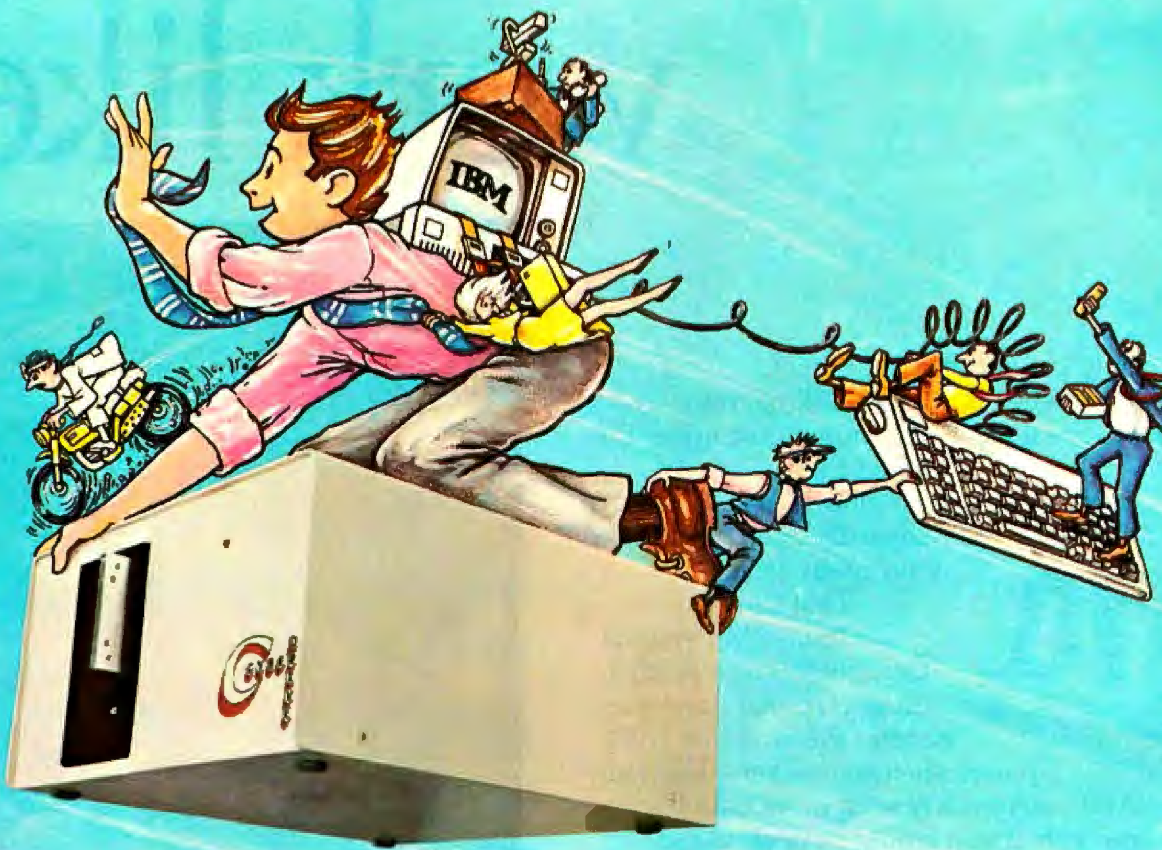

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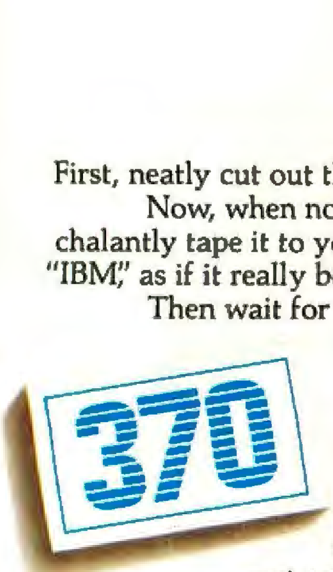

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Pin	Signal Name		Pin	Signal Name	
A01	$\overline{\text{I/OCHNLERR}}$		B01	GND	
A02	SYSDAT7		B02	BRESET	
A03	SYSDAT6		B03	V_{cc}	
A04	SYSDAT5		B04	IRQST2	
A05	SYSDAT4		B05	−5 V DC	
A06	SYSDAT3	system	B06	DMARQST2	
A07	SYSDAT2	data	B07	−12 V DC	
A08	SYSDAT1	bus	B08	$\overline{\text{IOCHLDRQST}}$	
A09	SYSDAT0		B09	+12 V DC	
A10	IOCHNLRDY/$\overline{\text{WAIT}}$		B10	GND	
A11	$\overline{\text{SYSAEN}}$		B11	$\overline{\text{SYSMEMWR}}$	
A12	SYSA19		B12	$\overline{\text{SYSMEMRD}}$	system-status
A13	SYSA18		B13	$\overline{\text{SYSIOWR}}$	control
A14	SYSA17		B14	$\overline{\text{SYSIORD}}$	
A15	SYSA16		B15	$\overline{\text{DMACK3}}$	
A16	SYSA15		B16	DMARQST3	
A17	SYSA14		B17	$\overline{\text{DMACK1}}$	DMA control
A18	SYSA13		B18	DMARQST1	
A19	SYSA12	system	B19	$\overline{\text{BDMACK0}}$	
A20	SYSA11	address	B20	BSYSCLK0	
A21	SYSA10	bus	B21	IRQST7	
A22	SYSA9		B22	IRQST6	
A23	SYSA8		B23	IRQST5	
A24	SYSA7		B24	IRQST4	
A25	SYSA6		B25	IRQST3	
A26	SYSA5		B26	$\overline{\text{DMACK2}}$	
A27	SYSA4		B27	TCNT	
A28	SYSA3		B28	SYSALE	
A29	SYSA2		B29	V_{cc}	
A30	SYSA1		B30	BSYSCLK1	
A31	SYSA0		B31	GND	

Table 4: *Pin/signal relationships in the I/O-expansion connectors. These assignments are compatible with those in the expansion slots of the IBM Personal Computer. Many of the system control signals are buffered before being fed to these connectors.*

can potentially contain 1 megabyte of memory and still have spare expansion slots for special-purpose I/O modules, which might include videotex decoders, process-control or data-acquisition interfaces, or local-network interfaces.

The standard MPX-16 system board has five expansion connectors installed in alternating positions, effectively located on 1-inch center-to-center spacings. An additional four connectors can be installed between them, if needed; the resulting nine connectors will be on half-inch center-to-center spacing. Spacing on 1-inch centers is usually required for disk controllers and I/O boards. Memory boards, on the other hand, will generally fit in half-inch spacing.

The I/O-expansion channel has been designed to be pin-for-pin hardware-compatible with the IBM Personal Computer (model 5150). The IBM PC bus was chosen, as I explained last month, to take advantage of the expected proliferation of IBM-PC-compatible peripheral-adapter modules and expansion memories. However, because the MPX-16 system board already supports most of the peripheral I/O functions that would ordinarily be added to the IBM computer, the I/O-expansion slots are available for new uses.

Table 4 lists the signal connections to the pins of the I/O-expansion connectors. All signal lines in the I/O channel are compatible with LS-TTL (low-power Schottky-diode-clamped transistor-transistor logic) signals. Brief descriptions of each group of lines follow.

Oscillator Clock (BSYSCLK1): This is a buffered version of the main system timing clock. It runs at a frequency of either 14.31818 MHz or 15.0 MHz, depending on which crystal is installed. It has a 50 percent duty cycle.

System Clock (BSYSCLK0): This is a buffered version of the system processor clock. It runs at a frequency that is one-third that of SYSCLK1. It has a 33 percent duty cycle (high for one-third of the cycle, low for two-thirds).

System Reset (BRESET): This is a buffered version of SYSRES, which is active on power-up. It is synchronized to the falling edge of the SYSCLK0 waveform and is used for initialization of all system hardware components.

Address Latch Enable (SYSALE): This signal is used to indicate the presence of a valid address on the system bus. The falling edge of SYSALE is normally used to latch the address. This signal is generated by the 8288 bus controller during bus cycles initiated by one of the local-bus masters. The system-address enable signal, $\overline{\text{SYSAEN}}$, should be used to enable this signal in the I/O channel.

System Address Enable ($\overline{\text{SYSAEN}}$): This line, when active-low, indicates that one of the system coprocessors (either the 8088 or the 8087) has control of the system bus. When $\overline{\text{SYSAEN}}$ is high, the 8237A-5 DMA controller has control of the system bus and drives the system address, system memory, and I/O-read/write lines.

I/O Channel Ready (IOCHNLRDY/$\overline{\text{WAIT}}$): This line is normally high. When a slow I/O device or expansion memory board decodes a valid address, this line should be driven low, causing the flip-flops IC25 and IC33 to insert wait states into the bus cycle until the slow device has completed its cycle. (To avoid conflict with memory refresh, this line should never be held low for more than 1 or 2 μs.)

System Memory Read ($\overline{\text{SYSMEMRD}}$): This control line is used to gate the memory-device data buffers onto the system data bus during memory-read cycles initiated by either the processor or DMA controller.

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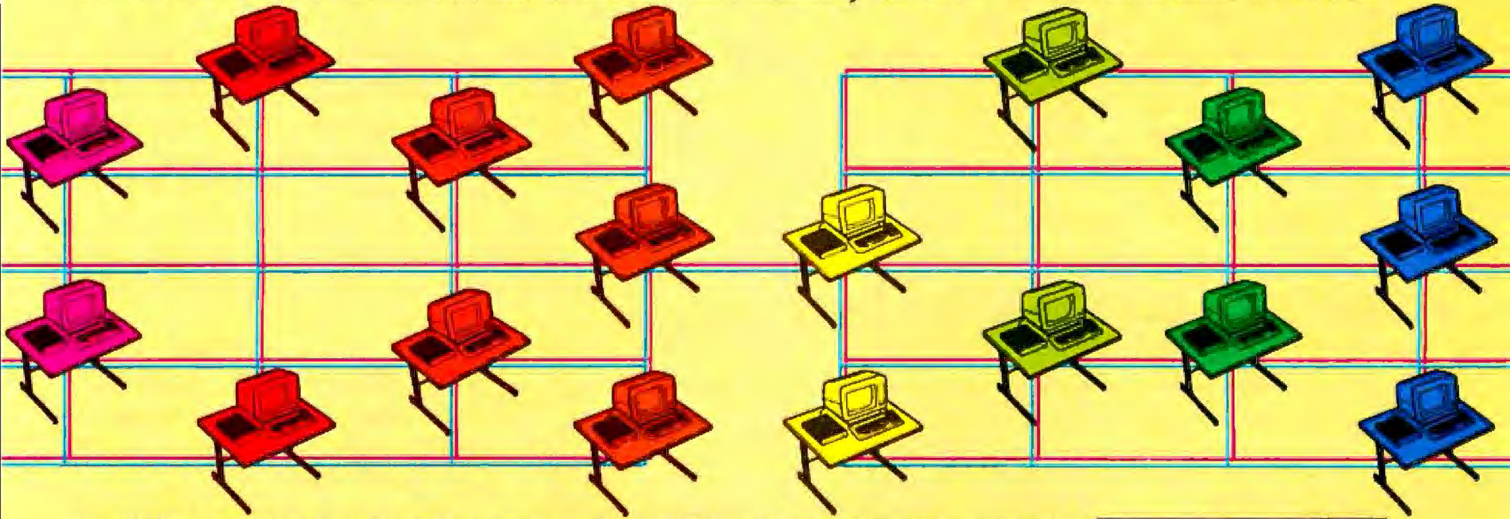

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System Board Peripheral Device	Base Address (hexadecimal)
8237A-5 DMA controller	000
8272 floppy-disk controller	020
DMA page registers 0 and 1	040
DMA page register 2	060
DMA page register 3	080
floppy-disk-drive motor-on register	0A0
parity-error flip-flop clear	0C0
spare (reserved)	0E0
spare (reserved)	100
8259A interrupt controller—slave	120
8259A interrupt controller—master	140
console serial I/O port	160
auxiliary serial I/O port	180
8255A-5 parallel I/O	1A0
8155H-2 parallel I/O and timer	1C0
8253-5 counter-timers	1E0

Table 5: *Base addresses of the I/O-device-control registers.*

System Memory Write (SYSMEMWR): This control is used to store the data present on the system data bus into the selected memory location during memory-write cycles initiated by either the processor or DMA controller.

System I/O Read (SYSIORD): This control line is used to gate the selected I/O device to accept the data present on the system data bus during I/O-read cycles initiated by either the processor or the DMA controller.

System I/O Write (SYSIOWR): This control line tells the selected I/O device to accept the data present on the system data bus. It is active in I/O-write cycles initiated by either the processor or DMA controller.

I/O-Channel (Parity) Error (I/OCHNLERR): This signal, when enabled by the system software, will cause an interrupt via the NMI input of the 8088 processor. It is normally used to alert the processor to a parity error in memory devices residing in the I/O channel.

System Address Bus (SYSA0 through SYSA19): These lines form a 20-bit system address bus, which can address up to 1 megabyte of memory. SYSA0 represents the least significant address bit (LSB), and SYSA19 represents the most significant address bit (MSB). These lines can be driven either from the processor or from the DMA controller and are considered to be active-high.

The MPX-16 computer system can potentially contain 1 megabyte of memory and still have spare expansion slots.

System Data Bus (SYSDAT0 through SYSDAT7): These lines form the 8-bit system data bus and can be driven by the processor, memory devices, or I/O devices. They are bidirectional and are considered to be active-high. SYSDAT0 is the LSB, SYSDAT7 the MSB.

I/O Channel Interrupt Requests (IRQST2 through IRQST7): These lines are prioritized interrupt-request lines, with IRQST2 having the highest priority and IRQST7 the lowest priority. The lines are edge-triggered and active-high; however, the request signal must be maintained in the high state until the interrupt request has been acknowledged. The interrupt-service routine written for each particular device in use must usually do this.

DMA Requests (DMARQST1 through DMARQST3): These lines are prioritized DMA-request lines, with DMARQST1 having the highest priority and DMARQST3 the lowest priority. The lines are active-high and must be held high until the corresponding DMACK*x* line goes active-low. DMARQST2 is used by the system-board floppy-disk controller and is included in the I/O channel only for compatibility with the IBM Personal Computer. These lines are typically used by peripheral devices such as disk controllers to request DMA service.

DMA Acknowledge Lines (DMACK1 through DMACK3): These lines are used to acknowledge DMA requests generated by the DMARQST*x* lines.

DMA Acknowledge 0 (BDMACK0): This is a buffered DMACK0 line and signifies that a DMA-controlled dynamic-memory-refresh cycle is in progress.

DMA Terminal Count (TCNT): This signal is active-high when any of the four DMA channels reaches a terminal count. The corresponding DMA-acknowledge line should be used in conjunction with the TCNT signal.

Peripheral Power: +5 volts (V) DC ±5%, logic ground, +12 V DC ±5%, −12 V DC ±10%, and −5 V DC ±10% power connections are all provided in each expansion connector.

I/O-Decoder Logic

The MPX-16 computer system contains a variety of onboard, high-performance peripheral devices: direct support for all of the major I/O functions needed to form a complete microcomputer system, as listed in table 1 on page 44.

All of the system-board I/O peripherals are addressed or selected by the 4-to-16 decoder IC52 (shown in

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*Universal Operating System is a trademark of SofTech Microsystems Inc., UCSD p-System is a trademark of the Regents of the University of California section 2, figure 2 on page 48). This decoding logic maintains addressing compatibility with IBM Personal Computer peripherals by using the system-address-bus line SYSA9 to determine whether the peripheral device being selected is on the main circuit board or off it. A low state on the SYSA9 line enables one of the strobe inputs of the decoder; the other strobed input is enabled if one of the local bus masters has control of the system bus, indicated by a low state on $\overline{88AEN}$. When an I/O-device interface chip is selected by this decoded address and either the $\overline{SYSIORD}$ or $\overline{SYSIOWR}$ line is active, an I/O bus cycle is performed. During DMA cycles the I/O decoder is disabled.

The base address for each of the system-board I/O devices is shown in table 5 on page 76. The total number of address-space locations used by each peripheral device varies; this will be discussed in more detail next month in part 3.

Next Month:

If you've followed everything in this second installment on the Circuit Cellar MPX-16 computer system, you're doing well. In the January article I'll fill you in on the serial and parallel I/O ports, counters, floppy-disk controller, and operating-system BIOS, among other topics.■

Acknowledgments

Thanks to Jim Norris, George Martin, and Linda Spencer of Owl Electronic Laboratories for their contributions to this project.

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Thanks to Bill Morello and his staff at Techart Associates for their careful work in drawing the schematic diagrams.

Editor's Note: *Steve often refers to previous Circuit Cellar articles as reference material for each month's current article. Most of these past articles are available in reprint books from BYTE Books, McGraw-Hill Book Company, POB 400, Hightstown, NJ 08520.*

Ciarcia's Circuit Cellar, Volume I, *covers articles that appeared in BYTE from September 1977 through November 1978.* Ciarcia's Circuit Cellar, Volume II, *contains articles from December 1978 through June 1980.* Ciarcia's Circuit Cellar, Volume III, *contains the articles that were published from July 1980 through December 1981.*

To receive a complete list of Ciarcia's Circuit Cellar project kits available from the Micromint, circle 100 on the reader service inquiry card at the back of the magazine.

References

1. Cantrell, Thomas. "An 8088 Processor for the S-100 Bus." Part 1, September 1980 BYTE, page 46. Part 2, October 1980 BYTE, page 62. Part 3, November 1980 BYTE, page 340.
2. Ciarcia, Steve. "Build the Circuit Cellar MPX-16 Computer System, Part 1." November 1982 BYTE, page 78.
3. Ciarcia, Steve. "Ease into 16-Bit Computing." Part 1, March 1980 BYTE, page 17. Part 2, April 1980 BYTE, page 40. Reprinted in *Ciarcia's Circuit Cellar, Volume II*. Peterborough, NH: BYTE Books, 1981, page 171.
4. Ciarcia, Steve. "The Intel 8086." November 1979 BYTE, page 14. Reprinted in *Ciarcia's Circuit Cellar, Volume II*. Peterborough, NH: BYTE Books, 1981, page 120.
5. *Component Data Catalog*. Santa Clara, CA: Intel Corporation, 1981.
6. *IAPX Book*. Santa Clara, CA: Intel Corporation, 1981.
7. *IAPX 86,88 User's Manual*. Santa Clara, CA: Intel Corporation, 1981.
8. Morgan, Christopher L. and Mitchell Waite. *8086/8088 16-bit Microprocessor Primer*. Peterborough, NH: BYTE Books, 1982.

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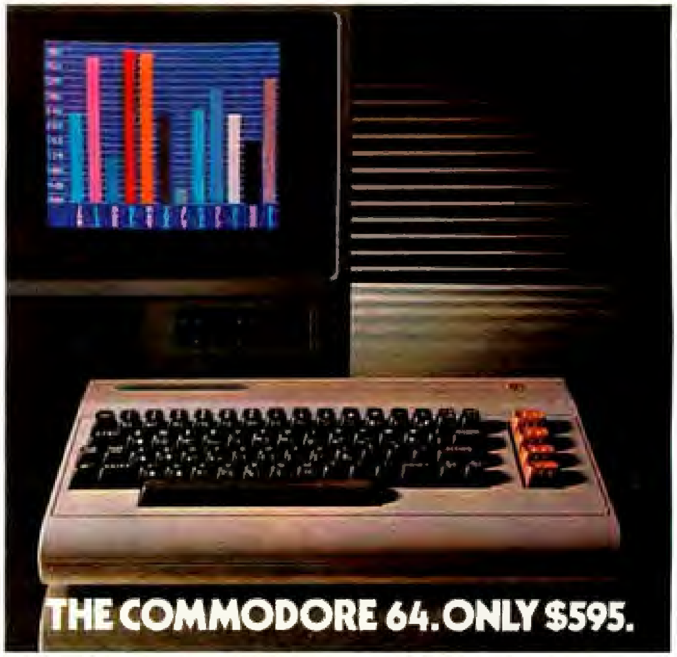

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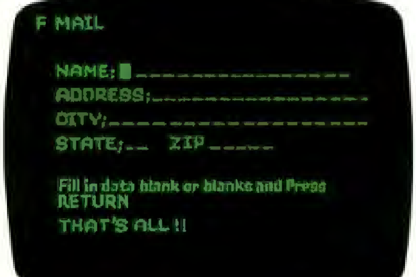

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GAME PLAN 1982

The Coinless Arcade—Rediscovered

Pamela Clark, Technical Editor
and Gregg Williams, Senior Editor

A faceless stranger gave you directions the first time you came to The Coinless Arcade. After a glorious night of gaming, you came away retaining a pocket full of quarters and not a few new friends. Everyone met together the next night, ready for more gaming, but you could not find the arcade—anywhere! Night dampness chilled your bones as the search continued, and, for a while, you combed the town every night: still, no arcade. You kept in touch with your new friends, if only to prove that you hadn't imagined it all.

A year has passed. You walk out the alley exit of a theater and, surprised, hear faint arcade noises. You follow them through the alleyways, only distantly aware that you never cross a main street. And there it is: the neon facade declaring "The Coinless Arcade" with festive colors, the air alive with electronic sounds. Once inside, you see a familiar face, then another. Soon everyone has arrived. Laughing, you run to the nearest empty machine, reach for some quarters—and realize there's no need. You wish your friends good luck and press the flashing red button labeled START. The fun begins again.

Another computer gaming year has passed. Game designers continue to squeeze more than we've ever seen before from a given machine, and we applaud their efforts. In fact, some of the most exciting programming this year has been done for the cartridge game systems. That's why we're including two pages of games for the Atari (or Sears) Video Computer System and the Mattel Intellivision Game System.

Luckily for you players, The Coinless Arcade exists in your imagination and in your microcomputer. We've brought you these games from our Coinless Arcade. Put them in your microcomputer (or cartridge game system) and they're yours forever.

Playing Cannonball Blitz can provide entertainment for you and chuckling enjoyment for a crowd of onlookers. The object of the game is to get the rebel soldier up Nutcracker Hill and destroy the castle. The poor soldier, however, must contend with a barrage of cannonballs and constant trips and obstacles. It becomes hard not to laugh as you try to outrun or jump over cannonballs, or just plain get out of the way. **Cannonball Blitz** by Olaf Lubeck for the Apple II or II Plus, $34.95 (disk), from Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614.

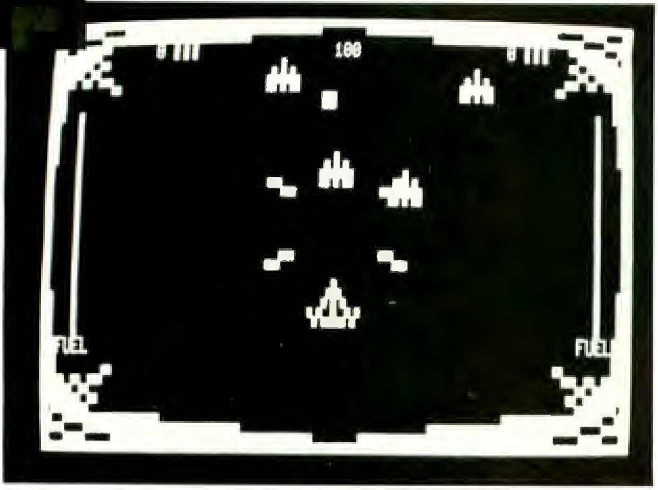
Want a challenge with a bizarre twist? First, you take a job with the ASPCA and are put in charge of controlling the lemming population. All you have to do is lock them in a room so they won't breed. Sounds easy until you try it. There are lemmings running everywhere, breeding faster and faster and getting run over by trucks. If you're not real careful, a mass suicide occurs as they march to the sea. This is one of the strangest topics for an arcade game that we have seen. **Lemmings** by Jerry Jewell, Terry Bradley, and Dan Thompson for the Apple II or II Plus, $29.95 (disk), from Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

The city is under attack, and it's up to you to rescue the only remaining inhabitants. Pilot your Needlefighter and swoop in, picking up each of the 18 survivors and transport them through a hazard-filled sky to temporary safety. Once you have saved all of the people, you must risk your life and theirs once again, as you move them to permanent quarters. It isn't easy—hero stuff never is. **Protector** by Mike Potter for the Atari 400/800, $34.95 (cassette), from Synapse Software, 820 Coventry Rd., Kensington, CA 94707. (Also available on disk.)

If you love playing two-person strategy games but can't always find a willing opponent, Renaissance may be the answer. This is a computer version of the board game Othello (trademark of Gabriel Industries) that is designed to let you challenge the machine, although it may be used with two human players. You can choose from eight levels, set up special games, and save and recall games from tape. **Renaissance** by Louis X. Savain for the VIC-20, $49.95 (cartridge), from United Microware Industries Inc., 3503-C Temple Ave., Pomona, CA 91768.

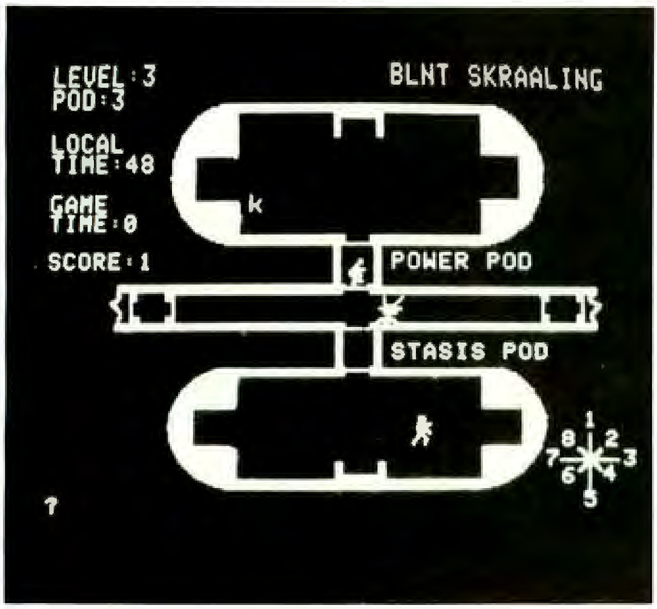
As the commander of a nuclear submarine, you guide your vessel through a subterranean obstacle course, avoiding mountains, twisting through passages, and staying away from the webs of explosive mines rising from the sea floor. And if that wasn't enough to make a hazardous trip, watch out for the enemy attack stations, falling stalactites and mines, and, of course, lasers. The scrolling seabottom gives you the equivalent of 24 screens laid end-to-end, and the game also offers a two-player option. **Sea Dragon** by Wayne Westmoreland and Terry Gilman for the TRS-80 Models I and III, $24.95 (disk), from Adventure International, POB 3435, Longwood, FL 32750. (Also available for the Apple and the Atari 400/800.)

Amid the sounds of explosions and the sight of burning buildings, you must manuever your helicopter and rescue the 64 kidnapped delegates to the United Nations Conference on Peace and Child Rearing. Watch out for jet fighters and air mines and try to get as many of the hysterical hostages back to safety as you can. It's great fun manipulating the helicopter with a joystick acting as the throttle; and the little folks on the ground really wave to you! **Choplifter!** by Dan Gorlin for the Apple II or II Plus, $34.95 (disk), from Broderbund Software, 1938 Fourth St., San Rafael, CA 94901. (Requires joystick with two buttons; also available for the Atari 400/800.)



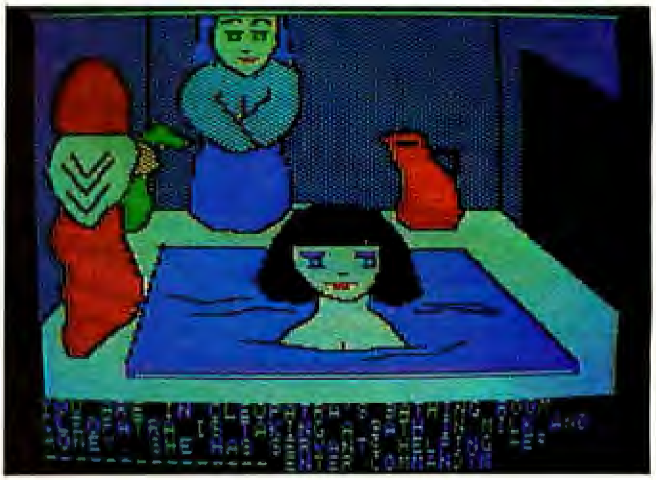
Escorting and defending cruisers through front-line battle zones becomes a hazardous task when Cretonian forces try to destroy your protective field. Your fuel supply is limited, so your mission must be completed rapidly, while you fight off three waves of Cretonian ram craft, energy torpedoes, and Kilr mines. **Stellar Escort** by Jeff Zinn for the TRS-80 Models I and III, $19.95 (disk), from Big Five Software, POB 9078-185, Van Nuys, CA 91409. (Also available on cassette.)

If you suffer from nightmares of being caught in a snake-filled maze, don't play Serpentine before bedtime. Not only must you try to keep your nice blue serpents alive, but you must also make their lives long enough to lay eggs and raise new serpents. You can't merely avoid predator serpents: you must eat them in order to grow. Big serpents always swallow little serpents, so growing up fast can be a real advantage. **Serpentine** by David Snider for the Apple II or II Plus, $34.95 (disk), from Broderbund Software, 1938 Fourth St., San Rafael, CA 94901.



Use your problem-solving skills in a science-fiction scenario that makes you race against the clock in a simulation of an emergency situation aboard a biological survey spaceship. After a mid-space accident, your ship begins to malfunction. The crew must locate the main computer console, access the plans to the multipod vessel, and repair the damage before time runs out. During the search, you must look out for dangerous biological specimens and attacking robots. While the game can be played as solitaire, it can also incorporate up to seven players in a cooperative effort to save the ship (and your lives!). **Wreck of the B. S. M. Pandora** by Stephen Abrams for the Apple II or II Plus, $50 (disk), from Apple Computer Inc., 20525 Mariani Dr., Cupertino, CA 95014.

If you always had a secret desire to conquer barbarian hordes, Legionnaire is the game for you. High-resolution graphics, sound, and real-time combat combine to create a live-action battlefield. You command the Roman Legions of Julius Caesar, while the computer controls the Gaulish barbarian hordes. With up to ten legions to command, you select any two of 16 barbarian tribes to fight. The game provides you with a topological map, which must be mastered to defeat the most vicious of the barbarians. Don't let the cover art deter you (the worst we've seen this year!)—the game is great entertainment, even for those who haven't been war-game fans before. **Legionnaire** by Chris Crawford for the Atari 400/800, $35 (cassette), from Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214. (Also available on disk.)



The Guinness Book of World Records must be getting ready for a computer games category, if Time Zone is any indication of things to come. Without a doubt, it is the longest adventure to date with more than 1400 color graphic pictures and six floppy disks packed (front and back!) with this challenging game. Not only do you become a time traveler, but you must be able to solve puzzles built into the game. This ultimate adventure is already a legend in its own time. **Time Zone** by Ken and Roberta Williams for the Apple II or II Plus, $99.95 (disk), from Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614.

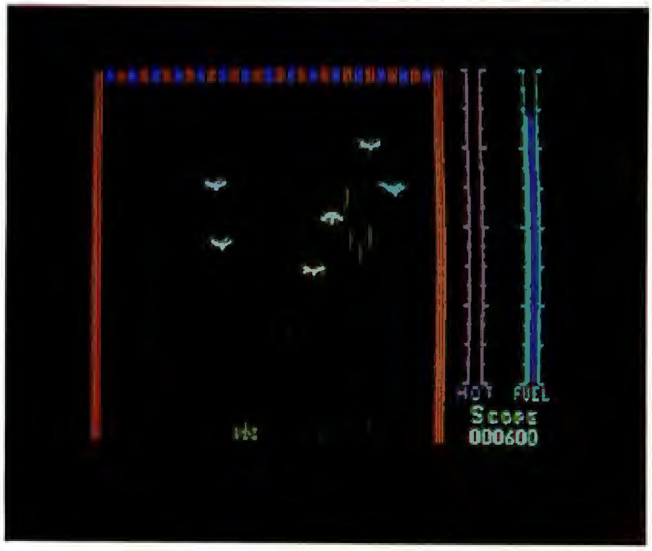
The award (if we had one) for the most arcade-like game of the year would go to Bandits. In this spectacular contest, every new wave of aliens has a different strategy and a different weapon to challenge you. And, of course, the more you manage to blast them off your screen, the faster they attack. Good graphics and great action make this game a must for arcade fans. **Bandits** by Tony and Benny Ngo for the Apple II or II Plus, $34.95 (disk), from Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827. (Also available for the Atari.)

If you have always been a fan of the old Saturday matinee monster movies, here is a game that allows you to create your own interactive version. Choose your favorite locale to be devoured: Washington, Tokyo, New York, or San Francisco. Next, from a choice of six killer creatures, select the monster you would most like to be when you grow up. With more than 100 possible scenarios, you can wreak havoc to your heart's content. Watch out for the National Guard and the mad scientist, though, because they are determined to eliminate your monster at any cost. **Crush, Crumble, and Chomp!** by Jon Freeman, J. W. Connelley, Michael Farren, and Toni Thompson for the Apple II or II Plus, $29.95 (disk), from Epyx/Automated Simulations Inc., 1043 Kiel Court, Sunnyvale, CA 94086. (Also available on disk for the TRS-80 Models I and III and the Atari 400/800 and on cassette for the VIC-20.)

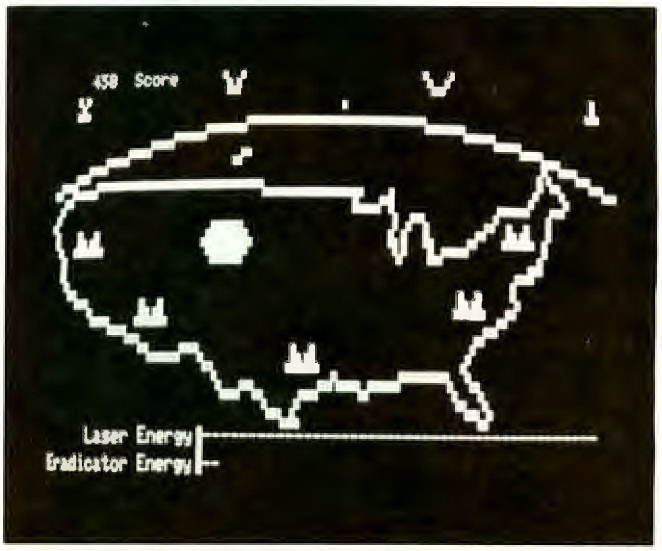
For an added thrill, try using two joysticks with Cyborg. Move your human/machine hybrid with one joystick and fire with the other as you battle robots, killer hyper-spheres, and giant spiders in a series of arenas. Each arena or wave may contain all of one type of opponent or a mixture of all, with each new arena harder to get through than the one before. **Cyborg** by Simon Smith for the Atari 400/800, $29.95 (disk), from Med Systems Software, POB 2674, Chapel Hill, NC 27514.

By allowing you to independently shoot and move in four directions, Crossfire emerges as one of the most difficult and challenging arcade games to play. Surrounded by aliens, with laser shots flying at you from all directions, you are confined in a grid. Instead of the freedom of the skies, you must exercise tight control over the movement of your ship, firing missiles at the same time. The reflexes take a long time to master, but, once you get the hang of it, it's addictive. **Crossfire** by Jay Sullivan for the Apple II or II Plus, $29.95 (disk), from Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614. (Also available on disk, cassette, or cartridge for the Atari 400/800.)

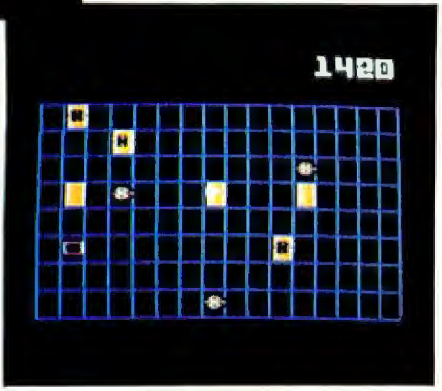
As Dakota Smith, adventurer, treasure hunter, you must locate the golden Mask of the Sun to halt the deterioration of your body brought on by a mysterious amulet. You begin your quest for this solid gold mask with a face-to-face meeting with Professor de Perez in the Aztec ruins of Mexico. This graphics adventure uses a special animation and graphics language to draw full-screen graphics quickly enough to give the illusion of movement: people walk toward you and your jeep cruises down a country road. **The Mask of the Sun** by Alan Clark, Larry Franks, and Christopher and Margaret Anson for the Apple II or II Plus, $39.95 (disk), from Ultrasoft Inc., 24001 Southeast 103rd St., Issaquah, WA 98027.



Endless waves of aliens (what else?) fill the skies. They are programmed to destroy you. You shoot at them, but if you shoot too quickly, your guns overheat and it's doomsday once again. The graphics are stunning, with each wave bringing a new variety of alien invader. **Threshold** by Warren Schwader and Ken Williams for the Apple II or II Plus, $39.95 (disk), from Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614. (Also available for the Atari 400/800.)



You're in control of the strategic defense satellites of the United States and, looking through your viewfinder, you can see nuclear rockets being launched from the Soviet Union. Quickly, you must intercept the rockets and destroy all of the Soviet missile sites as well. But the missiles keep coming, and now even your satellites are under attack. A graphic arcade experience awaits. **Laser Defense** by Simon Smith for the TRS-80 Models I and III, $18.95 (disk), from Med Systems Software, POB 2674, Chapel Hill, NC 27514.



SPECIAL EFFECTS

As the game loads, a voice announces the title, Space Spartans. This is the first cartridge designed for use with the Intellivoice Voice Synthesis Module. Four voices are generated, but only two are used with regularity: the ship's computer and your central computer. The game is designed to be a reenactment of the Battle of Thermopylae in space. Because the voices provide vital information, the game isn't playable without the synthesis module. **Space Spartans** for Intellivision, $45 (cartridge; Voice Module, $80), from Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250.

Phasor Patrol is included when you purchase a Supercharger for your Atari VCS. (The Supercharger plugs into the cartridge slot on your machine and adds enough memory to give games increased action and more graphic detail. The games, available on cassette, load rapidly from any cassette player.) Phasor Patrol lets you use a sector map to warp hop from one section of the galaxy to another. The hyperdrive simulation is very impressive. Using the second screen, you locate enemy forces and use the torpedo sight to lock-in on your target. Scoring well in this game is a combination of skill and strategy. **Phasor Patrol** for the Atari VCS (video computer system), $69.95 (cassette; includes the Supercharger), from Starpath Corp., 324 Martin Ave., Santa Clara, CA 95050.

OLD FAVORITES

A graphics version of an old computer game, Utopia lets you rule your own island state. One or two players can compete by scoring points that reflect the overall well-being of the people you rule. By controlling agriculture, housing, education, the military, industry, and hospitals, you alone are responsible for the people. Just remember to keep an eye out for the rebels and pirate ships. **Utopia** for Intellivision, $40 (cartridge), from Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250.

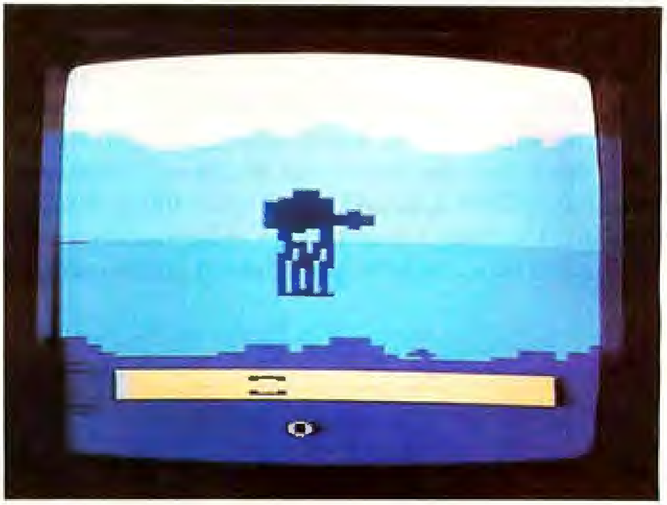
Although not a new entry, Tennis is a favorite here at BYTE. Not only is this game engaging, the winning feature is that the ball carries a shadow underneath it. Try it when you can't get outdoors for your exercise at the net. **Tennis** by Alan Miller for the Atari VCS, $22.95 (cartridge), from Activision, Drawer 7286, Mountain View, CA 94042.

RE-CREATIONS

An implementation of one of the most successful arcade games, Defender is now available for you to play at home. You are the commander of a spaceship trying to blast the aliens from the skies and rescue the kidnapped humanoids before they are transformed into flying mutants. An excellent adaptation of the original. **Defender** for the Atari VCS, $37.95 (cartridge), from Atari Inc., POB 427, Sunnyvale, CA 94086.

Another favorite of the commercial arcades is ready to challenge you at home. In Berzerk, you are trapped in an electronic maze, hounded by robots and the Evil Otto. Use the joystick to move through the maze and hit the button to fire your laser at the robots. Several playing options let you choose between armed and unarmed robots, characteristics for Otto, and the number of bonus lives available. **Berzerk** for the Atari VCS, $31.95 (cartridge), from Atari Inc., POB 427, Sunnyvale, CA 94086.

One of the favorites for all ages, Frogger is a faithful implementation of the coin-operated video game with an extra bonus: an easy option that lets the frog stay on the moving log when it wraps around to the other side of the screen. Trying to get the poor frog to hop across the busy highway can be quite a trick. **Frogger** by Ed English for the Atari VCS, $30 (cartridge), from Parker Brothers, POB 1012, Beverly, MA 01915.



NEW!

Pitfall Harry has three chances and 20 minutes to find gold and silver bars, money bags, and diamond rings. But on his way to discover all of these treasures, he must avoid crocodile-infested swamps, vicious cobras, disappearing tarpits, and deadly scorpions in the underground passage. One of the trickiest moves you have to learn is how to make Harry jump up and catch the swinging vine. **Pitfall** by David Crane for the Atari VCS, $31.95 (cartridge), from Activision, Drawer 7286, Mountain View, CA 94042.

The Imperial Walkers are on the march, and you must use your fleet of Snowspeeders to destroy them before they reach the power generator on the ice planet Hoth. Using a joystick to manuever your craft, you fly over, around, and under the lumbering army of Walkers. Your battlefield is eight television-screens-wide, and the enemy will approach you in single file from left to right. When the lead Walker reaches the right end of your radar band, the power generator is a lost cause. A surprisingly strong entry for a first attempt in the video-game market. **The Empire Strikes Back** by Rex Bradford for the Atari VCS, $30 (cartridge), from Parker Brothers, POB 1012, Beverly, MA 01915.

The Vectrex Arcade System

A VECTOR-DISPLAY GAME SYSTEM FOR $200 BRINGS TRUE ARCADE ADVENTURES INTO THE HOME.

Pamela Clark
Technical Editor

Here is one of the greatest game machines we have seen this year. With superb *vector* graphics, excellent sound, cartridges for some of the best coin-operated arcade games, and a suggested retail price of $200, the Vectrex Arcade System is a good bet to score big with the consumer. Developed and distributed by General Consumer Electronics (GCE), a subsidiary of the Milton Bradley Company, the Vectrex comes closer to duplicating a real arcade game than any other game system on the market.

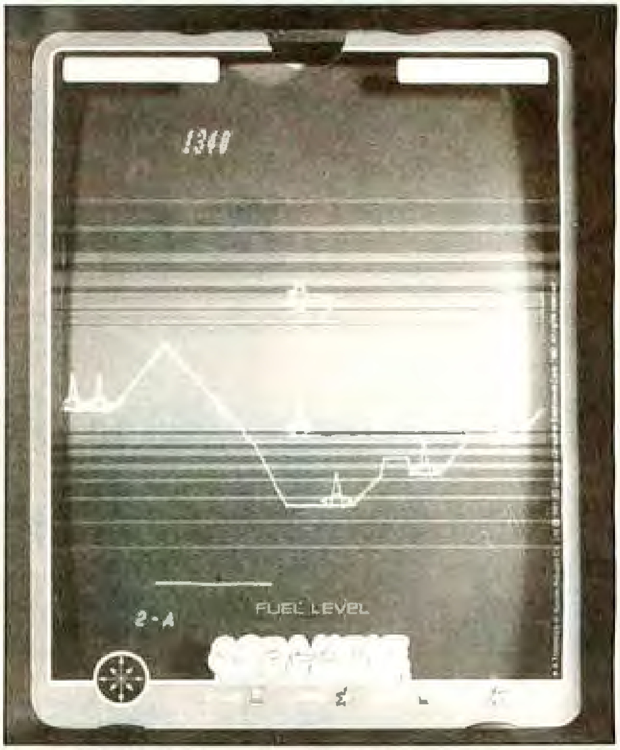
Because the Vectrex is a stand-alone system, you won't have to fight other people for use of the television set. Just take your Vectrex and plug it in wherever you have an electrical outlet. The system uses a Motorola 68A09 microprocessor chip in order to offer more speed and power than is available in most video games. You have a detachable control panel with a self-centering joystick and four buttons to play the games. You can plug in an additional optional control panel if you want to play

Games Available

GCE has obtained licensing rights and produced versions of the following coin-op arcade games: from Cinematronics Inc., Armor Attack, Space Wars, Star Hawk, Rip Off, and Solar Quest; from Konami Industry, Scramble; and from Stern Electronics Inc., Berzerk.

Several games have been developed in-house by GCE, including the Star Trek game, modeled after the movie; Mine Storm, the resident space game; Blitz, an action football game; Cosmic Chasm, a space action game; Clean Sweep, an action maze game; and Hyper Chase, an auto race adventure. In Clean Sweep, you try to clean up your bank after a burglary. The bank robbers, in trying to blow open the vault, have scattered money through the bank corridors. Use the joystick to move your vacuum cleaner through the maze, sucking up all of the loose money. But be careful, the robbers want the money too and will be trying to destroy you at every turn.

If you dream of being a formula-one race driver, then Hyper Chase is your game. The vector graphics are superb, as you use the controls to drive a grueling grand prix. All of these cartridges will retail for about $30.



with a friend (or foe). The realistic sound, produced by a General Instrument AY38912 chip, includes music, explosions, and crowd cheers. And the display—well it almost has to be seen to be believed; imagine playing games at home (or in the office) using vector graphics with three-dimensional rotation and zoom.

Not only does this machine look and sound like its coin-operated counterparts, but it already has cartridges for seven of the more popular arcade games (see box). One game, Mine Storm, was created by GCE and is resident in the 64K-byte ROM (read-only memory). GCE has also developed additional game cartridges, each with a screen overlay to provide color and detail to the 9-inch black-and-white display, and a complete player's reference manual. It is unusual and refreshing to see a product appearing on the market with its software ready to run. But enough of these words, just look at what it can do.■

Board to Death

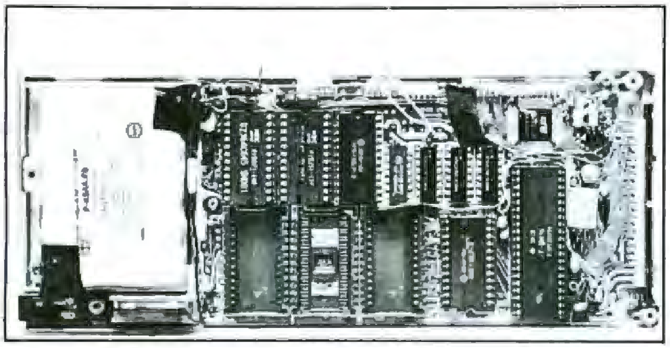


Photo 1: *All sounds.*

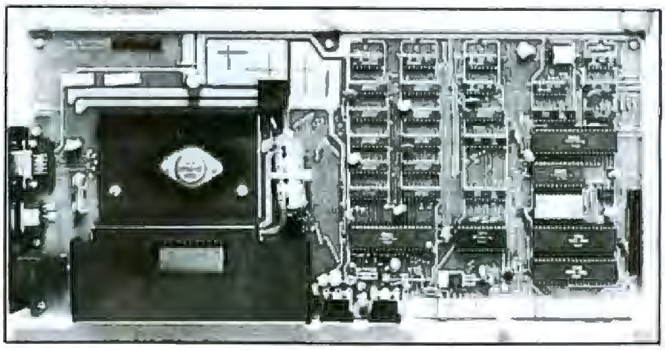


Photo 2: *German obscenity.*

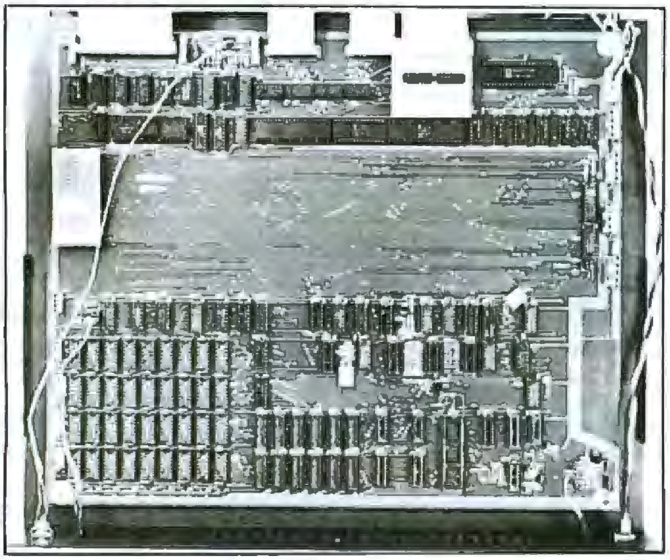


Photo 3: *George Washington's diary.*

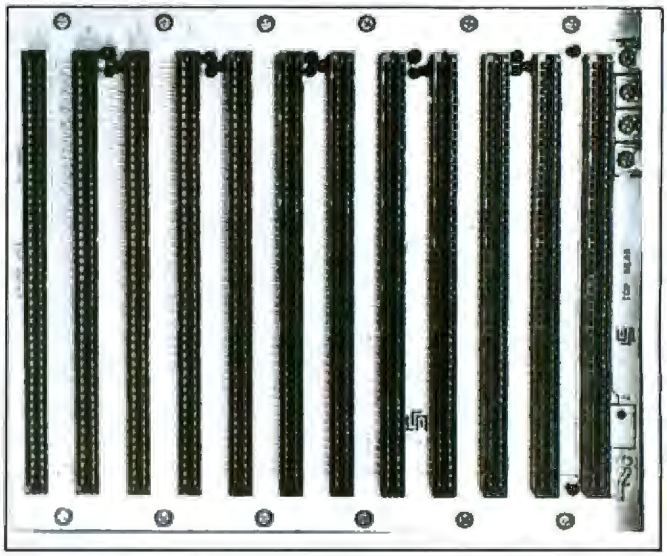


Photo 4: *Gold rush state.*

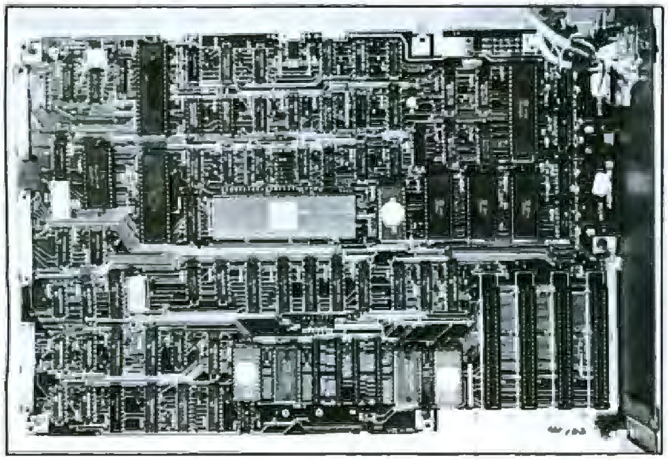


Photo 5: *Five-star idea.*

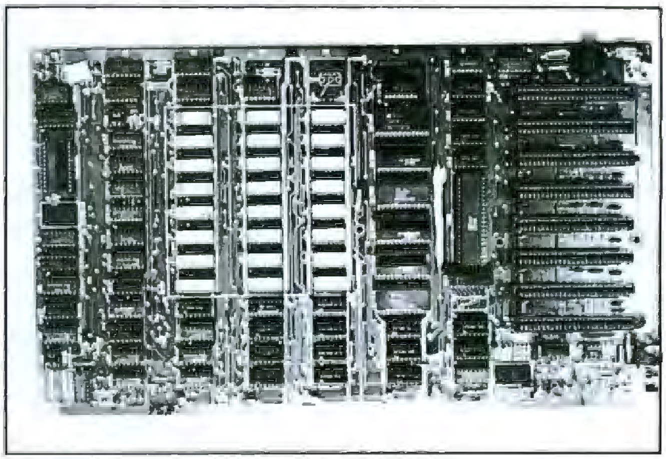


Photo 6: *Born in a garage.*

Test your hardware savvy. Presented here are 12 microcomputer system boards (sometimes referred to as motherboards). See how many you can recognize using just the photos (if you are really good), or read the clues under each photo for help. You may turn to page 590 for the answers only out of desperation. Don't feel too bad if you can't guess them all. Steve Ciarcia got only 8 out of 12. . . . J. N. S.

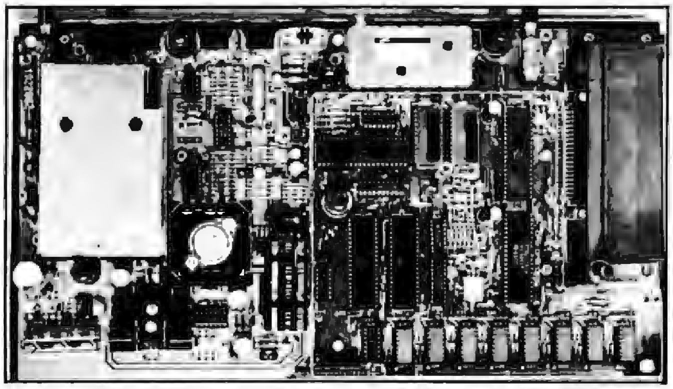


Photo 7: *Tandy dandy.*

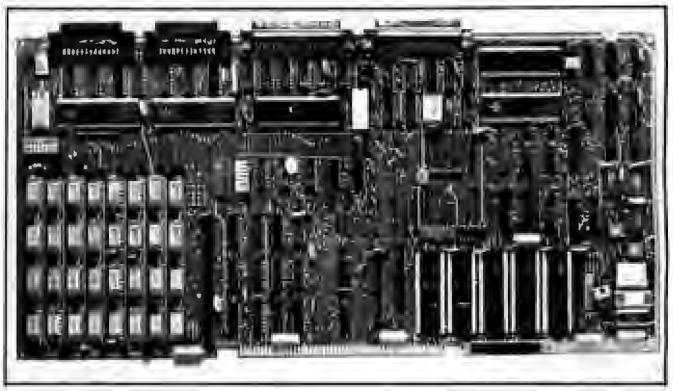


Photo 8: *A very small motor.*

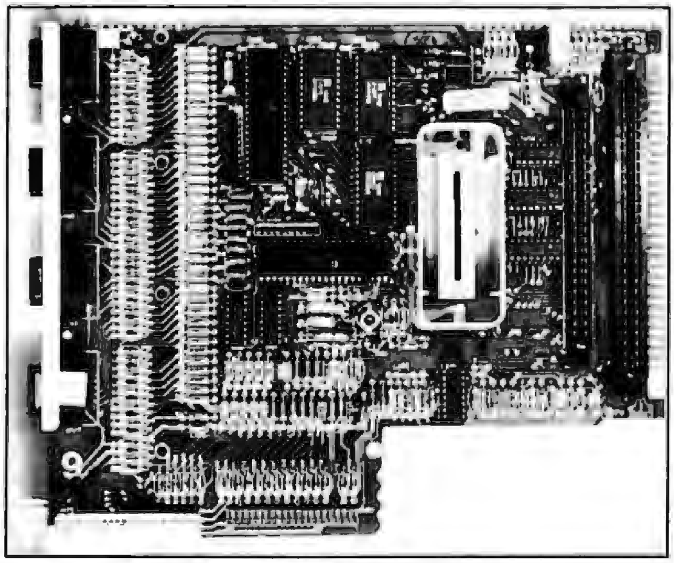


Photo 9: *Go players beware.*

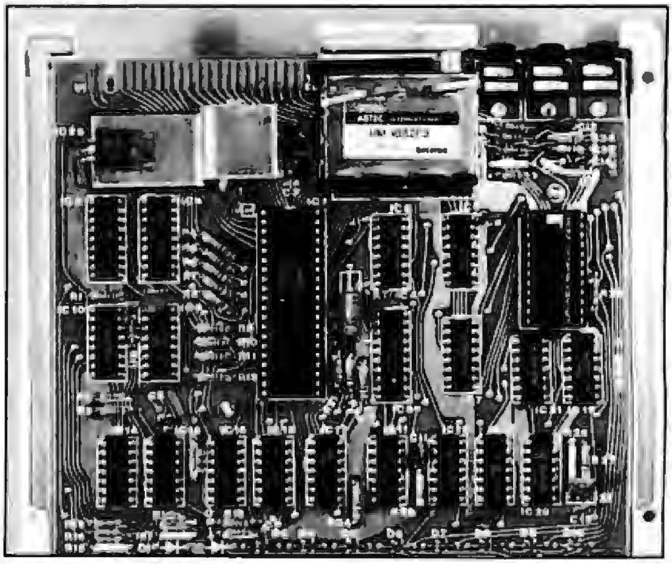


Photo 10: *Surrogate promotion.*

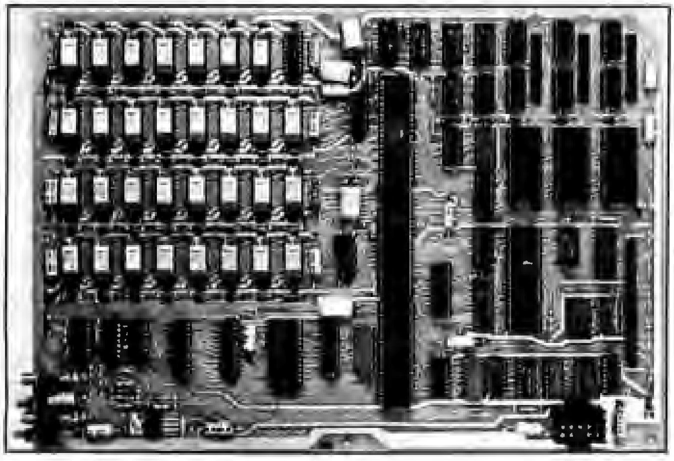


Photo 11: *Control your car?*

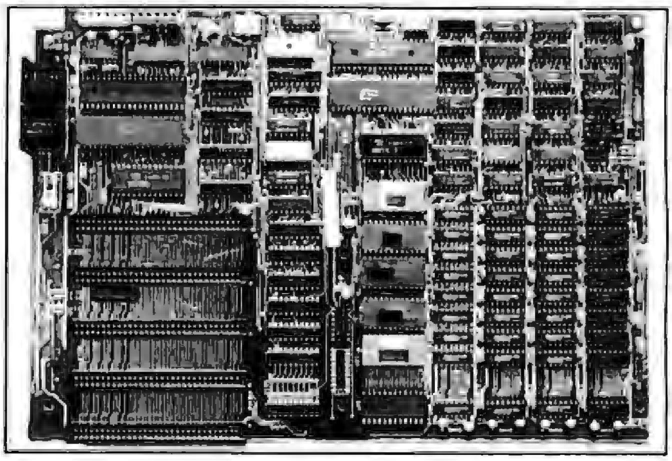


Photo 12: *A little blue.*

Design Techniques and Ideals for Computer Games

Chris Crawford
Atari Inc.
1265 Borregas Ave.
POB 427
Sunnyvale, CA 94086

Why are some computer games better than others? Game manufacturers and authors constantly try to answer this million-dollar question. Many factors contribute to the appeal of a computer game, including technical quality, graphics, sound, pace, game play, and action. Yet we cannot merely list the properties of a given game and expect the length of the list to tell us whether that game will be a success. Game design is an art form, and like any art form the individual components are less important than the manner in which they are put together, the overall technique.

All artists develop their own special techniques and ideals for the execution of their art. The painter worries about brushstrokes, mixing of paint, and texture; the musical composer learns procedures of orchestration, timing, and counterpoint. The game designer also acquires a variety of specialized skills, techniques, and ideals for the execution of the craft. In this article I will describe some of the techniques I use in my games. I don't understand my own art well enough to present my techniques in a hierarchical or logical sequence; instead, I'll simply offer a potpourri of interesting ideas grouped under the concepts of balance, relationships, monotonicity (having a positive monotonic learning curve), and winnability.

About the Author
Chris Crawford leads the Games Research Group at Atari. He has designed several microcomputer games and has written articles and books about computers and programming.

Balancing Solitaire Games

A solitaire game pits the human player against the computer. The computer and the human are very different creatures; where human thought processes are diffuse, associative, and integrated, the machine's thought processes are direct, linear, and arithmetic. This difference causes a problem. A designer creates a computer game for the benefit of the human, and therefore the game is played in the intellectual territory of the human, rather than in the intellectual territory of the computer. The computer is thus at a natural disadvantage. Although the computer could easily whip the human in games involving computation, sorting, or similar functions, such games would be of little interest to the human player in most cases. The computer must play on the human's home turf, which it does with great difficulty. How, then, do we design a game to enable the computer to compete with and challenge the human? Four techniques are available: *vast resources, artificial reckoning, limited information*, and *pace*.

Vast Resources

In what is by far the most heavily used technique for balancing a game, the designer provides the computer with immense resources that it uses stupidly. These resources may consist of large numbers of opponents that operate with only the most rudimentary intelligence. Many games use this ploy: Space Invaders, Missile Command, Asteroids, Centipede, and Tempest, for example. It is also possible to equip the computer with a small number of opponents more powerful than the human player's units, such as the super-tanks in Battlezone. The effect in both cases is the same: the human player's advantage in intelligence is offset by the computer's material advantages.

The vast-resources technique has a number of benefits. First, the conflict between the human and the computer assumes a David-versus-Goliath air. Most people would rather win as an apparent underdog than as an equal. Second, this technique is the easiest to implement. Providing intelligence for the computer's players can be difficult, but making hordes of computer players repeat a single process takes little more than a simple loop. Of course, the ease of implementation carries a disadvantage: everybody can do it. We are knee-deep in such games. Laziness and lack of determination have far more to do with the prevalence of this technique than game-design considerations.

Artificial Reckoning

The obvious alternative to giving the computer player an advantage of sheer numbers is to provide it with intelligence adequate to meet the human player on equal terms. Unfortunately, artificial intelligence techniques are not understood well enough to be useful in this context. The development of tree-searching techniques allows us to produce passable chess, checkers, and Othello computer players. Any other game that can be expressed in direct tree-searching terms can also be handled with these techniques. Very few games, however, are appropriate for this treatment.

An alternative is to develop ad hoc artificial intelligence routines for each game—the method I have used in Tanktics, Legionnaire, and Eastern Front 1941 with varying degrees of success. Although this strategy demands great effort from the game designer, the routines are so primitive that referring to them as artificial intelligence is misleading and almost arrogant. Instead, I use the less ambitious term artificial reckoning.

The first aim of any artificial reckoning system is to produce reasonable behavior. The computer should not drive its tanks over cliffs, crash spaceships into each other, or pause to rest directly in front of the human's guns. In other words, the artificial reckoning system must not allow obviously stupid moves. This requirement tempts us to list all possible stupid moves and write code that tests for each such stupid move and precludes it. This is the wrong way to handle the problem because the computer can demonstrate unanticipated creativity in the stupidity of its mistakes. A better (but more difficult) method is to create a more general algorithm that obviates the most absurd moves.

A second requirement of an artificial reckoning routine is unpredictability. The human player should never be able to second-guess the behavior of the computer, for this would shatter the illusion of intelligence and make victory much easier. This second condition seems to contradict my first requirement of reasonable behavior because reasonable behavior follows patterns that should be predictable. We can resolve this apparent contradiction through a deeper understanding of the nature of interaction in a game. To arrive at such an understanding, we must combine three premises. First, a reaction to an opponent is in some ways a reflection of that opponent. A reasonable player tries to anticipate an opponent's moves by assessing the opponent's personality. Second, interactiveness is a mutual reaction—both players attempt to anticipate each other's moves. Third, the level of interactiveness is a measure of the quality of the game. We can combine these three premises in an analogy. Think of a game in terms of two mirrors facing each other, with each player looking out from one mirror. A weakly interactive game is analogous to two mirrors *almost* aligned toward each other; each player can see and interact at one or two levels of reflection. An ideal, perfectly interactive game is analogous to two highly reflective mirrors aligned *precisely* toward each other; each of the two players recursively exchanges

Photo 1: *Chris Crawford, computer-game artist, uses a variety of design techniques to create new, stimulating games for the microcomputer.* *Photo by Franklin L. Avery.*

places in an endless tunnel of reflected anticipations. No matter how reasonable the behavior, the infinitely complex pattern of anticipation and counter-anticipation defies prediction. The pattern is reasonable yet unpredictable, and thus satisfies the requirements of artificial reckoning.

Experience has shown me that game algorithms are most predictable when they are particular, emphasizing a single element of the overall game gestalt. For example, in war games, algorithms such as "determine the closest enemy unit and fire at it" are particular and yield predictable behavior.

I find that the best algorithms for reasonable and unpredictable behavior consider a greater amount of information in a broader context. That is, they will factor into their decision making a large number of considerations rather than focus on a small number of key elements. Compared to the example above, a better algorithm might be "determine the enemy unit posing the greatest combination of threat and vulnerability (based on range, activity, facing, range to other computer tanks, cover, and sighting); fire on unit if probability of killing exceeds probability of being killed."

How does one implement such principles into specific, programmable algorithms? I doubt that an all-purpose system can ever be found. The best general solution I have found so far uses a combination of point systems, field analysis, and changes in the game structure.

First, I establish a point system for quantifying the merit of each possible move. This is a time-honored technique for many artificial intelligence systems. A great deal of thought must go into the point system. An initial complication is one of dynamic range: the designer must ensure that the probability that two accessible moves will each accumulate a point value equal to the maximum value allowed by the word size (8 bits) approaches zero. In other words, we can't have two moves each getting a score of 255 points or we have no way of knowing which is truly the better move.

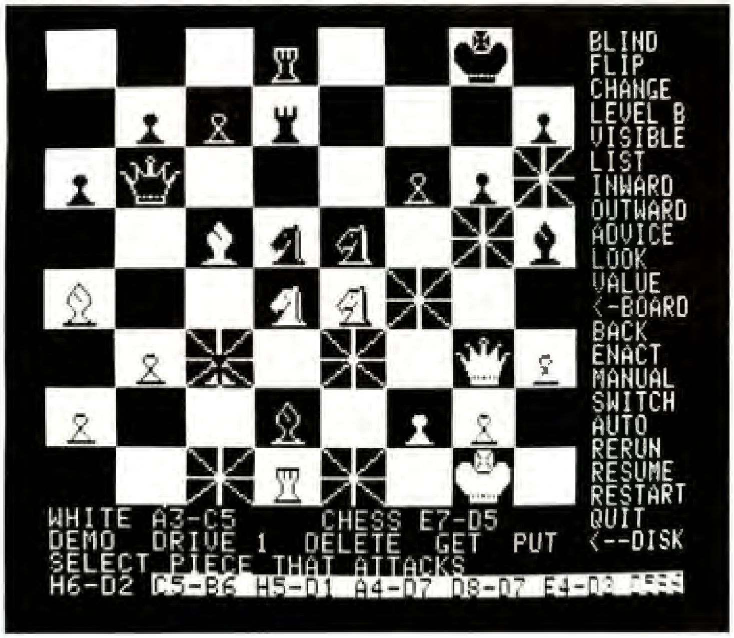
Another problem with the point system is the balancing of factors against each other. Suppose we have a tank game in which we know that climbing on top of a hill is good, but we also know that moving onto a road is good. Which is better? If a hilltop position is worth fifteen points, what should a road position be worth? Ten points? Twenty? You really need a deep familiarity with the play of the game to answer these questions. Unfortunately, such familiarity is impossible to attain with a game not yet completed. Instead you have to rely on broad experience, a thorough understanding of the situation being represented, painstaking analysis, and lots of experimenting.

The best game algorithms consider a great amount of information in a broad context.

Another artificial reckoning technique, field analysis, applies only to games involving spatial relationships. In such games the human relies on pattern recognition to analyze positions and plan moves. The microcomputer is incapable of true pattern recognition on the same level as humans; however, field analysis allows the computer to attain something approaching pattern recognition. The key effort for the designer is the creation of a calculable field quantity that correctly expresses the critical information needed by the computer to make a reasonable move. For example, in several of my war games I've used safety and danger fields to tell a unit the level of risk in a given situation. Danger is calculated by dividing each enemy unit's strength by its range and summing the quotients of the different units; thus large or close units are very dangerous, and small or distant units are only slightly dangerous. A similar calculation with friendly units yields a safety factor. A unit decides whether to exhibit bold or timid behavior by comparing the danger and safety values at its position. Once this decision is made, the unit looks around and measures the net danger minus safety in each position it could move to. If the unit is feeling bold, it moves toward the danger; if it is feeling timid, it moves away. In this particular case, I find a vector field to be more informative than a scalar field; in some cases the scalar field is adequate. The vector field tells the magnitude and direction of danger; the scalar field tells only the magnitude. If the algorithm is intelligent enough to use the direction information, the vector field is more useful.

Coordinating the moves of the many units under computer control is a special dilemma. How is the computer to assure that the different units move in a coordinated way and that traffic jams don't develop? Usually the game designer's response is to use a sequential planning system coupled with a simple test to determine the position of other units. Thus, unit #1 moves first, then #2, followed by #3, with each one avoiding collisions. I can assure you from my own experience that this system serves only to replace collisions with the most frustrating traffic jams. A better method uses a virtual-move system in which each unit plans a virtual (hypothetical) move based on the virtual positions of all other units. Here's how it works: we begin with an array of real positions of all computer units. We create an array of virtual positions and initialize all virtual values to the real values. Then each unit plans its move, avoiding colli-

Explore the Frontiers of Intelligence



- ◀ Variations of blind-fold play—camouflaged or invisible pieces
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- ◀ Change between 15 levels of play, plus postal and mate-finder modes
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- ◀ Chess suggests a move
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- ◀ Return to board or switch to command menu
- ◀ Take back a move (repeatable)
- ◀ Play move suggested by look-ahead search
- ◀ Chess plays neither side
- ◀ Switch sides
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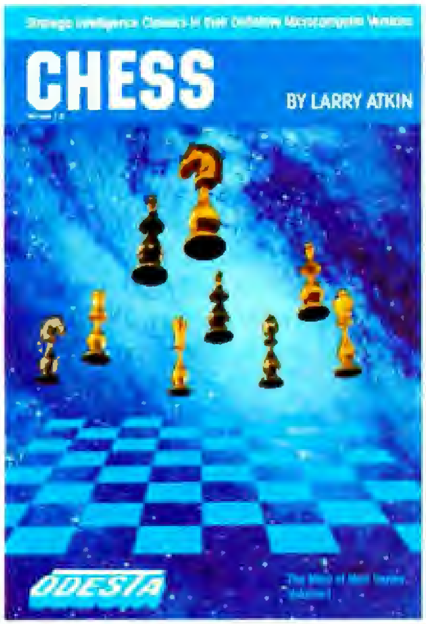
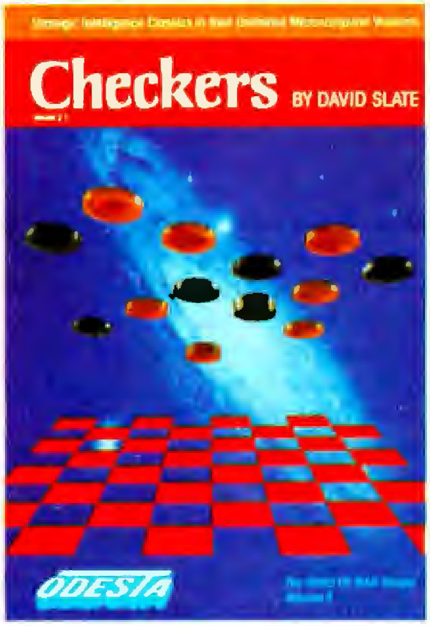
All features self-documented; all choices cursor-controlled
Screen shows "outward" and "look" features being used

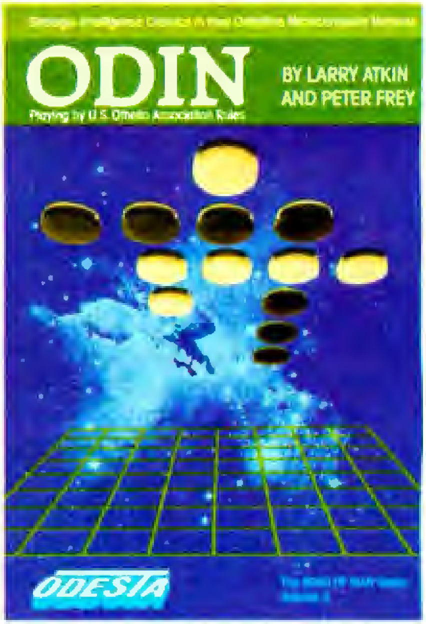
THE PEOPLE BEHIND THE PROGRAMS:

Larry Atkin & David Slate: Authors of the Northwestern University Chess 4.7 program—World Computer Chess Champion, 1977-1980

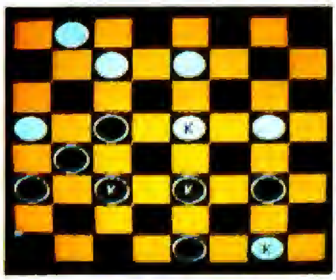
Peter Frey: Northwestern University professor
Editor: **Chess Skill in Man and Machine**
One of U.S. Othello Assoc.'s top-ranked players



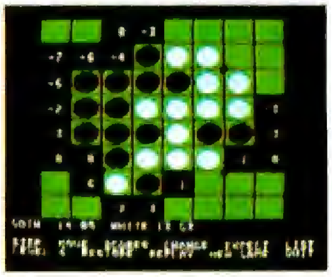




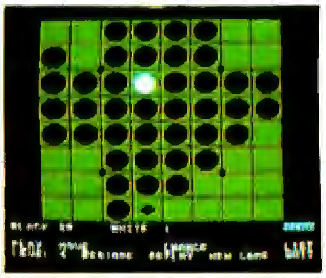
Checkers' features



Black to move and win
(From Checkers documentation)



"Scores" feature in Odin



A clue to the secret of Odin:
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Circle 551 on inquiry card.

Photo 2: *Legionnaire, a recently released war game about Caesar and the barbarian hordes, is a good example of a refined attack algorithm. Chris tried several strategies before the single advance-to-attack algorithm emerged.*

sions with the virtual positions. After the unit plans its move, the planned final position is put into the virtual array. Other units then plan their moves. After all units plan one virtual move, the process repeats, with each unit planning its move on the basis of the interim virtual-move array. This huge outer loop should be convergent; after a sufficient number of iterations the routine terminates and the virtual positions form the basis of the moves made by the computer's units. This technique is useful for coordinating the moves of many units and preventing traffic jams.

Another technique for achieving reasonable and unpredictable algorithms is so simple that it seems like cheating: change the game. If a crucial element of the game is not tractable with artificial reckoning, remove it. If you can't find a good way to use a feature, you really have no choice but to delete it. For example, while designing Tanktics, I encountered a problem with certain lakes. If the computer approached a U-shaped lake from the wrong direction, it would drive its tanks to the end of the peninsula formed by the lake, see the water blocking its forward progress, back up, change direction slightly, and drive back into the peninsula, only to be blocked again by the lake. The U-shaped lake created a trap for my artificial reckoning algorithm. I expended a great deal of time working on a smarter artificial reckoning routine that would not be trapped by such lakes and yet would retain desirable economies of motion. After much wasted effort I discovered a better solution: delete U-shaped lakes from the map. Ideally, the experienced game designer has enough intuitive feel for algorithms to sense game factors that are intractable and avoid them during the design stages of the game. However, most of us must discover these things the hard way and retrace our steps to modify the design.

No matter how good an algorithm is, its applicability is limited. The odds are that a specific algorithm will work best under a narrow range of conditions. To be truly interesting, a good game design must offer a broad range of conditions. Thus with many games the designer must create a number of algorithms and switch from one to another as conditions change. The transition from one algorithm to another is fraught with peril; if you don't maintain continuity across the transition, the computer units may exhibit highly unreasonable behavior patterns. I well remember a frustrating algorithm transition in Legionnaire. The computer barbarians were controlled by three algorithms that caused them to either run for safety, approach to contact, or attack. Under certain conditions a barbarian operating under the approach-to-contact algorithm would decide on bold behavior, dash forward to make contact with the human, and make the transition to the attack algorithm, which would declare an attack unsafe. The barbarian would thus balk at the attack and convert to the run-for-safety algorithm, which would direct it to turn tail and run. The human player was treated to a spectacle of ferociously charging and frantically retreating barbarians, none of whom ever bothered to actually fight. I eventually gave up and redesigned the algorithms, merging all three into a single advance-to-attack algorithm with no transitions.

The artificial reckoning techniques I have described so far are designed for use in games involving spatial relationships. Many games are nonspatial and require other reckoning techniques. A common type of nonspatial game is a complex system simulation, often involving coupled differential equations. Lunar Lander, Hammurabi, Energy Czar, and Scram are examples of this type of game. In such games the primary problem facing the designer is not so much to defeat the human as to accurately model system behavior. I advise the game designer to be particularly

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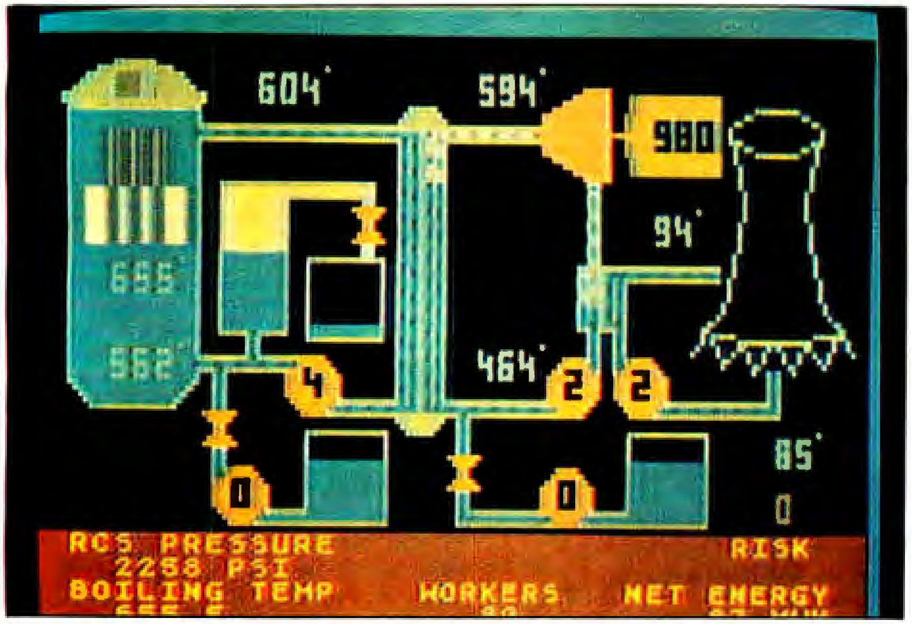

Photo 3: *Scram is a nuclear-power-plant simulation that uses coupled differential equations to model complex behavior.* *Photo by Franklin L. Avery.*

careful with games involving large systems of coupled differential equations. Hammurabi uses three coupled first-order differential equations, and most programmers find that number easy to manage. But the complexity of the problem rises very steeply with the number of differential equations used. Energy Czar used the fantastic sum of 48 differential equations, a feat made believable only by the fact that many constraints were imposed on them. In general, be wary of more than four coupled differential equations. If you must use numerous differential equations, try to use parallel equations in which the same fundamental equation is applied to each element of an array of values.

Each differential equation should have a damping factor that must be empirically adjusted:

$$\text{new value} = \text{old value} + \frac{\text{driving factor}}{\text{damping factor}}$$

A small damping factor produces lively simulated systems that bounce around wildly. A large damping factor yields sluggish systems that change slowly. Unfortunately, recourse to simple damping factors can backfire when a relationship of negative feedback exists between the new value and the driving force. In this case, a large damping factor inhibits the negative feedback, and one of the variables changes erratically. The behavior of systems of differential equations is complex; I suggest that designers interested in these problems familiarize themselves with the mathematics of overdamped, underdamped, and critically damped oscillatory systems. For more general information on solving systems of differential equations, any good textbook on numerical analysis will serve as a useful guide.

The application of all these methods may well produce a game with some intelligence, but your expectations should not be too high. Even great effort is not enough to produce truly intelligent play. To date, none of my three attempts play with adequate intelligence to tackle a human player on equal terms. Indeed, they still need force ratios of at least 2 to 1 to stand up to the human player.

Limited Information

Another way to make up for the computer's lack of intelligence is to limit the amount of information available to the human player. If the human does not have the information to process, he cannot apply his superior processing power to the problem. Applying this technique to excess can reduce the game to one of chance. Used with discretion, however, limited information can equalize the odds between the player and the computer. If the information is withheld in a reasonable context (e.g., the player must send out scouts), the restrictions on information not only seem natural, but they add to the realism and excitement of the game.

Game designers often overlook or misunderstand the value of limited information. Limited information can tickle the imagination of the player by suggesting details without actually confirming them. You must artfully choose the limitations on the information, however. Randomly assigned gaps are confusing and frustrating rather than tantalizing.

Pace

Controlling the pace of the game provides another way to even the balance between human and computer. The human may be smart, but the computer is much faster at performing simple computations. If the pace is fast enough, human players will not have enough time to apply their superior processing skills and will be befuddled. This is a very easy technique to apply, so it comes as no surprise that many designers of skill and action games use it heavily.

These four techniques—vast resources, artificial reckoning, limited information, and pace—are never used in isolation; every game uses some combination of the four. Most games rely primarily on pace and vast resources for balance, with very little artificial reckoning or limited information. The reason for this emphasis is simple: pace and vast resources are easy to implement, while artificial reckoning and limited information are more difficult. Economy of effort

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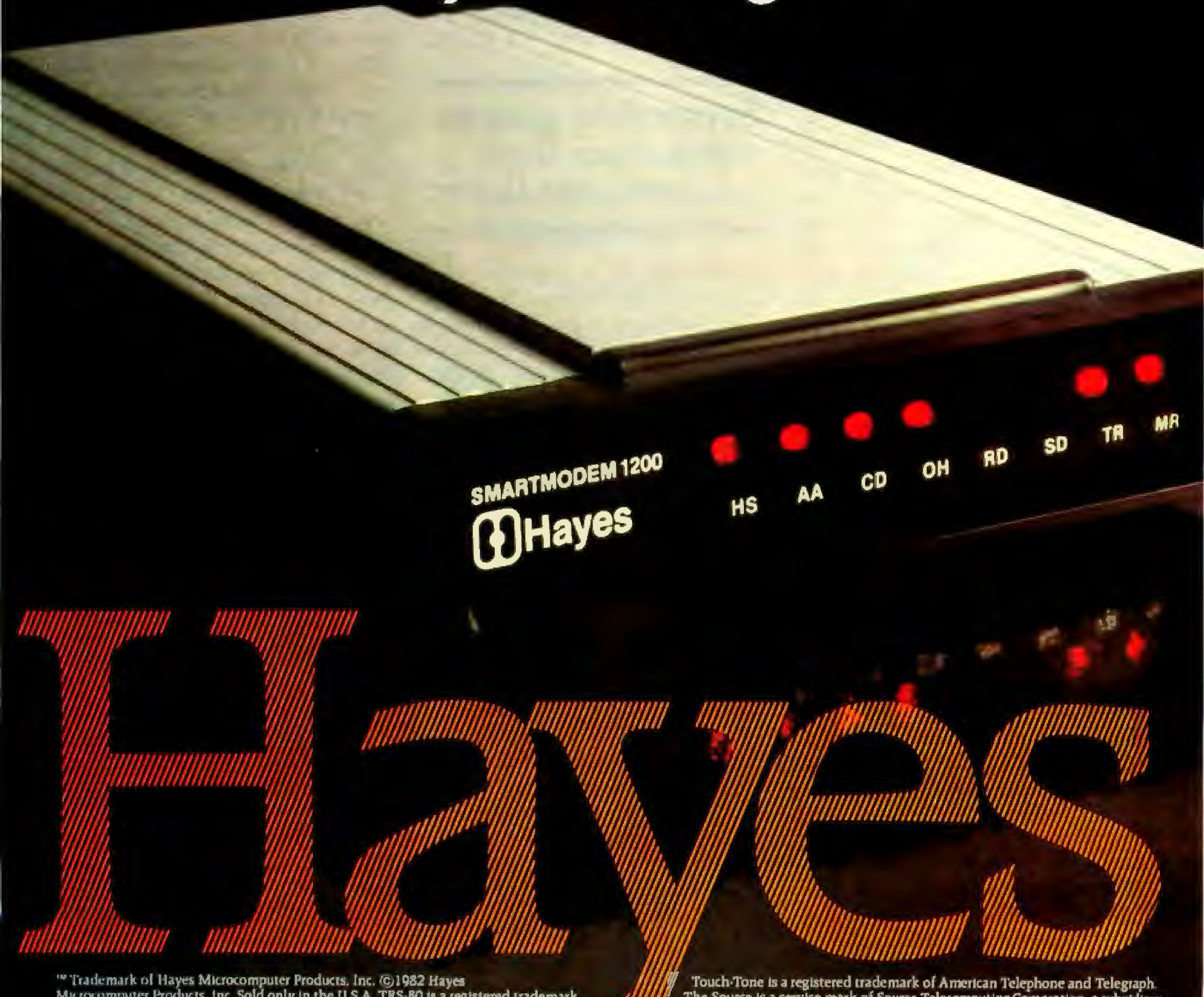

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is no longer justifiable in the lucrative market for games. There's no reason why a game could not incorporate all four techniques; indeed, this should make the game all the more successful, for by using small amounts of each method, the game need not strain the limitations of any one method. The designer must decide the appropriate balance of each for the goals of the particular game.

Relationships Between Opponents

The concepts I've discussed so far apply primarily to computer games. Now let's consider some general game theory. Every game establishes a relationship between opponents that each player strives to exploit to maximum advantage. The fundamental architecture of this relationship, *symmetric* or *asymmetric*, plays a central role in the game. The simplest architecture establishes a *symmetric relationship* between the two players Both possess the same properties, the same strengths and weaknesses. Symmetric games have an obviously desirable feature: they are automatically balanced. Because the same processes are applied to each player, symmetric computer games tend to be easier to program. Finally, these games are easier to learn and understand. Examples of symmetric games include Combat for the Atari 2600, Basketball, and Dog Daze.

Symmetric games suffer from a variety of weaknesses, the greatest of which is their relative simplicity. Any strategy that promises to be truly effective can and will be used by both sides simultaneously. In such a case, success derives not from planning but from execution. Alternatively, success in the game turns on very fine details. Chess provides an example: an advantage of but a single pawn can be parlayed into a victory.

Because of the weaknesses of symmetric games, many game designers attempt to establish an *asymmetric relationship* between the opponents. Each player has a unique combination of advantages and disadvantages. The game designer must somehow balance the advantages so that both sides have the same likelihood of victory, given equal levels of skill. The simplest way of doing this is with plastic asymmetry. Games incorporating this relationship are formally symmetric, but the players select initial traits according to some set of restrictions. For example, in the board game Wizard's Quest the players have the same number of territories at the beginning of the game, but they choose their territories in sequence. Thus, what was initially a symmetric relationship (each player is entitled to *n* territories) becomes an asymmetric one (player A has one combination of *n* territories while player B has a different combination). The asymmetry is provided through the choices of the players themselves at the outset of the game, so if the results are imbalanced, the players are responsible.

Symmetric games suffer from their relative simplicity.

Other games have a more explicitly asymmetric relationship. Almost all solitaire computer games establish an asymmetric relationship between the computer player and the human player because the computer cannot hope to compete with the human in matters of intelligence. Thus, the designer gives resources to the human player allowing the use of his or her superior planning power, while the computer gets resources that compensate for its lack of intelligence.

The advantage of asymmetric games lies in the ability to build nontransitive or triangular relationships into the game. Nontransivity is a well-defined mathematical property. In this context, it is best illustrated with the rock-scissors-paper game. Two players play this game; each secretly selects one of the three pieces; they simultaneously announce and compare their choices. If both make the same choice the result is a draw and the game is repeated. If they make different choices, then rock breaks scissors, scissors cut paper, and paper enfolds rock. This relationship, in which each component can defeat one other and can be defeated by one other, is a nontransitive relationship; the fact that rock beats scissors and scissors beat paper does not mean that rock beats paper. This particular nontransitive relationship only produces clean results with three components so that each component relates to only two other components; it beats one and loses to the other. A rock-scissors-paper game with binary outcomes (win or lose) cannot be made with more than three components. You could make a game with multiple components if several levels of victory (using a point system, perhaps) were included.

Nontransitivity is an interesting mathematical property but it does not yield rich games if we hew to the strict mathematical meaning of the term. Its value to game design lies in the generalization of the principle into less well-defined areas. I use the term "triangular" to describe such asymmetric relationships that extend the concepts of nontransitivity beyond its formal definition.

A simple example of a triangular relationship appears in the game Battlezone. When a saucer appears, the player can pursue the saucer instead of an enemy tank. In such a case, there are three components: player, saucer, and enemy tank. The player pursues the saucer (side one of the triangle) and is pursued by the enemy tank (side two). The third side of the triangle (saucer to enemy tank) is not directly meaningful to the human—the computer maneuvers the saucer to entice the human into a poor position. This example is easy to understand because the triangularity assumes a spatial form as well as a structural one.

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Photo 4: *Eastern Front 1941 is a World War II game whose design incorporates one major trick. Once you learn the trick, mastery of the game becomes possible.*

Triangularity is most often implemented with mixed offensive-defensive relationships. In any conflict game, players must make offensive and defensive actions. Some games concentrate the bulk of a certain activity on one side, making one player the attacker and the other player the defender. This game design is risky, for some people do not enjoy playing a single role, especially that of defender, throughout an entire game. After all, the defender can only lose status and never gain any. Much more entertaining are games that mix offensive and defensive strategies for each player. This way, each player gets to attack and to defend. What is more important, players can trade off defensive needs against offensive opportunities. Triangular relationships automatically spring from such situations.

The essential value of triangularity lies in its indirection. A binary relationship makes direct conflict unavoidable; the antagonists must approach and attack each other through direct means. These direct approaches are obvious and expected and such games often degenerate into tedious exercises following a narrow script. A triangular relationship allows each player indirect methods of approach. The indirect approach always creates a far richer and subtler interaction.

Positive Monotonic Curve

An important trait of any game is a positive monotonic curve of results as a function of effort. Although my lumbering expression of the idea sounds imposing, its meaning is far simpler: as players work with a game, their scores should reflect steady improvement. Beginners should be able to make some progress, intermediate people should get intermediate scores, and experienced players should get high scores. If I were to make a graph of a typical player's score as a function of time spent with the game, that graph should show a curve sloping smoothly and steadily upward. I describe such a game as having a positive monotonic curve.

A variety of learning curves can arise. A game that has a relatively flat curve is hard to learn. If the curve is steep, the game is easy to learn. If the curve has a sharp jump in it, apparently there is just one trick to the game, mastery of which guarantees mastery of the game. (Eastern Front 1941 is a good example of such a game.) If the game has many sharp jumps, we say that there are many tricks. In all cases, the most desirable trait is a positive monotonic learning curve.

The designer works a positive monotonic curve into a game by providing a smooth progression from the beginner's level to an expert level. To do this, the game designer must create not one game but a series of related games. Each game must be intrinsically interesting and challenging to the level of player for which it is targeted. Ideally, the progression is automatic; players start at the beginner's level and the advanced features are brought in as the computer recognizes proficient play. More commonly, players must declare the level at which they desire to play.

Games without a positive monotonic curve frustrate players by failing to provide them with reasonable opportunities for bettering their scores. Players feel that the game is either too hard or too easy. Positive monotonic games challenge players at all levels and encourage continued play by offering the prospect of new discoveries. Tempest is an excellent example of such a game.

The Illusion of Winnability

An important trait of any game is the illusion of winnability. If a game is to provide a continuing challenge to players, it must also provide a continuing motivation to play. The game must appear to be winnable to all players, beginners and experts, but it must never be truly winnable or it will lose its appeal. This illusion is very difficult to maintain. Some games maintain it for the expert but never achieve it for the beginner; these games intimidate all but the most determined players. The most successful game in this respect is Pac-

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Man, which appears winnable to most players, yet is never quite winnable. Tempest, on the other hand, intimidates many beginners because it appears to be unwinnable.

The simplicity or cleanliness of the game is the most important factor in creating the illusion of winnability. A dirty game intimidates its beginners with an excess of details. Many beginners never overcome the inhibiting suspicion that somewhere in the game lurks a "gotcha," some complicating detail or hidden factor that they haven't yet discovered. By contrast, a clean game encourages all players to experiment with the game as it appears.

Another key factor in maintaining the illusion of winnability arises from a careful analysis of the source of player failure. In every game the players are expected to fail often. What trips up the players? If they believe their failure is caused by some flaw in the game or its controls, players become frustrated and angry with what they rightly judge to be an unfair and unwinnable situation. If players perceive their failure to be a result of their own limitations and decide that winning the game requires superhuman performance, they reject the game as unfair and unwinnable. But if players perceive failures to be attributable to correctable errors on their own part, then they believe the game to be winnable and play on in an effort to master the game.

Summary

In this article I have described a number of design factors and ideas that I have used in developing several games. These should not be used in grab-bag fashion, for taken together they constitute the elusive element we call technique. Technique is part of an artist's signature, as important as theme. When we listen to Beethoven's majestic Fifth Symphony, the rapturous Sixth, or the ecstatic Ninth, we recognize in all the identifying stamp of Beethoven's masterful technique. If you would be a computer game designer, you must establish and develop your own technique. ■

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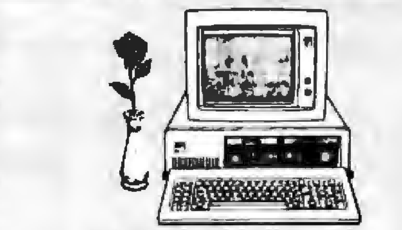

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Charge!

C. Anthony Ray
39 Carriage Place
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One long, cold winter evening when I was in need of some amusement I decided to write a computer program to simulate the trajectory of a free electron through a sparse lattice of stationary ions. I placed symbols for positive and negative ions on the screen and assigned an initial speed and direction to an electron originating in the upper left corner of the field. As the electrons began to fly across the screen, my family clamored for a chance to play what looked like a game to them. I did some additional work on the program and Charge! came into being.

Object of the Game

The object of Charge! is to give a direction to an electron launched from the upper left corner of the playing field that will cause it to travel to the lower right corner of the field. You specify the direction by entering an x,y coordinate pair that corresponds to the point you would like to hit. But there's a catch. For each round of the game, a random-number generator places ions on the screen that, depending on their charge (positive or negative), exert a push or pull on the electron. (See figure 1.) The influence of these ions alters the trajectory in ways that become more predictable as your experience with the game increases. When the electron impacts the border of the field, your score is the product of the x and y coordinates of that point. The closer your electron comes to the lower right corner, the higher your score. (I have kept the Applesoft screen-coordinate system, where the coordinates for the upper left corner are 0,0 and those for the lower right corner are 279,159.)

Although solitary play is possible, the game is more interesting as a competition for two to four players. Five different playing fields are displayed and each player is given a turn on each. To keep any one player from gaining an advantage, the computer varies the order of

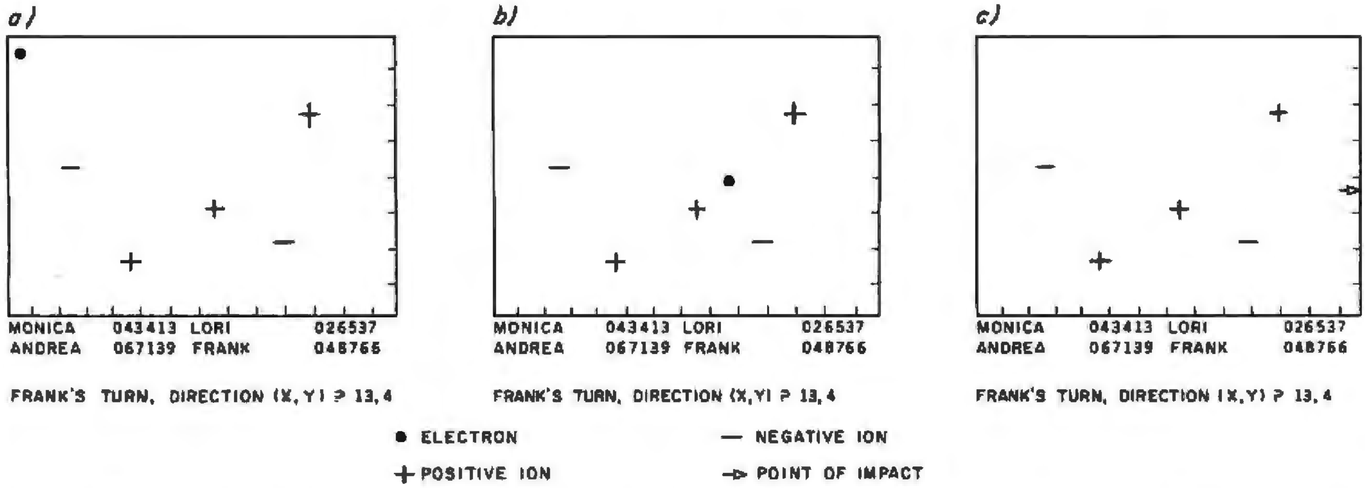

Figure 1: *The electron is launched and proceeds according to the direction specified by the player. Its path is influenced by the pull and push of the ions, and the final point of impact is marked with an arrow.*

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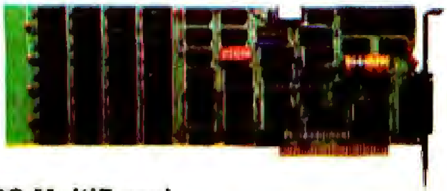

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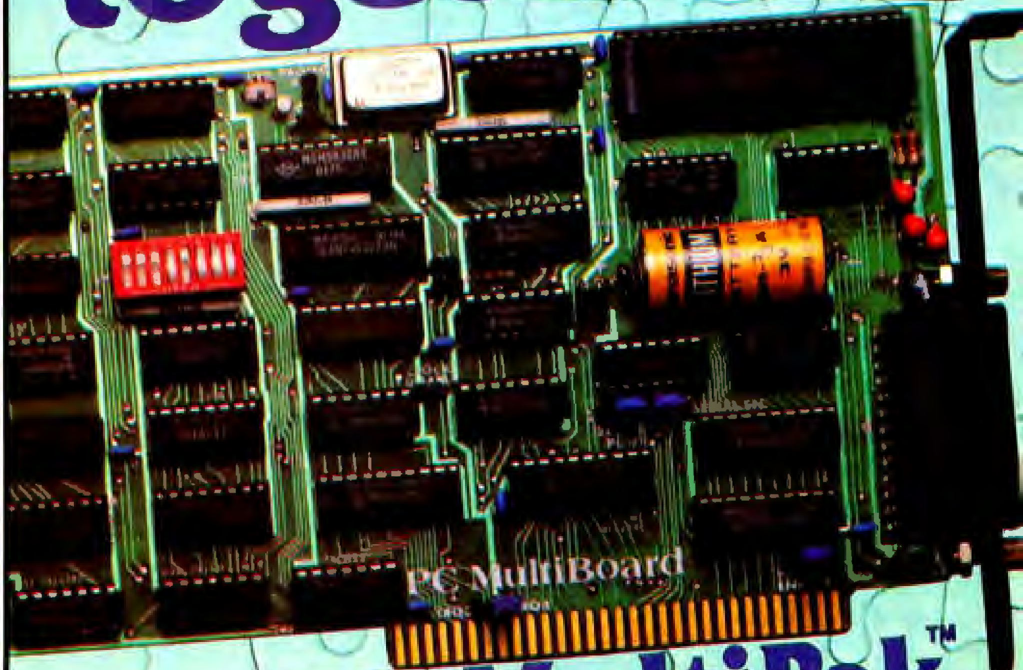

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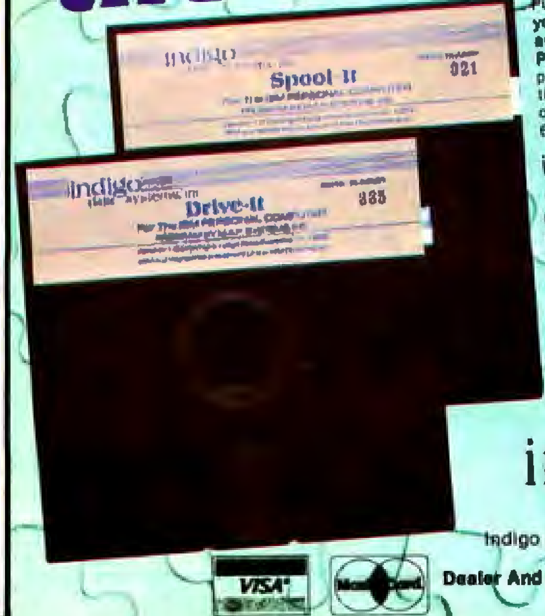

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players' turns with each new playing field. The scores are cumulative and the person with the highest score at the end of five rounds is the winner.

Law of Motion

In life, the force or magnitude of the push or pull exerted upon an electron by an ion is inversely proportional to the square of the distance from the electron to the ion. For Charge!, however, I adapted this law of physics and used an inverse-distance (as opposed to an inverse-distance-squared) force algorithm. This change gives distant ions more influence over the electron and provides more dynamic action.

The Program

The primary features of Charge! are in straightforward BASIC and could be converted easily for use with other computers, including those with only low-resolution graphics (see listing 1). Some embellishments incorporated in the program take advantage of the Apple's unique characteristics, but these features could be deleted without significantly altering the game. For example, lines 8000 through 8180 contain a subroutine that causes the scores to be clicked up in pinball-machine fashion, complete with sound effects. A simple print statement could replace the entire routine. Another embellishment appears in the title display (lines 6030 through 6190). When the program starts, a flashing marquee appears on the screen, followed by a musical fanfare (generated by the subroutine in lines 9000 through 9290), and finally the title and the copyright notice are displayed. The fanfare is also played at the end of each game. (See listing 2 for an assembly-language version of the fanfare routine.) Further enhancements that could be left out include the sound effects sprinkled throughout the program. These can be recognized easily in the listing because they contain the variable SS.

The rest of the program is regular BASIC. Lines 7000 through 7170 keep track of the skill level, the number of players, and the players' names. Lines 4000 through 4140 register the score for each player, the number of electrons fired, and the number of people who have played in the current round. This information is used to determine which player goes next. The routine that draws the field and the scale markings and places the ions on the field appears in lines 2000 through 2170 and uses the shape table information in listing 3. This section also assigns a positive or negative value to each ion. Movement of the electron is handled in lines 1000 through 1090. Using the directional input provided by the player, the program translates the pair of coordinates into a velocity vector of magnitude SO. A new velocity vector is then computed based on the position and charge of each of the ions. Lines 3000 through 3050 contain the impact sequence. If the electron has gone outside the field, its position vector is set to the nearest field position, and an arrow is drawn indicating the point of impact. This position determines the player's score. The ending sequence for the game is provided in lines 5000 through 5150. The primary function of this sequence is to determine if another game is requested and, depending on that determination, either exit or set the parameters for the new game.

Charge! is a game that can be enjoyed by players of all ages. My engineering friends find it to be a challenge to their professional vanity and yet the game is simple enough that my 4-year-old daughter is an enthusiastic player. ■

The author has offered to make copies of his program available to BYTE readers for $8. Send a blank disk and a self-addressed stamped envelope to:

C. Anthony Ray
39 Carriage Place
Urbana, IL 61801

Listing 1: *The BASIC program for Charge!*

```
10   REM  ***********************
20   REM  *                     *
30   REM  *       CHARGE!       *
40   REM  *                     *
50   REM  * COPYRIGHT (C) 1982 *
60   REM  * BY C. ANTHONY RAY  *
70   REM  *                     *
80   REM  ***********************
90   REM
100  GOSUB 6010: DIM SG(5,2): GOTO
     7010
1000 REM  * CHARGE MOVE ROUTINE *
1010 HP = SQR(XO * XO + YO * YO):
     IF HP = 0 THEN HP = 1
1020 XO = XO * S0 / HP:YO = YO *
     S0 / HP
1030 FOR I = OE TO FV: IM = PEEK
     (SS):IM = PEEK(SS):NEXT
1040 DRAW TR AT XP,YP
1050 XN = XO:YN = YO
1060 FOR I = ZE TO SL:X = SG(I,ZE)
     - XP:Y = SG(I,OE) - YP:HP =
```

Listing 1 continued on page 116

spinwriter
+
IBM

Listing 1 continued:

```
      X * X + Y * Y:XN = XN - CG *
      SG(I,TW) * X / HP:YN = YN -
      CG * SG(I,TW) * Y / HP: NEXT
1070  XDRAW TR AT XP,YP:XP = XP +
      XN:YP = YP + YN
1080  IF XP < ZE OR XP > TN OR YP <
      ZE OR YP > O9 THEN GOTO
      3010
1090  XDRAW TR AT XP,YP: GOTO 1060
2000  REM  * DRAWS IONS *
2010  HGR : SCALE = OE: ROT = ZE
2020  HPLOT ZE,ZE TO 279,ZE TO 279,
      159 TO ZE,159 TO ZE,ZE
2030  FOR I = OE TO 13: HPLOT 20 *
      I,157 TO 20 * I,159: NEXT
2040  FOR I = OE TO 7: HPLOT 277,
      20 * I TO 279,20 * I: NEXT
2050  HC = FV:SP = TW
2060  PO = - OE:PI = OE
2070  FOR I = OE TO SL
2080  SG(I,ZE) = 2 * INT (125 * RND
      (1)) + 15
2090  SG(I,OE) = 2 * INT (65 * RND
      (1)) + 14
2100  SG(I,TW) = - PI
2110  PI = PI * PO
2120  HC = HC - PI:SP = SP + PI
2130  HCOLOR = HC
2140  DRAW SP AT SG(I,ZE),SG(I,OE)
2150  NEXT
2160  HCOLOR = 7
2170  RETURN
3000  REM  * IMPACT SEQUENCE *
3010  IF XP > 279 THEN XP = 279: ROT =
      48
3020  IF YP > 159 THEN YP = 159; ROT =
      0
3030  IF XP < 0 THEN XP = 0: ROT =
      16
3040  IF YP < 0 THEN YP = 0; ROT =
      32
3050  DRAW FR AT XP,YP: FOR I = OE
      TO 50;IM = PEEK (SS) - PEEK
      (SS): NEXT
4000  REM  * SCOREKEEPING & WHOSE
      TURN *
4010  FOR I = OE TO HM
4020  IF I = MC THEN S(I) = S(I) +
      INT(XP * YP)
4030  NEXT
4040  IF INT(XP * YP) = 0 THEN
      PRINT : GOTO 4070
4050  GOSUB 8010
4060  HOME
4070  C = C + 1
4080  IF C = FV * HM GOTO 5010
4090  IF M = HM THEN IF H = HM THEN
      H = OE: M = OE: MC = OE: GOSUB
      2010:GOTO 7150
4100  IF H = HM THEN M = M + OE: MC
      = M: H = OE: GOSUB 2010: GOTO
      7150
4110  MC = MC + 1
4120  H = H + 1
4130  IF MC > HM THEN MC = 1
4140  GOTO 7150
5000  REM  * ENDING SEQUENCE *
5010  POKE 34,0
5020  HTAB 1: VTAB 24: GOSUB 9060:
      PRINT "ANOTHER GAME? (Y/N)";
5030  GET Y$: IF Y$ < > "Y" THEN
      GOTO 5150
5040  H = 1: M = 1: MC = 1: C = 0
5050  FOR I = OE TO HM:S(I) = ZE:
      NEXT
5060  VTAB 21: HTAB 1: PRINT SPC(
      80)
5070  HOME
5080  VTAB 24: HTAB 1: PRINT "SAME
       SKILL LEVEL? (Y/N) ";: GET
      Y$
5090  IF Y$ < > "Y" THEN HOME:
      VTAB 24: HTAB 1: INPUT "SKILL
      LEVEL (1-5) ? ";SL
```

Listing 1 continued on page 118

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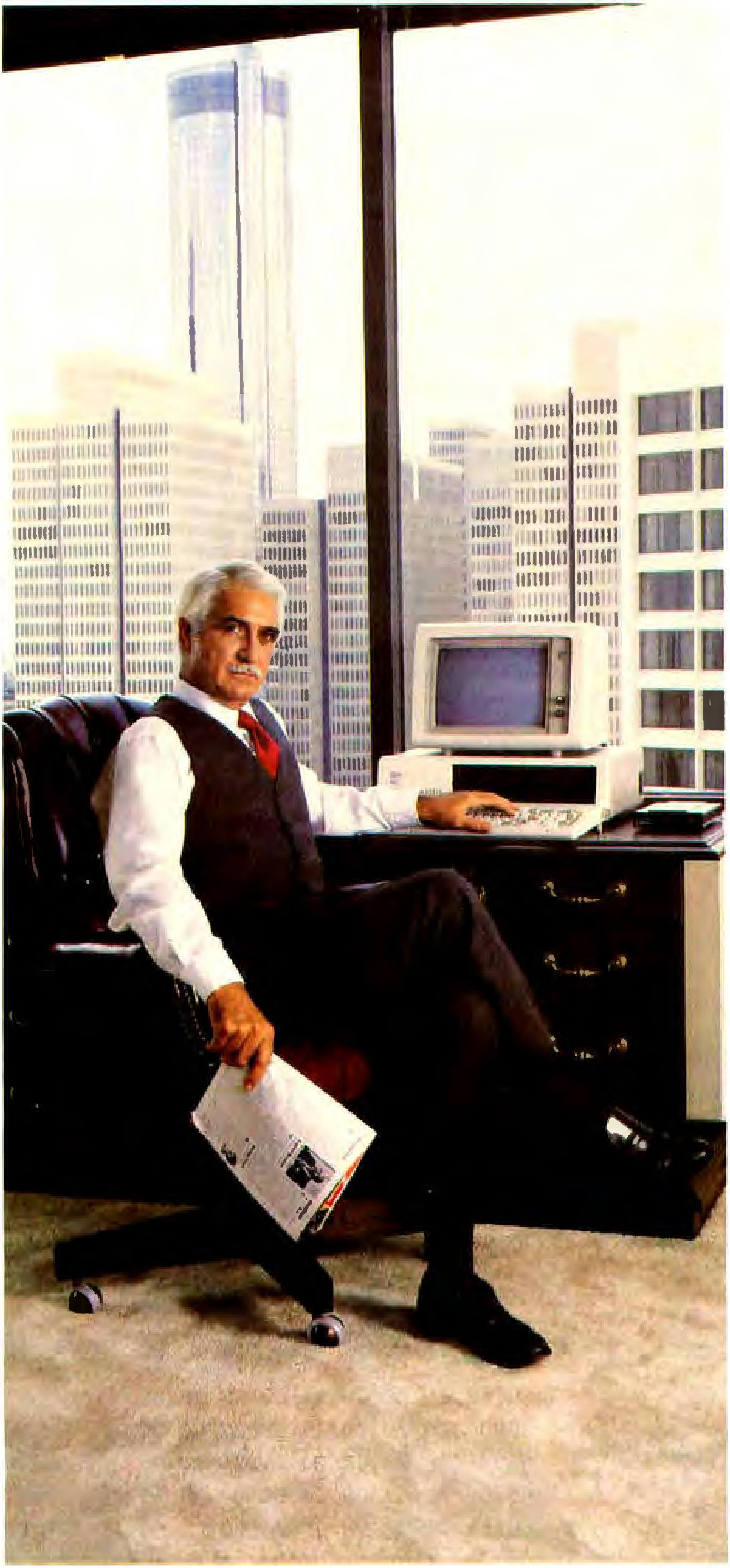
Listing 1 continued:

```
5100  IF SL < OE OR SL > FV GOTO
      5090
5110  HOME
5120  VTAB 24: HTAB 1: PRINT "SAME
      PLAYERS? (Y/N) ";: GET Y$
5130  IF Y$ = "Y" THEN C = Ø: GOSUB
      2010: GOTO 7140
5140  GOTO 7040
5150  HOME: TEXT: END
6000  REM * HEADING *
6010  PRINT CHR$(4)"BLOAD CHARGE
       SHAPES": POKE 232,Ø:POKE
      233,96
6020  ZE = Ø: OE = 1: TW = 2: C = Ø:
      TR = 3: FR = 4: FV = 5: SØ + 1Ø:
      CG = 25: SS = -16336: TN = 279:
      O9 = 159
6030  TEXT
6040  FLASH
6050  PRINT "*************************
      *************"
6060  FOR I = OE TO 21: PRINT "*"
      ;: HTAB 39: PRINT "*": NEXT
6070  PRINT "*************************
      **************"
6080  NORMAL
6090  GOSUB 9010
6100  VTAB 3: HTAB 14: PRINT "---
      ---------";
6110  FOR I = OE TO TR: VTAB TR + I:
      HTAB 14: PRINT "!
         !";: NEXT
6120  VTAB 7: HTAB 14: PRINT "---
      ---------";
6130  VTAB 5; HTAB 17: PRINT "CHARGE!";
6140  VTAB 1Ø: HTAB 12: PRINT "A
      GAME FOR UP TO";
6150  VTAB 12: HTAB 14: PRINT "FOUR
      PLAYERS";
6160  VTAB 16: HTAB 11: PRINT "CO
      PYRIGHT (C) 1982";
6170  VTAB 18: HTAB 11: PRINT "BY
      C. ANTHONY RAY";
6180  FOR I = 1 TO 15ØØ: NEXT I
6190  RETURN
7000  REM  * START INFO *
7010  HOME : HGR
7020  VTAB 22: INPUT "SKILL LEVEL
      (1-5) > "; SL
7030  IF SL < 1 OR SL > 5 THEN 7Ø1Ø
7040  GOSUB 2Ø1Ø
7050  HOME : VTAB 22: INPUT "HOW
      MANY PLAYERS? ";HM
7060  H = 1: M = 1: MC = 1
7070  IF HM < 1 OR HM > 4 THEN GOTO
      7Ø5Ø
7080  FOR I = 1 TO HM
7090  HOME : VTAB 22: INPUT "WHAT'S
      YOUR NAME? "; NAME$(I)
7100  PRINT "HI, ";NAME$(I)
7110  FOR J = 1 TO 5ØØ: NEXT J
7120  HOME
7130  NEXT I
7140  VTAB 21:HTAB 1: PRINT NAME
      $(1): IF HM > 1 THEN VTAB 21:
      HTAB 2Ø:.PRINT NAME$(2); IF
      HM > 2 THEN VTAB 22: HTAB 1:
      PRINT NAME$(3): IF HM > 3 THEN
      VTAB 22: HTAB 2Ø: PRINT NAME$
      (4)
7150  XP = 7: YP = 7: POKE 34,23
7160  VTAB 24: HTAB 1: PRINT NAME
      $(MC);"'S TURN. DIRECTION (X
      ,Y) ";
7170  INPUT XO,YO: GOTO 1Ø1Ø
8000  REM  * TICKS UP SCORE *
8010  IF MC = 1 THEN HT = 12:VT =
      21
8020  IF MC = 2 THEN HT = 32:VT =
      21
8030  IF MC = 3 THEN HT = 12:VT =
      22
8040  IF MC = 4 THEN HT = 32:VT =
      22
```

Listing 1 continued on page 120



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Listing 1 continued:

```
8050  AM = S(MC)
8060  D%(1) = AM/100000:AM = AM -
      D%(1) * 100000
8070  D%(2) = AM/10000:AM = AM -
      D%(2) * 10000
8080  D%(3) = AM/1000:AM = AM -
      D%(3) * 1000
8090  D%(4) = AM/100:AM = AM -
      D%(4) * 100
8100  D%(5) = AM/10:AM = AM - D%
      (5) * 10
8110  D%(6) = AM
8120  FOR J = 6 TO OE STEP -1
8130  FOR I = ZE TO D%(J)
8140  HTAB HT + J: VTAB VT: PRINT
      I;
8150  IM = PEEK(SS) - PEEK(SS)
      + PEEK(SS) - PEEK(SS) +
      PEEK(SS) - PEEK(SS)
8160  NEXT I
8170  NEXT J
8180  RETURN
9000  REM  * FANFARE *
9010  FOR I = 0 TO 18
9020  READ X
9030  POKE 768 + I,X
9040  NEXT
9050  DATA   173,48,192,136,208,
      4,198,1,240,8,202,208,246,
      166,0,76,0,3,96
9060  S = 768
9070  POKE 1,50
9080  POKE 0,91
9090  CALL S
9100  FOR I = 1 TO 3: NEXT I
9110  POKE 1,33
9120  POKE 0,82
9130  CALL S
9140  FOR I = 1 TO 3: NEXT I
9150  POKE 1,33
9160  POKE 0,75
9170  CALL S
9180  FOR I = 1 TO 3: NEXT I
9190  POKE 1,130
9200  POKE 0,66
9210  CALL S
9220  FOR I + 1 TO 30: NEXT I
9230  POKE 1,50
9240  POKE 0,75
9250  CALL S
9260  POKE 1,255
9270  POKE 0,66
9280  CALL S
9290  RETURN
```

Listing 2: *The fanfare assembly-language routine. This information is placed in memory by the POKE statements in lines 9010 through 9050 of the main program.*

```
0300:                  ORG  $300
0300:AD 30 C0    START LDA  $C030
0303:88          B1    DEY
0304:D0 04             BNE  B2
0306:C6 01             DEC  $1
0308:F0 08             BEQ  B3
030A:CA          B2    DEX
030B:D0 F6             BNE  B1
030D:A6 00             LDX  $0
030F:4C 00 03          JMP  START
0312:60          B3    RTS
```

Listing 3: *The game shape table, including the positive ion, negative ion, electron, and arrow (in that order).*

```
6000- 04 00 0A 00 1D 00 27 00
6008- 2A 00 24 24 37 36 36 36
6010- 25 24 2D 2D 3C 3F 3F 3F
6018- 3F 2E 2D 05 00 3F 3F 2E
6020- 2D 2D 2D 25 3F 3F 00 2C
6028- 3E 00 08 20 24 24 24 95
6030- 92 62 0C 0C DC DB DB 13
6038- 0E 0E 0E 0E 06 00
```

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The action takes place in a 30- by 30-unit galaxy that may be thought of as the surface of a sphere. While your view of the galaxy appears limited by the confines of the screen display, there are no boundaries: if you move off the top of the galaxy, you will reappear at the bottom; leaving from one side will cause you to reenter on the other. The size of your galaxy may be changed by altering the SIZE constant in the program.

The Cosmic Arena

The primary graphics display is the battle-fleet scan, the part of the galaxy immediately surrounding your current fleet (see figure 1). The battle-fleet symbol is in the center of the display, surrounded by the stars, the planets, the colonies, and the enemy battle fleets. The scan remains centered on the battle fleet currently under your control, and when you make a move the planets, stars, etc., appear to move past your fleet. The *x* and *y* values displayed below the scan are coordinates that identify the present position of your battle fleet in the galaxy. The number of fighting ships available in your current fleet is also listed below the scan display, as well as the number of troop legions on board the fleet. Other information displayed includes the number of credits you have available and your score so far.

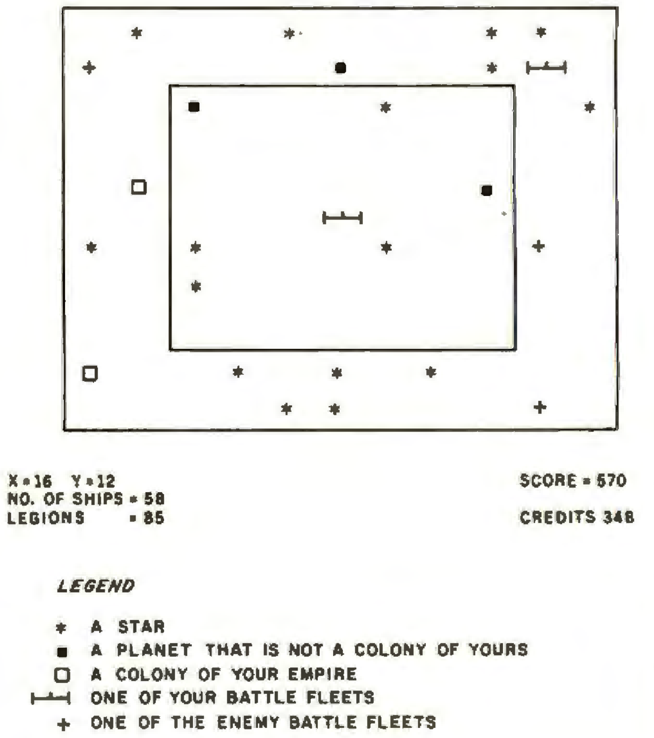

Figure 1: *An example of the screen display during the game. Use the legend to identify the game symbols.*

About the Author

Alan Sartori-Angus is Professor of Computer Science at the University of Natal, Durban, South Africa. He has been involved with computing since 1976 and specializes in data communications and operating systems, especially as applied to microcomputers. His interests include both standard and computer chess, war-gaming, and sports. He is presently involved in the design and construction of a FORTH engine using bit-slice components.

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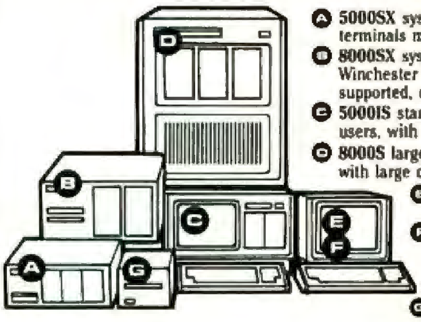

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You begin the game with 250 credits, which can be used to purchase more ships or enlist additional legions. Although you don't have control of any colonies at this point, you have two fleets, each consisting of 20 ships and 50 legions. In addition, you have no idea what the galaxy looks like and no clues to what the enemy (the computer) is up to. Using one of the several commands available (see the text box on page 128), you can begin to create a powerful empire.

Your score indicates the strength of your empire, which you can increase by adding to the number of planets you control and the number of legions and ships you have. However, the strength of your empire is reduced by the strength of the computer's empire. You therefore have two methods of gaining strength: first, colonize as many planets as possible, and keep your troop numbers high; second, reduce the enemy's strength by taking over its colonies and destroying its battle fleets.

In determining your strategy, you will be faced with several difficult decisions. Do you place large garrisons on your planets to make them secure from the enemy and from internal revolt, or do you use those legions to colonize more planets? Do you spend your credits on ships that can help you destroy enemy battle fleets, or do you pay to enlist more legions? It's highly unlikely that you'll find a clear winning combination of strategy and tactics. In fact, you may be well on the way to a high score when your fleet disappears from the screen upon being swallowed by a black hole.

Design Decisions

Cosmic Conquest is designed to be a single-player game of real-time action and strategic decision making. I wanted the game to be played in real time but to be more than just a game to test quick reactions in the manner of Space Invaders. I also decided that each play of the game should be different and that the game would use the precept of offering incomplete information to create a game for which there is no consistent winning strategy.

These design decisions are important to the play of Cosmic Conquest. The use of real time adds to your sense of tension as you play. Having to make split-second decisions all the time, some of which may cost you the game, is what I wanted Cosmic Conquest to be about. If you have all day to make decisions, it becomes too easy to win. The program further challenges you by never producing the same game twice. Not only is the galaxy different each time, but the winning tactics also change.

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Cosmic Commands

The following commands are available to you during the course of a game:

Move: *The current battle fleet (the one shown in the center of the scan) can be moved up, down, left, and right merely by pressing the W, Z, A, and S keys, respectively.*

Other Fleet: *To make your other battle fleet your current fleet, press the 0 key. The display will change to show the area around your new current fleet. You can move, fight, colonize, etc. only with your current fleet.*

Information: *Additional information about the current state of the game can be obtained at any time by hitting the I key. This information includes the number of planets in your empire and the number of both planets and battle fleets in the computer's empire.*

Fire: *You can attack an enemy battle fleet in an adjoining square to your current battle fleet by pressing the F key. Casualties are inflicted on both fleets in proportion to the strength of the enemy fleet. (A rough guide is that a fleet will inflict a casualty rate of 40 percent of its strength upon the enemy fleet.) Battles may continue as long as you wish or until either one of the fleets is destroyed.*

Tax: *You may tax all the planets in your empire at any time by pressing the T key. The amount of tax provided by a planet is in proportion to the class of the planet. A larger-class planet will generally provide more taxes. However, because planets do not like being taxed it's possible that one or more will revolt. The likelihood that this will occur increases each time the planets are taxed. When a revolution occurs, you are told which planet revolted and whether or not the revolt was successful.*

Land: *You can attempt to land on any planet adjacent to your current battle fleet. The display prompts for the direction of the planet relative to the fleet and you indicate your choice by using the MOVE keys. When you land on the planet, you are faced with one of three situations: the planet is already a member of your empire, the planet is uncolonized, or the planet is garrisoned by enemy forces.*

If the planet is already a member of your empire, you are told the class of the planet and the size of the local garrison and are given a choice from five options: (1) leave legions on the planet, (2) gather legions from the planet, (3) buy ships, (4) enlist troops, and (5) leave.

Option 1 lets you transfer legions from the fleet to the planet to strengthen local garrison. This garrison puts down revolts when they occur and wards off attacks by the enemy. With option 2, you can reduce the strength of the local garrison in order to increase the number of legions with the fleet. The fleet legions are needed when you attack the enemy and capture other planets. By choosing option 3, you can purchase additional ships for your fleet. The planet will tell you the cost per ship, and you can buy as many ships as your credits will cover. If you choose option 4, you can raise new legions from the inhabitants of the planet. However, the planet is only capable of producing a limited number of legions and the cost of enlistment is an important factor. The planet will inform you as to the number of legions available and what they cost. The larger the class of a planet, the more legions it will be able to produce and the higher the cost will be for raising them. With both options 3 and 4, a built-in safeguard prevents you from repeating your request to buy in an effort to overcome the limitations on the numbers available. To leave the planet, you must choose option 5.

If the planet is uncolonized, you will be told the class of the planet and asked whether you wish to attack. A rough estimate of the strength of the planet can be made from the class; a planet is capable of having legions numbering the same as its class. If you decide to attack, the computer calculates the result of the battle and tells you either that your forces are now in control or that your forces have retreated. Whatever the outcome of the battle, you will also receive a report of losses.

When the enemy controls the planet, you are told the class of the planet and the size of the garrison. You are asked if you wish to attack, and if you respond affirmatively the computer calculates the result of the battle and displays it along with the number of losses.

Additionally, at any moment in time you can see only the portion of the galaxy that immediately surrounds the battle fleets. You have to cope with incomplete information, not knowing where the computer's fleets are nor which planets the computer has under control.

Programming the Action

I wrote the game program in FORTH for several reasons. The real-time aspect required that the speed of the display be as fast as possible, and the intended complexity of the game seemed to require a high-level language. FORTH satisfied both of these criteria. Another factor was the continued growth and development of the game program. Because the game has been growing and changing since its conception, it was important for me to use a language that would allow fundamental changes to the program with a minimum of time and effort.

The information for the game is stored mainly in the three 30 by 30 arrays called GALAXY, INFO1, and INFO2 (see listing 1). The GALAXY array registers the contents (planets, battle fleets, etc.) of each square unit of the galaxy. For each of these squares that contains a planet, the corresponding array, INFO1, has two pieces of information about the planet. The least significant three bits contain the alliance factor for the planet, which is randomly set at the beginning of the game and decremented each time the planet is taxed. When the fac-

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CP-202C

Circle 220 on inquiry card.

tor reaches zero, the planet revolts. The most significant five bits hold the class of the planet. The array INFO2 has various pieces of data. If the corresponding entry in the GALAXY array is a planet, then INFO2 holds the size of the local garrison. If the corresponding GALAXY entry shows an enemy fleet, then INFO2 gives the number of ships in that fleet.

The primary game loop is contained in the FORTH word RESTART. The program loops here and while waiting for you to press a key determines if the computer should be taking any action. The game program is written so that the computer will continue to play even if you do nothing. When you do press a key, that command is decoded by the FORTH word OBEY-COMMAND and is subsequently executed.

Another point of interest is the method by which the program handles the screen display. The graphics symbols are defined in shape tables, but in my initial use of them I discovered that the processor updated the main display too slowly. To make the display update faster, I defined a small array, SCREEN, which at any moment during the game contains the description of the contents of the main graphics display on the screen. When the display is updated, the program first checks in SCREEN to see what is already there. If the display is already showing the symbol in question, no update takes place. The only time the screen is updated is when a different symbol has to be placed at a position on the screen. Although this method involves more calculation, it increases the speed of the display considerably because fewer symbols are written to the Apple high-resolution area on each update.

So with a limited amount of time, you must capture and keep as many planets as possible, avoid black holes, stamp out revolutions, and hold the enemy at bay by destroying opposing fleets. With over 2500 possible scenarios, Cosmic Conquest should keep you occupied for some time.■

Listing 1: *The FORTH program for Cosmic Conquest.*

```
COSMIC CONQUEST: THE LISTING
( constants)
30 CONSTANT SIZE  ( the size of the galactic array)
SIZE 2 * CONSTANT NO-OF-STARS  ( no. of stars in galaxy)
SIZE 3 * 2 / CONSTANT NO-OF-PLANETS  ( planets in galaxy)
4   CONSTANT NO-OF-B-HOLES     ( no. of black holes)
200 CONSTANT W1   ( weight value assigned to planets in score)
5   CONSTANT W2   ( weight assigned to ships and troops)
10  CONSTANT W3   ( weight assigned to computers troops)
20000 CONSTANT SPEED ( how quickly computer moves)

( variables)
0 VARIABLE TEMP1  ( a temporary storage variable)
0 VARIABLE VTAX   ( tax collected)
0 VARIABLE C-LEGIONS  ( no. of computer legions for attacks)
0 VARIABLE CLASS-TOTALS ( computers planets classes totals)
0 VARIABLE C-FLEETS ( no. of computer fleets)
0 VARIABLE LEN    ( no. of moves remaining in game)
0 VARIABLE TROOPS ( no. of computers troops in game)
0 VARIABLE RAND1 ( first random number seed)
0 VARIABLE RAND2 ( second random number seed)
0 VARIABLE X      ( temporary storage for X position)
0 VARIABLE Y      ( temporary storage for Y position)
0 VARIABLE BUY-V  ( count to stop player buying every move)
0 VARIABLE LEG    ( the no. of legions available to buy)
0 VARIABLE NEW    ( how often new fleet created)
0 VARIABLE COMP-START ( how quickly computer plays)
0 VARIABLE COMPUTER ( how quickly computer plays)
0 VARIABLE DIFF   ( difficulty of game 1-4)
0 VARIABLE C-PLANETS ( no. of computer planets)
0 VARIABLE PLANETS ( no. of players planets)
1 VARIABLE FLEET-FLAG ( no. of players current fleet)
250 VARIABLE CREDIT ( players credit in taxes)
0 VARIABLE START   ( starting score in the game)

( defining words)
: ARRAY          ( 2D array)
   <BUILDS DUP C, * ALLOT DOES>
   ROT 1 - OVER C@ * + + ;

( arrays)

SIZE SIZE ARRAY GALAXY   ( the galactic array)
SIZE SIZE ARRAY INFO1    ( planetary array)
SIZE SIZE ARRAY INFO2    ( strength array)
11 11 ARRAY SCREEN       ( the screen array)
2 6 ARRAY FLEETS         ( players fleets info.)

( the case statement)
: CASE
   ?COMP CSP @ !CSP 4 ; IMMEDIATE

: OF
   4 ?PAIRS COMPILE OVER COMPILE = COMPILE 0BRANCH HERE 0 ,
   COMPILE DROP 5 ; IMMEDIATE

: ENDOF
   5 ?PAIRS COMPILE BRANCH HERE 0 , SWAP 2 [COMPILE]
   ENDIF 4 ; IMMEDIATE

: ENDCASE
   4 ?PAIRS COMPILE DROP BEGIN SP@ CSP @ = 0= WHILE 2
   [COMPILE] ENDIF REPEAT CSP ! ; IMMEDIATE

( general utility words)
: DELAY                        ( delay a fixed amount of time)
   5000 0 DO LOOP ;

: CLEAR-MSGE                   ( clear message area on text screen)
   18 10 DO
         I 0 VHTAB 35 SPACES
       LOOP ;

: XY@
   X @ Y @ ;

: CLEAR-SCREEN                 ( clear hires screen 1)
   H1 HCLR ;

: CLEAR-DISP                   ( fill screen array with FF's)
   1 1 SCREEN 121 255 FILL ;

: CLEAR-GALAXY                 ( fills galactic array with NULLs)
   1 1 GALAXY SIZE SIZE * 0 FILL ;

: CLEAR-INFO                   ( fills info arrays with NULLs)
   1 1 INFO1 SIZE SIZE * 0 FILL
   1 1 INFO2 SIZE SIZE * 0 FILL ;

: RANDOM1  (  --- ran )       ( random number in range 1-SIZE)
   RAND1 @ 37 * 651 + DUP RAND1 ! ABS SIZE MOD 1+ ;

: RANDOM2  (  --- ran )       ( random number in range 1-SIZE)
   RAND2 @ 53 * 773 + DUP RAND2 ! ABS SIZE MOD 1+ ;

: EDGE-CHECK  ( n --- ng )
             ( calculates wrap around of galaxy)
   SIZE 1 - + SIZE MOD 1+ ;

: INPUT   (  --- n1 )         ( number input routine)
   0 BEGIN                     ( start with zero total)
       KEY DUP EMIT DUP 8 =    ( is it backspace?)
       IF
         DROP 10 / 0           ( get rid of last digit)
       ELSE
         DUP 57 >           ( check if char. is digit)
         IF  DROP 1
         ELSE DUP 48 <
            IF DROP 1
            ELSE 48 - SWAP 10 * + 0
            ENDIF
          ENDIF
        ENDIF
      UNTIL ;

: F      ( n1 --- addr )    ( indexes current fleet array)
   FLEET-FLAG @ SWAP FLEETS ;
```

Listing 1 continued on page 132

Which Spreadsheet lets you:

- Use every cell (never see "out of memory")
- Consolidate multiple spreadsheets
- Split the screen as often as you want

VisiCalc. . . . . .NO
SuperCalc. . . . . . .NO
CalcStar . . . . .NO

ScratchPad . . . YES

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BYTE GAME CONTEST

Listing 1 continued:

```
: TEXT                       ( selects text screen )
  0 -16303 C! ;

: END-MSGE                   ( end of game message)
  TEXT 12 0 VHTAB ." END OF GAME COMMANDER" ;

( graphics shapes and utilities)

0 VARIABLE SPACEFIG 80 ALLOT  ( shape tables)

: C$                         ( loads 8-bit value into table)
  OVER C! 1+ ;

: $                          ( loads 16-bit value into table)
  OVER ! 2 + ;

SPACEFIG                     ( load shape tables)
  12 $ 31 $ 41 $ 47 $ 63 $  74 $ HEX
( space shape)
  24 C$ 3F C$ 37 C$ 36 C$ 2E C$ 24 C$ 2C C$ 36 C$ 2E C$ 2C C$
  2E C$ 25 C$ 24 C$ 3C C$ 37 C$ 2E C$ 34 C$ 36 C$ 00 C$
( colony shape)
  12 C$ 2D C$ 24 C$ 24 C$ 3F C$ 3F C$ 36 C$ 36 C$ 20 C$ 00 C$
( planet shape)
  2C C$ 36 C$ 3F C$ 24 C$ 05 C$ 00 C$
( star shape)
  3C C$ 36 C$ 2D C$ 24 C$ 1C C$ 1F C$ 16 C$ 16 C$ 0D C$ 0D C$
  1C C$ 2C C$ 1C C$ 0C C$ 04 C$ 00 C$
( players fleet shape)
  3C C$ 1B C$ 36 C$ 26 C$ 0B C$ 2D C$ 2D C$ 25 C$ 36 C$ 36 C$
  00 C$
( computers fleet shape)
  36 C$ 07 C$ 20 C$ 29 C$ 32 C$ 00 C$

DECIMAL DROP FORGET C$  ( we don't need C$ and $ any more)

: SKETCH  ( n ---  )     ( sketch shape n at current position)
  2 * 0 SWAP SPACEFIG + @ SPACEFIG + DRAW ;

( into the main game words)

: SET-UP-GALAXY
  NO-OF-STARS 0 DO 2 RANDOM1 RANDOM2 GALAXY C!
               LOOP   ( set up stars in galaxy)
  NO-OF-PLANETS 0 DO RANDOM1 RANDOM2 2DUP 4 ROT ROT
                  GALAXY C!  ( set up planets)
                  RANDOM1 4 * 8 + ROT ROT INFO1 C!
                  ( set up class of planet)
                LOOP
  NO-OF-B-HOLES 0 DO 0 RANDOM1 RANDOM2 GALAXY C!
                  ( set up black holes)
                LOOP ;

: INITIALISE         ( initialise all variables and arrays)
  CR CR
  BEGIN
     ." WHAT LEVEL OF DIFFICULTY (1-4) " INPUT DUP
     5 < IF  ( correct response) 1
         ELSE ( incorrect response) DROP CR 0
         ENDIF
  UNTIL
  DIFF !       ( store difficulty)
  HOME CR CR
  ." DO YOU WANT" CR ." 1. SHORT" CR ." 2. MEDIUM" CR
  ." 3. LONG" CR ." GAME"
  KEY 127 AND      ( pick up reply)
  CASE
     49 ( 1) OF 350 LEN ! ( 350 moves) ENDOF
     50 ( 2) OF 700 LEN ! ( 700 moves) ENDOF
              1500 LEN ! ( 1500 moves otherwise)
  ENDCASE
  HOME ." INITIALISING"
  CLEAR-GALAXY CLEAR-DISP CLEAR-INFO SET-UP-GALAXY
  1 FLEET-FLAG !             ( make fleet 1 current fleet)
  250 CREDIT !               ( players credit)
  0 PLANETS !                ( no planets)
  0 C-PLANETS !              ( none for computer either)
  20 1 3 FLEETS ! 20 2 3 FLEETS ! ( fleets start with 20 ships)
  50 1 5 FLEETS ! 50 2 5 FLEETS ! ( fleets have 50 legions each)
  DIFF @ 4 * 0 DO ( position computers fleets)
                  RANDOM1 RANDOM2 2DUP 17 ROT ROT GALAXY C!
                  15 ROT ROT INFO2 C!
             LOOP
  16 22 18 GALAXY C! 16 18 22 GALAXY C! ( position fleets)
  22 1 1 FLEETS C! 18 1 2 FLEETS C!
  18 2 1 FLEETS C! 22 2 2 FLEETS C!
  29 3 DIFF @ * - NEW !  ( how often computer creates fleets)
  15 DIFF @ 4 * * TROOPS ! ( initial no. of computer troops)
  20 DIFF @ * C-LEGIONS ! ( no. of spare computer legions)
  DIFF @ 4 * C-FLEETS !   ( no. of computer fleets)
  SPEED DUP COMPUTER !
  COMP-START !    ( how often computer moves)
  1 BUY-U ! ;

: DRAW-BORDERS    ( draw borders of display and headings)
  CLEAR-SCREEN
  7 HCOLOUR       ( colour white)
  17 5 HPOSN
     238 5 HLINE 238 126 HLINE 17 126 HLINE 17 5 HLINE
  57 27 HPOSN
     198 27 HLINE 198 104 HLINE 57 104 HLINE 57 27 HLINE
  HOME
  ." PLAYER"
  2  0  VHTAB ." PLANETS ="
  4  0  VHTAB ." EMPIRE"
  6  0  VHTAB ." FLEETS"
  6  21 VHTAB ." PLANETS"
  20 0  VHTAB ." X="
  20 7  VHTAB ." Y="
  21 0  VHTAB ." NO. OF SHIPS ="
  22 0  VHTAB ." LEGIONS ="
  20 25 VHTAB ." SCORE ="
  22 21 VHTAB ." CREDITS" ;

: FIND-DIRECTION     ( --- X Y )
                     ( find out which square player means)
  23 0 VHTAB ." WHICH DIRECTION?"
  2 SPACES KEY 127 AND
  CASE
     87 (    up) OF -1  0 ENDOF
     90 (  down) OF  1  0 ENDOF
     83 ( right) OF  0  1 ENDOF
     65 (  left) OF  0 -1 ENDOF
                     0  0
  ENDCASE
  23 0 VHTAB 35 SPACES   ( clear message)
  2 F C@ + EDGE-CHECK SWAP
  1 F C@ + EDGE-CHECK SWAP ;

: PRINT-IT  ( c --- )
     ( shape determined by c is printed on screen at)
     ( position in X,Y)
  DUP X @ 1+ Y @ 1+ SCREEN C@ =
  IF  ( display is already showing this shape so don't bother)
    DROP
  ELSE
    DUP X @ 1+ Y @ 1+ SCREEN C! ( remember what screen has)
    0 HCOLOUR                   ( colour black)
    X @ 20 * 27 + Y @ 1+ 11 * HPOSN
    0 SKETCH                    ( blank out char. there)
    7 HCOLOUR                   ( colour white)
    X @ 20 * 27 + Y @ 1+ 11 * HPOSN
    CASE                        ( draw shape)
        2 ( a star)          OF 3 SKETCH ( draw star)      ENDOF
        4 ( empty planet)    OF 2 SKETCH ( a planet)       ENDOF
        5 ( enemy planet)    OF 2 SKETCH ( a planet)       ENDOF
      132 ( players planet)  OF 1 SKETCH ( a colony)       ENDOF
       16 ( players fleet)   OF 4 SKETCH ( players fleet)  ENDOF
       17 ( enemy fleet)     OF 5 SKETCH ( enemy fleet)    ENDOF
    ENDCASE
  ENDIF ;

: DRAW-SCAN                        ( draw the screen display)
  1 F C@ 5 - 2 F C@ 5 -
  11 0 DO
     11 0 DO
          OVER EDGE-CHECK OVER EDGE-CHECK
          J Y ! I X ! GALAXY C@
          PRINT-IT 1+
        LOOP
        11 - SWAP 1+ SWAP
     LOOP
  DROP DROP ;

: DRAW-FIGURES    ( draw the totals in the display)
  2 10 VHTAB PLANETS @ 5 .R
  20 33 VHTAB PLANETS @ C-PLANETS @ - W1 *
          1 3 FLEETS @ 2 3 FLEETS @ + W2 * +
          1 5 FLEETS @ 2 5 FLEETS @ + W2 * +
          TROOPS @ W3 * - 6 .R
  6 0   VHTAB C-FLEETS @ 5 .R
  6 29  VHTAB C-PLANETS @ 5 .R
  20 2  VHTAB 2 F C@ 2 .R
  20 9  VHTAB 1 F C@ 2 .R
  21 15 VHTAB 3 F @ 4 .R
  22 10 VHTAB 5 F @ 6 .R
  22 31 VHTAB CREDIT @ 6 .R ;

: DRAW-DISPLAY
  1 SCALE H1 DRAW-SCAN DRAW-FIGURES ;

: NEW-FLEET  ( fleet destroyed for some reason)
  0 1 F C@ 2 F C@ GALAXY C!   ( remove fleet symbol)
  0 3 F !                     ( no ships left)
  0 5 F ! ;                   ( no legions left)

: MOVE-FLEET  ( X Y --- )
  2DUP
  0 1 F C@ 2 F C@ GALAXY C!   ( remove old symbol)
  16 ROT ROT GALAXY C!        ( position fleet)
  2 F C! 1 F C! ;             ( update fleet array)

: CHECK-POSITION  ( X Y --- )
                  ( check if move to position X Y is possible)
                  ( and take apropriate action)
  EDGE-CHECK SWAP EDGE-CHECK SWAP 2DUP GALAXY C@
  CASE
     0 ( space)      OF MOVE-FLEET ENDOF
     8 ( black hole) OF 23 0 VHTAB ." FLEET IN BLACK HOLE"
                        MOVE-FLEET DELAY NEW-FLEET
                        23 0 VHTAB 35 SPACES ENDOF
```

Listing 1 continued on page 134

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Listing 1 continued:

```
      DROP DROP
   ENDCASE
   DRAW-DISPLAY ;

: OTHER-FLEET   ( make other fleet curent fleet)
   FLEET-FLAG @ 1 =
   IF  2 FLEET-FLAG !
   ELSE 1 FLEET-FLAG !
   ENDIF
   DRAW-DISPLAY ;

: MOVE-LEFT
   1 F C@ 2 F C@ 1 - CHECK-POSITION ;

: MOVE-RIGHT
   1 F C@ 2 F C@ 1+ CHECK-POSITION ;

: MOVE-DOWN
   1 F C@ 1+ 2 F C@ CHECK-POSITION ;

: MOVE-UP
   1 F C@ 1 - 2 F C@ CHECK-POSITION ;

: ENLIST    ( enlisting legions on a planet)
   BUY-V @ 0=
   IF  ( it's ok to buy)
      5 BUY-V !  ( can't buy for 5 more moves)
      ( calculate cost of legions)
      RANDOM1 8 / XY@ INFO1 C@ 7 / + DUP TEMP1 !
      10 0 VHTAB ." COST PER LEGION =" 3 .R
      ( calculate no. of legions available)
      XY@ INFO1 C@ 6 / DUP LEG !
      12 0 VHTAB ." NO OF LEGIONS AVAILABLE = " 3 .R
      ( take the order)
      14 0 VHTAB ." HOW MANY DO YOU REQUIRE?" INPUT
      LEG @ MIN DUP TEMP1 @ * CREDIT @ >
      IF  ( not enough money)
         16 0 VHTAB ." NOT ENOUGH CREDIT"
      ELSE
        5 F @ OVER + 5 F !  ( update legions)
        TEMP1 @ * CREDIT @ SWAP - CREDIT ! ( update credit)
      ENDIF
   ELSE
      10 0 VHTAB ." NO TROOPS AVAILABLE"
   ENDIF ;

: BUY    ( purchasing of ships at planet)
   BUY-V @ 0=
   IF     ( it's ok to buy)
      5 BUY-V !                  ( stop continous buying)
      RANDOM1 5 / XY@ INFO1 C@ 10 / + 1+ DUP TEMP1 !
      10 0 VHTAB ." COST PER SHIP = " 2 .R
      12 0 VHTAB ." HOW MANY DO YOU WANT?" INPUT
      CREDIT @ TEMP1 @ / MIN     ( no more than he can afford)
      DUP 3 F @ + 3 F !          ( update ships in fleet)
      TEMP1 @ * CREDIT @ SWAP - CREDIT !  ( update credit)
      16 1 F C@ 2 F C@ GALAXY C!  ( make sure fleet symbol there)
   ELSE
      10 0 VHTAB ." NO SHIPS AVAILABLE"
   ENDIF ;

: GATHER   ( pick up legions from garrison onto fleet)
   10 0 VHTAB ." HOW MANY DO YOU WISH TO TAKE?" INPUT
   XY@ INFO2 C@ MIN TEMP1 !  ( no more than are there)
   5 F @ TEMP1 @ + 5 F !      ( update legions on fleet)
   XY@ INFO2 C@ TEMP1 @ - XY@ INFO2 C! ; ( update on planet)
: LEAVE   ( leave legions from fleet on planet as garrison)
   10 0 VHTAB ." HOW MANY DO YOU WISH TO LEAVE?" INPUT
   5 F @ MIN TEMP1 !            ( no more than you have)
   5 F @ TEMP1 @ - 5 F !        ( update legions on fleet)
   XY@ INFO2 C@ TEMP1 @ + 255 MIN ( no more than 255)
   XY@ INFO2 C! ;               ( update on planet)

: FRIENDLY-PLANET   ( options upon landing at colony)
   BEGIN
      10 0 VHTAB ." CLASS " XY@ INFO1 C@ 8 / 2 .R
      ."  PLANET" 16 SPACES CR  ( give class of planet)
      ." LOCAL GARRISON IS " XY@ INFO2 C@ 3 .R ."  LEGIONS"
                               ( give size of local garrison)
      12 0 VHTAB ." DO YOU WISH TO:" 12 SPACES ( give options)
      CR ." 1.  LEAVE LEGIONS ON PLANET"
      CR ." 2.  GATHER LEGIONS FROM PLANET"
      CR ." 3.  BUY SHIPS"
      CR ." 4.  ENLIST TROOPS"
      CR ." 5.  LEAVE" CR
      KEY 127 AND                ( get reply)
      CLEAR-MSGE
      CASE
         49 ( 1) OF LEAVE 0   ( leave legions) ENDOF
         50 ( 2) OF GATHER 0 ( gather legions) ENDOF
         51 ( 3) OF BUY 0        ( buy ships) ENDOF
         52 ( 4) OF ENLIST 0  ( enlist troops) ENDOF
                          1 ( the default: leave planet)
      ENDCASE DELAY
   UNTIL
   HI CLEAR-MSGE DRAW-DISPLAY ;

: COLONISE   ( attack an uncolonised planet)
   CLEAR-MSGE
   XY@ INFO1 C@ 8 / RANDOM1 1 - 5 / 7 + * 10 / DUP TEMP1 !
   ( calaculate relative strength of planet)
   5 F @ >
   IF   ( planet drives off your forces)
      10 0 VHTAB ." YOUR FORCES RETREAT"
      12 0 VHTAB ." YOUR LOSSES = "
      5 F @ 2 / DUP 3 .R 5 F @ SWAP - 5 F !
      DELAY DELAY
   ELSE ( you capture planet)
      10 0 VHTAB ." PLANET CAPTURED"
      12 0 VHTAB ." YOUR LOSSES = "
      TEMP1 @ 3 .R
      5 F @ TEMP1 @ - 5 F !    ( update legions in fleet)
      1 PLANETS +!              ( increment no. of planets)
      132 XY@ GALAXY C!         ( colony symbol in galaxy)
      DELAY DELAY
      FRIENDLY-PLANET
   ENDIF ;

: EMPTY-PLANET   ( in orbit round uncolonised planet)
   CLEAR-MSGE
   10 0 VHTAB ." UNCOLONISED CLASS " XY@ INFO1 C@ 8 / 2 .R
   ."  PLANET"
   12 0 VHTAB ." DO YOU WISH TO ATTACK?" KEY 127 AND 89 =
   IF
      COLONISE
   ENDIF
   HI CLEAR-MSGE ;

: NOT-PLANET   ( there isn't a planet where he's trying to land)
   10 0 VHTAB ." NO PLANET THERE"
   DELAY HI CLEAR-MSGE ;

: ATTACK         ( attack a planet controlled by the computer)
   CLEAR-MSGE
   XY@ INFO2 C@ RANDOM1 1 - 5 / 7 + * 10 / DUP TEMP1 !
               ( calaculate enemy garrisons effective strength)
   5 F @ >
   IF   ( enemy garrison wins)
      10 0 VHTAB ." YOUR FORCES RETREAT"
      12 0 VHTAB ." YOUR LOSSES = "
      XY@ INFO2 C@ 5 F @ * TEMP1 @ / 2 / XY@ INFO2 C@ SWAP
      - XY@ INFO2 C!
      5 F @ 2 / DUP 3 .R 5 F @ SWAP - 5 F !
   ELSE
      0 XY@ INFO2 C!             ( reduce legions on planet to 0)
      10 0 VHTAB ." PLANET CAPTURED"
      12 0 VHTAB ." YOUR LOSSES = "
      TEMP1 @ 3 .R
      5 F @ TEMP1 @ - 5 F !     ( update legions with fleet)
      132 XY@ GALAXY C!         ( put colony in galaxy)
      1 PLANETS +!              ( increment planets)
      -1 C-PLANETS +!           ( decrement computer planets)
      XY@ INFO1 C@ 8 / MINUS CLASS-TOTALS +!
      DELAY                    ( reduce classes of comp. plnts)
      FRIENDLY-PLANET
   ENDIF
   DELAY HI CLEAR-MSGE ;

: ENEMY-PLANET   ( player orbits enemy planet)
   XY@ INFO1 C@ 8 /
   10 0 VHTAB ." CLASS " 2 .R ."  PLANET" CR CR
   ." ENEMY GARRISON OF STRENGTH "
   XY@ INFO2 C@ 3 .R CR CR
   ." DO YOU WISH TO ATTACK?" KEY 127 AND 89 =
   IF
      ATTACK
   ENDIF
   HI CLEAR-MSGE ;

: LAND   ( land on adjacent planet)
   FIND-DIRECTION
   2DUP Y ! X ! TEXT GALAXY C@
   CASE
      4 ( uncolonised planet) OF EMPTY-PLANET    ENDOF
      5 ( computers planet)   OF ENEMY-PLANET    ENDOF
    132 ( players colony)     OF FRIENDLY-PLANET ENDOF
        NOT-PLANET  ( otherwise it's not a planet)
   ENDCASE ;

: REVOLT?   ( planet at X,Y revolts)
   12 0 VHTAB ." PLANET AT " Y @ . X @ . ." REVOLTS" DELAY
   XY@ INFO1 C@ 8 / XY@ INFO2 C@ 2DUP >
   IF   ( revolt succeeds)
      DROP 4 XY@ GALAXY C!          ( place planet symbol)
      8 * 7 + XY@ INFO1 C!          ( set revolt factor 7)
      0 XY@ INFO2 C!                ( set legions to 0)
      -1 PLANETS +!                 ( reduce no.of planets)
      7 EMIT                        ( ring bell)
      14 0 VHTAB ." SUCCEEDS"
   ELSE ( revolt fails)
      SWAP 2 / - XY@ INFO2 C!       ( reduce legions)
      XY@ INFO1 C@ 7 OR XY@ INFO1 C!  ( set revolt factor 7)
      14 0 VHTAB ." FAILS"
   ENDIF
   DELAY
   12 0 VHTAB 30 SPACES
   14 0 VHTAB 12 SPACES ;            ( clear messages)
```

Listing 1 continued on page 136

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Listing 1 continued:

```
: TAX      ( collect taxes on players planets)
   0 VTAX !                              ( set tax to 0)
   TEXT                                  ( select text page)
   10 0 VHTAB ." TAX COLLECTED ="
   10 17 VHTAB 0 .
   SIZE 1+ 1 DO
     SIZE 1+ 1 DO
               I J GALAXY C@ 132 =
               IF    ( it's a colony)
                  I J INFO1 C@ 3 * 5 / ( tax from planet)
                  VTAX @ + DUP VTAX !  ( update tax)
                  10 17 VHTAB 5 .R
                  I J INFO1 C@ 7 AND -DUP
                  IF ( doesn't revolt)
                     I J INFO1 DUP C@ 1 - SWAP C!
                  ELSE ( revolt)
                     I X ! J Y ! REVOLT?
                  ENDIF
               ENDIF
             LOOP
          LOOP
   CREDIT @ VTAX @ + CREDIT !            ( update credit)
   HI CLEAR-MSGE DRAW-DISPLAY ;

: COMPUTER-TURN   ( computers turn to do something)
   -1 NEW +!                             ( decrement NEW)
   NEW @ 0=
   IF     ( computer creates new fleet)
      7 EMIT                             ( ring bell)
      1 C-FLEETS +!                      ( update comp. fleets)
      29 4 DIFF @ * - NEW !              ( reset NEW)
      CLASS-TOTALS @ 8 / DUP C-LEGIONS +!
      DUP TROOPS +!
      BEGIN
        RANDOM1 RANDOM2 2DUP GALAXY C@ 0=
        IF  ( empty space in galaxy)
           2DUP 17 ROT ROT GALAXY C!    ( place fleet symbol)
           INFO2 C! 1                    ( plus legions)
        ELSE
           DROP DROP DROP 0
        ENDIF
      UNTIL
   ENDIF
   DIFF @ 0 DO   ( see if computer colonises planet)
      RANDOM1 RANDOM2 2DUP GALAXY C@
      CASE
         4 OF ( empty planet)
              2DUP 2DUP 5 ROT ROT GALAXY C! ( place colony)
              C-LEGIONS @ 2 / DUP C-LEGIONS !
              ROT ROT INFO2 C!
              1 C-PLANETS +!
              INFO1 C@ 8 / CLASS-TOTALS +!  ENDOF
       132 OF ( players planet)
              2DUP Y ! X ! INFO2 C@ C-LEGIONS @ 2 / <
              IF ( captures planet)
                 C-LEGIONS @ 3 / C-LEGIONS !
                 5 XY@ GALAXY C!
                 XY@ INFO1 C@ 8 / CLASS-TOTALS +!
                 1 C-PLANETS +!
                 -1 PLANETS +!
                 5 0 DO 7 EMIT LOOP ENDIF ENDOF
           DROP DROP
      ENDCASE
   LOOP
   DRAW-FIGURES ;

: FIRE   ( players fleet attacks computer fleet)
   0 X !
   TEXT
   2 F C@ 2 + DUP 3 - DO
      1 F C@ 2 + DUP 3 - DO
         I EDGE-CHECK J EDGE-CHECK GALAXY C@ 17 =
         IF  ( there's a fleet in range)
            I EDGE-CHECK X ! J EDGE-CHECK Y !
         ENDIF
      LOOP
   LOOP
   X @ 0=
   IF
      10 0 VHTAB ." NO ENEMY FLEET IN RANGE"
   ELSE
      3 F @ XY@ INFO2 C@ OVER 4 * 10 /
      OVER 4 * 10 / DUP
      10 0 VHTAB ." FLEET HIT BY " 5 .R ." UNITS"
      ROT ROT - 0 MAX DUP 0=
      IF ( computers fleet destroyed)
         DROP TROOPS @ XY@ INFO2 C@ - TROOPS !
         ( reduce computers troops)
```

Listing 1 continued on page 138

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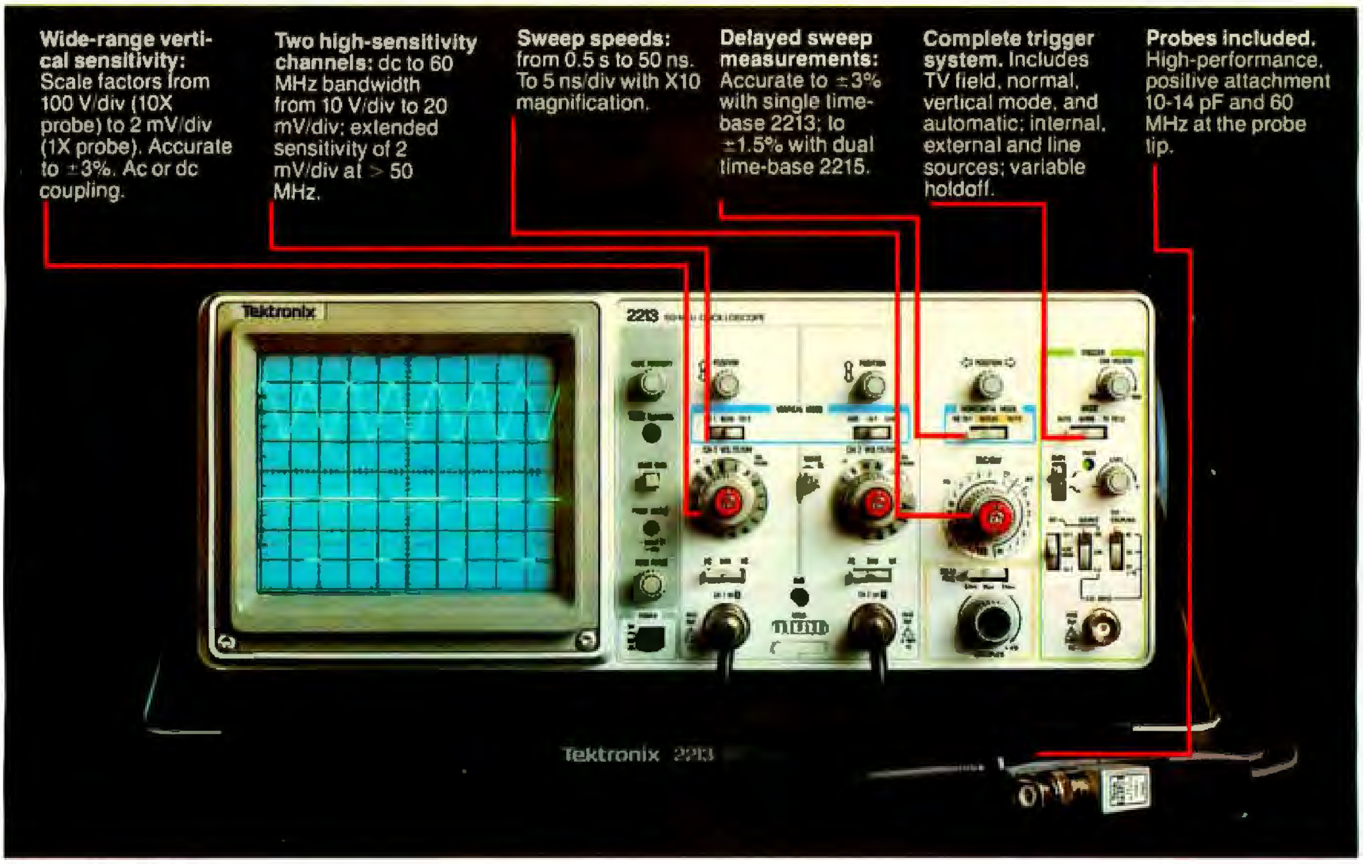

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Listing 1 continued:

```
         0 XY@ GALAXY C!         ( destroy fleet symbol)
         -1 C-FLEETS +!          ( reduce comps fleets)
      ELSE
         XY@ INFO2 C@ OVER - TROOPS @ SWAP - TROOPS !
         ( reduce spare troops)
         XY@ INFO2 C!            ( reduce legions in fleet)
      ENDIF
      - 0 MAX DUP 0=
      IF  ( players fleet destroyed)
         DROP NEW-FLEET
      ELSE
         3 F !
      ENDIF
   ENDIF
   DELAY DELAY DRAW-DISPLAY H1 CLEAR-MSGE ;

: INFORMATION  ( display the text screen information)
   TEXT KEY H1 ;

HEX

: OBEY-COMMAND
   BUY-V @ -DUP
   IF
      1 - BUY-V !
   ENDIF
   C001 C@                  ( pick up keyboard character)
   CASE
      ( A) 41 OF MOVE-LEFT   ENDOF
      ( S) 53 OF MOVE-RIGHT  ENDOF
      ( W) 57 OF MOVE-UP     ENDOF
      ( Z) 5A OF MOVE-DOWN   ENDOF
      ( O) 4F OF OTHER-FLEET ENDOF
      ( I) 49 OF INFORMATION ENDOF
      ( L) 4C OF LAND        ENDOF
      ( T) 54 OF TAX         ENDOF
      ( F) 46 OF FIRE        ENDOF
   ENDCASE SP! ;

: COMPUTER?    ( is it the computers turn or not)
   COMPUTER @ 1 - DUP 0=
   IF
      COMP-START @ COMPUTER ! DROP 1
   ELSE
      COMPUTER ! 0
   ENDIF ;

: GAME-END?
   LEN @ 0= ;     ( game end if LEN is zero)

: RESTART          ( restarts the stopped game)
   CLEAR-DISP
   HOME DRAW-BORDERS DRAW-DISPLAY
   BEGIN
      ?TERMINAL
      IF     ( player has pressed a key)
         OBEY-COMMAND
         -1 LEN +!
         COMPUTER-TURN
      ENDIF
      COMPUTER?
      IF
         COMUTER-TURN
      ENDIF
      GAME-END?
   UNTIL
   END-MSGE ;

: CONQUEST    ( the main game word)
   HOME ." HIT ANY KEY" KEY RAND1 ! CR ( random number seed)
        ." AND AGAIN  " KEY RAND2 !    ( random number seed)
   HOME CR CR CR
   ." WELCOME TO COSMIC CONQUEST" CR CR
   ." DEVISED AND WRITTEN BY" CR CR
   ." ALAN SARTORI-ANGUS"
   INITIALISE
   RESTART ;
```

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BYTE GAME GRID

Ricochet

Gregg Williams
Senior Editor

Given the unique resources of microcomputers, you'd think someone would come up with an entirely new approach to game playing. Unfortunately, design innovations in video games are all too rare; we see new maze games, new shoot-'em-up games, and new adventure games, but seldom anything that stretches the imagination. There's a reason for this: adapting an existing, commercially proven idea and then programming for six months is much easier than agonizing over a new concept, programming for six months, and hoping for the best. Fortunately, a few brave souls thrive on the challenge of charting new territory. Thanks to two of them, we have a game called Ricochet.

I cannot find enough good things to say about Ricochet. It's easily the most original game I've seen this year, it's fun to play, and on top of that it's very modestly priced (under $20, often discounted to about $16). Available for three of the most popular microcomputers—the Apple II, the Atari 400/800, and Radio Shack TRS-80 Models I and III—the game has graphics, sound, and (on the Apple and Atari versions) color. You can choose from five game variations and play against a human or one of four computer opponents. And one of Ricochet's most interesting features is that it dynamically handicaps the more skillful of the two players to keep the game challenging even with players of widely varying skills. What more could you possibly want?

Before you rush out to buy Ricochet, you should know that it's not likely to be the favorite of the arcade set. Although it has arcade-like elements in it, Ricochet is primarily a game of strategy. Let's take a look at it.

Playing Ricochet

The Atari game board for Ricochet is shown in photo 1; the Apple and TRS-80 versions look somewhat different but play almost the same. The two players, Left and Right, start the game with two bumpers (the hourglass-shaped pieces at the left and right edges of the screen) and two launchers each (one in each corner of the screen). The launcher can fire a launch (ball) that ricochets off the pieces (straight bars) and both players' bumpers; a launch is complete when it veers off the screen or hits any launcher. Pieces deflect the launch by 90 degrees, then immediately turn 90 degrees themselves. A move consists of firing a launcher or moving one or more pieces in the same direction (up, down, right, or left). You gain points for hitting any pieces or your opponent's launchers or bumpers; you lose points for hitting your own launchers or bumpers.

Although there are a few more rules I'll explain later, the paragraph above covers the behavior of most of the game. But no amount of rules can possibly convey how

Photo 1: *Ricochet in progress. Photos 1a through 1c show the state of the board before, during, and after activation of the launcher in the lower left-hand corner. See the article for further details.*

1a

much fun Ricochet is to play. The word that best describes my reaction to it is "delight." Rarely have I played a game that pleased me as much as Ricochet. No matter how good you are at visualizing what certain launches will do, some of them may remain in play much longer than you expect or hit an unexpected target. But even when the surprise costs you points, it's so much fun that you don't really mind.

Photos 1a through 1c show a simple example of a Ricochet launch in action. At the beginning of the move, the board is as shown in photo 1a. Left shoots his lower launcher; the launch bounces off pieces C and E (increasing Left's score by two points), hits the top wall of the game field, and ricochets into Right's top bumper. Photo 1b shows the game board just as the launch hits the top right bumper; notice that pieces C and E have rotated 90 degrees. Left then scores 10 points for hitting the bumper, and the launch hits pieces H and J (which rotate and contribute two more points) before exiting off the right edge of the screen. Photo 1c shows the final result. And that's a *simple* shot in Ricochet. I've seen shots that ricochet 25 or even 50 times before ending and have launched shots that accumulate 20 points only to hit my own bumpers and disable the original launcher.

No matter how good you are at visualizing what certain launches will do, some of them may remain in play much longer than you expect.

Ricochet in the Long Run

The sequence of Ricochet described above is a match; it ends when one player can no longer shoot or if both launchers are either temporarily disabled or empty. The player with more points wins the match, and in the basic version of the game, play continues until one player wins two matches.

Now comes the fun part: Ricochet has a self-handicapping feature that enables players of different skill levels to compete as equals. The player who loses a match has a bumper removed in the next one; because the winning player has half as many bumpers to score from (one instead of two), winning the next game is harder for him. And if the winning player wins by a substantial margin, the value of his bumpers and launchers increases to a number *above* 10, which makes it easier for the losing player to win the next game. Ricochet also uses a "smart clock" that penalizes a player for playing more slowly than his opponent. These handicaps are all fine-tuned to make the players an equal match for each other even if they start at different skill levels. The more matches they play together, the more players become evenly matched. To carry the handicapping into future games, the computer issues a handicap rating to each player at the end of a game. If these values are typed in at the beginning of the next game, the players start the game more evenly matched.

Ricochet has a total of five variants, all of which are sufficiently different to warrant different strategies. You can play opposite a human opponent—in which case the program acts as a scorekeeper and referee—or against one of four computer "opponents," each of which has a distinct playing style. I found the computer players very difficult to beat, so you don't have to have a human op-

1b

1c

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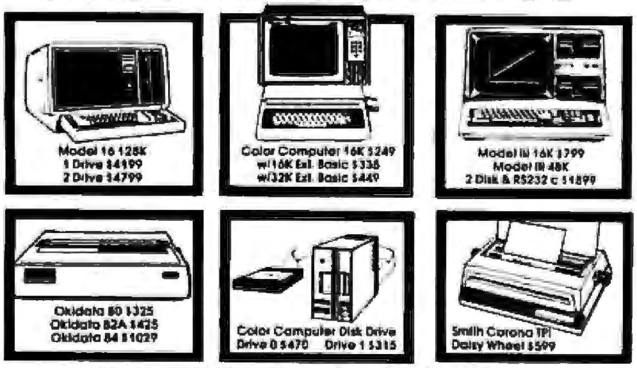

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BYTE GAME GRID

ponent to enjoy playing Ricochet. The 20 different games (5 variants multiplied by 4 possible computer opponents) available for solitaire play are sufficiently varied to keep you interested in the game.

Versions of Ricochet

Ricochet is available in both cassette and floppy-disk versions for the TRS-80 and Atari and in a floppy-disk version for the Apple II. I played the game on all three computers (disk-based versions for the TRS-80 and Apple II, cassette version for the Atari). The Apple version requires Applesoft BASIC and 48K bytes of memory, the other two disk versions require BASIC and 32K bytes of memory, and the cassette versions require BASIC and 16K bytes of memory. The Atari cassette version loads in two steps to help prevent unauthorized copying and takes an excruciatingly slow 10 minutes to load; prospective cassette-based users are hereby warned.

Although it has very little sound and color, the Apple version has the smoothest graphics. The TRS-80 and Atari versions, on the other hand, use character-sized graphics that don't create an illusion of continuous movement. The Atari version has the best sound and color, but

At a Glance

Name
Ricochet

Type
Strategy game

Manufacturer
Automated Simulations
1043 Kiel Court
Sunnyvale, CA 94086

Price
$19.95

Authors
Bernie De Koven and Jeff Connelley

Format
Cassette tape or floppy disk

Language
BASIC

Computer Needed
Radio Shack TRS-80 Models I or III with 16K bytes of memory (cassette) or 32K bytes of memory (disk), Apple II with Applesoft or Apple II Plus with 48K bytes of memory (disk), Atari 400 or 800 with BASIC cartridge and 16K bytes of memory (cassette) or 32K bytes of memory (disk)

Documentation
8-page instruction manual and separate loading instructions

Audience
Strategy game enthusiasts, any age

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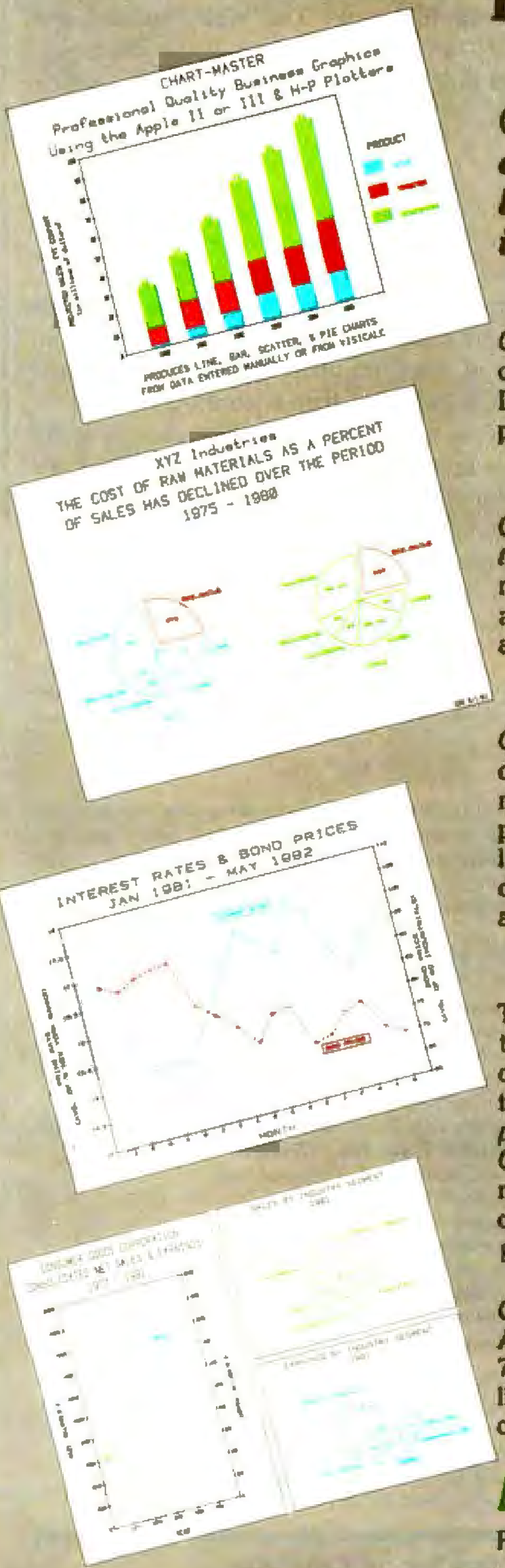

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it plays more slowly than the Apple version and, paradoxically, penalizes you more quickly for not moving. (These differences are probably due to the idiosyncrasies of the different versions of BASIC in each machine; Ricochet is written in BASIC.) The TRS-80 version has the coarsest graphics and no color, but it makes some sound available through the cassette port (the sound is available even though the TRS-80 documentation doesn't mention it). Incidentally, the limitations of TRS-80 graphics make the pieces appear shorter when they are vertical than when they are horizontal, which, until you get used to it, may lead you to believe a path is blocked by pieces when it really isn't.

The Philosophy of Ricochet

I can tell from my own experience with game development that Ricochet was well designed and then polished for maximum playability. Such attention to detail is rare; most people release a game as soon as the program is free of programming errors—of course, that accounts for the countless mediocre games that are being sold today. As a result, you enjoy playing Ricochet even if you lose; you leave the game feeling satisfied instead of embittered. That Ricochet is a game player's delight is really no surprise, because it was designed by Bernie De Koven and Jeff Connelley, both experienced game designers. De Koven's wonderful book, *The Well-Played Game* (Anchor Press, 1978), expresses many of the ideals that are implemented in Ricochet. It's a must for prospective game designers.

Conclusions

Ricochet is not only a fantastic strategy game but a reasonably priced one as well. (Arcade-game enthusiasts, take note: it is neither visually stunning nor the conventional arcade variety.) Automated Simulations should be commended for creating a totally new kind of game that takes advantage of the computer's unique strengths and for selling it at a lower price than it could command.

Ricochet has five variations, four different computer opponents, and a human-versus-human option. It can be played as a casual or a serious game, and in either case it is delightful. Interactive handicapping makes the game a challenge regardless of your relative skill level. If Ricochet is indicative of Automated Simulations' offerings, I eagerly await the company's next release.■

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Action Games for the VIC-20

Russell Kavanagh
16921 Lakefront Circle, #47
Huntington Beach, CA 92647

The Commodore VIC-20 computer has been available in the United States for more than a year now, but until fairly recently very little software was available for it. Creative Software, however, is one firm that provided software early on. Eager to do something with my new VIC-20, I mail-ordered a copy of the company's "Action Games" package, which includes VIC Trap, Seawolf, and Bounce Out.

I received the games in surprisingly short order and rushed to the VIC to try them out. To my chagrin, I experienced a few minutes of frustration because I had difficulty loading the programs. Fortunately, past experience with the VIC cassette interface had taught me that it's a bit flaky, but nothing that a little reorientation of the cassette drive and cabling can't fix. Sure enough, that did it, and I was able to load the first program.

I haven't had any trouble loading any of the games since then, and I suspect the problem I had was the VIC's fault. Inspection of the cassette cable indicates that it could use some attention to grounding and shielding . . . but that's another article. On to the matter at hand: playing games.

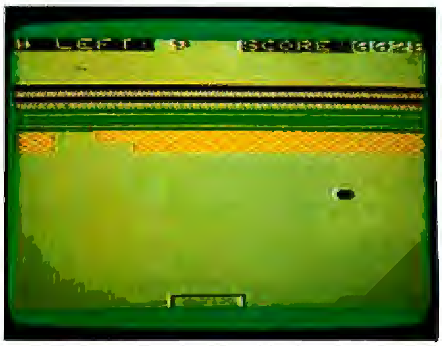
VIC Trap

Like the other two games in this package, VIC Trap makes good use of the VIC's color and sound capabilities and can be played using either a joystick or the keyboard. Of the three games, it is the only one written in BASIC. To play, you guide a character around the screen, leaving a trail behind it. At the same time, the VIC does the same thing with its own character. The object is to try to trap the VIC by surrounding its character with your trail and/or the screen borders. The first player to collide with either the trail or the border loses. A point goes to the victor, and the process starts over again.

I didn't find VIC Trap very challenging, so I soon grew tried of it. The game is very slow moving and does not require you to develop a real strategy. The younger set might enjoy it, but I think even they would soon want to move on to the other games in this package. Still, VIC Trap is an interesting demonstration of the VIC color graphics and sound, and as such it might serve as a simple introduction of your computer to friends.

Seawolf

The second game in the package is written in machine language and is run through the use of a BASIC statement that jumps to the machine-language program. In this game you are the skipper of a "swift and dangerous submarine" that is positioned along the bottom of the screen.

Scenes from the Action Games package for the Commodore VIC-20 microcomputer. Left to right: VIC Trap, Seawolf, Bounce Out.

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BYTE GAME GRID

At a Glance

Name
Action Games; includes VIC Trap, Seawolf, and Bounce Out

Type
Game

Manufacturer
Creative Software
201 San Antonio Circle, No. 270
Mountain View, CA 94040
(415) 948-9595

Price
$24.95 plus $1.50 shipping and handling

Format
Cassette tape

Language
BASIC and machine language

Computer
Commodore VIC-20 with 5K bytes of memory

Documentation
Six-page pamphlet

Audience
Game players

You can control motions to the left and right and fire torpedoes up through the water.

Above you are three levels of enemy ships, which you try to sink with your torpedoes. The ships move at different speeds; the one closest to you is the slowest and largest—easiest to hit and worth the least number of points. Ships enter the screen randomly from either side. Mines float between you and the ships above, and although they do you no damage, they will block your torpedo—in effect, running interference for the ships.

The play lasts for 60 seconds, during which you try to score as many points as possible. If you score enough points, you get a bonus of 30 seconds' more playing time. When your time is up, your new score is displayed along with your previous high score. Two levels of play enable you to change the speed and point values of the passing ships.

Seawolf has an arcade look to it; the graphics are fast and colorful, and the sound effects are good. There is no noticeable delay in controlling the submarine, although the instructions do warn you that your crew requires some time to "reload" a torpedo after a shot. I found the game reasonably entertaining, although the instructions overestimate the skill required to score that extra 30 seconds of play. I earned some of my highest scores by merely parking the sub and holding down the Fire button. That strategy works because you have an unlimited supply of torpedoes. I think Seawolf could be improved by limiting the torpedo supply and providing more rewards after the first bonus of 30 seconds. Maybe there are more rewards, but I never found them. Nonetheless, this game should be a popular one, especially for newcomers to the computer-game domain.

Bounce Out

The third and final game is a colorful and challenging version of the well-known video game Break Out. You

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BYTE GAME GRID

are given 10 balls at the start, and your goal is to knock out a wall of bricks. Your paddle moves along the bottom of the screen, and the bricks are positioned in three colored layers near the top of the screen. The bricks in each layer are worth successively more points. Each brick you hit with the ball disappears, and you add its value to your score. The ball bounces off the brick wall and the side boundaries and returns for you to hit with the paddle. The value of the bricks is also determined by how many balls you've used; you'll score more points if you clear the screen with only one ball instead of all of them. If you miss a ball with your paddle, you lose it. You continue playing until all 10 balls are gone. If you clear the screen, a new set of bricks appears. As the score adds up, the ball speed increases, and your paddle size may even change—it will be smaller, of course. At the end of the game, your final score is displayed along with your previous high score. Two levels of play enable you to select the size of your paddle, but all of the other features remain the same.

Of the three games, Bounce Out is the winner, the one I usually go to for a quick game with my VIC.

Of the three games, I think Bounce Out is the winner. At least it's the one I usually go to for a quick game with my VIC. It's written in machine language, so it's fast and responsive. And because the ball speeds up, anticipating its path and returning it takes quite a bit of concentration. All in all, the game is sufficiently challenging to encourage you to try to beat your highest score. Bounce Out should be a welcome addition to your VIC game library.

Joystick Versus Keyboard

All of these games can be played by using either the keyboard or the joystick/pushbutton combination. Because many readers may not own a joystick, I thought the subject deserved some attention. Commodore does not sell a joystick, but Atari-compatible joysticks will plug right in. Of course, computer hobbyists of the old school can build one from scratch. How-to information is available in the Commodore VIC-20 Programmer's Reference Guide, which is now available.

If you don't have a joystick, don't worry, because you can play the games very well without one. In fact, I think VIC Trap and Bounce Out are a little easier when you use the keyboard. That's partly due to the fact that the movement of the character or the paddle can be controlled in

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discrete steps with the keyboard; each time you push a key and release it, only one direction change (in VIC Trap) or one movement of the paddle (in Bounce Out) occurs. With the joystick, however, split-second timing and precise positioning are difficult. Note that if you push a key down and do not release it, the command will be read continuously, just as if you were holding the joystick in a given direction.

I also found the keyboard easier to use because my joystick required fairly accurate positioning, and if the stick was slightly off the mark, the command did not register. Seawolf is much better suited to the joystick, not only because it gives the game that arcade feel but because you can shoot and maneuver at the same time. In fact, games that have Fire buttons and the like are probably better played with pushbuttons instead of the keyboard, because people tend to get carried away (read "violent") pushing keys. Watching the neighborhood kid trying to push the space bar through the bottom of your computer may convince you to get a joystick.

Games like Seawolf are best played with a joystick—which also saves wear and tear on your computer.

Conclusions

Of these three games, Bounce Out is my favorite. It combines a colorful playing field, fast action, and sound effects for a challenging game. Seawolf is also entertaining, but it's somewhat easily mastered. It has more of an arcade look than the others, and it's especially enjoyable when you use a joystick. VIC Trap is . . . well, the other game. Enough said.

Creative Software's documentation is good, and the cassette appears to be of good quality. Unfortunately, any attempt to save a program results in a locked-up VIC. I dislike this policy; I always feel better when I have an extra copy safely stored away. There are few worse sensations than when you see a LOAD ERROR message flash on your screen but don't have another copy of that program. No mention is made in the documentation of a replacement policy in the event that your copy is damaged, so I don't know how that would be handled. With good care, at any rate, the tape should last.

The Action Games package should be a welcome addition to your VIC-20 game collection. It is reasonably priced (three games for $26.45 is about $9 a game), and you might even find it for less through some of the mail-order software distributors.■

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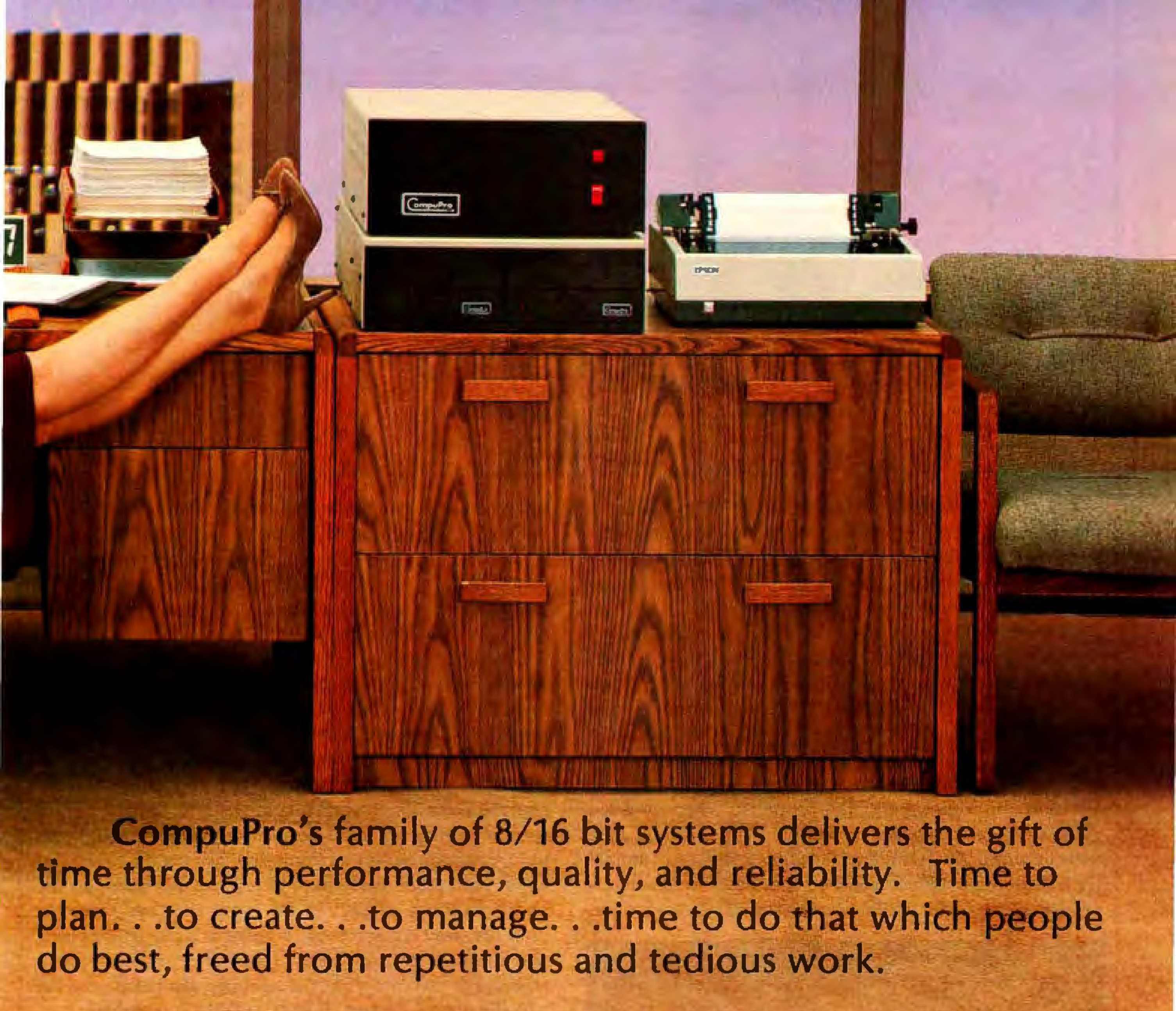

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Deadline

Chris Morgan
Editor in Chief

The eternal dilemma of the reviewer of mysteries is how to discuss the plot without revealing the ending. But that's not a problem with Deadline, a fascinating new program from Infocom, the creators of the Zork family of adventure games.

Deadline puts you in the role of the detective, plants you firmly in the cliché-ridden trappings of a thirties murder mystery, and challenges you to discover the culprit. Naturally, this involves your wandering in and around a large mansion, the scene of the recent murder—apparently by poisoning—of the master of the house.

In classic adventure style, the game begins when you arrive at the front gate of the property, where you are given a typically elaborate description of your immediate surroundings. But Deadline is quite a different animal from traditional adventures. For one thing, it's much less deterministic. Your actions have definite, if sometimes unpredictable, effects on the various characters who inhabit the mansion (all are suspects, incidentally). In fact, if you get too nosy in your clue-hunting, you may be threatened or, in some cases, killed. In these respects Deadline resembles the other programs in the Zork family of adventure games.

Deadline's radical departure from the prototypical mystery is that it has more than one ending. The denouement depends on your actions and possibly on randomizing factors I haven't detected yet.

As the detective, you have a varied repertoire of strategies. Among other things, you can gather objects, analyze them for fingerprints at the lab, test them for a specific substance, arrest people (for that you should wait until you're quite sure of yourself!), ask people to tell you about each other or about objects you show them, accuse and even *kill* a suspect in the event that one threatens your life, wait for someone to arrive at a particular place, and so on. You can also use relatively complicated sentences. For instance, "Put the wrapper, the ticket, and the nail file on the dresser" is syntactically acceptable.

The game takes 12 hours (Deadline hours, that is) to play. You begin at 8 a.m. and have until 8 p.m. to solve the mystery. As with other adventure-style games, you can save your position at any time if you want to restart the game and try a new approach. One thing I discovered (and it's not giving too much away) is that in many cases events in the game occur at prearranged times. For instance, a phone that rings at 9:06 a.m. on your first pass through the game will probably ring at 9:06 in future passes—something to keep in mind if you miss an opportunity during the first pass (a common occurrence, I assure you).

Philosophically, I found I was playing the game like an old detective inspired by Edgar Allan Poe. And like Poe's character, I concentrated on the myriad clues rather than the characters. But the real key to success in this game, as I discovered, is to monitor both the clues and the characters with equal diligence. And watch out for red herrings: there are many more of them than I initially suspected.

Deadline's documentation is useful, complete, and even witty—surely a rarity in personal computer software. With its clever, dossier-like folder for printed material, 8 by 10 glossy of the scene of the crime, actual plastic packet of crushed tablets "found near the body," and the like, I felt like Lord Peter Wimsey arriving at the police commissioner's office to pick up the official file. A mystery addict couldn't ask for more.

Deadline is more than mere escapism, however; it's not for the player who prefers vicarious to actual experience. You're the one who'll do the work, and that includes solving the case. But in this case the work is great fun.

I do have one quibble: the beginning Deadline player deserves a few clues at the outset. After all, this is a very tricky game. For starters, it would be helpful to be present at the reading of the will. Rather than risk infuriating potential players by continuing, I have printed some pertinent clues upside down at the bottom of the page. Play the game for a few hours (real time, that is) before you glance at the clues. They don't give away too much, but they'll spare you a lot of make-work.■

At a Glance

Name
Deadline

Type
Interactive mystery game

Manufacturer
Infocom Inc.
55 Wheeler St.
Cambridge, MA 02138

Price
$49.95 ($59.95 for the CP/M and PDP-11 versions)

Computer
Any of the following with 32K bytes of read/write memory and one disk drive: Apple II or II Plus, Atari 400/800, any CP/M-based system with 8-inch disk drives, IBM Personal Computer, DEC PDP-11

Author
Marc Blank

Language
Interlogic Machine Language (an Infocom language)

Documentation
A computer reference card, an inspector's casebook, and a dossier that includes transcripts of interviews with witnesses, lab reports, letters, memos, an 8 by 10 glossy of the scene of the crime, and a small bag of pills "found near the body"

Audience
Game players

Clues for Deadline

1. *Find out what's bothering the gardener. The way you phrase your questions is important here as well as throughout Deadline.*
2. *Watch out for tricky wording in the game's description of the newspaper when it arrives.*
3. *George is a key character. Get his reactions to people and objects.*
4. *The library is a particularly important room for several reasons. Examine it and its contents.*
5. *Be sure to examine things carefully when appropriate.*
6. *It's instructive to follow certain characters around at times. But be careful!*
7. *Show the same clues to various people and compare their reactions.*
8. *Don't get preoccupied with clues at the expense of the suspects.*

Penetrator

Stan Wszola
Technical Editor

Let's face it: graphics on the TRS-80 Models I and III have never been exciting. And playing games on a screen that has fat little pixels leaves a lot to be desired. That's why I got excited when I first saw Penetrator. Phillip Mitchell's game uses TRS-80 graphics in an imaginative and effective manner. Playing Penetrator on my Model III is like changing a carrot peeler into a Cuisinart.

The game begins with this scenario: you are the sole survivor of your squadron, and it is your job to invade the enemy's territory, penetrate the four defensive rings, destroy the cache of neutron bombs, and return to your base. The enemy defenses consist of radar stations, ground-based missiles, and alien parachutists who use themselves as ammunition. You are allotted five fighters per game.

In the game, you pilot an advanced fighter that is controlled by the four arrow keys on the keyboard or by an Alpha joystick. You press the appropriate keys or maneuver the stick to go up or down or to create right or left thrust. You can brake your fighter by pressing the arrow key opposite from the direction you're flying. But you can't stop your fighter for any length of time because you must maintain forward momentum.

Your fighter's armaments include bombs launched by pressing the space bar or fire button and missiles fired by rapidly pressing the right arrow key or jiggling the joystick to the right. You use your weapons to destroy the missiles, parachutists, and radar stations in your path.

The object of the game is to score points by destroying the maximum number of missiles, radar bases, and aliens. Points are scored as follows:

Grounded missiles = 10
Flying missiles = 50
Radar bases = 100
Parachutists = 200
Neutron bombs = First = 1000
Second = 2000

Your score will be displayed in the upper right-hand corner of the screen.

Stage 1: *Your fighter has just entered enemy territory. You can see two missiles rising to destroy you. All player information is displayed on the top line.*

Stage 2: *You must pilot your fighter through a cavern. This stage of the game gives new meaning to the term "low ceiling."*

At a Glance

Name
Penetrator

Type
One- or two-player arcade-style game

Manufacturer
Melbourne House
6917 Valjean Ave.
Van Nuys, CA 91406
(213) 272-8456

Price
$24.95

Author
Phillip Mitchell

Format
Cassette or 5¼-inch floppy disk. The game package includes both Model I and Model III versions.

Language
Z80 machine language

Computer
TRS-80 Model I or Model III with 48K bytes of memory and one disk drive. You will need a speaker amplifier to hear the sound effects, and the program is compatible with the Alpha (Atari-type) joystick.

Documentation
16-page booklet

Audience
Game players

Four Defensive Rings

The game is divided into four stages that increase in difficulty, so progressing through them requires constant concentration. Each stage demands a different strategy. In stage 1 you merely shoot enemy missiles and destroy every radar station in your path (see photo). The radar stations must be destroyed because they pass along information about your course and tactics; unless you destroy them, they increase the level of danger for your ship and make successive stages more difficult.

Stage 2 increases your chances of crashing by forcing you to fly in a cavern (see photo). The low ceilings, ground obstructions, and flying missiles greatly limit your maneuverability. Of course, you still must fire your missiles and drop bombs to score points.

Stage 3 tests your reflexes because it requires a coordinated use of the thrust and braking controls (see photo) to maneuver through narrow vertical and horizontal corridors. Missiles are located at the bottom of silos. Destroying a missile requires braking over the target, dropping a bomb, and quickly maneuvering away in case you missed.

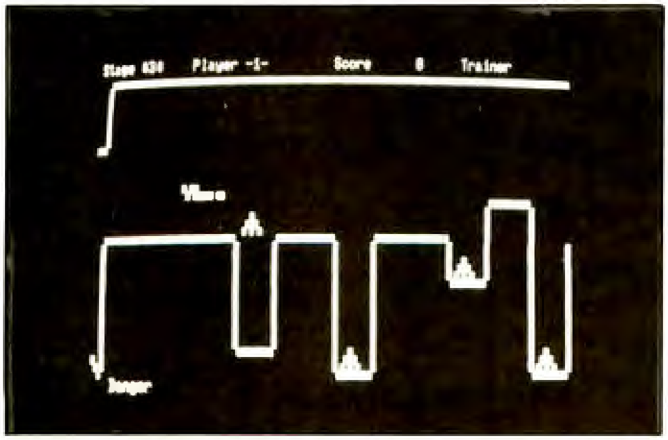
Stage 4 is the toughest of all. Not only does it incorporate features from all the previous stages, it adds alien parachutists (see photo). The aliens have a limited ability to maneuver themselves, so you can outmaneuver them even if you can't shoot them with your missiles.

If you manage to survive all four levels, you can destroy the neutron bombs at the center of the alien defensive rings and then try to fly back home through the four stages once more.

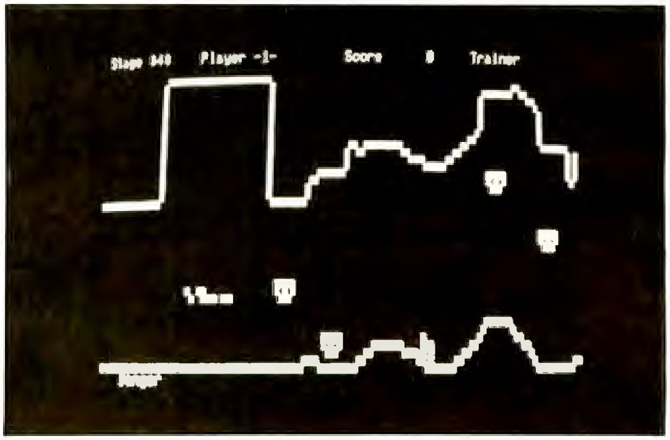
Game Features

If that were all there was to Penetrator, it would be a good game. But Mitchell gives us more: a training-simulation option and the ability to customize the game.

The training simulation lets you start at the beginning of any of the four stages with an unlimited number of ships at your disposal. The game will automatically



Stage 3: *The enemy missiles are located in concrete silos, which makes them very difficult targets for your bombs.*



Stage 4: *Alien parachutists fall from the ceiling of the cavern. Beyond this stage is the neutron bomb cache.*

repeat any stage until you successfully complete it, and only then can you move on to the next higher stage. This is a nice feature if you want to practice mastering one particular stage.

The ability to tailor the game to suit your tastes is one of Penetrator's most attractive features. You can alter the shape of the landscape and change the number and position of the missiles and radar bases. The changes in the game may be saved to disk or cassette, and the game will prompt you at the start to load a previously saved landscape. This ensures that the game will always be fresh even to an experienced player. The feature also enables you to simplify the game for very young children or make it more challenging for battle-hardened players.

Conclusion

My only complaint with Penetrator concerns the methods you must use to control the fighter. When you control the game from the keyboard, using the arrow keys is awkward. The Alpha joystick is a better alternative because it offers greater control; unfortunately, it makes controlling missile fire tricky. If you jiggle the stick to the right too slowly, you get thrust instead of missile fire.

Penetrator is a perfect example of how "less is more." The game shows what an inspired programmer can do with the limited graphics of TRS-80 Models I and III. Because it is eminently playable and it can be customized, Penetrator will be on my game shelf for a long time. ■

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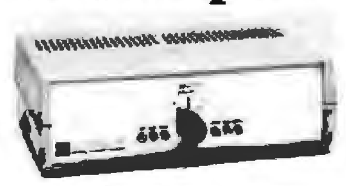

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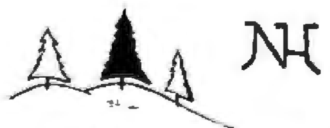

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Character Editor for the Atari

DESIGN SPECIAL CHARACTERS OR GRAPHICS SYMBOLS WHILE EXPLORING THE ATARI'S ANTIC 4 AND 5 MODES.

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One of the most powerful features of the Atari 400 and 800 computers is that they allow you to redefine the character set. Thus a creative programmer can design foreign-language alphabets, special symbol tables, or unique graphics characters for custom screen displays. This feature uses less memory than alternative Atari graphics modes and allows easy manipulation of characters in the form of text strings. Many of your favorite computer games use character graphics in BASIC mode 1 or the hardware-only ANTIC 4 mode. In this article I shall explain how to use the elusive five-color ANTIC 4 mode because it offers the greatest graphics resolution and design challenge.

Editor's Note: *The Atari personal computers incorporate several sophisticated features that allow tremendous flexibility in the design of computer-generated graphics. Readers who want more background information on display lists and character modification should consult the following articles: "An Introduction to Atari Graphics," (January 1981 BYTE, page 18); "The Atari Tutorial, Part 1: The Display List," (September 1981 BYTE, page 284); and "The Atari Tutorial, Part 2: Graphics Indirection," (October 1981 BYTE, page 70). Other aspects of the Atari computers are covered in further articles in the Atari Tutorial series that appeared in BYTE from November 1981 through June 1982.*

In brief review, the Atari computers support three text modes (GRAPHICS 0 through 2) and six graphics modes (GRAPHICS 3 through 8) accessible through Atari BASIC. (The new GTIA-chip-equipped computers have three additional graphics modes: GRAPHICS 9, 10, and 11.) But five more modes are available to BASIC programmers only through display-list modification. The display list is that set of instructions that determines how data found in screen memory will be displayed. Its beginning location in memory varies but can always be found in the pointers at memory locations 560 and 561 (230 and 231 hexadecimal). Both the display list and screen memory are subject to programmable modification.

While you may have heard of these hidden modes, few programmers take advantage of their unique features. The ANTIC 4 mode is very easy to establish by means of a simple display-list modification, which can be accomplished by the program in listing 1. However, if you try to print text characters on the screen while in this mode they will be distorted and unreadable because in this mode character data is interpreted differently than in other text modes. The first time you use the ANTIC 4 or ANTIC 5 mode you will immediately see that normal character sets such as the one supplied with your computer just won't work. The best way to design a new character set, one that will work in ANTIC 4 mode, is to use a character-set editor, a program that will assist you in quickly designing a custom character set and saving it for future use. While several character editors are available commercially, none are specifically designed for use with ANTIC 4 and ANTIC 5 modes. The Character Graphics Editor will work with these modes.

Interpreting Character Data

A character set consists of 128 characters, each having an identifying character number and 8 bytes of

Listing 1: *The ANTIC 4 Display-List Modifier program. Any text characters entered on the screen while this program is running will be unreadable.*

```
10 REM ANTIC 4 Display List Modifier
20 GRAPHICS 0
30 DL=PEEK(560)+256*PEEK(561)
40 POKE DL+3,4+64
50 FOR I=0 TO 22
60 POKE DL+6+I,4
70 NEXT I
```

data that determine its shape. The character numbers, from 0 to 127 (called ATASCII numbers by Atari) are each stored as one byte in a program. The shape data for each character is stored permanently in the ROM (read-only memory) inside the computer. When you call GRAPHICS 0 mode and print text to the screen, the computer fetches 8 bytes of shape data for each character; each byte represents 8 bits of information for a total of 64 bits per character. Each byte of shape data is converted into an 8-bit binary number containing zeros and ones. A bit that is "on" (a number one) displays a dot. A bit that is "off" (a number zero) does not. In figure 1 you can see that the letter X has 24 on bits and 40 off bits. The computer dutifully displays the 24 on dots, which you perceive as the X character.

In ANTIC 4 mode, however, the 64 bits of character data are interpreted differently. The computer takes one byte at a time. Instead of breaking down each byte into 8 separate bits, it takes 2-bit units, or bit pairs, and interprets each pair as a single dot in one of four colors (see figure 2). If neither bit in the pair is on, then the background color (whatever is in color register 4) is chosen and no dot appears on the screen. If a right-hand bit is on, the dot will be the color in register 0. If the left-hand bit is on, the dot will be the color in register 1. If both bits are on you will see a colored dot from register 2. (COLOR 1 comes from register 0, COLOR 2 from register 1, and so forth, except for COLOR 0, which comes from register 4.)

So, where the computer reads four bit pairs, four dots could be displayed for each byte with a choice of three colors, four if you count the background color. Characters are still 8 bytes tall, so you have 32 dots (or pixels, as they should be called) per character instead of 64, but the letters are not tall and skinny as you might expect. Each pixel in ANTIC 4 mode is twice as wide as in GRAPHICS 0 mode. The physical dimensions of the displayed character will be the same in either mode, and the screen still displays 40 characters per line by 24 lines.

Figure 3 is the ANTIC 4 mode interpretation of figure 2 showing how some dots in a character would be COLOR 1, some COLOR 2, and some COLOR 3. Such characters look confusing on the screen. We have to redesign them if we are to use them in this mode.

Designing ANTIC 4 Characters

Usually redesigning an alphabetic character to read properly in ANTIC 4 mode requires working with one color at a time. Referring back to figure 1, use only bits in columns 0, 2, 4, and 6 for characters with register 0 color, and columns 1, 3, 5, and 7 for characters with register 1 color. If both bits of a pair are on, then a third color, from register 2, will be used. But with the Character Graphics Editor program, you won't have to worry about bit columns or register numbers. By choosing a color, either 1, 2, or 3, the editor automatically plots points in the right position. If the letter X were redesigned, it might look like one of the versions illustrated in figures 4 and 5. Each variation produces the same character (except for color) in ANTIC 4. Notice that bit pair 0–1 on the right was not used in these cases; the right bit-pair column was left blank for spacing between text characters. This is not necessary when designing graphics symbols, especially when combining two or more characters to make one large character. For example, you could redefine the letters C, A, and R to be the front, midsection, and back of an automobile. Multiple colors could be incorporated for detail and realism.

A fifth color can be achieved by de-

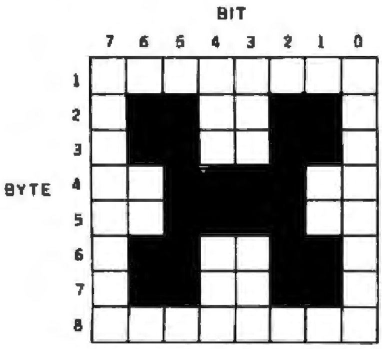

Figure 1: *GRAPHICS 0 mode bit map for the X character. A character is composed of 64 bits, with selected bits turned on to display the character.*

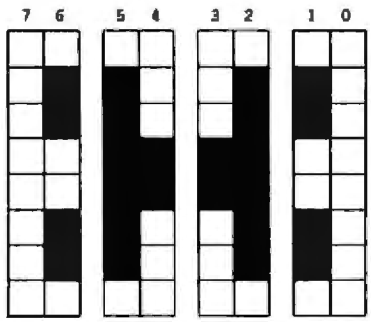

Figure 2: *ANTIC 4 bit map for the X character. The bit map is divided into bit pairs for use by ANTIC 4 and 5 modes.*

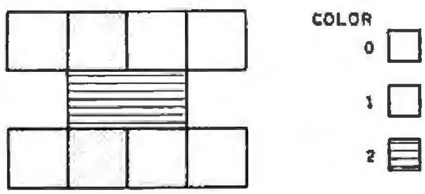

Figure 3: *ANTIC 4 mode interpretation of figure 2. The configuration of the bit pairs determines the color on the screen.*

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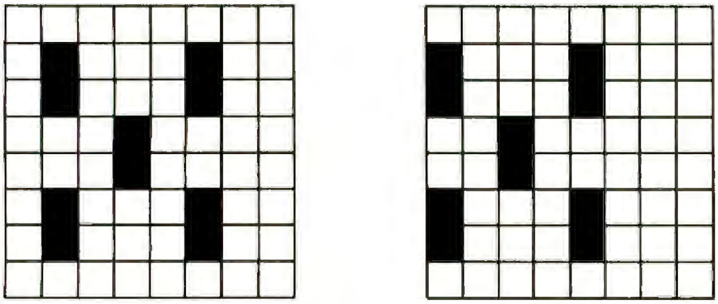

A B

Figure 4: *Alternative configurations for bit pairs. If all the right-hand bits are on, as in A, the X would be the color in register 0, while the X in figure B would be the color in register 1.*

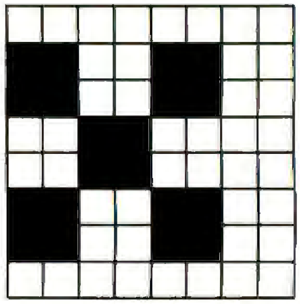

Figure 5: *Inverse video character. By having all the bits in the bit pairs on and printing the character as an inverse video character you can obtain the color in register 3.*

signing the character to have both bits in a bit pair on *and* printing the character as an inverse-video character (setting the most significant name bit). The X in figure 5, for example, if printed inverse, would be printed in the register 3 color. A single on bit, either left or right in a bit pair, will not be affected by inverse video; only when both bits are on will the color switch with inverse printing. Using this technique you can have a total of four character colors plus the background color, just like GRAPHICS modes 1 and 2. ANTIC 4 mode allows the use of all 128 characters at one time, whereas GRAPHICS 1 and 2 allow only 64 characters at a time.

ANTIC 5 mode is another hardware-only mode, just like ANTIC 4 except the characters are twice as tall. Twelve lines of ANTIC 5 mode characters will fit onto a full video display screen. The same redefined character

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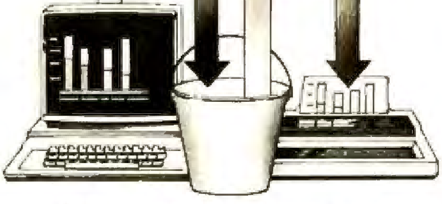

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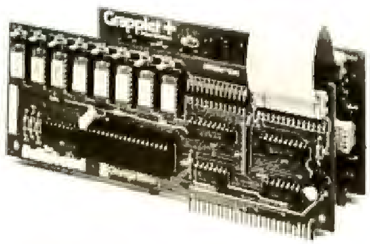

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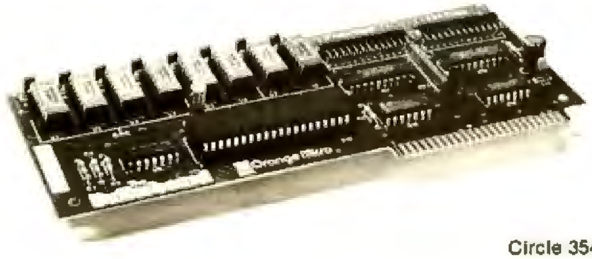

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Listing 2: *The ANTIC 5 Display-List Modifier program. Characters entered on the screen will be displayed twice as tall as normal, again making them unreadable.*

```
10 REM ANTIC 5 Display List Modifier
20 GRAPHICS 0
30 DL=PEEK(560)+256*PEEK(561)
40 POKE DL+3,5+64
50 FOR I=0 TO 10
60 POKE DL+6+I,5
70 NEXT I
80 POKE DL+17,65:POKE DL+18,PEEK(560):
POKE DL+19,PEEK(561)
```

set used in ANTIC 4 mode may be used for ANTIC 5 mode. The display-list modification is similar to that for ANTIC 4 mode (see listing 2). Although I have never seen ANTIC 5 mode used in a practical program, the tall text characters do offer exciting potential.

Listing 3 demonstrates multicharacter, multicolored graphic symbols; the special characters are incorporated into the program in the form of DATA statements. The program displays GRAPHICS 0, ANTIC 4, and ANTIC 5 modes with five colors of characters. Look for the inverse video characters (underlined) in lines 110 and 140.

Character Graphics Editor

One way to design a character set is by hand. With lots of graph paper, colored pens, and imagination, you can design a set in an hour or so. Then you must convert the graphic data into numerical data and code it in a program as DATA statements. This isn't difficult, but it is very time consuming. With the Character Graphics Editor program, the Atari computer can handle all these tasks, except for supplying the imagination, so let it do the work. Type in listing 4, using inverse characters whenever you see an underlined character. Line 140 has an Escape/Control key sequence in braces that will cause a down arrow to appear on the screen during the program run. The program requires 13K bytes of free RAM (random-access read/write memory).

If you've used other character editors before, you'll probably find this one different visually and operationally. You will need to understand how ANTIC 4 and ANTIC 5 modes interpret data, as previously explained, because you will be working with three colors in a 4- by 8-dot grid.

When you run the editor, the screen will be divided into five windows, each for a different mode. The top window (GRAPHICS 3) displays an enlarged character in two grids. The left grid is the working grid; the right grid is an 8- by 8-dot interpretation of the left grid. Below these is the instruction window; watch for prompts and the menu here.

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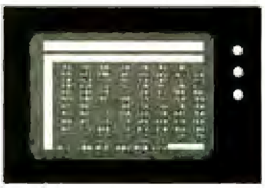

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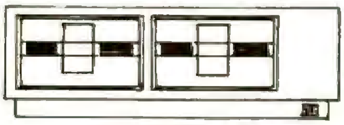

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respectively, that will show actual-size samples of your design singularly, in inverse video, and in a multiple string. Plug a joystick into port 1, and you're ready to design.

Using the Editor

The character set initially loaded is the Atari standard set. The first character displayed, the letter A, doesn't look like a letter at all. Press C for clear. Your joystick movements will reposition the red cursor. Press the Fire button and a yellow dot will be plotted behind the cursor. (I know you'll want to move the cursor just to see if the dot is really there.) Press the button again and the dot will be erased. Select a color by pressing 1, 2, or 3. Atari's default colors (1 equals orange, 2 equals light green, and 3 equals blue) will be used for now. If you plot blue dots in the top window, the character's inverse color will be color 4, red. Using the SETCOLOR command, you can choose any character and background colors you wish in your own programs.

Press E to edit a different character. The Escape key, normally required to display some characters, isn't needed. The down arrow, for example, is displayed by pressing the Control and = keys simultaneously.

To save your character set as a data file, press S and enter a filename (cassette users should enter C: as a filename). Load a previously saved data file by pressing L and entering a filename. Pressing the Select key alters the display list so that the entire character set in the third window switches from GRAPHICS 0 to ANTIC 4 mode. Test any letter or character combination by pressing T and the inverse (Atari logo) key, if you wish.

Now that you have the tool to make a proper character set, put it to use in a practical program of your own. Type in either listing 1 for an ANTIC 4 screen or listing 2 for ANTIC 5. Add the following lines and you will be able to load and use your newly created graphics character set:

```
10 RAMTOP=PEEK(106):
   POKE 106,RAMTOP-8:
   CHBASE=RAMTOP+4
20 OPEN #1,4,0,"filename":
   REM change filename to
   the one you used.
200 FOR I=0 TO 1023:
   GET #1,D:
   POKE CHBASE*256+I,D:
   NEXT I
210 POKE 756,CHBASE
```

Special Features

The Character Graphics Editor program uses several features that greatly enhance the program execution speed and could be used in your own BASIC programs. A machine-language display-list interrupt (DLI) service routine is loaded into page 6 of the computer's memory at initialization. It allows the use of the standard character set in the menu window while displaying custom characters in the lower half of the screen display. The service routine is called 60 times per second by the DLI instruction located in the modified display list. Without this feature the menu would be unreadable.

A second machine-language routine, only 6 bytes long, saves and loads the character set in a fraction of the time it would take if the program used PUT and GET commands in loops. It too is located in page 6 and is initiated by a USR call.

String manipulations are used to transfer the standard character set from ROM to RAM, where it can be altered. String manipulations are also used to transfer a string containing zeros into screen memory, thus clearing displays with machine-language speed.

Player-missile graphics, an extremely powerful feature of the Atari computers, is used for the cursor and the two grid patterns of the Character Graphics Editor screen display. The cursor is moved via another string manipulation that is so fast that a delay loop was necessary to slow it down to a usable speed.

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started using ANTIC 4 or ANTIC 5, try to design a character set to graph molecular structures, a set of architectural symbols used in house-plan designs, or maybe a set of terrain symbols for a board game. The Character Graphics Editor can open two new modes for you, so let your creativity flow.■

Listing 3: *The Demo program demonstrates the GRAPHICS 0, ANTIC 4, and ANTIC 5 modes with multicharacter, multicolored graphics symbols.*

```
5 REM ANTIC 4 & 5 Demo Program
10 GOSUB 1000
20 DIM ORCH1$(3),ORCH2$(3)
30 GRAPHICS 0
40 SETCOLOR 0,4,6:SETCOLOR 2,0,14:SETC
OLOR 1,8,6:SETCOLOR 3,14,12:SETCOLOR 4
,0,10
50 DL=PEEK(560)+256*PEEK(561)
60 POKE DL+3,68
70 FOR I=0 TO 6:POKE DL+I+6,4:NEXT I
80 FOR I=0 TO 3:POKE DL+I+15,5:NEXT I
90 POKE DL+24,65:POKE DL+25,PEEK(560):
POKE DL+26,PEEK(561)
100 POKE 756,CADR/256
110 ORCH1$="ab ":ORCH2$="cd "
120 FOR R=0 TO 3:FOR I=0 TO 11:? ORCH1
$;:NEXT I:? "":FOR I=0 TO 11:? ORCH2$;
:NEXT I:? "":NEXT R
130 POSITION 8,8:? CHR$(27);CHR$(28);"
 THIS IS ANTIC 4 MODE ";CHR$(27);CHR$(
28)
140 POSITION 16,11:? "eeeeffff":POSI
TION 16,12:? "gggggggg"
150 POSITION 8,14:? CHR$(27);CHR$(28);
" THIS IS ANTIC 5 MODE ";CHR$(27);CHR$
(28)
160 END
1000 POKE 106,PEEK(106)-5:GRAPHICS 0:P
RINT "Transferring characters from ROM
 to   RAM . . . ."
1010 CADR=256*(PEEK(106)+1)
1020 FOR I=0 TO 1023:POKE CADR+I,PEEK(
57344+I):NEXT I
1030 ? :? "Redefining 7 characters . .
 . ."
1040 FOR I=0 TO 55:READ X:POKE 776+CAD
R+I,X:NEXT I
1050 DATA 3,63,247,255,255,61,223,61
1060 DATA 240,124,252,223,253,255,252,
244
1070 DATA 3,3,3,15,63,0,0,0
1080 DATA 192,192,192,240,252,0,0,0
1090 DATA 0,170,187,170,187,170,187,17
0
1100 DATA 0,85,255,85,255,85,255,85
1110 DATA 255,85,255,85,255,85,255,85
1120 RETURN
```

Listing 4: *The Character Graphics Editor program. It allows you to design your own character set of graphics for use in the ANTIC 4 and 5 modes.*

```
10 REM CHARACTER GRAPHICS EDITOR
20 REM (C) Copyright 1982 Tim Kilby
50 DIM A$(1),D$(1),CLEAR2$(1),ZERO$(1)
,CLEAR1$(1),CLEAR4$(1),FILE$(15),A(7,8
)
60 GOTO 1600
80 SOUND 0,Y/2+100-X/4,10,4:FOR D=1 TO
 8:NEXT D:SOUND 0,0,0,0:RETURN
100 REM MENU
110 GOSUB 180:POSITION 1,0
120 ? "Edit                 Load Set    C
lear"
130 ? "Color 1,2,or 3    Save Set     T
est"
140 ? "SELECT  (ESC-ESC-ESC-CTRL-=)mod
e(ESC-ESC-ESC-CTRL-=)            * CHOOSE
 ONE *";:RETURN
180 CLEAR2$=ZERO$(1,120):RETURN
200 REM SCREEN MEMORY ORIENTATION
210 POKE 87,3:POKE 88,PEEK(DL+4):POKE
89,PEEK(DL+5):RETURN
220 POKE 82,1:POKE 87,0:POKE 88,HOME+1
00-INT((HOME+100)/256)*256:POKE 89,INT
((HOME+100)/256):RETURN
230 POKE 82,4:POKE 87,0:POKE 88,HOME+2
20-INT((HOME+220)/256)*256:POKE 89,INT
((HOME+220)/256):RETURN
240 POKE 82,2:POKE 87,0:POKE 88,HOME+3
80-INT((HOME+380)/256)*256:POKE 89,INT
((HOME+380)/256):RETURN
250 POKE 82,2:POKE 87,0:POKE 88,HOME+4
60-INT((HOME+460)/256)*256:POKE 89,INT
((HOME+460)/256):RETURN
300 REM PLOT POINTS
310 GOSUB 210:F=X/4:G=(Y-20)/4:LOCATE
8+F,G+1,A:SOUND 0,20+G-F,10,2:COLOR C*
(A=0):PLOT 8+F,G+1:PLOT 9+F,G+1
320 IF C=1 THEN PLOT 28+F,G+1:COLOR 0:
PLOT 27+F,G+1:A(G,F+1)=INT(2^(6-F)+0.1
)
330 IF C=2 THEN PLOT 27+F,G+1:COLOR 0:
PLOT 28+F,G+1:A(G,F)=INT(2^(7-F)+0.1)
340 IF C=3 THEN PLOT 27+F,G+1:PLOT 28+
F,G+1:A(G,F)=INT(2^(7-F)+0.1):A(G,F+1)
=INT(2^(6-F)+0.1)
350 IF A>0 THEN A(G,F)=0:A(G,F+1)=0
360 A(G,8)=0:FOR D=0 TO 7:A(G,8)=A(G,8
)+A(G,D):NEXT D:POKE CHBASE+CHR*8+G,A(
G,8)
370 SOUND 0,0,0,0:GOSUB 220:RETURN
400 REM EDIT
410 GOSUB 180:GOSUB 480
420 POSITION 10,1:? "- Select characte
r -";
430 GET #3,CHR:GOSUB 500:GOSUB 220:RET
URN
470 FOR A=0 TO 7:POKE CHBASE+CHR*8+A,0
:NEXT A
480 CLEAR1$=ZERO$(1,100)
490 FOR A=0 TO 7:FOR B=0 TO 8:A(A,B)=0
:NEXT B:NEXT A:RETURN
500 REM PLOT CHARACTER
510 POSITION 6,0:? "Use joystick to mo
ve cursor.":POSITION 8,1:? "Press FIRE
 to plot point."
520 POSITION 14,2:? "(M for MENU)";
530 GOSUB 240:POSITION 11,1:? CHR$(27)
;CHR$(CHR):POSITION 18,1:? CHR$(27);CH
R$(CHR+128):POSITION 25,1
540 FOR A=1 TO 5:? CHR$(27);CHR$(CHR);
:NEXT A:? :GOSUB 250
550 POSITION 11,1:? CHR$(27);CHR$(CHR)
:POSITION 18,1:? CHR$(27);CHR$(CHR+128
):POSITION 25,1
560 FOR A=0 TO 5:? CHR$(27);CHR$(CHR);
:NEXT A:GOSUB 210:IF CHR>127 THEN CHR=
CHR-128
570 IF CHR>127 THEN CHR=CHR-128
580 IF CHR>31 AND CHR<96 THEN CHR=CHR-
32:GOTO 600
590 IF CHR<32 THEN CHR=CHR+64
600 R=CHBASE+CHR*8:FOR A=0 TO 7:D=PEEK
(R+A):B=A+1
610 F=0:IF D>127 THEN D=D-128:F=F+1:CO
LOR 2:PLOT 27,B:PLOT 8,B:PLOT 9,B:A(A,
0)=128:A(A,8)=A(A,8)+A(A,0)
```

Listing 4 continued on page 179

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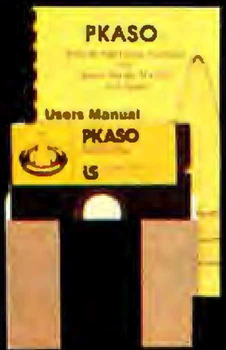

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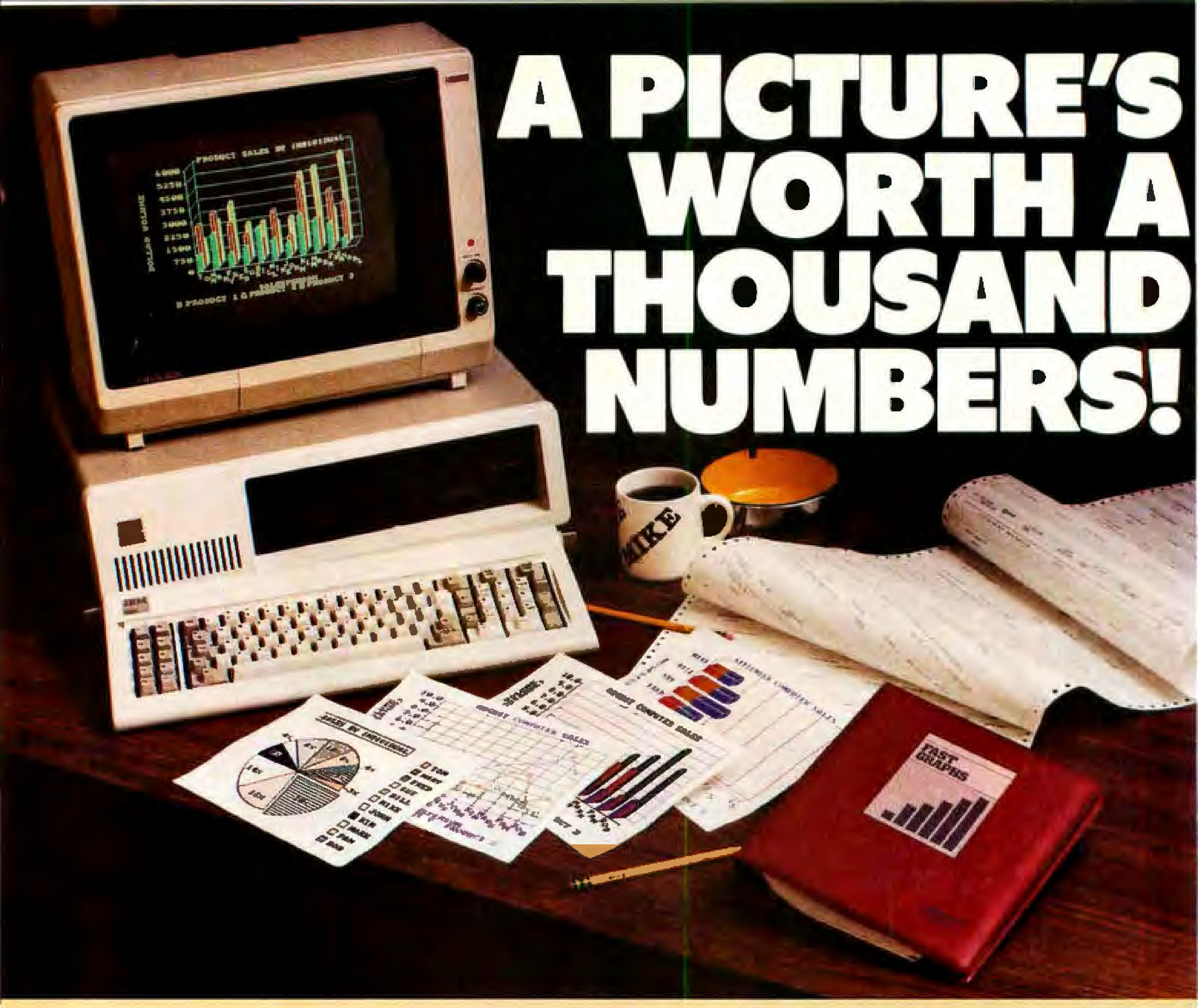

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ATARI GRAPHICS

Listing 4 continued:

```
620 IF D>63 THEN D=D-64:F=F+1:COLOR 1:
PLOT 28,B:PLOT 8,B:PLOT 9,B:A(A,1)=64:
A(A,8)=A(A,8)+A(A,1)
630 IF F>1 THEN COLOR 3:PLOT 27,B:PLOT
 28,B:PLOT 8,B:PLOT 9,B
640 F=0:IF D>31 THEN D=D-32:F=F+1:COLO
R 2:PLOT 29,B:PLOT 10,B:PLOT 11,B:A(A,
2)=32:A(A,8)=A(A,8)+A(A,2)
650 IF D>15 THEN D=D-16:F=F+1:COLOR 1:
PLOT 30,B:PLOT 10,B:PLOT 11,B:A(A,3)=1
6:A(A,8)=A(A,8)+A(A,3)
660 IF F>1 THEN COLOR 3:PLOT 29,B:PLOT
 30,B:PLOT 10,B:PLOT 11,B
670 F=0:IF D>7 THEN D=D-8:F=F+1:COLOR
2:PLOT 31,B:PLOT 12,B:PLOT 13,B:A(A,4)
=8:A(A,8)=A(A,8)+A(A,4)
680 IF D>3 THEN D=D-4:F=F+1:COLOR 1:PL
OT 32,B:PLOT 12,B:PLOT 13,B:A(A,5)=4:A
(A,8)=A(A,8)+A(A,5)
690 IF F>1 THEN COLOR 3:PLOT 31,B:PLOT
 32,B:PLOT 12,B:PLOT 13,B
700 F=0:IF D>1 THEN D=D-2:F=F+1:COLOR
2:PLOT 33,B:PLOT 14,B:PLOT 15,B:A(A,6)
=2:A(A,8)=A(A,8)+A(A,6)
710 IF D>0 THEN F=F+1:COLOR 1:PLOT 34,
B:PLOT 14,B:PLOT 15,B:A(A,7)=1:A(A,8)=
A(A,8)+A(A,7)
720 IF F>1 THEN COLOR 3:PLOT 33,B:PLOT
 34,B:PLOT 14,B:PLOT 15,B
730 NEXT A:GOSUB 220:RETURN
800 REM TEST CHARACTERS
810 GOSUB 180:POSITION 5,0:? "Your typ
ed characters":POSITION 7,1:? "will ap
pear below.        NORMAL"
820 POSITION 2,2:? "- Press  RETURN  f
or menu -";
830 D=1:POKE 764,255:CLEAR4$=ZERO$:GOS
UB 480
840 IF PEEK(764)=255 THEN 840
850 IF PEEK(764)=39 OR PEEK(764)=103 T
HEN 900
860 GET #3,CHR:IF CHR=155 THEN GOSUB 4
80:CLEAR4$=ZERO$:GOSUB 220:POKE 694,0:
RETURN
870 GOSUB 240:POSITION D,1:? CHR$(27);
CHR$(CHR):GOSUB 250:POSITION D,1:? CHR
$(27);CHR$(CHR)
880 D=D+1:IF D>38 THEN D=1
890 POKE 764,255:GOTO 840
900 POKE 694,128*(PEEK(694)=0):POKE 53
279,0:GOSUB 220
910 IF PEEK(694)=128 THEN POSITION 29,
1:? " INVERSE "
920 IF PEEK(694)=0 THEN POSITION 29,1:
? " NORMAL  "
930 POKE 764,255:GOTO 840
1000 REM LOAD CHARACTER SET
1010 GOSUB 1080:TRAP 1140:OPEN #1,4,0,
FILE$:POKE 850,7:GOSUB 1120:RETURN
1080 POKE 752,0:GOSUB 220:GOSUB 180:PO
SITION 1,0:? "Enter FILENAME. (e.g. D1
:FILENAME.SET)"
1090 POSITION 11,1:INPUT FILE$:POKE 75
2,1:GOSUB 180:RETURN
1100 REM SAVE CHARACTER SET
1110 GOSUB 1080:TRAP 1140:OPEN #1,8,0,
FILE$:POKE 850,11:GOSUB 1120:RETURN
1120 POKE 852,0:POKE 853,CHBASE/256:PO
KE 856,0:POKE 857,4:POKE 756,CHBASE/25
6:A=USR(1555)
1130 CLOSE #1:TRAP 40000:POKE 54286,19
2:POKE 756,224:RETURN
1140 GOSUB 180:POSITION 1,1:? CHR$(253
);"-Bad connection or improper filenam
e-":FOR D=1 TO 600:NEXT D:GOTO 1130
1200 REM JOYSTICK
1210 A=STICK(0):B=STRIG(0)
1220 IF A=7 THEN X=X+8:IF X>24 THEN X=
0
1230 IF A=11 THEN X=X-8:IF X<0 THEN X=
24
1240 IF A=14 THEN Y=Y-4:IF Y<20 THEN Y
=48
1250 IF A=13 THEN Y=Y+4:IF Y>48 THEN Y
=20
1260 POKE 53251,X+56:A$=O$(81-Y,81-Y+1
28)
1270 IF B=1 AND A<>15 THEN GOSUB 80
1280 IF PEEK(764)<>255 THEN GOSUB 1400
1290 IF PEEK(53279)=5 THEN FOR D=0 TO
3:POKE DL+D+19,4*(PEEK(DL+D+19)=2)+2*(
PEEK(DL+D+19)=4):NEXT D
1300 IF B=0 THEN GOSUB 300
1310 GOTO 1200
1400 REM KEYBOARD CHECK
1410 GOSUB 220:GET #3,KEY:IF KEY=76 TH
EN GOSUB 1000:GOSUB 100
1420 IF KEY=83 THEN GOSUB 1100:GOSUB 1
00
1430 IF KEY=69 THEN GOSUB 400
1440 IF KEY=67 THEN GOSUB 470
1450 IF KEY=84 THEN GOSUB 800:GOSUB 10
0
1460 IF KEY=77 OR KEY=32 THEN GOSUB 10
0
1470 IF KEY=49 THEN C=1
1480 IF KEY=50 THEN C=2
1490 IF KEY=51 THEN C=3
1500 POKE 764,255:RETURN
1600 REM INITILIZATION
1610 RAMTOP=PEEK(106)-12:POKE 89,RAMTO
P:POKE 88,0:? CHR$(125):C=1:CHR=65:OPE
N #3,4,0,"K:"
1620 POKE 106,RAMTOP:CHBASE=(RAMTOP+8)
*256:PMBASE=(RAMTOP+4)*256:GRAPHICS 0:
POKE 710,176
1630 POKE 203,CHBASE/256:POSITION 9,3:
? " INITIALIZING PROGRAM";:GOSUB 490
1640 FOR A=0 TO 24:READ B:POKE 1536+A,
B:NEXT A:POKE 512,0:POKE 513,6
1650 VT=PEEK(134)+256*PEEK(135):AT=PEE
K(140)+256*PEEK(141)
1660 X=CHBASE-AT:Y=57344-AT:GOSUB 1800
1670 POKE VT+2,X2:POKE VT+3,X1:POKE VT
+4,1:POKE VT+5,4:POKE VT+6,1:POKE VT+7
,4
1680 POKE VT+10,Y2:POKE VT+11,Y1:POKE
VT+12,1:POKE VT+13,4:POKE VT+14,1:POKE
 VT+15,4:A$=O$
1690 X=PMBASE+896-AT:Y=PMBASE-AT:GOSUB
 1800:POKE VT+2,X2:POKE VT+3,X1:POKE V
T+10,Y2:POKE VT+11,Y1
1700 X=PEEK(88)+256*PEEK(89)+100-AT:Y=
RAMTOP*256-AT:GOSUB 1800:POKE VT+18,X2
:POKE VT+19,X1:POKE VT+26,Y2
1710 POKE VT+27,Y1:X=PEEK(88)+256*PEEK
(89)-AT:GOSUB 1800:POKE VT+34,X2:POKE
VT+35,X1
1720 X=PEEK(88)+256*PEEK(89)+380-AT:GO
SUB 1800:POKE VT+42,X2:POKE VT+43,X1
1730 FOR A=4 TO 44 STEP 8:FOR B=0 TO 3
:READ D:POKE VT+A+B,D:NEXT B:NEXT A:GO
TO 2000
1800 X1=INT(X/256):X2=INT(X-(256*X1)):
Y1=INT(Y/256):Y2=INT(Y-(256*Y1)):RETUR
N
2000 REM PLAYER/MISSILE GRAPHICS
2010 POKE 54279,PMBASE/256
2020 FOR D=53248 TO 53255:READ X:POKE
D,X:NEXT D:FOR D=53256 TO 53258:POKE D
,1:NEXT D:POKE 53259,3:X=0
2030 FOR A=0 TO 256 STEP 128:FOR D=20
TO 52 STEP 4:POKE PMBASE+512+A+D,21:NE
XT D:NEXT A
2040 FOR D=22 TO 50 STEP 4:POKE PMBASE
+384+D,85:NEXT D:POKE 623,17
2050 Y=20:FOR D=0 TO 3:POKE PMBASE+D+Y
+896,3:NEXT D:FOR D=0 TO 3:POKE PMBASE
+D+80,3:NEXT D
2200 REM ESTABLISH DISPLAY SCREEN
2210 GRAPHICS 0:POKE 752,1:POKE 711,68
:DL=PEEK(560)+256*PEEK(561):HOME=PEEK(
DL+4)+256*PEEK(DL+5):POKE DL+3,72
2220 FOR D=0 TO 8:POKE DL+D+6,8:NEXT D
:POKE DL+18,144:POKE DL+23,4:POKE DL+2
4,4:POKE DL+25,5:POKE DL+26,5
2230 POKE DL+27,65:POKE DL+28,PEEK(560
):POKE DL+29,PEEK(561):POKE 54286,192
2240 GOSUB 230:POSITION 4,0:FOR F=0 TO
 3:FOR D=0 TO 31:? CHR$(27);CHR$(D+32*
F);:NEXT D:? :NEXT F
2250 POKE 559,46:POKE 53277,3:GOSUB 53
0:GOSUB 220:GOSUB 100:FOR D=0 TO 2:POK
E 704+D,6:NEXT D:POKE 707,68:GOTO 1200
2400 DATA 72,138,72,152,72,165,203,141
,10,212,141,9,212,104,168,104,170,104,
64,104,162,16,76,86,228
2410 DATA 128,0,128,0,128,1,128,1,120,
0,120,0,160,0,160,0,100,0,100,0,160,0,
160,0
2420 DATA 149,161,173,56,83,91,99,107
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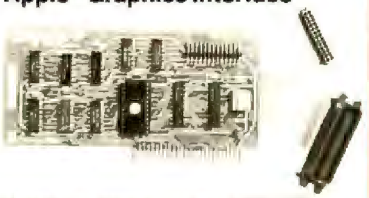

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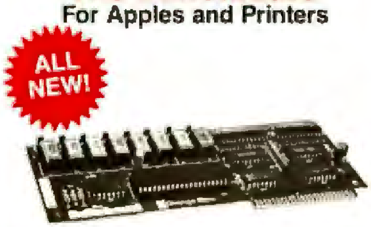

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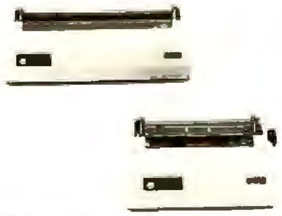

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Lotus Development Corporation's 1-2-3

A fast, versatile package that combines spreadsheet, graphing, and database functions

Gregg Williams
Senior Editor

When does "evolution" become "revolution"? When I first saw 1-2-3, a spreadsheet/database/graphing system from Lotus Development Corporation, I thought, "Hmm, very well done, but it's just an extension of existing software." True enough. But after using the product for a few hours, I realized it impressed me as more than just an evolutionary product. There may be nothing new under the sun, as they say, but there *are* novel ways to combine old things. In that sense, Lotus's 1-2-3 is modestly revolutionary because it synergetically combines three packages. In this product description, we'll take a look at the system's capabilities.

Spreadsheet Capabilities

1-2-3 is, above all else, a spreadsheet. Like most spreadsheets, it lets you enter either text, numbers, or formulas in a network of "cells" so that, by changing the content of certain cells, you can perform an involved set of calculations automatically. It's safe to say that 1-2-3 has all the features you've ever seen on spreadsheets. You can copy ranges of cells, insert and delete rows and columns, change the output format of a range of cells or the width of a column of cells, and do numerous other functions.

The size of the spreadsheet is 2048 rows of 256 columns. Lotus claims that 1-2-3 will handle up to 640K bytes of memory. You can't fill the entire spreadsheet with that, but it's probably considerably more than enough for most applications.

1-2-3 will soon be available for the IBM Personal Computer (PC) and will eventually be converted to other microcomputers that use the Intel 8086 or 8088 microprocessor. The initial version of 1-2-3 will need an IBM PC with two disk drives, 128K bytes of memory, and either a monochrome or a color display; if the computer has both, you can view the spreadsheet (on the monochrome monitor) and graphs (on the color monitor) at the same time. If you have only the monochrome video display, you cannot view your graphs; you can only print them out. If you have only the color video display, you can alternate between viewing the spreadsheet and the graph.

Graphing Capabilities

1-2-3's sophisticated graphing commands enable you to create graphs of up to four variables using information already on the spreadsheet. Photo 1a shows a small spreadsheet; photos 1b and 1c show the two graphs of the same data. You can ask for one of five kinds of graphs, including bar and line graphs (of which photo 1b is an example), a pie chart (of one variable only), a stacked bar chart, or an *x-y* graph (two lists of variables used as *x-y* coordinate pairs). During my first session, I set up the parameters for a graph in under three minutes; after a few tries, I could do it in less than a minute. The graph is drawn in under two seconds—a far cry from graphing, say, on the Apple II.

Once you've made a graph, three keystrokes will display it in another form; if data in the spreadsheet has been changed, you can display a revised graph with one keystroke. Various options let you change the look of a graph; you can display one in black-and-white if you don't have a color monitor attached to the color video in-

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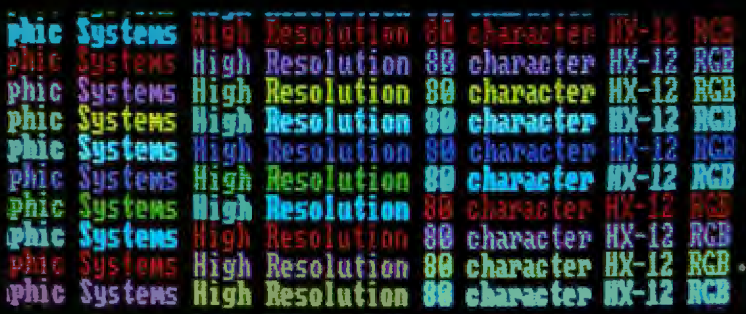

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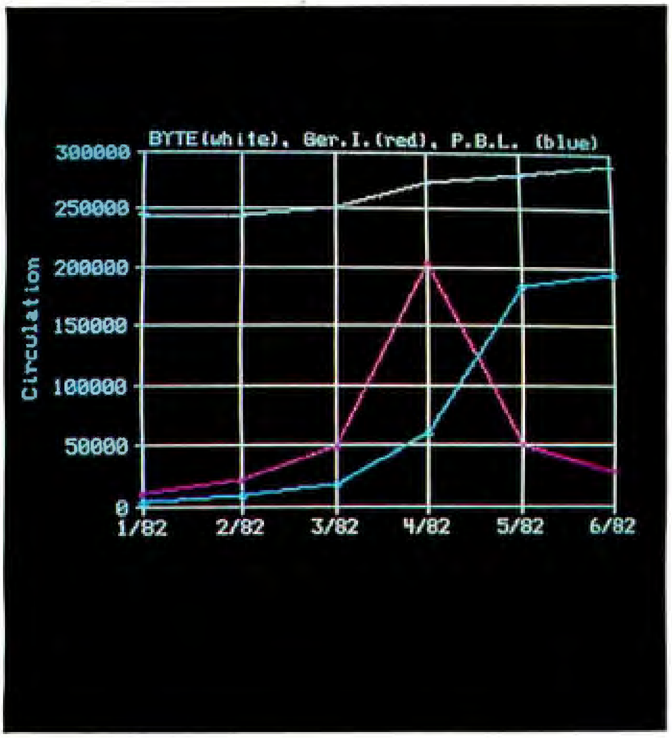
1a

1b



1c

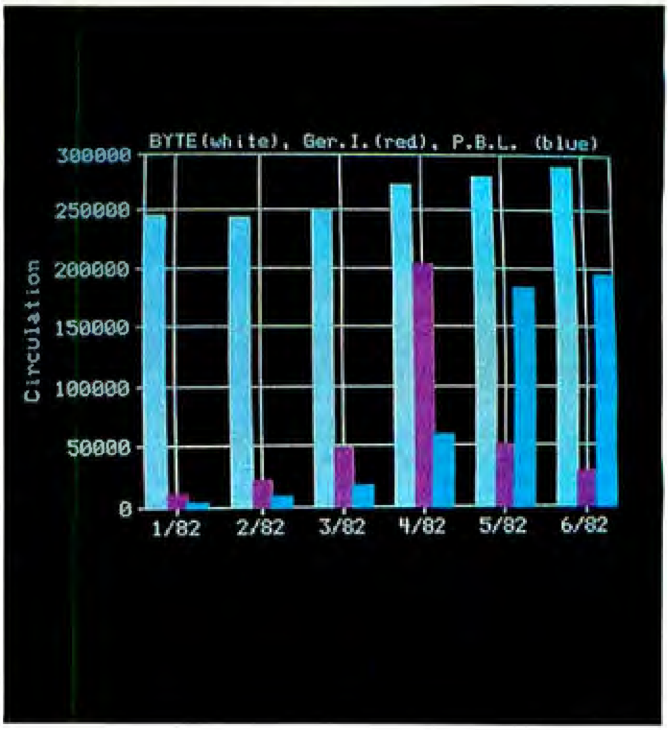


Photo 1: *Making graphs from spreadsheet data. Given the small spreadsheet shown in photo 1a, the line graph in photo 1b and the bar graph in photo 1c were both made from the data on the spreadsheet. Once the data to be used has been specified, a different type of graph can be drawn (or a graph with new data can be redrawn) in less than two seconds.*

terface. You can also send a graph to the printer; at the moment, only the Epson MX-80 printer is supported, but others will be supported in the final version.

Database Capabilities

You can also use 1-2-3 as a database for storing, sorting, and retrieving records. Although its database capabilities are not comparable to those of, say, dBASE II, they are very useful in conjunction with the other two.

1-2-3 will take an arbitrary area of the spreadsheet to be a database; the entries on a given row are considered to be a *record*, and record fields must be vertically aligned. (The database can be anywhere on the spreadsheet along with nondatabase information.) You can sort a set of records, query it, or use it to retrieve selected records. Records are sorted by a maximum of two keys, each of which specifies a sort operation by either ascending or descending order. The query and retrieve operations are very similar. Both find records that match certain criteria; the former modifies the action of the cursor-up and cursor-down keys so that the cursor will highlight only records that match the criteria, and the latter copies the matching records into a designated area of the spreadsheet.

Photo 2a shows a small collection of records that is being readied for a retrieve operation. 1-2-3 prompts you for the area of the spreadsheet that is considered a collection of records; when you choose that area, 1-2-3 highlights it in reverse video. The top line of the database area contains the values (or, in the case of inequalities, the relationships) you're searching for, the second line is the name for each field, and the lines below that are the actual records. Once the retrieve function is completed, the matching records are deposited in the assigned destination area (see photo 2b).

Granted, 1-2-3's database capabilities don't match those of the expensive databases, so it would be foolish to buy the system in lieu of a full-featured one. But *selection* is a fundamental data-manipulation operation, and any package that can speak to this need is superior to those that don't. I suspect that the database functions in 1-2-3 will be used most often to isolate specific data that will then be graphed (if you had to isolate the data manually, you probably wouldn't bother graphing it). Still, 1-2-3's database can be used in several traditional applications as well as in some less traditional ones—scheduling, for example.

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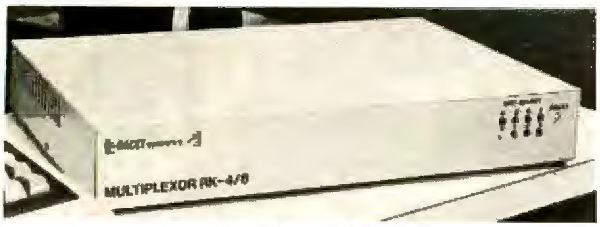

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2a

2b

Photo 2: *The retrieve function in 1-2-3. If we consider a series of spreadsheet rows to be records of a file, we can select certain records based on given criteria. In photo 2a, we are setting up a database of records (shown in inverse video) to be queried for all the records that have a name field of "Mary"; 1-2-3 will place the matching records in a separate area in the bottom half of the screen, as shown in photo 2b.*

The Computing Power of 1-2-3

We've seen enough spreadsheet programs to expect each new one to improve on the previous versions. In this case, the program fulfills our expectations; 1-2-3 is the product of a few very creative minds. The program was designed by Mitch Kapor and Jonathan Sachs and programmed by Sachs, George Riner, and Rick Ross. Sachs worked on four spreadsheet programs before this, and 1-2-3's easy-to-use design reflects his experience.

Numbers alone don't tell the full story, but they'll have to do here. Visicorp's Visicalc for the IBM Personal Computer has 15 arithmetic, logical, and relational operators, 28 functions, and 32 commands. 1-2-3 has 15 operators, 41 functions, and 66 spreadsheet-related commands. If we include the database and graphing commands, 1-2-3 actually has 110 commands.

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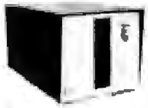
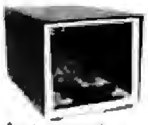


Front—Tandon Panel



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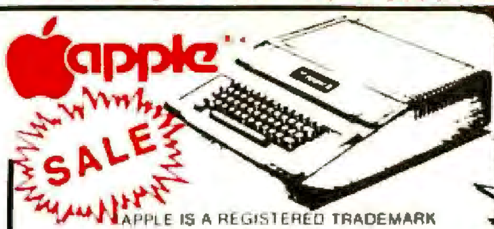

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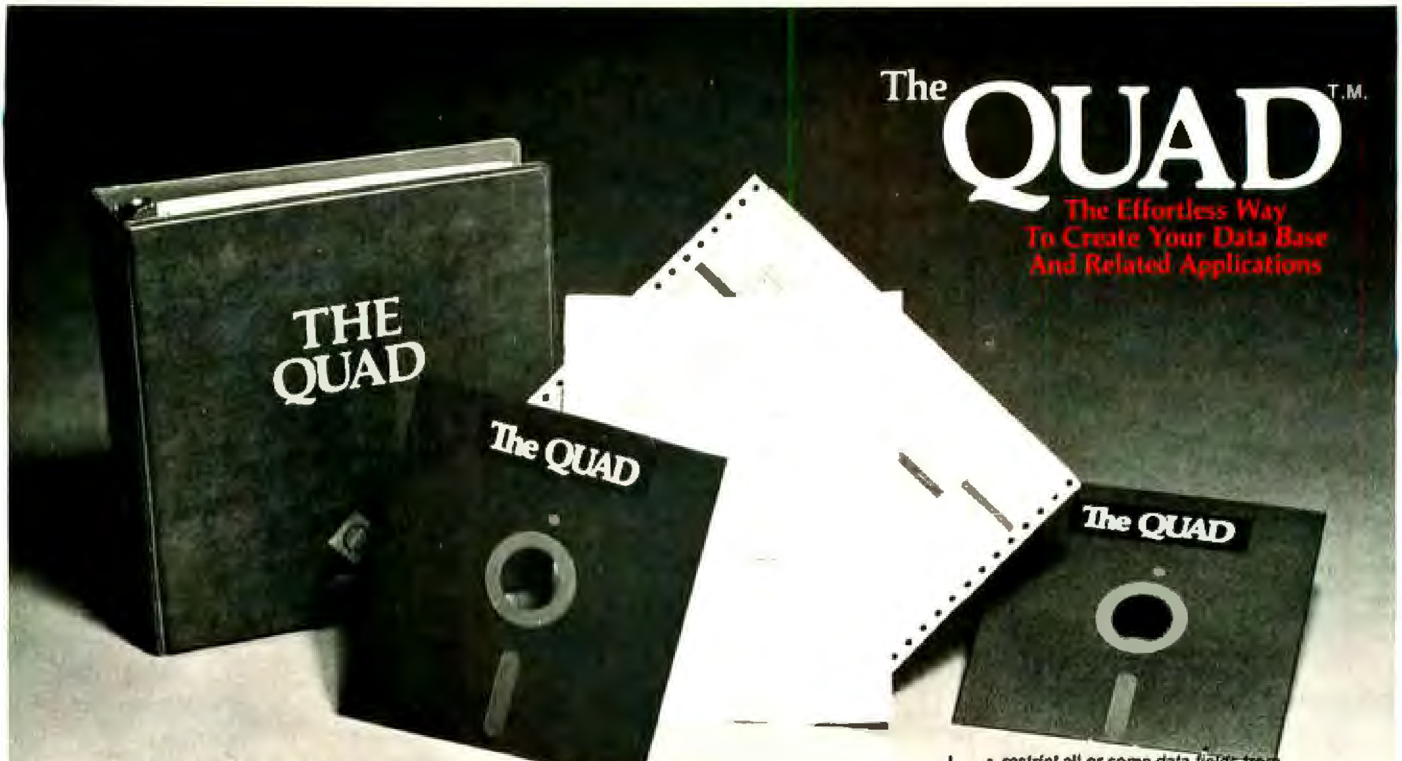

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EXTENSIVE REPORTING CAPABILITIES

The QUAD enables you to create an unlimited number of reports in any specific size or form you desire using data from the QUAD database or another database. You may process and/or print data during any report.

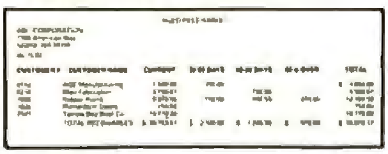
PROCESSING DATA

- access information in up to *10 or more files* during a report
- perform *arithmetic calculations* on any data from any file
- update and/or create files based on report processing
- easily *compare date* information for quick aging analysis
- perform up to *5 levels of subtotaling* within each report
- retrieve records in *sequential or indexed* order
- perform processing based on comparison of data such as nested *IF THEN logic*

PRINTING DATA

- utilize your printer's capability by *printing on any size paper anywhere* on the page
- *print checks* using the English equivalent for dollar and cent values
- specify content of page headings, control headings and footings, detail lines and total lines
- pause between printing of forms

SAMPLE REPORT

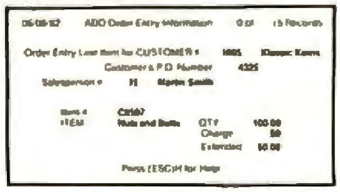


POWERFUL UPDATING CAPABILITIES

The QUAD gives you two methods to update data within the data base. One way is directly through the terminal using a data entry process. The other is through batch updating based on existing data within the data base.

- *update* as many as *10 or more* files simultaneously, using the batch update mode
- totally *user defined screens*
- *full screen editing*
- record sizes up to *900* characters
- *perform calculations* based on data entered and data residing in other files
- access three different *help screens* during the data entry process
- utilize your terminal's *video capabilities* when creating your terminal update screens
- *restrict* all or some *data fields* from future changes
- *edit each data field* for items such as phone numbers, numeric data, alphanumeric data, date, time, social security number, etc., or your own defined edits
- *IF-THEN logic* available during both terminal and batch updating

SAMPLE SCREEN



OTHER FEATURES

SORT, INDEX, and REORGANIZE data files quickly and easily. Also link to user-written programs directly from the QUAD. Automatically generate menus to access each of your applications.

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3a

3b

Photo 3: *Two-dimensional table creation in 1-2-3. When it's given a spreadsheet, two lists of input values, input cells for both lists, and an output cell, 1-2-3 can automatically create a table that gives the output value for each combination of the two input values. Photos 3a and 3b show the spreadsheet before and after the command is given. The output function shown here is the ratio of the two input values.*

Although several features of the spreadsheet module are new to this product, two stand out. First, 1-2-3 allows you to manipulate both spreadsheets and their printed versions (called print files). That means you can save or combine parts of either the spreadsheet itself (including the formulas in each cell) or its printed representation (the letters and numbers in each cell).

The second set of especially noteworthy commands, /DT1 and /DT2, is for creating tables. With them, you can automate the tedious work of charting the behavior of a spreadsheet when one or two input variables vary across a given range of values. You can specify either one or two lists of input arguments, the cell positions in which these values are to be entered, and the cell that will contain the desired output. 1-2-3 will then substitute the input values into the spreadsheet and accumulate the output values in a one- or two-dimensional table. Photo 2a shows the format of the two input ranges (one a column and the other a row) and the corner of the spreadsheet that performs the calculation (for illustrative purposes, the ratio of the two input values). Photo 2b shows the table created by the execution of the /DT2 two-dimensional table-creation command.

Human Engineering

1-2-3 also excels in human engineering factors, those elements of a program that make it easy to use. I cannot overemphasize the importance of human engineering in microcomputer programs. To date, computers have been hard to understand and inconvenient to use, which has discouraged many people from using them. 1-2-3 is one of the few pieces of software that can literally be used by anybody. You can buy 1-2-3 and an IBM Personal Computer and be using the two together the same day.

1-2-3 is one of a new breed of advanced software products that has a disk-based help file. At any time, you can hit a Help button (the F1 key on the IBM PC) and get one or more screens of information on literally any aspect of the program. The help file, which resides on the A disk of the IBM PC, contains over 250 screens of information. When you hit the F1 key, a menu of topics appears on the screen in under one second (an important consideration if waiting to see disk-based information discourages you from using the Help key). You then use the IBM PC arrow keys to move an inverse-video cursor to the desired topic and press the Return key. Each screen is cross-indexed to related screens and to a main menu, and you can get to any screen in less than 15 seconds. I was able to find the information as quickly as if I had looked it up in the 1-2-3 documentation. Those who are new to computers will be very impressed with this feature and will be much more inclined to use 1-2-3 because of it. (Software Arts' TK Solver also uses a disk-based help file, and I understand future products from Visicorp will include them as well.)

1-2-3 is, to my knowledge, the first spreadsheet program to distribute a comprehensive tutorial package that teaches the beginner how to use it. Software producers have always deliberated over the best way to teach a buyer (regardless of his understanding of the computer) how to use a complicated product. Lotus has incorporated these interactive tutorial programs into 1-2-3. They are reputed to cover, in some depth, the entire program. The segment I saw does its job well; it interactively shows you around the IBM PC keyboard and tells you how to move the cursor around a spreadsheet. This set of programs is, in effect, an indefatigable instructor who is always ready and willing to show you how to use the product and who will never laugh at your mistakes. This is another very strong incentive for the beginner to buy 1-2-3. No matter what your level of expertise, it's a very nice feature.


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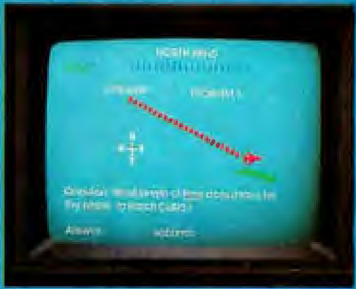


CONTROL DATA

PLATO

COMPUTER-BASED EDUCATION

Another feature that illustrates 1-2-3's human-engineering design is its jargon-free prompts, explanatory messages, and fail-safe mechanisms. Suppose I want to delete a spreadsheet file. When I type "/F", I get a menu of possible file actions, the first of which is in inverse video. I can execute any action by either moving the inverse video cursor to that action name and hitting the Return key or hitting the key that is the first letter of the action name. If I hit the right-arrow key until the action name "Delete" is in inverse video, I get an explanatory note immediately below the command line that says, "Delete a worksheet, print, or graph file" ("worksheet" is Lotus's name for a spreadsheet). That's what I want to do, so I conveniently hit Return. The inverse video cursor is already positioned on the option I want, "Worksheet", so I hit Return again. 1-2-3 now reads the current disk and gives me a menu of all the spreadsheet files by name. I then move the inverse video cursor to the spreadsheet I want to delete and hit Return again (there's no need to type the file name—just point to it). 1-2-3 displays two options, "No" and "Yes", with the cursor on the "No" option and an explanatory note, "Do not delete the file". By moving the cursor onto the word "Yes" (which includes the note "Delete the file") and pressing Return, I can delete the spreadsheet file. Wouldn't you like a piece of software that does all that for you?

1-2-3 gives you a lot of visual feedback on your choices. The inverse-video cursor and menu system described above is one such example. (The resemblance to Visicorp's Visiplot package is not accidental: Mitch Kapor, who designed Visiplot, is the president of Lotus.) Another example is 1-2-3's ability to let you specify coordinates by moving the cursor to them instead of listing them by row-column designation. To specify an area of the spreadsheet, you simply move the cursor to a corner of the area with arrow keys, "tack" it in place (usually with the same "." command used in Visicalc), and move the cursor away from that point. A rectangular area that spreads from the current cursor location to the "tacked" location appears in inverse video (see photo 2a).

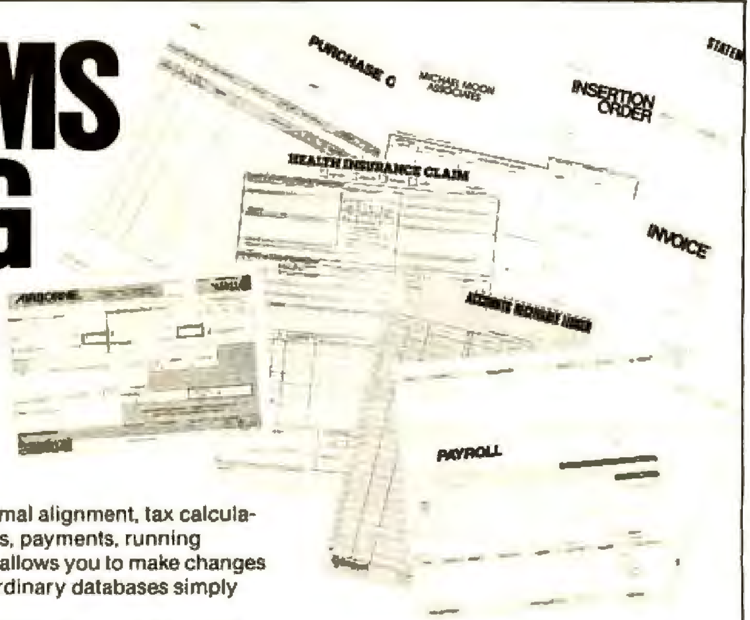
Pressing a previously defined macro key causes the equivalent string to be executed as if it had been typed in from the keyboard— a feature with great potential.

Pointing to both spreadsheet locations and menu options makes 1-2-3 very easy to use and reduces errors.

Named ranges are another way of pointing to an area of memory. Any cell or rectangular area of the spreadsheet can be given a name of up to 15 characters. That name can then be used wherever the cell or range coordinates would usually be used. Sometimes, a named range is simply a convenience; in other places (e.g., in the formula for the value of a given cell), it makes the spreadsheet more readable. Microsoft Consumer Products' Multiplan automatically assumes that you can refer to a cell by the text label immediately to its left; 1-2-3 stipulates that you create a named range, but that range is more versatile than a named cell in Microplan. (People at Lotus have told me that the final version of 1-2-3 has an option that lets you refer to a cell automatically by an adjacent label value; you have the choice of positioning the labels below, above, or to the left or right of the cells.)

1-2-3 uses the ten IBM PC function keys (on the left side of the keyboard) in two ways. The unshifted keys are used for ten often used 1-2-3 commands; for example, F1 is the Help key described above, F5 is a Goto key that moves the spreadsheet and cursor to a given location, and F10 is a Redraw command for the most recently drawn chart. The ALT key pressed simultaneously with a letter key gives you 26 user-defined macro keys. You can define each of the 10 available macro keys to be any string of characters you desire, including the unshifted function keys, the arrow keys, and the Return key. When pressed, the macro key causes 1-2-3 to execute the equivalent string as if it had been typed in from the keyboard. This feature has great potential; in certain situations, you may be very glad not to have to retype the same keystrokes repeatedly.

WHY A FORMS PROCESSING DATABASE?



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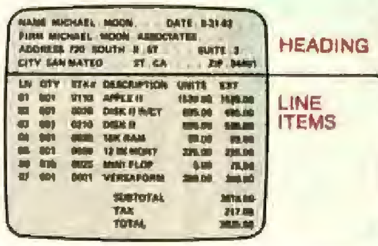

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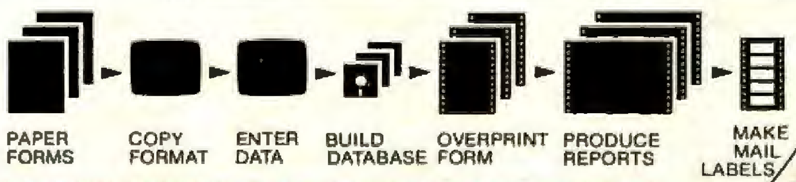

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1-2-3 has what I call "intelligent" labels, text strings that are not influenced by the current cell width. Say, for example, I want to print a 30-character title across a spreadsheet, and assume that all the cells are 8 characters wide. In many spreadsheet programs, you'd have to split the title manually and enter it in four 8-character chunks—awkward and tedious, right? In 1-2-3, though, you enter the full title in the first cell you want it to occupy. The string itself stays in that cell as its formula, but in its display it spills over into the space normally used by cells to the right. The effect is the same as with other spreadsheets, but it is achieved much more easily. What if you decide your cells must be 10 characters wide? In other spreadsheet programs, the title is mangled when you change the cell width—each 8-character chunk has two blank characters to its right. But because the value of the string is retained in only one cell, 1-2-3 displays the title correctly despite the change in cell width. Several text-justification commands in 1-2-3 also help format a single string into rectangular spreadsheet areas that occupy one or more rows of cells.

1-2-3's ability to "protect" cells means that data cannot be destroyed unintentionally.

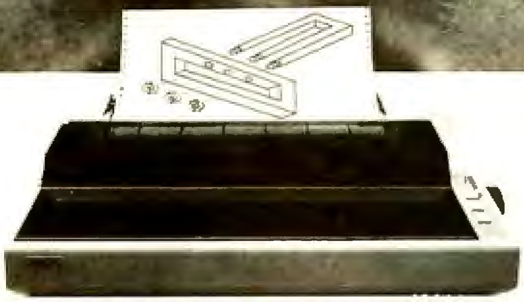
One final human-engineering feature of 1-2-3 is its ability to *protect* cells—that is, to keep you from assigning new values to cells or ranges of cells. When a spreadsheet is used by anyone but its designer, protected cells allow the person to use it without inadvertently destroying valuable data or formulas. If you try to write a new value into a protected cell, you will get an error message that says the cell is protected. This is a nice feature, but it would be more useful if cells could be "locked" (so you couldn't cancel the protection of a cell) and made invisible, features that are available in Visicorp's Visicalc Advanced Version for the Apple III computer.

Speed and Integration Advantages

In addition to being powerful and easy to use, the various modules of 1-2-3 are fast and well integrated.

Many software developers (Software Arts, Visicorp, and Microsoft Consumer Products, to name a few) are writing their software in high-level languages that are usually compiled to the native code of the machine's microprocessor. They do that in order to move a given program to more than one machine and thus maximize their profits. (Rightly so—good software is very expensive to create.) An interesting side effect of using high-level languages is that the resulting product is slower than if it had been written strictly for the native microprocessor. Depending on the efficiency of the high-level language used, an assembly-language version of a product can be considerably faster and more compact than its high-level counterpart. This is certainly the case with 1-2-3; it is coded in highly optimized 8086 assembly-language code. Granted, I have only Lotus's word that it is "highly optimized," but 1-2-3 *is* fast—I didn't have to wait when I expected to. [**Editor's Note:** *A demonstration of 1-2-3's capabilities at its recent public unveiling illustrated the program's speed. For example: a spreadsheet was displayed showing a listing of 25 hotels ordered by location. To the right of the hotel listings were 12 or so columns of data showing vital statistics for the hotels. After setting up the appropriate initial conditions, the program was able, within five seconds, to re-sort the hotels by revenue, calculate averages for key pieces of data, reinsert them into the model, add compensating factors for possible future inflation, calculate projected revenue figures for the next few years, and graph the results. . . .* **C. M.**]

Integration is a very important characteristic of 1-2-3. Because the spreadsheet, database, and graphing programs are in the computer simultaneously (1-2-3 does not use overlays to bring in sections of code when called), you are more likely to use them. I for one am always annoyed when I have to wait for UCSD Pascal to load another part of the language system whenever I go, say, from the Filer to the Editor. I would be less apt to experiment with graphing different sets of data with Visicorp's Visicalc and Visiplot, which would involve saving my data to disk, exchanging disks, starting up the Visiplot



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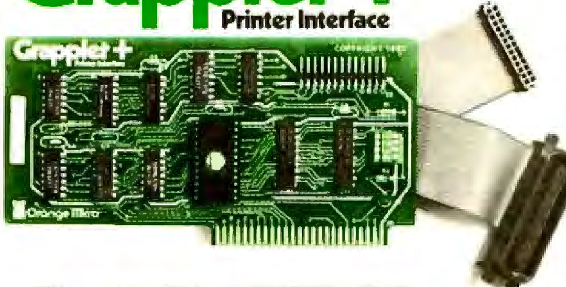

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program, exchanging disks again, reading in the data, and, finally, plotting the data. I would do a similar sequence of disk and program switching to get back to Visicalc and adjust my data. How much experimentation does that rigamarole encourage?

Caveats

This product description is based on more than 20 hours of experimentation with a version of 1-2-3 Lotus loaned to me a month before the design and code were finalized. I experimented with all of the features mentioned in this article and several others. I found 1-2-3 easy to use; it didn't mislead me into doing something I didn't want to do or leave me confused as to my place within the structure of the program. Although I didn't have a copy of the final documentation, I found that a functional specification document I was given and the disk-based help file provided all the information I needed. I did have trouble specifying a new range by pointing in some situations; Lotus told me that this error will be corrected before the product is available commercially.

News from Lotus

1-2-3 will be available for the IBM Personal Computer sometime next month; it will eventually be available for other 8086- and 8088-based microcomputers, although Lotus has announced no definite plans or machines. Lotus has also fixed the price of 1-2-3 at $495, which makes it a tremendous buy for the money. Staff members point out that 1-2-3 improves on the Visicorp trilogy of Visicalc, Visiplot, and Visidex (which together sell for a total of $700 in their IBM PC versions) in both price and capabilities.

Mitch Kapor and his team of designers and programmers are incredibly creative: they have come up with more good ideas than they can possibly implement at one time, but they also implement more of them than I would have thought possible. They have indicated that 1-2-3 will probably be able to read dBASE II files, thus making it possible for 1-2-3 to interchange data with one of the most popular databases around. They also told me that 1-2-3 will be able to make the spreadsheet look like a business form with blanks to be filled in by the user, thus enabling you to enter data into 1-2-3 database areas.

Lotus plans to add several graphics features to the final version. These include visual superimposition of charts, the use of text in user-chosen shapes, sizes, and colors; choice of printed chart size; manual scaling of graph axes; and support of the Hewlett-Packard HP7470A plotter and several popular printers. In addition, Lotus plans to add word-processing capabilities to subsequent releases of 1-2-3.

Conclusions

On the basis of the prerelease version of the software, 1-2-3 promises to be a fast, easy-to-use, integrated package for people who need to manipulate numbers, graphs, and records of data. Its instantly available help file, interactive tutorial programs, and incorporation of tested human-engineering concepts make it particularly impressive. It is one of the first of a new breed of sophisticated applications software that is both powerful *and* easy to use, even for beginners.

I'm very pleased about 1-2-3's price of $495. That puts it within the grasp of both the professional who needs a sophisticated spreadsheet program and the individual who wants one for personal use.

In any case, even unfinished, 1-2-3 is a fine piece of software. I look forward to seeing the first and subsequent versions of it.■

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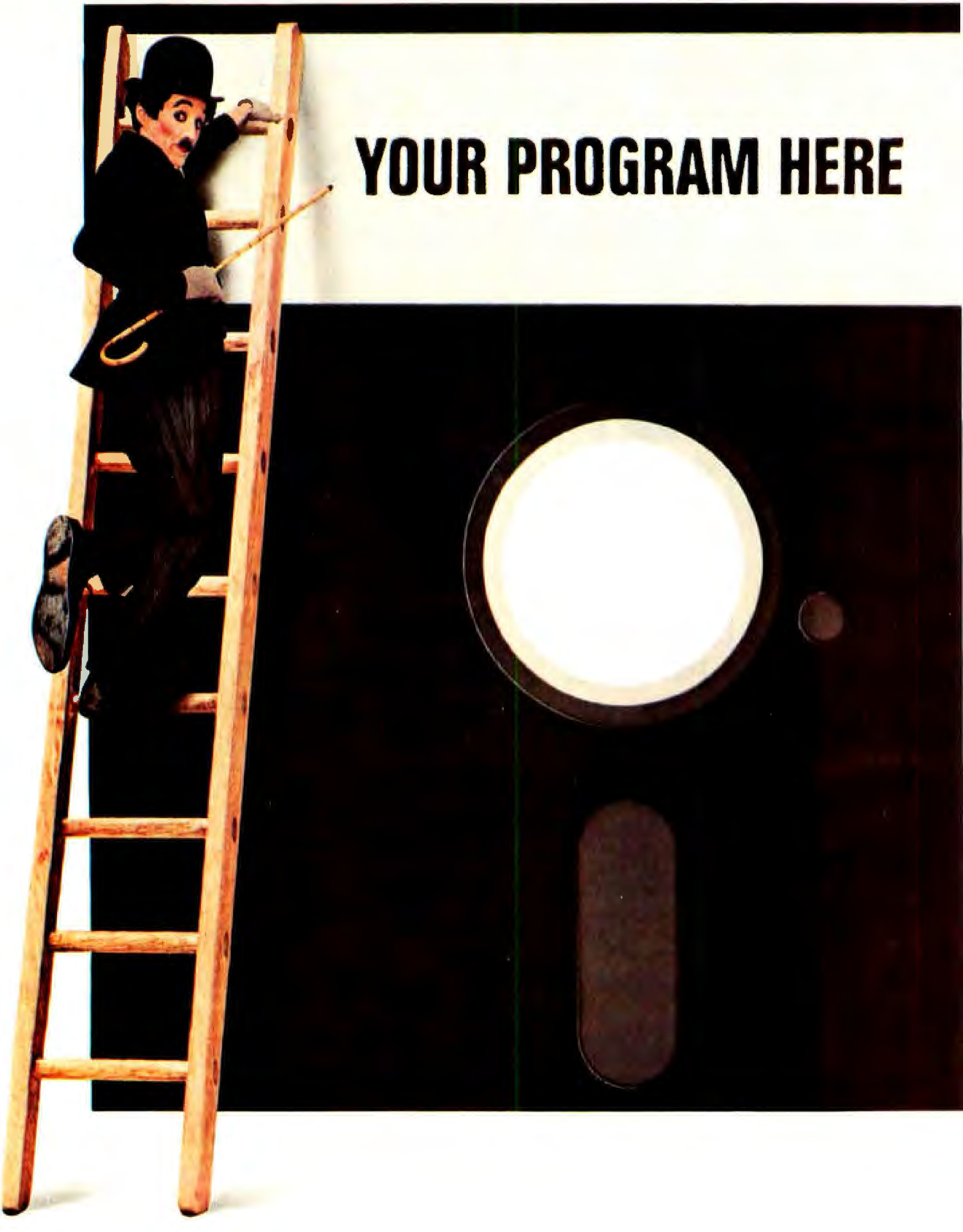
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Book Reviews

PET/CBM BASIC

Richard Haskell
Prentice-Hall, 1982
154 pages, softcover
$12.95

Reviewed by
Joseph Holmes
13049 Broadway Terr.
Oakland, CA 94611

Like other microcomputers, the PET premiered without much published information ready to guide its users. Fortunately, considerably more information is now available. One of the latest and most useful books is *PET/CBM BASIC* by Richard Haskell.

The book is intended to be a course in BASIC programming using a 40-column PET. The modifications for the 80-column CBM microcomputer are listed in one of the book's nine appendixes. The introductory presentation level makes the book useful as both a text and a classroom reference. Haskell stresses structured programming throughout and makes an effort to relate concepts and commands found in other languages or versions of BASIC to PET's BASIC. This approach adds to the value of the book as a programming text.

The inclusion of graphics in many of the program examples, a subject often treated lightly in other PET texts, is a welcome feature. Examples make the book especially well suited to teaching programming to junior high or elementary level students, who respond well to graphics.

The chapters are well organized, and a variety of drawings, diagrams, and photographs make the layout attractive. Because the author photographed most of the listings and all of the screen outputs directly from the video display, many are just not legible enough to be useful. There should be supplemental printed listings. Several of the photographed listings, however, are readable.

At the beginning of chapter one, Haskell describes his philosophy of learning by doing, and in keeping with that he introduces the reader to the keyboard first. In each successive chapter, he begins with a summary of learning objectives and ends with several practice exercises.

Graphics are introduced in chapter two, where the author discusses the use of the INSERT/DELETE key and RUN and LIST commands in the creation of short graphics programs. By chapter five, he presents programs that manipulate both numbers and graphic symbols to illustrate the INPUT statement.

My wife used the book with students in the upper elementary grades, and they especially enjoyed the Custom Checkerboard Patterns program in which the input of two graphics characters results in the output of a "homemade" checkerboard design. One of the benefits of using graphics in teaching programming is that they motivate the adventurous learner to experiment further.

In chapter seven, the author uses an unusual approach to discuss types of loops. He describes them as Repeat While, Repeat Until, Do While, and Do Until. The For-Next loop is introduced in the following chapter, which culminates in a program that generates an American flag, making liberal use of the loop.

Later in the book, Haskell introduces the use of subroutines as a method of building three-dimensional block letters. Chapter nine offers another example of the author's use of graphics to teach programming. The use of bar graphs gives the student additional practice in subroutines and serves as an introduction to the READ and DATA statements as well.

In chapter fourteen, Haskell explains how to make sounds on the PET, among them musical notes, clicks, sirens, and a phaser-firing noise. He also includes a schematic for an amplifier to connect to the PET's parallel port because the built-in sound in the latest PET/CBM computers is quite faint. The final chapter concludes with the development of a program called PET Organ, which combines graphics and sound. The program displays a labeled organ keyboard which creates sounds that correspond to the appropriate key pressed.

Overall, *PET/CBM BASIC* is both a good text for beginners and a useful reference for old hands. Richard Haskell has filled several gaps in the library of PET materials by including a number of useful graphics applications, an emphasis on structured programming, an explanation of PET sound, and practical examples from his own programming experience. I only wish the book had been published before I learned BASIC programming.■

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Data Resource's information products will be available to users from an on-line catalog and will contain data and formulas needed for specific applications. When a product is selected, the information will be transferred to the personal computer for ongoing use in Visicalc, Visicorp's popular electronic spreadsheet program.

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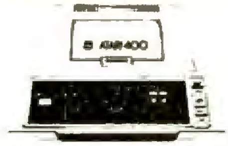

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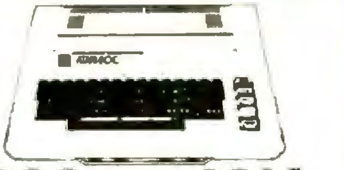

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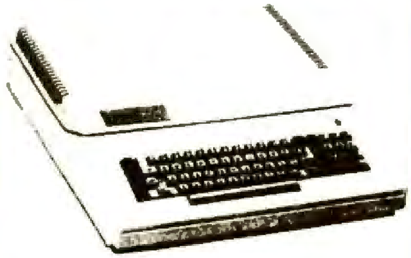

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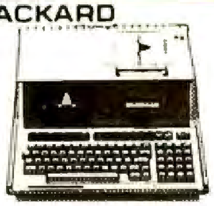

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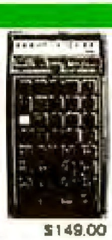

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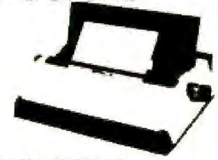

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Microshell and Unica

Unix-Style Enhancements for CP/M

Christopher Kern
Apartment 839
201 I St., SW
Washington, DC 20024

Unix, the computer operating system developed by Bell Laboratories, has been justly acclaimed for combining a number of powerful features in a simple and uniform package. As a consequence, interest in it has grown rapidly in the last few years.

Unix will run on a variety of large computers and is often used in university, industry, and government computer centers. Many of the new 16-bit microcomputers have Unix or Unix-like operating systems, which is one of the main sources of their appeal. One manufacturer, Cromemco, even makes a Unix-style operating system for an 8-bit computer, using special-purpose hardware.

Now, two new software products, Microshell and Unica, provide conventional 8080-, 8085-, or Z80-based microcomputers using the CP/M operating system with some of the features that have contributed to the popularity of Unix. Though neither one comes close to being a full Unix-like implementation, they are both real improvements over the normal CP/M environment. To appreciate what they do, a brief overview of some Unix features is necessary.

I/O Redirection

One of the most elegant concepts to be popularized by Unix is I/O (input/output) redirection. Many programs read and write a single I/O stream. Typically, the input is read in from the user's keyboard and the output is displayed on the screen of the video terminal. Sometimes, however, you may want to have the output go into a disk file instead. Unfortunately, with an operating system such as CP/M, there is no easy way to do this. But the Unix command interpreter allows the user to redirect input and output at the time a program is invoked. For example, the Unix command "prog < infile" would run the program "prog" and tell it to take its input from the text file "infile". And the command "prog > outfile" would run the program "prog" and send its output to the text file "outfile".

Suppose, for example, you want to create a file containing the directory of a given disk. If the program to list a directory is called "ls", the command "ls > direct" would write the contents of the disk to the file named "direct", rather than print the listing on the console screen. The file "direct" could then be edited, combined with other files (perhaps to produce a master listing of the contents of a number of disks), or treated just like any other text file.

Or you might need to make the same series of changes in a number of different text files. Under CP/M you would have to edit each of the files in sequence with your

At a Glance

Name Microshell (Version 1.1)	**Computer** 8080-, 8085-, and Z80-based machines running the CP/M 2.2 operating system; 32K bytes of RAM
Type Unix-style command interpreter for CP/M 2.2	**Documentation** 51-page user manual
Distributor New Generation Systems Inc. 2153 Golf Course Dr. Reston, VA 22091 (703) 476-9143	**Audience** CP/M operating system users who want a Unix-style command interpreter
Price $150 ($25 for manual only)	

At a Glance

Name Unica	**Computer** Z80-based machines running the CP/M 2.2 operating system; 32K bytes of RAM
Type Unix-style utility programs	**Documentation** Unica: 48-page user manual. XM-80: 171-page user and reference manual
Distributor Knowlogy POB 283 Wilsonville, OR 97070 (503) 639-3420	**Audience** CP/M operating system users who want Unix-style utility programs
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system text editor, repetitively entering the commands for each file. A Unix user, however, would probably make up an editing "script"—a text file containing all the instructions for the editor. Then the input of the editor would be redirected so that it would receive its commands from the script, rather than have them typed in one by one from the keyboard.

Under Unix, by the way, the various physical devices that are connected to the central processor—the console, for example, or the system printer—can be treated just like text files for many purposes, including I/O redirection. Thus, you could get a paper copy of the output of the listing command, "ls", just by directing the output of "ls" to the line printer. If the line printer was known to the system by the name "lp", the command would be "ls > lp".

Pipelines

Another important Unix concept is the *pipeline* or *pipe*. A pipeline is a way of connecting two programs together by sending the output of the first program to the input of the second program. This is one way that Unix implements the philosophy, which contributes so much to its success, of breaking down big computing jobs into small, manageable pieces. This not only makes *writing* programs easier (a small, simple program is obviously easier to write than a large, complex one), it also allows the user to rearrange various utility programs into new combinations. In this way, it is possible to perform tasks that were never contemplated when the individual component programs were designed.

For example, you might have one program that took a number of lines of text, arranged them neatly into columns, and displayed them on the console. By using a pipeline, the output of any other program could be fed into this formatting utility to produce multiple-column output. The same approach could be used with other kinds of formatting programs, sorting utilities, and the like. The command "prog1 ¦ prog2", for example, pipes the output of "prog1" to the input of "prog2". The vertical bar (¦) is the Unix symbol for a pipeline.

Ideally, "prog1" and "prog2" should be executing simultaneously, with the operating system handling the connection between them and managing any necessary coordination. But the concept of a pipeline can be implemented quite adequately—if somewhat more slowly—with temporary files. A pipeline such as the one above then becomes shorthand for a sequence of I/O redirection. The first half of the command is the equivalent of "prog1 >tempfile"; the second half is the equivalent of "prog2 <tempfile". As we shall see in a moment, this is how both Microshell and Unica handle pipelines.

Single-Function Programs

One practice that flows from the Unix philosophy of keeping programs small and simple is that a program should do only one thing, and that it should do it as well as possible. The result is that Unix (and Unix-style) utility programs exhibit a certain coherence. They tend to be devoid of unrelated features that, however useful they might be, would complicate program design, maintenance, and improvement. This simplicity encourages users to refine their earlier work and that of their predecessors. As a consequence, a given computer system evolves over time, becoming better and better adapted to its users.

The virtue of this approach is best demonstrated by a counterexample. Take the CP/M utility program, STAT. STAT is a very powerful program. It can calculate the amount of free space on a disk. It can provide an alphabetical listing of file names, showing the size and directory attributes (e.g., whether it is read-write or read-only) of each file. It can change the directory attributes of a file or group of files. It can reassign system devices, for example, to make the console a hard-copy terminal rather than a video terminal. It can display the capacity, block and track size, and number of available directory entries on each disk drive. And it can print out the current user number and show which other users have files on the disk drive currently being addressed.

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With all these capabilities, the STAT command would probably be very hard to modify. Digital Research, which markets CP/M, doesn't supply the source code for the STAT command, and perhaps it is just as well. It would probably be rather difficult to improve one of STAT's many capabilities without bollixing up some other feature.

Another problem is that STAT requires a bewildering variety of optional arguments for all these capabilities; you can't just type in a single mnemonic name and get the information that you want. In fairness, though, STAT provides a command summary—if you can remember how to get it. The default usage, "STAT" with no argument, prints out the bytes remaining on the currently addressed disk.

To be sure, Unix is not completely without problems itself. It has been criticized for its poor choice of mnemonics: "ls" is the directory listing command, "cat" types the contents of a file on the console, and "mv" is used to rename (move) a file. But having a program do only one thing, and having it provide its output in the most commonly used form without the need for optional arguments, is a big step toward simpler computer systems. And it has the important advantage of making it easier for different programs to work together.

Microshell

Microshell is a replacement for the CP/M command interpreter that provides I/O redirection, pipes, and a number of other useful features. The Unix command interpreter is known as the "shell," hence Microshell's name. In addition to the simple redirection commands, "<" for input and ">" for output, Microshell lets you echo output that is being directed to a file on the console ("> +") and to append directed output to an existing file ("> >").

As I mentioned earlier, Microshell provides pipeline capability by using temporary files. As an experiment, I created a pipeline to list the individual words in a text file in alphabetical order, using utility programs that (1) placed each word in the file on a separate line, (2) sorted the lines alphabetically, and (3) filtered out multiple occurrences of the same word. This pipeline didn't break any speed records, but it worked. And if you have an occasional need for a sorted list of the words in a file, connecting existing utilities in a pipeline is certainly an easier way to get it than writing a new program. Programs that read their input, alter it in some way, and then send it to their output are known as *filters*, which fits in with the plumbing analogy of the pipeline. (Incidentally, the source code for the programs I used to construct this word-list pipeline comes from an excellent book, *Software Tools*, by Brian W. Kernighan and P. J. Plauger [Addison-Wesley, 1976]. The programs in the book were written in RATFOR, a FORTRAN preprocessor based on the C language. The book is a good source for explanations of concepts, such as filters, which came from Unix. It is also available in a Pascal version, *Software Tools in Pascal* [Addison-Wesley, 1981].)

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One small but nevertheless important feature of Microshell is that it allows lowercase command-line arguments for programs. This is critical for many text-processing applications using filters. A Microshell program to print out each line containing the word "Microshell" will ignore the word "MICROSHELL". I mention this partly because I have been irked by the fact that the CP/M command interpreter turns the entire command line into uppercase, and partly because it illustrates how a seemingly minor improvement in a system function can make the system considerably more flexible. (File names are kept uppercase to guarantee CP/M compatibility.)

Shell Files

It is often useful to execute a batch of commands, one after another, without sitting at the computer console and entering each command individually. CP/M provides such a batch capability with its SUBMIT program. Improved batch processors have been developed by various CP/M users (e.g., Ron Fowler's SUPERSUB in the January 1982 issue of *Lifelines* magazine). But none equals the simplicity of Microshell's *shell files*. The Microshell command interpreter itself—rather than a separate program—reads a script of commands from a text file and performs them in sequence. Automatic argument substitution is provided, control characters can be included in a shell file, and a shell file can provide input to a program that would normally come from the console (this is similar to CP/M's XSUB program). Shell files can also be interrupted easily, cutting short a long batch sequence.

Shell files under Microshell are not as flexible as they are under Unix, however. Unix allows shell files to be nested (a command in a shell file can be another shell file). It also provides control structures that can be used to vary the command sequence. But Microshell's shell files are a big improvement over CP/M's SUBMIT. For shorter batch jobs, Microshell provides a nice alternative: multiple commands on a single line, each separated by a semicolon. This is a faster way to execute a simple series of programs than by using a shell file.

Another major Microshell feature is an automatic search routine for commands and files. This makes it possible to ignore which disk drive a particular program or file is on. When Microshell receives a command, it searches first on the disk that is currently being addressed (the logged-in drive, in CP/M parlance). If it can't find it there, it continues the search on other disks according to a user-specified sequence. In a multi-user CP/M system, the automatic command search will also search the User #0 area in addition to the user's own area. This has the effect of making User #0 "public."

Automatic file search comes into play when a running program issues a request for a particular file. If the file can't be found on the current disk, Microshell will search for it along the same search path specified for automatic program searches. Microshell, however, will perform these automatic file searches only for files with certain specified extensions. For example, you can specify

".OVL" as an automatic file search extension. Then, if a program requests a file such as "TESTFILE.OVL", Microshell will search all the disks for that file. But if a program requests a file such as "TESTFILE.TXT", Microshell will search only the current disk for that file.

Replacing the CCP

Microshell is loaded from the normal CP/M environment just like any other command file. When loaded, it automatically locates itself just below the CP/M BDOS (basic disk operating system), which contains the primitive system functions in a form that is identical on all machines. Microshell completely overlays the CCP (console command processor) that is supplied by Digital Research. And it supplies the standard CCP functions—e.g., TYPE, DIR, and USER—as well as its own Unix-style extensions. Because the Microshell command interpreter is much larger than the CCP, it reduces the amount of memory allocated to user programs. In the version of Microshell that I tested, the command interpreter occupied about 9500 bytes.

Because Microshell replaces the CCP, programs that require the CCP to be in place—such as MOVCPM, which is used to change system memory size—obviously will not work under Microshell.

Programs that address CP/M legally—that is, through the designated system calls documented by Digital Research—should run fine. Most commercial software will work under Microshell, but some users-group programs will not. The Microshell manual includes an appendix on program compatibility. No serious limitations are listed, and I did not find any on my own.

Performance

In some respects, Microshell slows down CP/M's performance. Checking for shell files (batch commands) and automatic command and file searching all require extra disk accesses. It is possible to restrict automatic command searching and to turn off automatic file searching altogether, which will minimize the delay. Restricting automatic command searches to a single disk (i.e., having a "system" disk that contains all executable programs), which most users will probably want to do anyway, will set a maximum of one extra disk access each time a program is invoked.

In one very important respect, however, Microshell speeds up overall system operation; it eliminates the warm boot—the resetting of the system—that occurs after most CP/M programs. (It provides an explicit log-in command for use when changing disks.) On balance, on my system, Microshell makes things happen somewhat faster than they do when the CCP is in place.

Search paths, extension specifications, and other Microshell parameters are supplied by a menu-driven configuration program that comes as part of the Microshell package. The program is easy to use, and Microshell can be reconfigured quickly as the user's needs change. The Microshell manual is difficult to follow in places, but it is quite well organized and appears complete. It even includes a short section entitled "How to

Listing 1: *Three files, FILE1, FILE2, and FILE3, can be concatenated "horizontally" by Unica's HC command. The result of the concatenation is shown in listing 2.*

```
A>TYPE FILE1

MICROPROCESSOR
WORD SIZE
REGISTER SIZE
MAIN MEMORY
MEMORY TYPE
HARD DISK CAPACITY
FLOPPY DISK CAPACITY
SIMULTANEOUS TASKS
OPERATING SYSTEM
SYSTEM LANGUAGE

A>TYPE FILE2

Z80
8 bits
8-16 bits
64 kilobytes
semiconductor
0 bytes
2 megabytes
1
CP/M
PL/M

A>TYPE FILE3

68000
16 bits
16-32 bits
512 kilobytes
magnetic bubble
50 megabytes
0.5 megabytes
5
UNIX
C
```

Run Microshell without Reading the Manual," which ought to be a statutory requirement for every manual.

Unica

Unica consists of Unix-style utility programs that run under CP/M on a Z80 microprocessor. True to the *Unix* approach to programming, each of these utilities performs a single function, although most have options that vary the way it performs that function. Some of the functions of the Unica utilities, such as those for directory listing and file concatenation, are available on programs supplied with CP/M by Digital Research. Others, such as file comparison and disk mapping, can be performed by programs that are available from other vendors or the CP/M Users' Group. A few, such as the utility that concatenates programs "horizontally" (see listings 1 and 2) or the one that creates multiple "links" to a single file, do indeed appear to be unique in the CP/M world, as the name "Unica" implies.

The Unica programs all provide input and output redirection, and output from one can be piped to the input of another. Like Microshell, Unica uses temporary files for pipes. Unlike Microshell, however, the I/O redirection and pipe mechanisms are built into each program. When a program is invoked, the first thing it does is scan its command line for these special directives. This allows the normal CP/M command interpreter to be left in place.

This means that while Unica programs allow pipelines, they cannot interact with non-Unica programs. Obviously, this is a less general mechanism than Microshell, which allows any program to participate in a pipeline (assuming the program normally communicates with the console). There is available, however, an optional program called the XM-80 macroprocessor, with which it is possible to write new programs that are compatible with the Unica originals.

Wildcards and Links

Unica programs also respond to Unix-style "wildcards," which are somewhat different than those available under CP/M. A wildcard is a way of specifying

Listing 2: *A horizontal concatenation of the three files in listing 1, achieved by using the Unica HC command. The integers in the command line before the last two file names indicate the column where the left margin of that file is to be placed.*

```
A>HC FILE1 31 FILE2 51 FILE3

MICROPROCESSOR                Z80                 68000
WORD SIZE                     8 bits              16 bits
REGISTER SIZE                 8-16 bits           16-32 bits
MAIN MEMORY                   64 kilobytes        512 kilobytes
MEMORY TYPE                   semiconductor       magnetic bubble
HARD DISK CAPACITY            0 bytes             50 megabytes
FLOPPY DISK CAPACITY          2 megabytes         0.5 megabytes
SIMULTANEOUS TASKS            1                   5
OPERATING SYSTEM              CP/M                UNIX
SYSTEM LANGUAGE               PL/M                C
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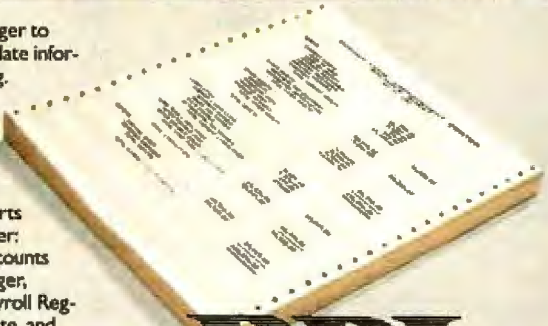

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3423 GUADALUPE / AUSTIN, TX 78705 / 512-454-2801 a group of file names with a single reference. For example, the CP/M command "DIR *.EXT" would list all files with the extension ".EXT"; the asterisk would match any file name in the directory. If you wanted to list all the files that began with the letter "A", you would type "DIR A*.*"; the first asterisk would match the remaining letters of the file name and the second asterisk would match the extension. Under Unix and Unica, all files beginning with "A" can be specified by typing "A*"—that is, "A" followed by just a single asterisk. The wildcard will read across the "." specifying the extension.

Two Unica programs—LN, the file link command, and RM, the file removal command—are used to create and eliminate multiple references in the directory to a single file. These references, or links, allow users with different CP/M user numbers to have the same programs or files available to them without cluttering up the disk with extra copies of the files. Although the regular CP/M erase command (ERA) will erase a file link created by the LN command, a warm boot is necessary afterward to make sure that the CP/M disk-allocation routines don't overwrite the file while other links to it remain. The RM program takes care of that automatically.

Unfortunately, the CP/M command interpreter restricts the use of one of the better Unica utilities, SR, which is modeled on the Unix utility GREP. (GREP, as you no doubt have guessed, is an acronym for "globally look for regular expressions and print.") If you use SR to list all the lines in a file containing the word "Unica", it will print all lines that contain "UNICA", "unica", or "unIca" as well because the CCP does not permit lowercase characters in command lines. SR has options to list only the lines that do not contain a given pattern, to count the number of matched lines, and to search more than one file, among others, and it is an extremely useful program to have around despite its command-line limitations.

Another excellent Unica program is the directory listing utility, LS (see listing 3). Although many directory programs are available for CP/M—I think I have collected about half a dozen from the CP/M Users' Group—Unica's LS program is the most flexible. It is also one of the Unica programs for which it is convenient to have directed output, because it is not uncommon to want to put the contents of a disk directory in a file. My only complaint is that LS as supplied insists on printing all the file names in lowercase. While this follows the Unix convention, Unix allows file names to be in lower-

Listing 3: *A directory obtained by using Unica's LS command with the optional arguments "—ALM". The "A" argument means show all files, including system files, that would normally not appear in the directory. The "L" option specifies a long format. The "M" argument means provide multicolumn output; otherwise, each file entry would have been printed on a separate line. The first field shows the file attributes. An "r" in the first column means the file is read-only. An "s" in the second column means it is a system file. The next field is the file size in bytes (in CP/M, a multiple of 128 bytes is always allocated). The last field is the file name. While it is printed in lowercase, CP/M file names are actually stored only in uppercase.*

```
A>LS -ALM
--     1,408 alloc.crl      --   4,352 dup.com        -s  16,640 mt280.ovl
--       384 alloc.h        --     128 ed.sub         -s  35,840 mt380.ovl
--     3,200 bcdreals.erl   --   6,656 edcpm.com      -s  14,848 mt480.ovl
rs     5,376 bios.sys       --   3,968 float.crl      -s  13,568 mt580.ovl
--       384 byte.h         --     128 fnj.h          --  38,912 mtplus.com
-s     1,152 c.ccc          --   5,760 format.com     --   9,472 mulisp.com
--     5,376 calc.com       --   9,856 fpr.com        --     256 nal.h
--    13,696 cc.com         --   7,680 fpreals.erl    --     128 nfnj.h
-s    15,872 cc2.com        --   2,432 fullheap.erl   --  22,912 paslib.erl
--     5,248 clib.com       --  10,880 hc.com         --  21,760 pencil.com
--     4,608 clink.com      --  18,176 l2.com         --   6,144 pie.com
--     5,120 config.dat     --   9,984 linkmt.com     --   7,424 pip.com
--    13,440 configur.com   --  15,232 lisped.sys     --   2,816 randomio.erl
--    22,912 crayon.com     --  16,256 lispexec.sys   --  35,968 sconfig.com
--     1,536 crck.com       --   3,456 lispfuns.sys   --  34,816 scribble.com
--    12,160 customiz.com   --   1,792 load.com       --  12,032 sh.com
--     1,792 d.com          --  13,312 ls.com         --  13,952 sr.com
--       512 date.com       --  11,776 mac.com        --   5,248 stat.com
--     4,864 ddt.com        --   6,144 marc.com       --   2,816 sysdef.h
--     9,856 debugger.erl   --  18,432 marc.cpm       --   1,792 sysgen.com
--     7,296 deff.crl       --     896 marc.doc       --  17,152 text.com
--     5,760 deff2.crl      --   2,304 marc.rel       --  13,568 unix.txt
--     7,680 diff.com       --   1,408 mh.com         --   7,168 wcount.com
--     2,304 display.com    -s  27,904 mt180.ovl      --   8,960 z80.doc
--     7,296 du.com         -s  23,808 mt185.ovl      --   6,016 z80.lib
```

MARC: An 8-Bit Counterpart to Unix

Microshell and Unica both provide some of the features that have made the Unix operating system so popular. While I was preparing this review, however, I received a prerelease copy of a new 8080-family operating system that goes considerably further toward providing a Unix-like environment. This new system is called MARC, for Machine-Aided Resource Coordinator.

MARC is a complete operating system, not just an enhancement to CP/M. It boots up under CP/M, however, and uses the CP/M BIOS routines (the hardware-dependent section of CP/M) of the host system. That means MARC should work on any machine that can run CP/M. The version I tested was for CP/M 2.2 only. A version of MARC for CP/M 1.4 does exist, but it is unclear at this point whether it will be marketed.

MARC provides a Unix-like command interpreter similar to that of Microshell (MARC, however, accepts Unix-style wildcards). It also provides a file system with a hierarchical directory structure. Devices and file names may be used interchangeably. MARC will run in a CP/M system with a single 64K-byte bank of memory and floppy-disk mass storage.

Because MARC can run only one program at a time, it creates pipelines by using temporary files. Properly speaking, it is a single-user, single-tasking operating system. However, it includes a sophisticated user and group security system, with encrypted password protection, allowing different users to use the system at different times but preventing access to the files of other users.

The MARC package will include a large number of Unix-style utilities; the exact number is still to be determined as of this writing. Chief among them will be the excellent BDS C compiler (see my review in the June 1981 issue of BYTE on page 356). Also, a CP/M emulator will allow most CP/M programs to run under MARC.

The selling price has not been set. It will cost more than CP/M—but not by too much.

I had experimented with an earlier version of MARC in early 1981. At that time, MARC was workable, but very rough, and pretty far away from marketing. Unfortunately, MARC's principal author, Edwin P. Ziemba, died in a swimming accident not long afterward, and responsibility for finishing the project passed to Lauren Weinstein of Vortex Technology (POB 2284, Culver City, CA 90230, (213) 641-7200).

The evaluation copy of MARC that I received in early 1982 was a much more mature product. The only essential piece of software that was missing was the CP/M emulator, and that is expected to be ready by the time this article reaches print. Weinstein was unable to provide a firm release date at the time this was being written. But from what I have seen, it can't be too far away.

case. CP/M does not, and it would make more sense to me to list the CP/M files the way they actually exist in the directory. Incidentally, I have been referring to the Unica programs in uppercase—following the CP/M convention—but in the manual the names are all in lowercase.

A list of the various utility files in Unica is shown in table 1.

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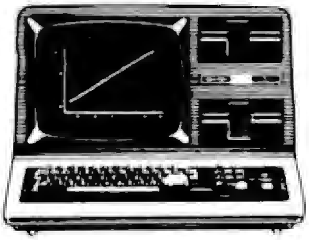

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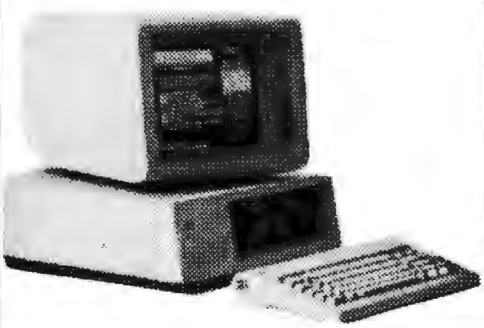

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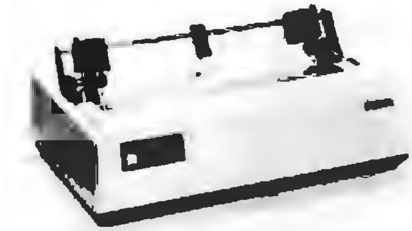

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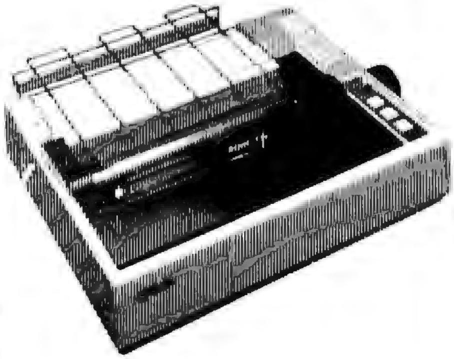

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Program	Function
BC	Compares binary files
CAT	Concatenates files or prints them on the terminal
CP	A file copy program
DM	A disk mapper
FID	Determines whether two files are identical
HC	A "horizontal" file concatenator
LN	A link program
LS	A directory listing program
MV	Renames (or moves) a file
RM	Removes files or links to files
SC	Compares source (text) files
SFA	Sets file attributes (e.g., read-only)
SR	A pattern searching program
SRT	Sorts lines alphabetically (in memory)
TEE	Reads one input stream and writes multiple output streams (like a T-shaped pipe fitting)

Table 1: *A list of the utility programs in the Unica software package.*

All the Unica programs are written in a macro language called XM-80, and all the source code for these programs is included. To write or modify programs in this language, you would need to buy the optional XM-80 macroprocessor ($100) along with the MACRO-80 assembler from Microsoft (about $120). XM-80 is designed to simplify program creation by providing a set of common primitives—such as those for providing I/O redirection and pipes—along with a standardized calling sequence for linking them with other program segments. The point is that if you write a primitive or module in a general enough way, you will have to write it only once. New programs can be put together by combining previously written modules from a library. I did not attempt to do any programming in XM-80, but using macroprocessing to extend an assembly language strikes me as a very good idea.

The Unica manual is extremely comprehensive, with well-designed sections describing each of the utility programs, an explanation of the theory behind XM-80, a detailed section on how to use XM-80, and descriptions of the XM-80 library components. Unfortunately, the prose style at times is turgid, which makes some of the explanations unnecessarily hard to follow.

Conclusion

Both Microshell and Unica provide good introductions to some of the features that have made Unix such a popular operating system. More than that, they are useful enhancements to existing CP/M computer systems in their own right. They increase an existing system's flexibility and make it friendlier to the user. These attributes should be high on the priority list of those who design the next generation of microcomputer operating systems. ■

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	NAME	DESCRIPTION
1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNUI	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RRCONVBD	Investor's rate of return on convertable bond
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Unaccustomed as he is to voicing his opinions, Jerry drops a few hints.

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The nature of this column dictates its contents; I have to write about what's been happening here at Chaos Manor. This month we've had two big flaps. One is a frantic effort to clean off my desk so that my wife and I can take a vacation in Europe. She's been planning this trip for a year now. So far I haven't had the heart to tell her that we won't be going alone: I'm taking an Otrona Attache with me.

Anyway, I've been trying to get two books (*Clan and Crown: Janissaries II* and volume one of *Future Men of War*) out the door, dash about to radio and television interview shows to publicize books, answer my mail, and write a couple of chapters of *Footfall*, the next big novel that Larry Niven and I are working on. The usual result of that much activity is that *nothing* gets accomplished, but actually I've done pretty well on everything but the mail.

Meanwhile, flap number two, which has got downright embarrassing: Alex Pournelle's Introduction to Pascal software package.

Alex's Intro was supposed to be a fairly simple job, requiring a month's work at most. The task was to take some of the teaching programs from Grogono's *Programming in Pascal* and the fundamental required programs and input/output primitives in Kernighan and Plauger's *Software Tools in Pascal* and get them running under two popular CP/M Pascal compilers. Then he'd write up notes on problems encountered, add a few pages contrasting the two compilers (Sorcim's Pascal/M and Digital Research's Pascal/MT+), add a few more pages of tips on using Pascal, and hand it to Barry Workman to publish.

If Pascal is a candidate for the language of the decade, then we may have problems.

The first draft using Pascal/MT+ was done and looked good, and I could honestly say that the materials saved me a *lot* of time when I tried learning Pascal, so I wrote about it. BYTE's pipeline is, after all, pretty long.

Not long enough. The article came out. Orders came in. The Intro wasn't ready. Now that's not quite accurate: something was ready, but Alex wasn't satisfied with it. He didn't think he was giving people their money's worth. Meanwhile, he'd run into some really colossal problems with the way the compilers handled CP/M files. He could get the teaching programs running, but only through kludges, and he wanted to start over.

Fortunately, the story has a happy ending: the Pascal Intro package has been completely done over, and everyone who bought the old package can get the new one at nominal

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cost. Now obviously I'm not a totally disinterested observer; my son wrote this stuff, largely to help me learn—and understand—Pascal. Still, I like to think I can be objective about such things (and do note that I don't own the programs; they belong to Alex). In my judgment, he's done a hell of a job. The package now contains not only the programs, with all the special routines required to get things running smoothly under CP/M, but also a number of essays on typical problems. There's an especially valuable treatment on Pascal errors and what probably causes them.

The Language Debate Goes On

There are at least two reasons I've given Alex's Pascal Introductory Package as much space as I have. One is obvious: as I said at the beginning, I have to write about what we're doing around here, and Lord knows that has been the major activity, not just this month but all summer. There's another and more important reason, namely, that it *did* take all summer.

Pascal is an important language. Nearly every computer publication acts as if it is, and indeed Pascal is a candidate for *the* language of the decade. It is taught to nearly every student at the University of California at San Diego (La Jolla), and UCSD isn't alone in that practice. There are several implementations of Pascal for CP/M, and more are coming.

Alex and his friends are pretty familiar with Pascal—at least with the UCSD implementation of it. Grogono's *Programming in Pascal* and Kernighan and Plauger's *Software Tools in Pascal* are very popular, very highly recommended books, usually thought to be the best introductory works on Pascal.

Yet it has taken *months* of work to get these standard textbook programs running and document the differences between what's printed in the textbook and what actually can run on your CP/M system. Moreover, if there's anyone else who has a package that competes with Alex's, we don't know about it, nor do the professional programmers at several large systems houses. We know that because we tried to find something, *anything*, that might answer some of the problems Alex encountered. We searched through programming manuals line by line. We called programmers. At one point we considered Ouija boards. None of that was much help. It finally came down to Alex doing just a lot of hard work, finding out what will and will not run, finding compiler bugs and anomalies and glitches, writing them up, and trying another approach, until eventually he had things working properly.

Now of course I'm proud of him; but I'm also appalled. If this is a candidate for *the* language of the decade, we may have problems.

Implementer Blues

You'd be amazed at some of the problems Alex ran into. For example, Kernighan and Plauger assume that the data-type records can contain files, and the ISO (International Standards Organization) standard for Pascal makes the same assumption. Pascal/MT+ follows the standard. Pascal/M, though, like UCSD Pascal, will not allow files in records, which makes file handling complex beyond belief if you want to have several files open at the same time. That situation alone required a number of special procedures and a week's work.

The Pascal/MT+ pattern-finder function POS, which is supposed to find the first instance of a pattern within an array, is not completely reliable. It *usually* works, but that's not good enough; and we didn't have time to map the boundary conditions, which would require more special tests.

Just getting text, when the routines assume that text files consist of 80-character lines terminated by a carriage return and linefeed, can be ridiculously complex.

Some bugs are obscure, but thoroughly deadly. Example: in Pascal/MT+ if you open a comment and forget to close it (that can happen when you erase lines or when you nest comments), Pascal/MT+ goes away into never-never land; you have to reset the whole computer to recover. It doesn't report errors, it

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just hangs up. Incidentally, Pascal/MT+ has Error #401, Unexpected End of Input, which is supposed to deal with that situation, but the message doesn't appear.

Neither the Pascal/M nor the Pascal/MT+ manual explains some vital things like forward declarations (stating the complete heading of a procedure before the first procedure or function that refers to it); and alas, neither do the textbooks that I mentioned earlier. The Pascal/M manual does refer the reader to page 82 of Jensen and Wirth's *Pascal User Manual and Report* (Springer-Verlag, 1975), but that doesn't help much. Alex had to add new sections to his teaching aid.

All the implementations—beginning with the UCSD compiler, which everyone has built around—have an annoying defect in string handling. They won't concatenate a single character into a string. They will concatenate "chr" types (example: chr(26) is Control-Z; chr(072) is H) but not single variables of type CHAR. Someone ought to fix that.

And on, and on, and on. Sigh.

Kernighan's Lament

My August column spoke of Unicorn Systems' implementation of the Kernighan and Plauger *Software Tools* and recommended that those who want to do their own programming learn Pascal rather than RATFOR and FORTRAN (see User's Column, August 1982 BYTE, page 342). Shortly after, I received a letter from Unicorn Systems' Deborah Sherrer.

Unicorn Systems publishes not only the Kernighan and Plauger *Tools* but, more important, what they call a "virtual operating system," that is, a Unix-like "shell" around CP/M. Mrs. Sherrer says, "The choice of language is not critical to the virtual operating system approach. Had the project been designed *solely* for the microcomputer environment, C or Pascal might have been a more appropriate choice. However, the preprocessor chosen (RATFOR) has proven quite successful in allowing portability between microcomputer and large machine environments. There is no reason why the package could not be available in several languages, though, perhaps with automatic translators between them. We are, in fact, looking into the possibility now and may eventually provide an automatic translator."

I hope Unicorn Systems does that. I like its "virtual operating system," because it lets the operating system do a number of the messy things that at the moment you must do inside your programs. One obvious example is file handling; one of the really horrible problems Alex had with implementing the *Software Tools in Pascal* was the difference in the ways that Pascal/M and Pascal/MT+ handle files; these problems go away if the operating system does this for you, and I am fond of Unicorn Systems' approach to the problem.

Deborah also enclosed a copy of Kernighan's lament.

In July, 1981, Brian Kernighan

published Bell Laboratories Computing Science Technical Report #100, entitled "Why Pascal Is Not My Favorite Programming Language." Alex's summary comment is that "he doesn't like Pascal because it isn't C." There's some justice to that. The C programming language was developed at Bell Labs, and Kernighan (with Dennis M. Ritchie) wrote the standard (and just about the only) book on the language (*The C Language*, Prentice-Hall, 1978).

There's also a lot of validity to Kernighan's indictments. The question before the house is, was Kernighan justified in concluding that "Pascal, at least in its standard form, is just plain not suitable for serious programming"; and if he was, then what changes must be made in Pascal to make it a "serious programming language"?

Kernighan divides his objections into four major categories: data types and scope, control flow, environment, and cosmetics.

His first complaint is universal. Pascal was designed as a "strongly typed" language. What that means in practice is that you cannot mindlessly set a variable of one type equal to a variable of another; the compiler will not let you do that. As Kernighan himself notes, this can be a pretty good thing, because it prevents the common FORTRAN mistake of sending a floating-point number off to a subroutine that expects an integer, causing a very hard to find error.

However, in Pascal the size of an array is part of its data type, which is to say that an array dimensioned, say, 10 by 10, is not only a different array from one dimensioned 10 by 15, but a different *kind of animal*, and it's very hard to set one array equal to another. Thus if you want to sort arrays, you have either to set aside a block of memory equal to the very largest array you will ever encounter, then use part of it, or recompile your program every time you have a new array size to worry about. The former method is very wasteful of memory. The latter procedure is at best inconvenient.

His next complaint is against a straw man—that is, there are no string variables in standard Pascal. In the original language there are only arrays of characters, and because each array size is a different *type*, it is very messy to compare strings or set one string equal to another. Kernighan says, "This botch is the biggest single problem with Pascal. I believe that if it could be fixed, the language would be an order of magnitude more useful." Fortunately, it has been fixed. No actual implementation of Pascal follows the standard. Nearly all CP/M Pascal implementations use the same device, namely, that a string is an array of characters with the zeroth element containing the string length. This has the inconvenient result that, in most 8-bit machines, strings cannot be longer than 255 characters, but it does give you a mechanism for getting the job done.

His next objection is certainly

valid: there are no *static* variables in Pascal.

A static variable is one that is retained but confined inside a particular function or procedure. An example would be the seed with which you call a random number: there is no necessity for the program as a whole to be able to see that seed, but certainly you must keep it around between calls to the random number function.

Alas, Pascal can't do that. When you exit a Pascal function or procedure, all its variables go away. To retain the seed, you would have to make it external to the procedure (and probably global), where it can be seen and interfered with by other parts of the program. This can lead to side effects, and bugs thereby generated are among the hardest to find.

And so forth. I'm not going through Kernighan's paper point by point; those interested should get a copy. However, one of his objections requires some discussion.

Terrorized by GOTO?

One real problem of Pascal is that it has no "break" statement; neither is there a "return" from a function or procedure.

This latter is not a bug, it's a feature: that is, the structured programming approach demands that there be a single entrance and a single exit from any part of a program. In Pascal, you "return" from a function or procedure by running off the end of it.

The problem comes when you want a program that goes

```
     (Pseudo-C version)
while (getnext(stuff)) {
   IF (something)
      break
   rest of while loop.
}
```

This is harder to implement in Pascal than it might seem. As Kernighan points out, the approach

```
done := false
while (not done) and
   (getnext(stuff)) DO
   if something then
      done := true
   else begin
      rest of loop
   end;
```

doesn't work, because in Pascal you cannot force the "(not done)" to be evaluated before the next call of "getnext". Getting around this leads to an extra level of nesting, for you must put the "getnext" loop inside a "while (not done)" loop.

Pascal enthusiasts would say, "And so what? It's a lot clearer if you make these tests explicitly hierarchical rather than relying on your knowledge of the compiler to see what's done first." They have a point, too. The C programming language (which does guarantee the order of expression evaluations) is popular with computer hackers, but it has a number of fine points that make it hard to use for those who don't work

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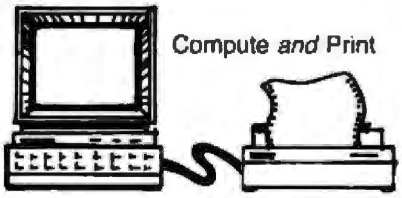

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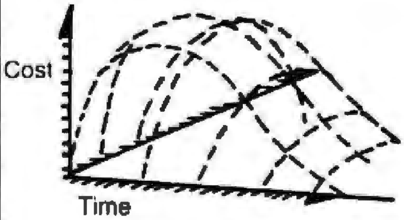

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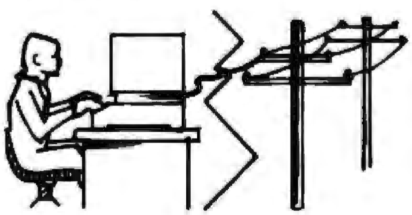

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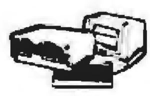

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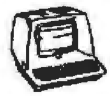

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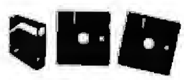

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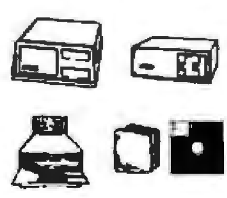

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at it a lot; at least I've found that to be true.

Still, the lack of a "break" statement in Pascal can, in more complex situations than the above, lead to some funny-looking code complete with superfluous "bookkeeping" variables. Kernighan goes on to say: "Of course recidivists can use a GOTO and a label (numeric only and it has to be declared) to exit a loop. Otherwise, early exits are a pain, almost always requiring the invention of a Boolean variable [a Boolean variable is one that takes only two values, true and false] and a certain amount of cunning."

Query: why is using GOTO and a label so horrible?

Yes, I know; questions like that can get me thrown out of the lodge. We've all been taught that use of GOTO is *always* improper. But is it? In the early days, the GOTO was much abused, so that it was impossible to follow program logic. The code led you into an opaque tangle of spaghetti.

But because something can be abused doesn't mean it has to be abolished. To return to our example, I see nothing at all wrong with:

```
LABEL 99;
begin
while (getnext(stuff)) DO
   if (something) then GOTO 99
      (* you're done *)
   else begin
      rest of loop;
99 :                     (* exit point *)
   end;
```

I mean, really, how is this different from the "break" statement? Is it harder to understand? To claim that any use of GOTO is "recidivist" is, in my view, blind prejudice.

There's a New C A'comin', . . .

I have mixed emotions about the C programming language. On the one hand, I open Kernighan and Ritchie and read a chapter or so, and I think I understand what they're saying; then I go try to write some code in C, and the results are an unmitigated disaster. I think I know what a statement like

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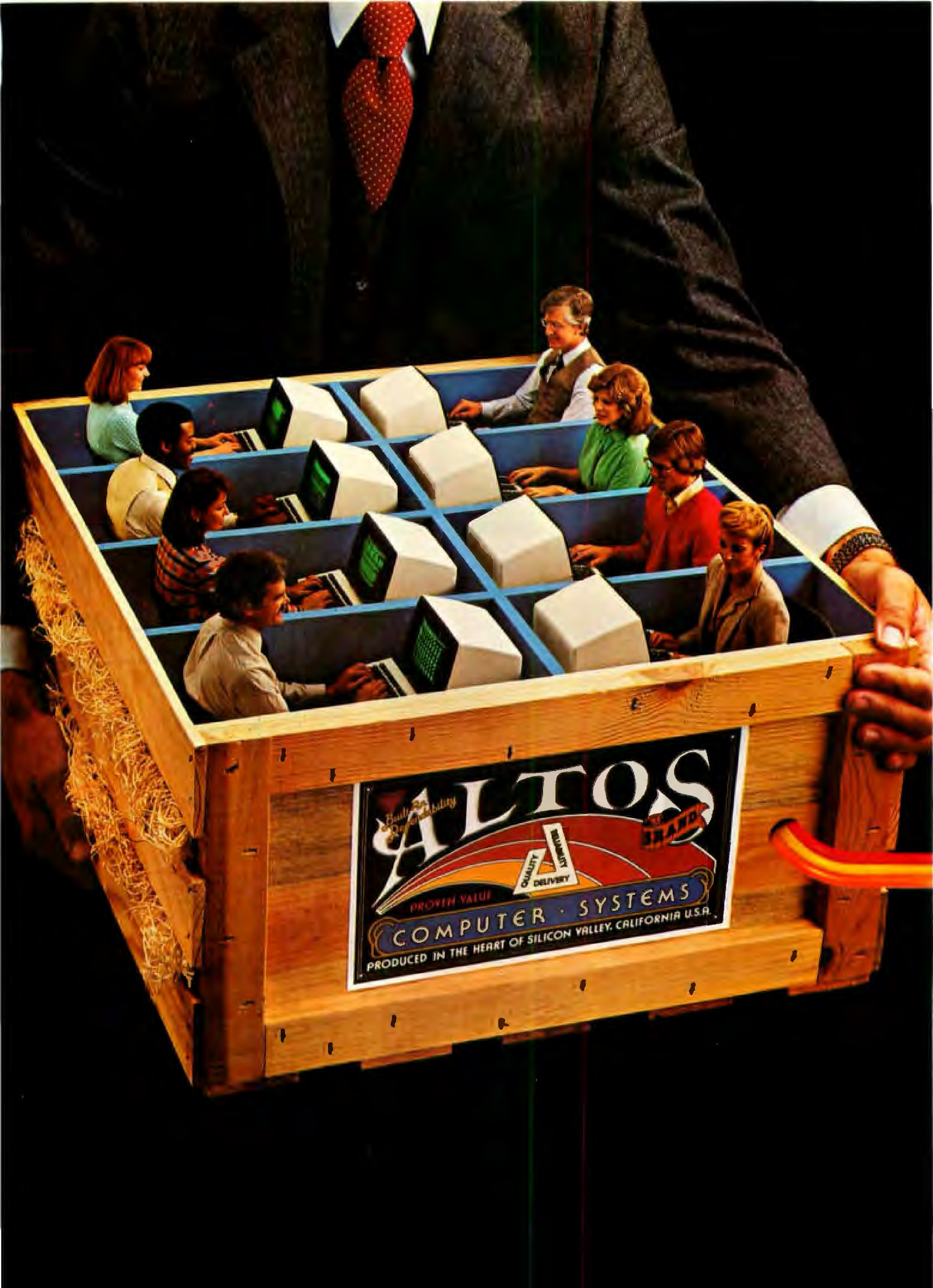
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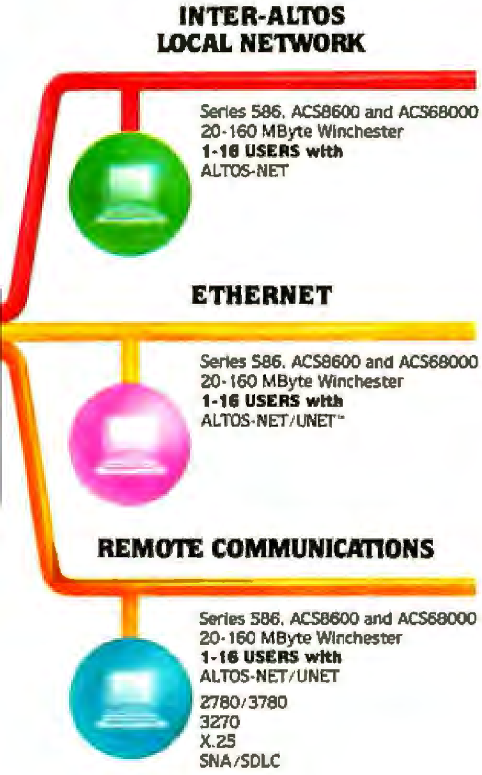

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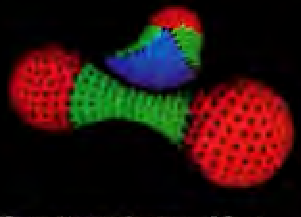

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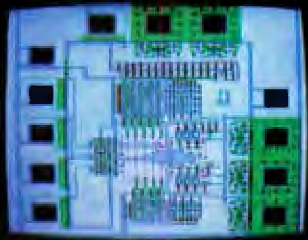

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```
for (i = 0; i < N; i++)
```

says, although you don't have to be away from the language long to forget; but then comes

```
int n;
for (n = 0; *s != '\0; s++)
  n++
return(n);
```

and I have to think some more. Whatever else you say about C, it doesn't much resemble English.

These are not fatal objections; as I said, I often find myself tempted to try using C, especially after I've spent a few minutes talking with Leor Zolman; his enthusiasm is catching. One big problem has been that we don't have a full C for small computers. (True, there's Whitesmiths C; but it wasn't intended for microcomputers; it's a fluke that it works with a Z80 or 8080, getting it running is no easy task, and if you're using it you don't need to read my columns to tell you about languages.)

Then there's Leor's BDS C (BD Software C), available from Lifeboat Associates. I've written about it many times; the main limit to BDS C is that it hasn't any floating-point data types. There are a few other limits, so that you can't—or at least *I* can't—just copy programs out of Kernighan and Ritchie and expect them to run.

There are a surprising number of other C compilers. Dr. James Van Zandt of Nashua, New Hampshire, has been kind enough to list them all for me:

- Small-C: written by Ron Cain, source code published in *Dr. Dobb's Journal*, no. 45, May 1980. Small subset of C, excludes structures, multidimensional arrays, floating point, case statements, and other vital stuff. Source and object code available for $17 from The Code Works.
- Small-C Plus: an extension of Cain's Small-C by Kirk Bailey (adds for and while loops, case statements, and some others). Available for $25 from Alpha Omega Computer Systems Inc.
- Q/C: Another extension of Small-C, by Jim Colvin (includes for loops, case statements, while loops, goto, assignment operators, command line arguments, I/O redirection, etc.) Source (!) and object code available for $95 from The Code Works.
- CW/C: A larger extension of Small-C (includes structures, unions, multidimensional arrays, #ifdef, etc.) Object code only available for $75 from The Code Works.
- C/80: A subset of C based in part on Small-C, with considerable changes by Walt Bilofsky. Excludes floating point, structures, pointers to pointers, etc. Compiles to 8080 assembly language. Object code only available for $49.95 from The Software Toolworks.
- Infosoft C: An extensive rewrite of Small-C by Richard Roth, described in an article in *Dr. Dobb's Journal*, November 1981. (Lacks float, goto, &&, etc.). Complex availability: "A runable version for $50 in conjunction with our SAL structured assembler development tool kit listed at $225. Or source may be licensed for an additional $250 when the runable version is licensed." From Infosoft Systems Inc.
- Supersoft C: They claim this is "most of version 7 Unix standard C." Object code is $250. Available from Supersoft Associates.
- Aztec C II: "All C language features except bit fields." Advertised in *Dr. Dobb's Journal*, no. 65, March 1982. Object code, assembler, linker available for $195 from Technical Software Systems. Compiler without floating-point numbers or long integers, $135.
- tiny-c One (interpreter) and tiny-c Two (compiler): A small language similar to C, described in *Dr. Dobb's Journal*, May 1980. Interpreter source and object code ($100) and compiler object code ($250) available from tiny-c Associates.

Dr. Van Zandt reports: "I've used Small-C and have started enhancing it. My version compiles at about 220 lines a minute, but it's still slow. I'm looking for a fast compiler that handles floating-point numbers and a matching interpreter for fast debugging. I suspect I'm not alone. Can you help in our search?"

I'm not sure I can help; except for Whitesmiths and BDS, I don't have any of those C compilers, and just at the moment, there aren't any C fanatics among the students and associates working here. Perhaps one day both will materialize. Meanwhile, there is a promising development.

As I began this article, I got a telephone call from the people at MDBS (Micro Data Base Systems Inc., POB 248, Lafayette, IN 47902). MDBS is a bunch of Purdue University people with their commercial hats on.

They have arranged to obtain the source code to Leor Zolman's BDS C, which they are enhancing. In particular, they're adding floating-point numbers and long variables.

That might be the answer to Professor Van Zandt's problem. I know that Leor continues to improve his BDS C package, and the MDBS people have a prodigious reputation for nearly indestructible software. The combination may be unbeatable.

However, I can't make any promises or guarantees about any of these. I'm not really competent to evaluate C compilers, since I barely know the language. From the amount of mail I get, I know many of my readers are interested in C, and indeed so am I, so I'm happy to report what I can; but alas, I can only report what I know, which isn't much.

MDBS

The MDBS program itself is a structured database system that ties into a regular programming language. I'm not certain precisely which languages are supported; I know that versions to match BASIC, FORTRAN, and PL/I are available, because I have them. I do not have them running, and therein lies a tale.

Over a year ago, my mad friend Mac Lean became fascinated with PL/I and, after a couple of months' work, became quite proficient in the language. When MDBS offered evaluation copies of its database, I asked for versions in BASIC and PL/I. Mac Lean took the PL/I version away; but he soon returned it.

"What's the matter?" I asked.

"I'm not *that* expert," he said. "I'll stick to dBASE II, thanks."

MDBS went back on the shelf for a while. The other day I dusted it off to see what had discouraged Mac Lean. It didn't take long to find out.

The top document in the MDBS package was "A Primer on Data Base Management Systems" by Dr. Clyde Holsapple.

I am thinking of giving an award for the most opaque and unreadable document of the year; if I do, Dr. Holsapple is a hands-down winner. I'm sure there's a lot of information in there, but I could read that document until I go blind and I wouldn't understand it. As I sit staring at it, a few glimmers of sense get through to me, but as soon as I put it down, all flees from my head.

Consequently, I have never implemented any MDBS programs; like Mac Lean, I find either my own "minimum database" or dBASE II more than adequate. I have,

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moreover, spoken with a number of MDBS users, including its owners, and they are universally agreed that MDBS is *not* a rival to dBASE II.

MDBS is for "professional programmers only," according to the company. You use MDBS to write highly structured database systems, accounting packages, accounts receivable, inventory management schemes, and highly cross-referenced filing systems. Most of the programming is done in the computer language of your choice; you then hook in the MDBS stuff, which is rigidly structured and said to be easy to work with once you know what you're doing.

Professional programmers I've talked with say they like MDBS. However, they also warn that it is *not* a tool for beginners. Moreover, most agree that MDBS in BASIC is not terribly useful: by the time you know enough about programming to be able to use MDBS, you'll have abandoned BASIC as a language.

My own suspicion is that's true, *except* for CB-80, which has sufficiently structured concepts to avoid nearly all of BASIC's quirks, and which is the one BASIC-like language that I think is a serious rival to Pascal and Ada.

As to the PL/I version, Mac Lean wasn't just trying to get out of work. MDBS and dBASE II are quite different in their approach to data management. dBASE II and its rivals are *relational* databases. They store information in what is fundamentally a large two-dimensional array. MDBS and the CODASYL database systems are *hierarchical* in structure. They store information in "trees" and limit the ways that you can climb around in the data tree.

The hierarchical structures are very useful if you know in advance what data you will want to store and have some ideas about how you want the data structured. However, hierarchical structures are not very flexible; if you want to change things around, it's not impossible, but it is quite difficult.

Relational structures, on the other hand, are slower and don't have the fancy record structure of the hierarchical databases; but they're much easier to set up and work with, and, more important, they're a whack of a lot easier to change. It's much easier to add new data categories to a *relational* database than it is to stuff them into a *hierarchical* system.

All of this is—more or less—explained in the MDBS documents, not all of which are quite as opaque as Holsapple's "Primer." Fair warning, though: to get through MDBS, you'll want to be pretty familiar with the computer language of your choice, and you'll want to know a good bit about the structure of the database you're trying to set up. I won't point out that you'll also have to be highly motivated: only the highly motivated will get through the introductory MDBS documents.

The Example Remover?

There's an old proverb, Whom the gods love, they chastise. I hope I may without blasphemy apply that to my relationship with Digital Research (DR).

That is, it should be obvious that I like CP/M, CB-80, Pascal/MT+, and PL/I, all of which are sold by DR; and indeed I'm particularly fond of CB-80, which is certainly the only BASIC that might rival Pascal.

My fondness for DR's products does not, however, extend to its documentation. Now true, I am on public record as saying that I think the old Compiler Systems CBASIC documents among the best in the microcomputer world. Alas, those were written by Gordon Eubanks prior to his company's being bought out by DR. After the sale, Gordon became a vice-president of DR and moved up to Monterey. CBASIC and CB-80 are now published by Digital Research.

The first edition of the CB-80 manual wasn't bad. It has those railroad-track syntax diagrams that I find either trivial or incomprehensible, but like the CBASIC manuals before it, it has plenty of examples.

It wasn't complete (as I learned

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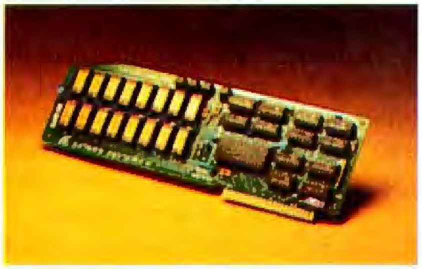

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when I got the obscene-sounding ERROR FU and couldn't find ERROR FU in the error list), and in places it was even wrong, as for example when it told how to make the compiler call attention to any undeclared variables in your program (this is an excellent optional feature of CB-80). So there came out a second edition.

Alas, although it now documents the FU error, the second edition has fewer examples; it's as if someone went through and took out some as superfluous.

If there are any software publishers listening, HEAR AND BELIEVE: there is no such thing as a superfluous example! Even poor documents can be made tolerable if they have plenty of examples, because then you can reason your way by induction; but when there aren't examples, what can you do?

Moreover, the act of testing your examples (and please, please, *never* publish an example unless you yourself have tested it!!) may show you things you didn't know about your program.

Item: one of Gordon Eubanks's assistants told me that the Read Line function in CB-80 reads until it reaches a carriage return.

"Goody!" thought I, for one of my biggest problems is how to deal with text created by editors that mark line ends with a carriage return but no linefeed, since ASCII (American Standard Code for Information Interchange—the character set we all use in CP/M) has no single Newline character.

I proceeded to write a text-mashing program. After all, CB-80 can handle strings up to 32,000 characters long; this ought to make it simple to do things to text. Unfortunately, as I learned to my sorrow, CB-80's Read Line does *not* read until it finds a carriage return. It reads until it finds a linefeed, and of course there aren't any in the files I wanted to work on.

Indeed, the problem gets even more complex: many text editors treat the formfeed character as a Newline as well as a New Page; that is, if you end a line of text with the FF character, the editor believes that you've also ended the line. This isn't an optimum situation, but lots of editors do it, so if you're trying to get text files into a program, you have to deal with the situation.

Eventually I got the following letter from Gordon Eubanks:

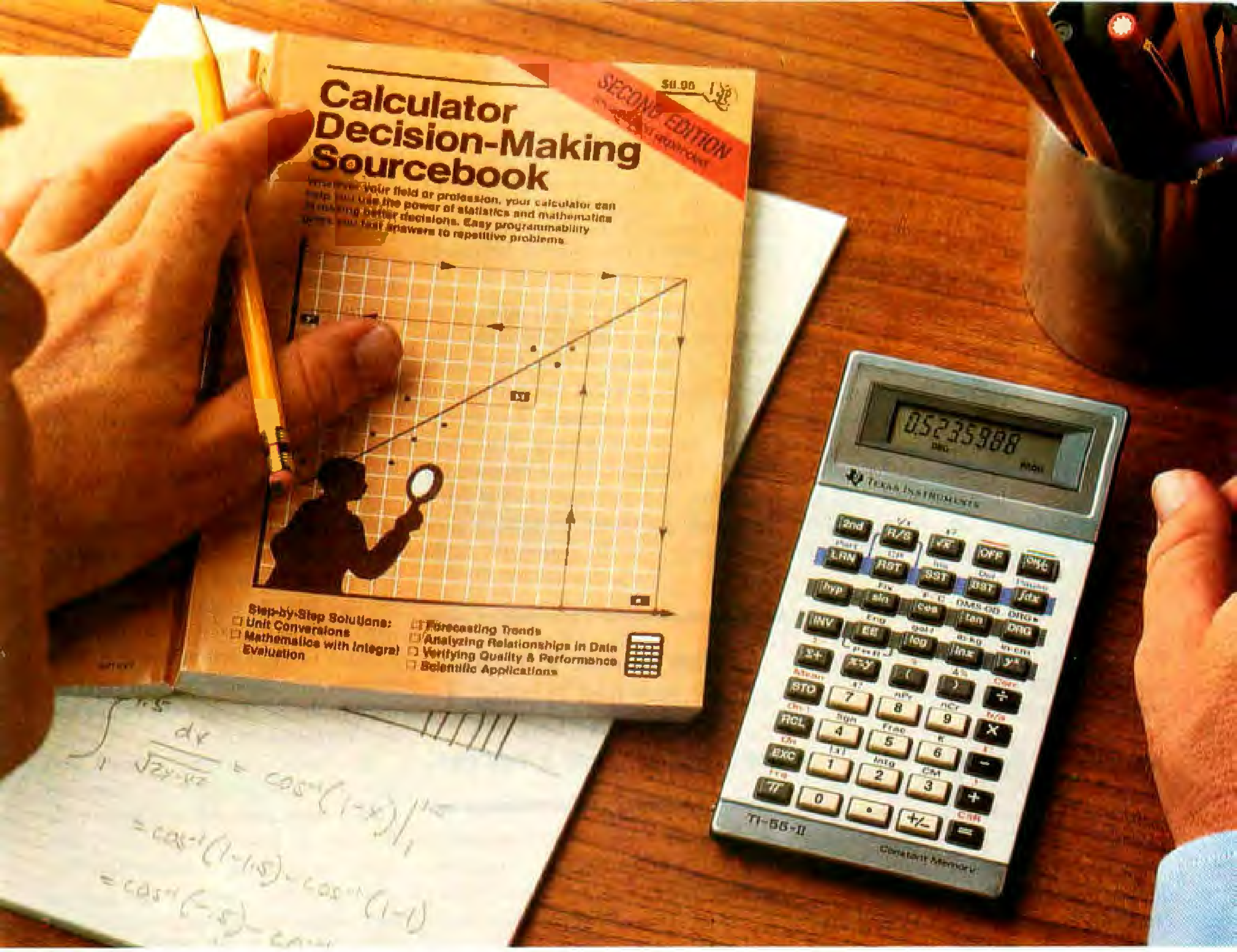
> Read Line reads until a linefeed is found. The carriage return is then stripped off the string. The bottom line is that the Read Line works with text files delimited with a carriage return and linefeed pair. The documentation will be updated to clarify this issue. A bigger problem is that many users, I am sure, would like to read text files delimited by a carriage return either followed by a linefeed or not followed by a linefeed.
>
> The reason Read Line is implemented this way is historic. (Historic in the sense that it was perhaps not the best thought out decision.) To change it now would jeopardize many existing programs. I feel a strong obligation to support existing programs and software developers. Any ideas on a solution?

On thinking about it, I have: add a new read statement, say, READ UNTIL (*X*) where *X* is something the user can insert for himself. The structure might be a Boolean flag that's false until the (*X*) character is encountered, then goes true; with that a programmer could handle nearly any file structure. You'd want to be able to do more than one READ UNTIL paired as OR statements: that is, suppose *X1* is a carriage return character (ASCII decimal 13) and *X2* is a formfeed (ASCII decimal 12); then you READ UNTIL (*X1*) OR (*X2*) and you'd have solved the problem of getting text from any editor.

Gordon adds, "The GET function *will* read a character at a time from a text file and allow you to build strings as you desire. Since CB-80 supports 32,000-byte strings, this is quite practical for many applications."

All true, and one reason I wanted to use CB-80 for my text masher. The problem is that GET is fairly slow. Ah, well.

I found one last problem with CB-80: I wanted to read in text, play about with it, and output it in lines of 80 or fewer characters, broken at spaces between words and terminated by a carriage-return/linefeed pair. (This is program Normal, which is available as part of Alex's Pascal In-



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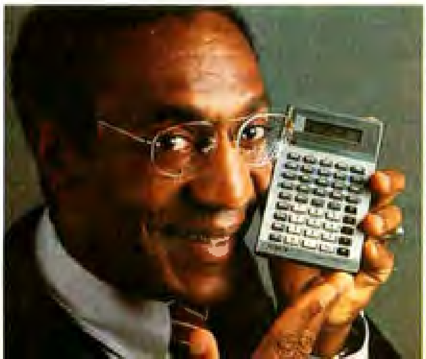

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TEXAS INSTRUMENTS

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tro package.) Alas, there's a problem in CB-80's output system, namely, that when it is supposed to output a completely blank line, it puts out a linefeed only *without* a carriage return; it's only if there's a space, or *something*, on the line that it puts out the carriage-return/linefeed pair that together make an ASCII Newline (which the documents imply is what CB-80 believes is a Newline character). This makes it very hard to set up Pascal programs that read the text so produced, especially if they're supposed to be programs that can work with both Pascal/M and Pascal/MT+, since M and MT+ look for different line terminators. (Pascal/M ignores linefeed characters entirely.)

Eventually I prevailed, but the result is not as fast as I'd like. Anyway, it works; but the CB-80 manual doesn't mention how CB-80 marks empty lines.

Jiggering Up Your IBM

In the West Coast Computer Faire report ("Computers for Humanity," July 1982 BYTE, page 392), I mentioned an article about how to buy a bare-bones IBM Personal Computer and add your own memory and disk drives. I inadvertently didn't include a reference to the article, which appeared in the first issue of a magazine called *Personal Computer Age*, 10057 Commerce Ave., Tujunga, CA 91042.

That Wrecked Keyboard

Readers will recall that I am no enthusiast of the key layout on the IBM Personal Computer (PC). The company has put extra keys between the normal typewriter-key layout's Z key and the Shift key, and it has reduced the size of the Return key and moved it far, far away from the home keys. It's an understatement to say I'm no enthusiast: indeed, I think it is (1) an insult to American touch-typists and (2) an unmitigated disaster. (I'm reminded of the lawyer who sent a telegram saying, "Sir: F—You. Strong letter follows.")

Davis Foulger of New Canaan, Connecticut, who otherwise likes my column, says:

> You're wrong about the keyboard on the IBM Personal Computer. . . . I met the engineer who designed it at a conference in New York. He was obviously pained by the criticism of his baby. . . . He told me that he had a lot of research to support the assertion that the IBM Personal Computer's keyboard was considerably better than a Selectric keyboard.

There follows a certain amount of irrelevant material condemning the QWERTY keyboard. It's not that it isn't true: we all know that not only is QWERTY not optimum for touch-typing, but it was designed that way! That is, when mechanical typewriters first came out, the young ladies using them were able to strike sequences of keys faster than the typewriter could keep up; so the keyboard layout was changed to separate key sequences like "th" and "ou" to slow down the typists. The fact remains that QWERTY is what most people learned on, and while it's easy to learn a new board like the Dvorak, it's nearly impossible to go *back* to a QWERTY after you've learned a new keyboard.

I didn't ask IBM to improve my typing. I only wanted a keyboard, not a career.

Then he points out that the IBM PC keyboard has a lot of keys that normal typewriters don't have. Where should they go?

Now I agree that putting on the full ASCII key set is a *must* for a good keyboard, and one of my major criticisms of the Osborne 1 is that it doesn't have the tilde (~), grave (`), and curly braces { }; indeed, the first thing I look at when I see a new computer is the keyboard, and if it's missing some of the keys my enthusiasm wanes rapidly.

But that, too, is irrelevant. My ancient DECwriter keyboard has the full set of ASCII keys while retaining the Selectric layout including the oversize Return and Shift keys. Mr. Foulger writes that once you become used to the IBM PC keyboard, you find your typing becomes much more accurate. "Since the Shift key on a Selectric is big, we can be clumsy in reaching for it. As a result, we often are. The PC keyboard forces precision. The Shift key is a small target that won't allow the user to make mistakes in reaching for it. As a result, typing improves."

The problem is that I didn't ask IBM to improve my typing. I only wanted a keyboard, not a career.

Comes now Jim Baen. Jim was my editor at *Galaxy* magazine and later at Ace Books. Somewhere along the line he caught my enthusiasm for small computers, and when the IBM PC came out, he bought one of the very first.

He loves it, except for the silly wrecked keyboard. They say you can get used to hanging if you hang long enough, and he could get used to the IBM keyboard—except that he has to go back to the office, where they have normal IBM Selectrics. You can't get used to the PC if you have to use normal machines too.

Jim Baen, however, doesn't give up. He's interested in computer games—one game he's going to publish will be Inferno, by Larry Niven and Jerry Pournelle—for the IBM PC; and now he's found a progammer who thinks he can write software to alter the IBM PC keyboard. The alteration would convert the stupid keys between the Z and the Shift, and the ? and the Shift into Shift keys. It would also convert the ridiculous key that's been put between the home keys and Return into a Return key. To get the characters that these "extra" keys normally make, you hit ALT and the key.

Jim's programmer swears that will work; as of now it's not available but will be Real Soon Now, at which time I may go buy an IBM PC.

Meanwhile, I see from the DEC personal computer documentation that DEC's keyboard also has software reprogrammable keys, and it's probable that some similar trick can be worked with it. It's a pity that you have to kludge things up that way; you'd have thought that IBM and DEC had people smart enough to quit winners. And one day someone will come out with a properly designed keyboard.

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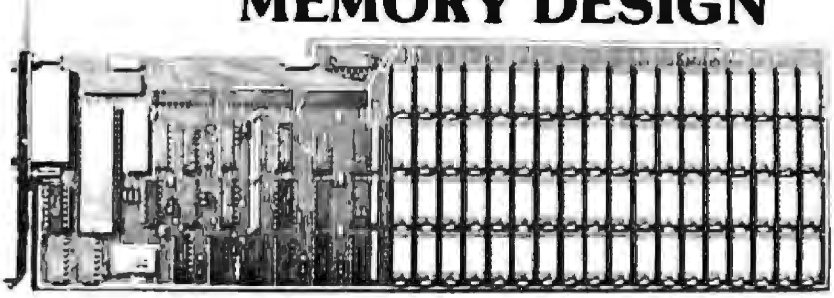

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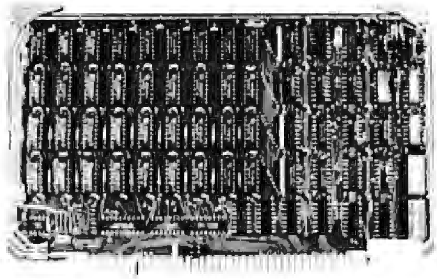

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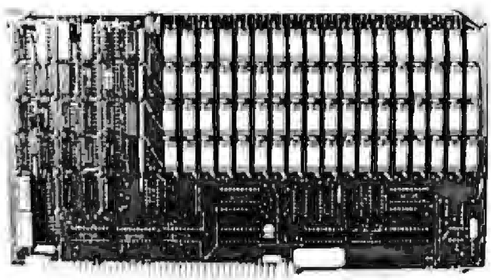

512KB SINGLE BOARD MULTIBUS MEMORY

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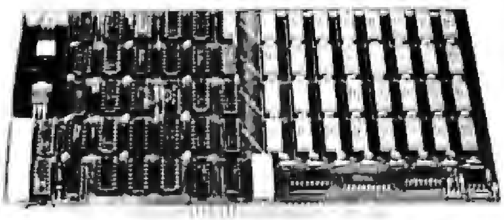

64KB SINGLE BOARD S100 MEMORY

- Addressable as a contiguous block in 4K word increments.
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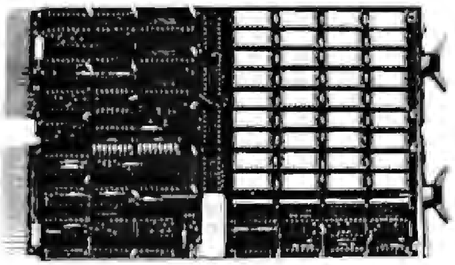

256KB SINGLE BOARD LSI 11 MEMORY

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Circle 88 on inquiry card.

Dire Warnings

Mr. Dale Peters of Oklahoma City is a professional programmer who uses COBOL. He wants me to warn microcomputer users away from COBOL before they become ensnared.

I agree with his sentiments, but I wouldn't have thought the warning necessary. However, Mr. Peters says that applications programming schools are still turning out so-called programmers who know nothing but COBOL, and that data-processing shop managers are beginning to make a serious distinction between COBOL-coders and "real programmers," which they must do "as the cost of program maintenance gets higher and higher compared to hardware costs."

I suppose I have been naive in thinking COBOL a dying language. If my views have any weight, I agree with Edsger Dijkstra: "Teaching COBOL ought to be regarded as a criminal act. . . ." The language is obsolete, limited in power and scope, and not well implemented on small computers. Most COBOL programs I have seen are hard to understand and harder to maintain. There has to be a better language for almost any application you have in mind.

Real Soon Now

Chaos Manor is filled with new stuff. I suppose it's appropriate since it's my birthday today. There's a neat new system that lets you read and write 8-inch CP/M files from an Atari 800. It comes from Vincent Cate, 6708 Landerwood, San Jose, CA 95120, and I've heard good reports about it. It's off with one of my associates who has an Atari; full report next month, but for now I'll just say it works.

We also have sitting on the living room floor the conversion kit to turn my DEC VT100 terminal into a DEC VT180 small computer. Holly Thompson, the DEC marketing lady who brought the system over, says the conversion will take only an hour or so. (Holly, incidentally, is one of the Friends of the English Regency, which Mrs. Marilyn Niven, my partner's wife, *is so mad on.*) In any event, full report when I get back from Europe.

I have some intriguing new software, too, such as the Statcom CRTform (Statcom, Suite 202, 5766 Balcones, Austin, TX 78731) programs that say they're programs that write programs. I have versions for CBASIC, PL/I, and PASCAL/MT+. They look similar to the MDBS programs, but the documents are a whole lot easier for me to understand. Alex will play with the MT+ version while I loll about in Florence and Venice.

I suppose I have been naive in thinking COBOL a dying language.

Some time ago (see User's Column, January 1982 BYTE, page 132) I reported on the Lobo LX-80, which takes the place of the expansion interface for the TRS-80 Model I. It's more reliable, has many new features including an external data separator, contains part of an operating system in PROM (programmable read-only memory), and in general is elegant; it kept my TRS-80 viable for at least a year longer than I'd otherwise have used it.

Eliot Lane of Lobo (354 South Fairview, Goleta, CA 93117) tells me Lobo has done it again: a full 64K-byte 5-MHz Z80 computer intended to compete with the TRS-80 Model III, to sell for about $800. Eliot is bringing one around for Alex to play with while I'm in Europe, so he should be pretty familiar with it by the time I return. If it's as well made as the Lobo LX-80 was, it should be quite a machine. [*For a Product Description of the Lobo Max-80, see page 390 of this issue. . .* ED]

And of course there's the Otrona Attache, which is a briefcase computer that competes with the Osborne 1 in the same way that a BMW competes with a Volkswagen. I'm taking the Attache rather than the Osborne 1 to Europe because the Attache has a higher tolerance for strange power frequencies and has switch settings to accommodate some of the voltages we're likely to encounter. With any luck there'll be both photographs and a report.■

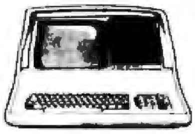
Items Reviewed

Aztec C II Technical Software Systems POB 55 Shrewsbury, NJ 07701 (201) 780-4004	object code compiler	$195 $135
BDS C Lifeboat Associates 1651 Third Ave. New York, NY 10028 (212) 860-0300		$150
C compiler for CP/M Whitesmiths Ltd. Parkway Towers 485 U. S. Rte. 1 South Iselin, NJ 08830 (201) 750-9000		$750
C/80, version 2.0 The Software Toolworks 14478 Glorietta Dr. Sherman Oaks, CA 91423 (213) 986-4885		$49.95

Continued on page 246

Circle 351 on inquiry card. →

Circle 360 on inquiry card.



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MDBS International Software Enterprises (distributor) 85 West Algonquin Arlington Heights, IL 60005 (800) 323-3629	version 1 version 3	$1300 $2250
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Supersoft C Supersoft Associates POB 1628 Champaign, IL 61820 (217) 359-2112	object code	$250
tiny-c One (interpreter)	(with source on disk and manual)	$100
tiny-c Two (compiler) tiny-c Associates POB 269 Holmdel, NJ 07733 (201) 671-2296	(with source on disk and manual)	$250
Software Tools for CP/M (with virtual operating system) Unicorn Systems 30261 Palomares Rd. Castro Valley, CA 94546 (415) 881-4490		$335

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Autocontrol's AC-85

A CP/M System on One Board

JoAnne Benedict
RR 1, Box 221B4
Longmont, CO 80501

The Autocontrol single-board computer is one of the best buys on the market. You get a complete computer on a single circuit card; it has been assembled, tested, and burned in for one week. It only needs to be connected to a video terminal and some disk drives in order to run the CP/M disk operating system and attendant software.

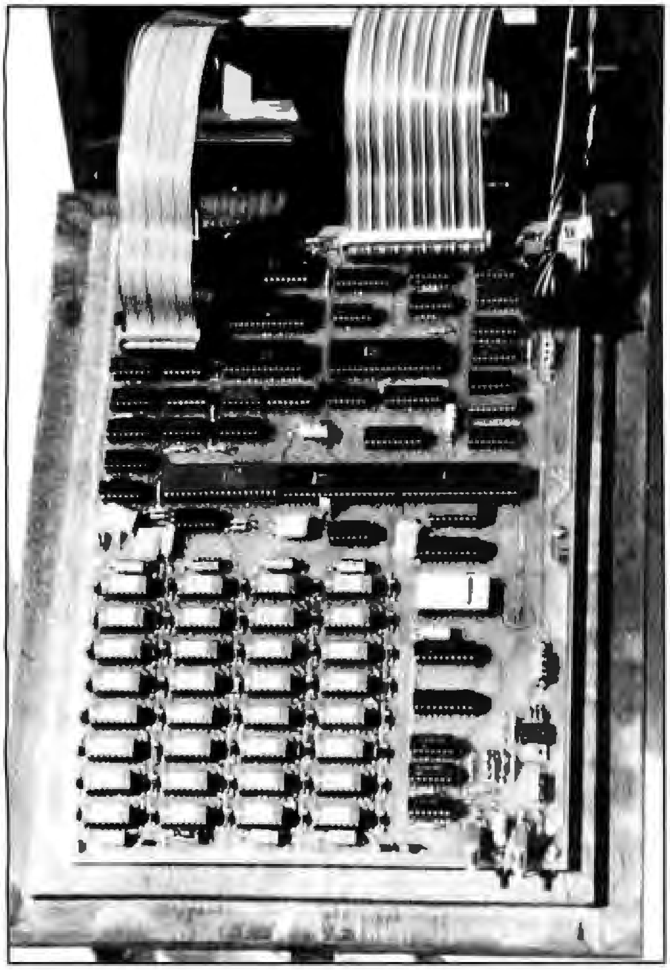

Photo 1: *The author's AC-85 mounted in a homemade cabinet.*

Although not quite as flexible as an S-100 system, a single-board computer is a cost-efficient way to get no-frills computing power.

"Maximum function at minimum cost." That was our primary goal as we began our search for *the computer*. Although word processing would be the primary use, we wanted enough versatility for record keeping and engineering problem solving. We wanted a small-business computer at the cost of a personal computer.

After examining and rejecting many popular systems because they were either too expensive or did not provide enough function, we decided to try to put together a system ourselves. Because I am a programmer and my husband is an electronics engineer, we believed we should have more than sufficient expertise to solve whatever problems would arise. We considered several single-board computers and S-100 bus systems, but finally decided on Autocontrol's AC-85 (see photo 1) as providing the best function at the least cost.

The AC-85 board has a fast 8085A-2 central processor and 64K bytes of memory. The floppy-disk controller is an NEC (Nippon Electric Company) µPD765, which can support up to four 8-inch single- or double-sided floppy-disk drives in either single- or double-density, with any mix of disks running at the same time. The disk controller can handle 5¼-inch disk drives, but the custom CP/M BIOS (basic input/output system) from Autocontrol will not recognize them. Three RS-232C channels with software-selectable settings of 50 to 19,200 bps (bits per second) will support a terminal, a printer, and any auxiliary serial device. The AC-85 board sells for $750 and is fully assembled, tested, and burned in for one week.

The AC-85 comes with a stand-alone monitor in PROM (programmable read-only memory). If Autocontrol's version of CP/M 2.2 is ordered, a new PROM with a custom BIOS is also shipped. This PROM will automatically load either a regular CP/M distribution disk or a custom CP/M disk from Autocontrol. During a *cold boot*, the custom BIOS and some common disk

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At a Glance

Name
AC-85 one-board CP/M computer

Manufacturer
Autocontrol Inc.
11744 Westline Industrial Dr.
St. Louis, MO 63141
(314) 739-0055

Price
$750 (includes RS-232C and power cables); instruction manual, $15

Dimensions
8.5 by 12 inches

Processor
Intel 8085A-2

System Clock Frequency
10 MHz

Memory
64K-byte dynamic programmable memory; 8202A RAM controller; PROM memory: 2716, 2K-byte ultraviolet erasable PROM contains a bootstrap loader or a monitor program

Mass Storage
NEC μPD765 disk controller capable of controlling four 8-inch floppy-disk drives in single- or double-density

RS232-C Channels
Three serial channels of 2651-type with 16 selectable data rates from 50 bps to 19,200 bps

Options
None, but power supplies and extra cables may be purchased

Software
2K-byte monitor EPROM (2716); CP/M 2.2 is available completely configured for an additional $150; programs to format single- and double-density disks; diagnostics programs for memory, interrupts, and disks; software to reconfigure an existing CP/M 2.2 operating system

Comments
Knowledge of connectors, reading circuit diagrams, and 8085 machine language is needed; board comes fully tested and burned in for one week, so few problems should occur

Audience
Those trying to save money while obtaining an effective computer system

routines are moved from the PROM into main memory and the density of each disk is determined. The density of the disks may not be changed without doing another cold boot. The bootstrap loader also moves CP/M from the system disk into memory.

Software is provided in Autocontrol's reconfigured CP/M disk for changing the serial port's data rates or formatting disks. Diagnostic programs for checking the memory, interrupts, and the single- and double-density floppy disks are also included. If you already have CP/M 2.2, a configuration disk is available separately.

Autocontrol's comprehensive manual contains instructions for loading a 20K-byte CP/M distribution disk, loading the AC-85 single-density disk, making 63K-byte CP/M single- or double-density disks, and for making the disk automatically cold boot when the system is first turned on. The manual also explains how to change the data rates for the terminal, printer, and auxiliary devices by modifying a code on the disk. By altering another byte in the same code, you can use either Autocontrol's PROM BIOS or the BIOS residing on the system disk.

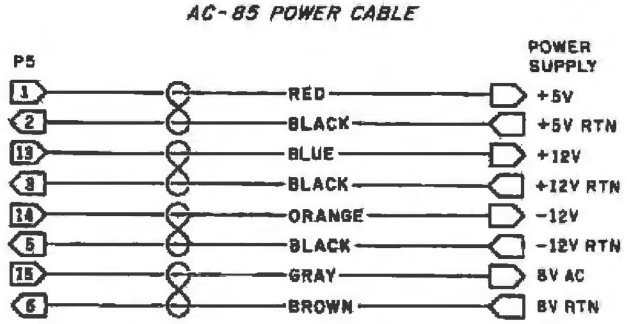

Figure 1: *Power-cable connection to the single-board computer.*

Cable Connections for the AC-85

The AC-85 single-board computer has four interface connectors and one power-cable connector (see figure 1). The power-cable connector comes prewired and color coded according to the circuit schematic in Autocontrol's documentation. The board includes an op amp that conditions an 8-volt (V) signal developed from the AC power lines that the 8085 can use in a timing or clock program. The signal is routed through the power cable from either a small separate transformer or the transformer that produces the +5-V DC power supply. The power supply must provide +5 V at 1.5 amperes (A), +12 V at 0.3 A, and −12 V at 0.1 A. An on-board voltage regulator converts the −12 V to the −5 V needed for the 4116 memory devices. This power configuration is very easy to accommodate with currently available supplies. We decided to use a larger +5-V supply to power our Siemens floppy-disk drives as well.

Autocontrol provides an RS-232C cable (25 conductors) with the connector to the board already mounted. All we had to do was check the connections needed at the terminal and wire the included connector to match. Autocontrol's instruction manual gives explicit instructions (see figure 2) for wiring all the needed cables to standard peripheral devices, but certain printers or terminals, such as an NEC Spinwriter, may require special configurations (see figure 2b). We found one small error in one of the schematic diagrams; they are correct, however, in the figures here.

The interface cable for the floppy-disk drives uses the standard Shugart pin assignments (see figure 3). We used a standard 50-pin card-edge connector and ribbon cable. Be very careful when attaching the ribbon cable to the pin and card-edge connectors, as a misalignment will result in the disk drives not working.

The instruction manual also gives clear instructions for wiring the options on the Shugart drives; those instructions do not apply to the Siemens drives. To interface to the NEC 765 floppy-disk controller, Siemens drives need two minor wiring changes: when the drives are connected in daisy-chain fashion, only the last drive must have the

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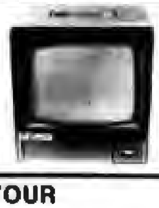

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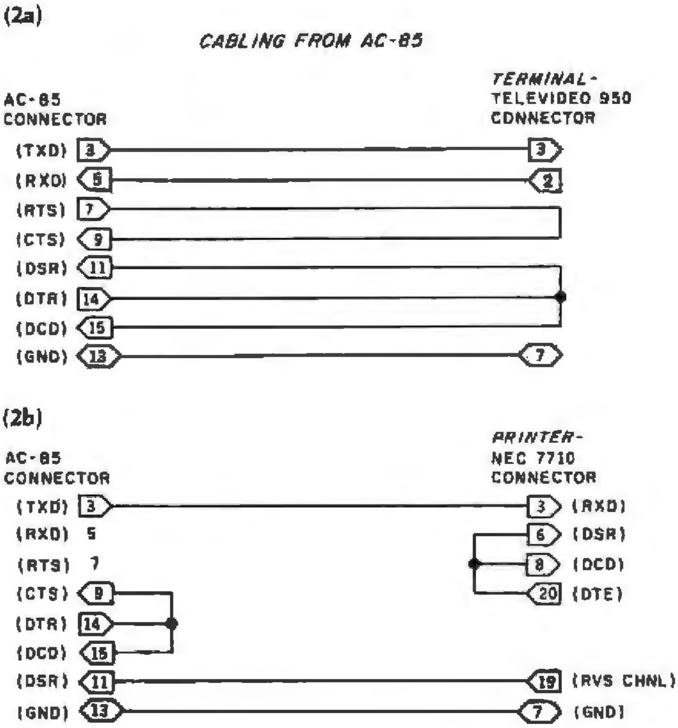


Figure 2: *Serial-cable connections for the single-board computer. These connection diagrams (contained in the Autocontrol manual) allow the user to configure RS-232C cables for use with most serial peripheral devices.*

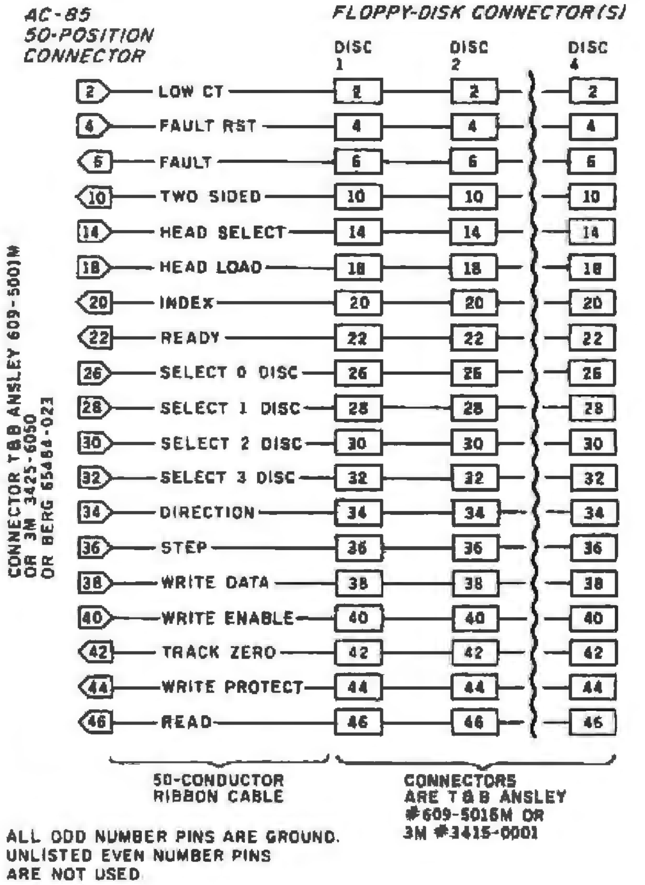


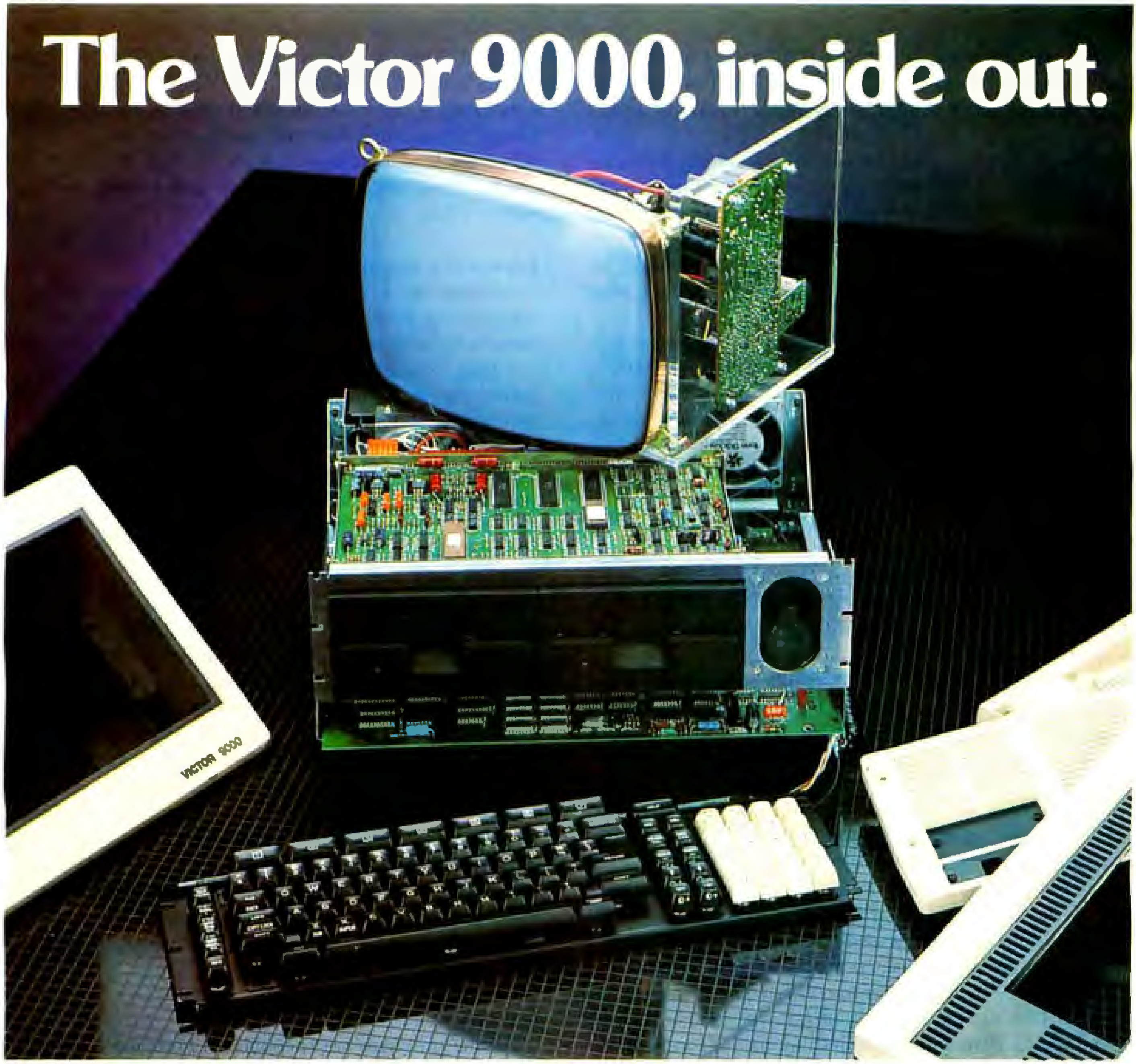
Figure 3: *Shugart-compatible disks are accommodated easily. Because the standard pin assignments are used, a cable can be made by attaching connectors directly to a 50-conductor ribbon cable.*

terminator network installed. We obtained these changes from the helpful engineering staff at Siemens OEM Division in Anaheim, California.

Because we mounted the AC-85 board in an enclosed cabinet, the Monitor and Boot push-button switches were inaccessible. To solve this problem, we added two normally open, momentary-contact push buttons on the front of the cabinet and wired them in parallel with the original switches. The added wire capacitance to the reset circuitry has not affected operation at all.

Putting It All Together

Using the same criteria for choosing our peripheral devices as we did for choosing the computer itself, we settled on four Siemens FDD 100-8 single-sided, dual-density disk drives; the new Televideo 950C terminal; and the recently introduced NEC Spinwriter 7710 (obtaining all at lowest discount prices). Our Televideo 950C terminal arrived first. Because it has a local mode, we were able to check it out quickly and become familiar with it. It had a few problems, but when we called the Televideo software staff, they were very helpful and sent us two new EPROMs (erasable programmable read-only



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memories) to replace the original ROMs. It has worked properly ever since. The 950 is an intelligent terminal that can be used with a printer as a memory typewriter with a 96-line capacity.

The NEC 7710, an improved version of the 5510, arrived next. The printer can be connected directly to the Televideo 950C's local printer port. After finally getting the data rate, parity, and word length set properly, we were able to check all the functions on the NEC 7710. We've had no problems with the printer, and its print quality is excellent.

We then connected the AC-85 board to the power supplies and the terminal's RS-232C connector. After a minor cable problem and a session with the instruction manual of the Televideo 950C, we were ecstatic to see the monitor-prompt message appear. With the stand-alone monitor PROM in the AC-85, we could change, display, and execute programs in memory. I wrote a short machine-language program and successfully checked the computer and the terminal.

Other commands available with the stand-alone monitor PROM include filling a block of memory with any hexadecimal value, displaying all the processor's registers, moving a block of data from one address to another, changing any register, reading the contents from a specified input port, writing a given byte to a specified output port, and loading from the PROM or from memory with or without initializing any I/O (input/output).

After an enjoyable session in the woodworking shop constructing an acceptable cabinet for the living room, we finally connected the Siemens floppy-disk drives and replaced the stand-alone monitor PROM with Autocontrol's BIOS PROM. Unfortunately, CP/M did not work. I wrote another machine-code program to issue disk commands to the floppy-disk controller and check the status. Using the monitor to enter and execute the program, we found that the read command failed: "Unable to Read Id," it said. After more troubleshooting, we found an embarrassing connector short in the ribbon cable we built. Now CP/M worked, but we kept getting "BAD SECTOR" messages four out of every five times we issued a CP/M command. One clue was that the problem occurred more often the farther into the disk we read.

It appeared to be a timing problem. I wrote another short machine-language program to tell the NEC 765 controller to change the head-step time from 8 milliseconds (ms) to 6 ms. Using the DDT function of CP/M, we entered and executed the program. The "BAD SECTOR" message no longer occurred, and we immediately changed the appropriate byte in the BIOS on the monitor EPROM. According to the Siemens manual, a step time of 3 ms is the lowest acceptable value. We tried all the values down to 3 ms, but 4 ms seemed to be the fastest reliable head-step time.

Prematurely elated by having three of the four components working, we were not expecting the final frustration when we connected the printer to the AC-85 board. We kept getting a buffer overflow on the NEC 7710. The AC-85 was not recognizing the printer's buffer 7/8 full condition. A call to Autocontrol gave us the correct cabling configuration for full handshaking. A few more selected protocol adjustments on the NEC 7710 and the printer never missed a byte, even after raising the data rate to 1200.

Experience Required?

Assembling a system from components built and designed by four different companies may not be for everyone, but if you have some electronics background, can read wiring diagrams, and understand a little programming, it should not be very difficult and can save you several thousand dollars.

Autocontrol also sells the AC-85 board assembled in a cabinet with two 8-inch floppy-disk drives. Although you can save some money by assembling it yourself, this may be a viable option for those who need an assembled system ready to go.

If you wish to avoid the interface problems, a call to Autocontrol to find out which peripheral devices they have used and how to connect them would be beneficial.

Another product, which Autocontrol introduced in October 1981, is a similar single-board computer, but with only two serial ports for a printer and auxiliary device. It has a device for controlling a keyboard, and one for controlling a video monitor (with an effective speed of 38,400 bps), so that an external video monitor is not needed. It can be purchased with just a self-contained monitor and keyboard; with the monitor, keyboard, and one floppy disk; or with the monitor, keyboard, one floppy disk, and one hard disk. This could very definitely bring down the cost of a complete system, and may also permit high-speed video graphics. We would not hesitate to buy either board in any case.

Conclusions

All the problems we encountered involved cabling or setting options on the floppy-disk drives, the terminal, and the printer. As of today, all hardware has worked flawlessly. We are very impressed with the lack of problems with the AC-85 board. We are also impressed with the help we received to solve our problems when we called Autocontrol.

I would have been happier if the AC-85 board had Zilog's Z80 instead of Intel's 8085 (mainly because of the additional software available), but the 8085 should be more than sufficient for our needs, because it can run all standard CP/M software.

While a single-board computer is not expandable like an S-100 or standard bus system, the AC-85 is a reliable, reasonably priced alternative. We were able to choose peripheral devices according to our own price/performance criteria, have the joys and frustrations of trying to mesh together four components from four manufacturers, and wind up with a real computer costing $2000 to $3000 less than a completely assembled system.■

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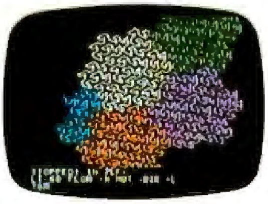

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The minicomputer of personal computers.

And further: "The trio of personal computers will blow everything else out of the market."

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MORE PERSONAL.
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The Soundchaser Computer Music Systems

Robert A. Moog
Big Briar Inc.
Leicester, NC 28748

The Soundchaser Computer Music Systems are two within a growing class of systems that take advantage of the potent processing, storage, and number-crunching capabilities of personal computers such as the Apple II. Both include a digitally scanned music keyboard to feed musical performance data to an Apple. The Analog system uses one or two of Passport Designs' proprietary, digitally programmable analog tone-producing cards, each of which incorporates three rudimentary synthesizer voices. The Digital system uses the Mountain Computer Musicsystem, a two-card accessory digital oscillator that produces up to eight two-component musical tones. Each system includes a software package that sets up the tone colors (timbre), ties the tone-producing circuitry to the music keyboard, and provides store and recall (record and playback) functions. Together with the Apple computer, either system is a polyphonic synthesizer with more open-ended versatility than any computerized packaged musical instrument costing less than a basic foreign sports car. The two systems differ in the types of tone colors they produce, the tone color controls provided, and the musical data-processing capabilities that are available. Photo 1 shows the components of these two systems.

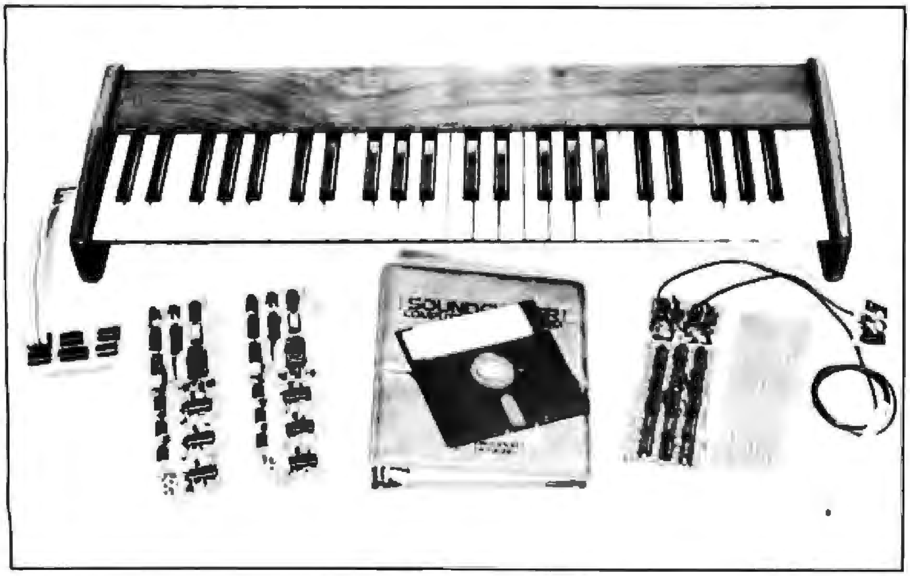

Photo 1: *The hardware of the Soundchaser Computer Music System. The three-voice audio cards of the Analog system are to the left of the instruction manual. The Mountain Computer Musicsystem, used with the Soundchaser Digital system, is to the right of the manual. At the top is the four-octave music keyboard used with both the Digital and the Analog system.*

The big difference between computer music systems like the Soundchasers and a conventional polyphonic synthesizer is in the type of "control panel." A conventional synthesizer has a set of hardware controls and switches that are the musician's "handles" to manipulate the sounds. The Soundchaser systems use a "soft" control panel—a graphic video representation of parameters, plus a set of instructions for accessing these controls through alphanumeric commands. For the performing musician, a soft panel is a mixed blessing because its versatility is offset to some degree by the longer time it takes to "set" soft controls. For studio musicians, teachers, and experimenters, however, the software-based system configuration's unprecedented versatility is of great value. It allows the system supplier to increase and improve the system's capabilities through software updates, at modest cost to the user. It also allows users to customize their own systems without danger of wrecking them the way hardware hot-rodders often do.

The Music Keyboard

Both the Digital and the Analog Soundchaser systems use a standard-size four-octave organ keyboard.

(Call it a clavier if you want to sound like a real musician.) The keyboard mechanism is housed in an attractive, solid walnut enclosure. No other real-time controls (such as a joystick to perform pitch bending or frequency modulation) are included. A ribbon cable connects the music keyboard to a small interface card, which plugs into one of the Apple's eight card slots. The ribbon cable is so short that the music keyboard must be placed immediately to the right of the Apple unless you have a 16-pin DIP (dual-inline package) extension cable.

The music keyboard tells the Apple which keys are being held down at any time. This information is updated frequently so that the delay between a key depression and the sounding of the tone is not ordinarily perceptible.

The Soundchaser Digital System

The Digital system uses the Mountain Computer Musicsystem digital oscillator as its sole audio source. The Musicsystem produces a tone by reading a wave table, which is a list of numbers that represent the amplitudes of a succession of closely spaced points on one cycle of a waveform. The wave table is read repeatedly in order to produce a periodic waveform that we hear as a pitched musical tone. The rate at which the wave table is read determines the frequency of repetition of the periodic signal and, therefore, the pitch that we hear. Under control of the Soundchaser Digital software, the Musicsystem covers the frequency range of 33 to 4186 Hz (1 Hz = one vibration per second), which in musical terms is a pitch range of three octaves below middle C on the piano to four octaves above. The Musicsystem frequency resolution is 0.5 Hz, which is adequate for most but not all musical applications.

The wave table for a single Musicsystem tone consists of 256 eight-bit numbers. It occupies one page in the Apple memory. In theory, you can specify any waveshape in the

At a Glance

Name
Soundchaser Computer Music Systems. Analog system, Digital system

Use
Implements a polyphonic (chord-playing) keyboard-controlled music synthesizer when used with the Apple II microcomputer

Manufacturer
Passport Designs Inc
116 North Cabrillo Hwy.
Half Moon Bay, CA 94019
(415) 726-0280

Dimensions
Music keyboard is 28 inches by 9½ inches by 3¼ inches; all circuit cards plug into Apple console.

Price
Three-voice Analog system, $1000, six-voice Analog system, $1350; Digital system, without Musicsystem card, $650, Digital system, including Musicsystem card, $1045, Notewriter software package, $99; and Musictutor software package $150

Features
Four-octave keyboard. Analog system uses three-voice or six-voice channels each consisting of a programmable-counter-type digital oscillator, analog voltage-controlled filter, and analog voltage-controlled amplifier, all under software control. Software generation of tone envelopes and low-frequency modulations, and recording and playing back of keyboard performances. Digital system uses the Mountain Computer Musicsystem to implement an eight-voice polyphonic synthesizer. Optional software implements music-transcribing and instruction programs

Hardware Needed
48K-byte Apple II computer with video monitor, disk drive, and game paddle, stereo sound system or musical instrument amplifier; Apple language card for some optional software

Documentation
MOS 3.0 manual (to run Analog system) 42 pages; MC1 manual (to run Digital system), 37 pages. Both in 3-ring binder. Musictutor and Notewriter documentation not available at time of writing.

Audience
Musicians, music teachers, sound designers, musical experimenters

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Superior quality at superior value is the key to those few items that rise above the crowd to shine as unique symbols of perfection. We call these the "best" products, and the best in Apple II®-compatible drives is the Micro-Sci line of 5¼" floppy disk drives and subsystems.

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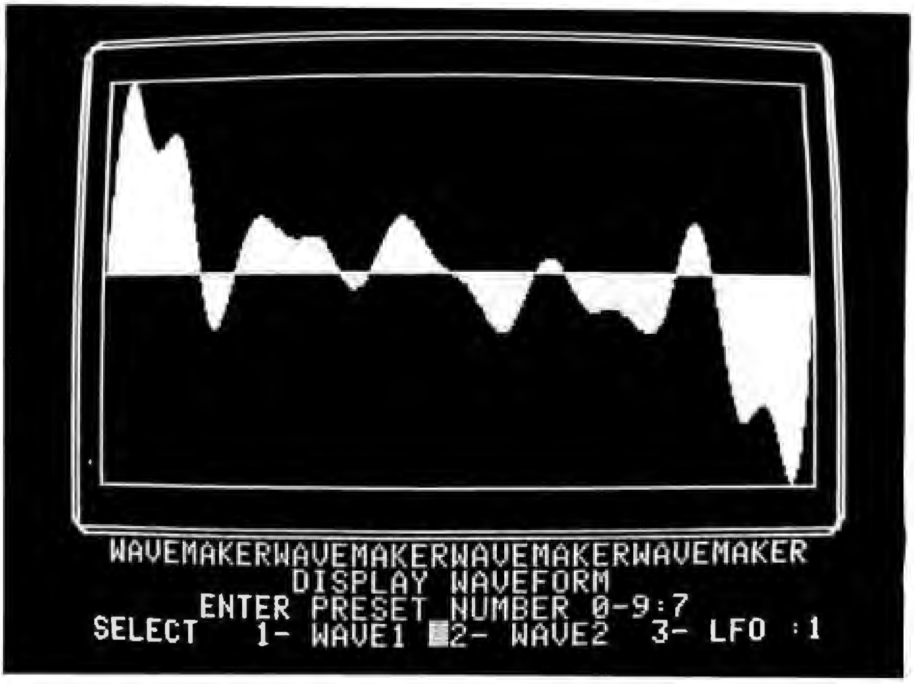


Photo 2: *The screen display of the Wavemaker section of the Soundchaser Digital system. The pattern is a graphic representation of one complete wave table.*

wave table and produce it with 8-bit resolution by the Musicsystem hardware. The shape of a cycle of a periodic wave determines its overtone content and, therefore, is a factor in determining the tone color that we perceive.

The Wavemaker Section

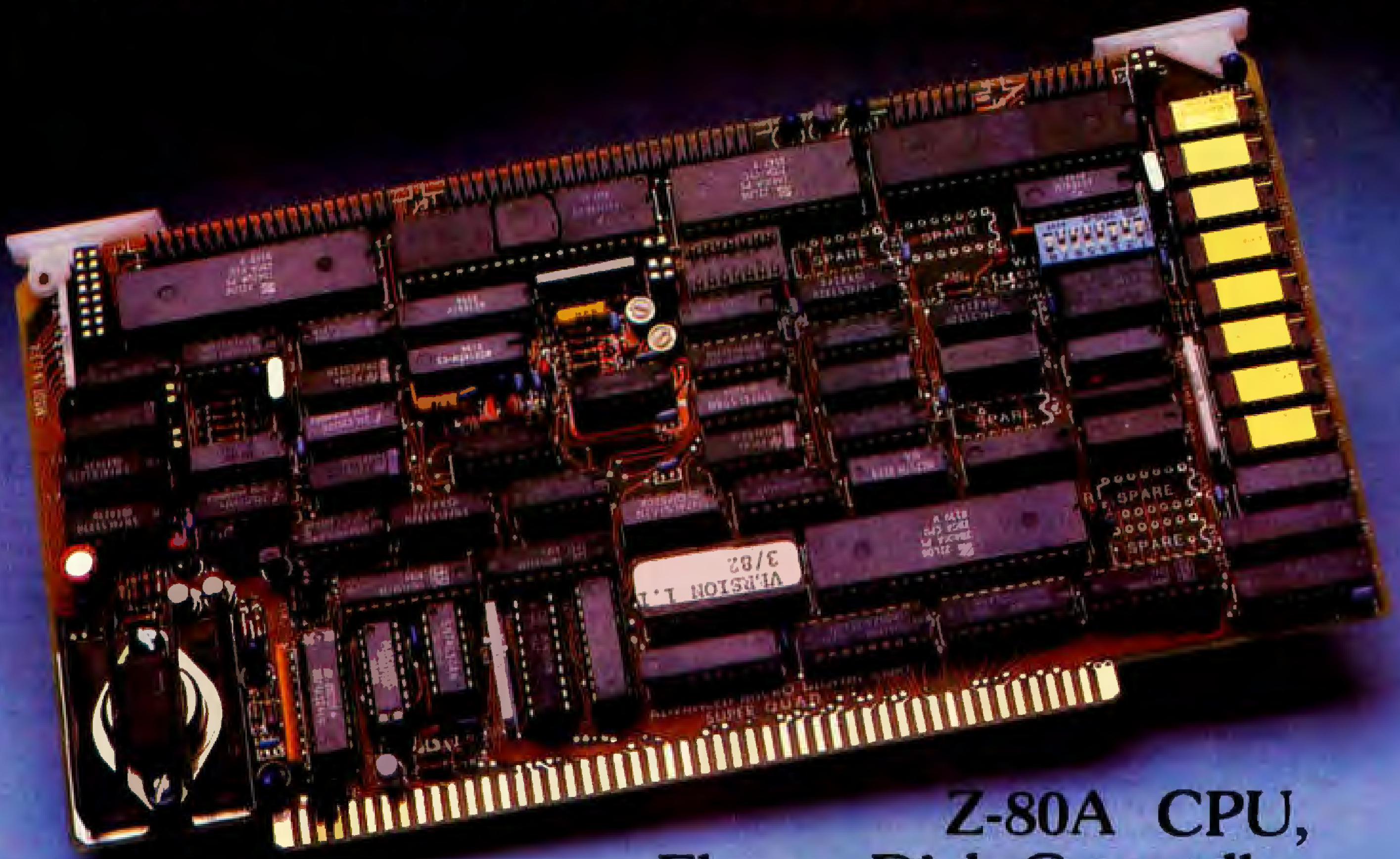
The Wavemaker section of the Soundchaser software provides the means for loading the wave tables. You specify the amplitudes of the fundamental pitch and the first 15 overtones by typing in the numerical values one at a time. (The sum of all amplitudes must be 100 or less.) The Apple then computes the wave-table entries by summing the sine waves corresponding to the overtones. The wave-table contents can then be displayed graphically as a single cycle. Photo 2 shows a typical display. Once a waveform is displayed, you can continuously redraw it by moving a cursor with a game paddle. Software will be available shortly from Passport Designs to redraw the waveform with straight line segments by first spotting the lines' end points with the paddle, then computing the lines.

In addition to the Create (which computes the waveform from overtones), Display (which shows the waveform on the screen), and Edit (which redraws a section of the waveform) functions, the Wavemaker section of the operating software offers Play (which sounds the waveform when a key is depressed) and Smooth (which provides simple filtering to reduce unwanted "alias" noise that often accompanies digitally generated tones). Aside from the Smooth function and the usual anti-aliasing output filters, the Musicsystem provides no filtering; what you put in the wave tables is what you get at the audio output. Because the waveform resolution is only 8 bits in both amplitude and time, the Musicsystem audio output does have steps that are audible as "aliasing" when high-pitched tones are being produced. Even with this limitation, however, the Musicsystem produces many musically useful tone colors (i.e., pleasant, easily blending with other tone colors, and distinctive in character), especially in the low and middle pitch ranges.

The Performance Section

The Performance section of the operating system offers alphanumeric access to pitch range (in octave steps), envelope shaping, low-frequency modulation, and overall volume. The

Chairman of the Boards



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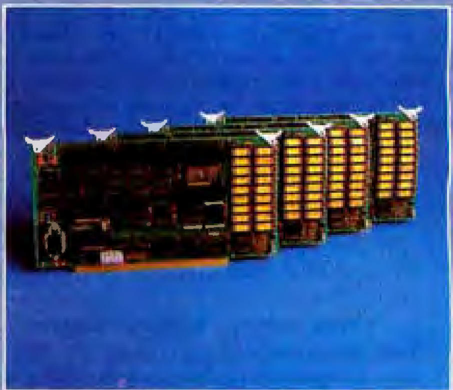

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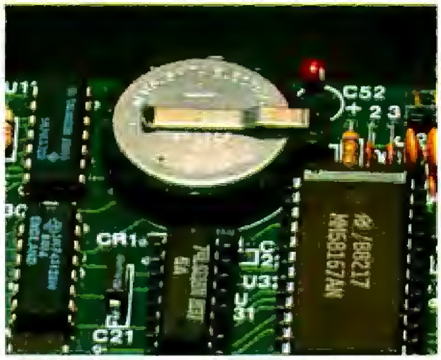

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amplitude (overall loudness) of each tone is shaped by an envelope that builds up, then partially dies away, and levels off as long as a key is held down, finally dying away to silence when the key is released. These envelope segments are called attack, decay, sustain, and release, respectively. Attack, decay, and release times can be set anywhere from 50 milliseconds (ms; 0.050 seconds) to about 6.5 seconds, with 8-bit resolution, while the sustain level can be set from 0 amplitude to the maximum envelope amplitude. Photo 3a shows a typical Soundchaser Digital envelope. When you compare it with a similar envelope from an analog synthesizer (photo 3b), you see that the decay and release segments of the Soundchaser envelope are straight lines rather than exponential curves, a characteristic that results in a somewhat abrupt and "unnatural" sound in some applications.

The Musicsystem has two audio output channels; eight tones are assigned to each channel. By triggering one tone per channel with each key depression and programming different waveforms and envelopes in each channel, you can produce many complex and interesting composite sounds. For instance, you can produce a bell-like sound by putting a sustained tone of low-overtone content in one channel and a rapidly decaying, high-pitched tone in the other channel. The Performance section allows the musician to set up completely separate envelopes for each of the channels, one of the more exciting sonic resources of the system.

Frequency modulation (for producing effects such as vibrato and trills) is implemented by first constructing the modulating waveform in the Wavemaker section and then determining its frequency and amplitude in the Performance section. Modulation speed ranges from one cycle very 6.5 seconds or so (for sirenlike effects) to about 20 cycles per second (for growl effects). When using both audio channels, you can independently control modulation amplitudes for each channel, a feature that has the potential for creating some attractive chorus effects. A negative aspect of

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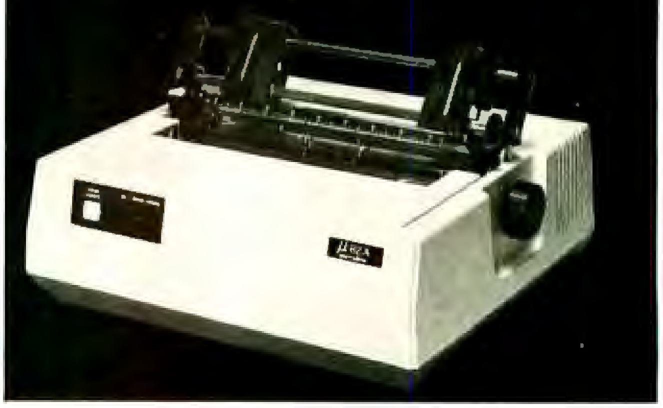

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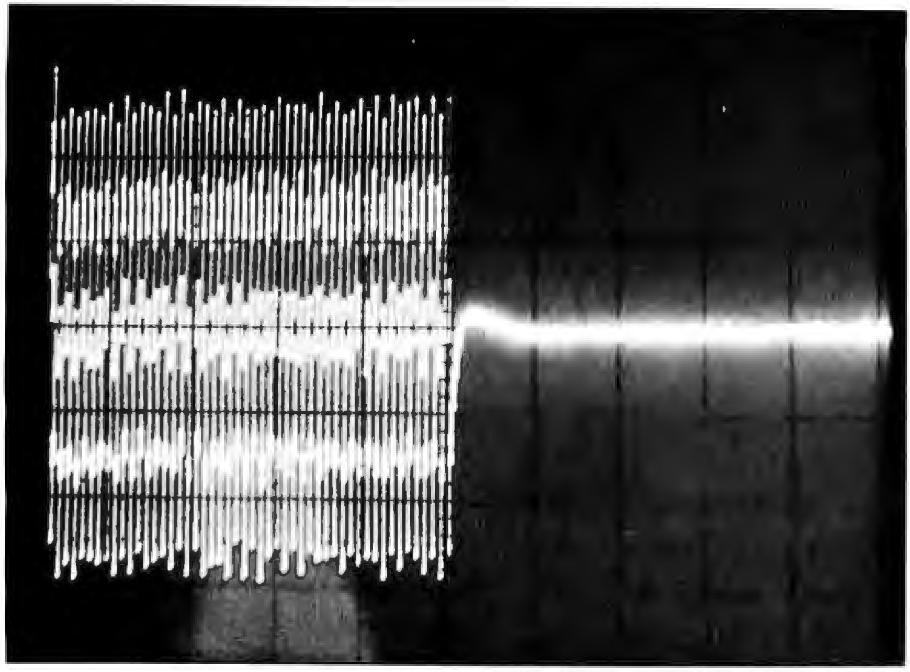

Photo 3a: *Screen display of the oscillograph of a Soundchaser digital tone with the fastest possible attack and decay times. The tone is 50 ms long. The overall shape is the tone's "envelope." The individual waveform cycles are not visible because they are so close together.*

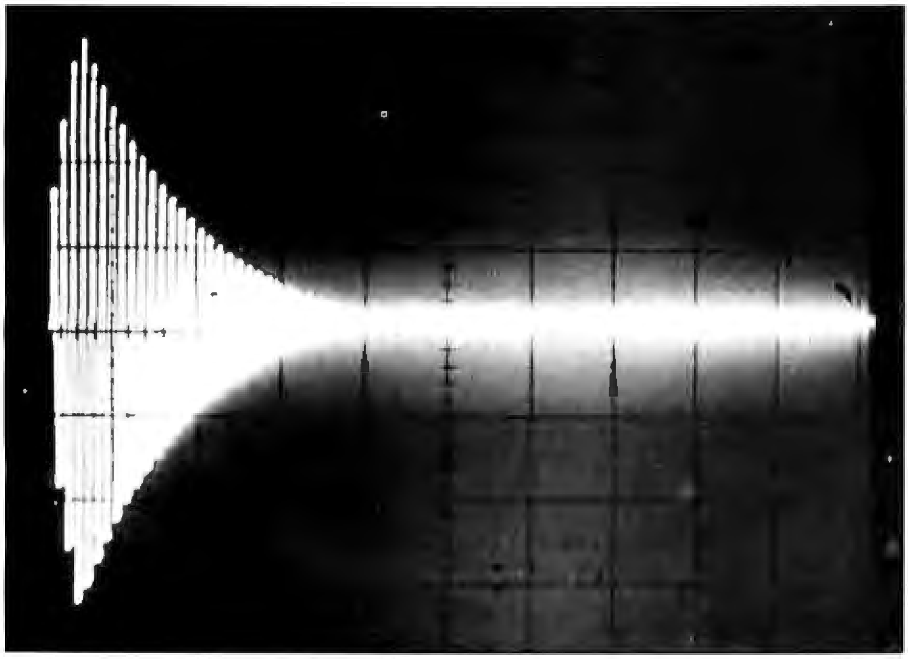

Photo 3b: *Screen display of the oscillograph of an analog synthesizer tone with 5-ms attack time and 10-ms decay time. Note that the envelope is shorter but smoother than that shown in photo 3a.*

the Performance section is that the modulation amplitude is not the same from note to note: low notes are more widely modulated.

The Sequencer Section

The Sequencer section enables you to record actual keyboard performances and assemble them to make multipart (polyphonic) compositions. Two modes are available: Link and 4-Track. In the Link mode, a keyboard performance is recorded as soon as the musician starts to play. At the end of the performance, a single command forms a loop of the performance, which then begins again when any music key is depressed and repeats until the stop command is issued. Thus, you can use the Link routine to create a repeating background pattern that musicians call an ostinato. The pattern usually serves as an accompaniment, over which a live keyboard performance can be played. The pattern may have as many as eight notes playing simultaneously. However, all notes must have the same tone color.

In the 4-Track mode, the Sequencer behaves somewhat like a four-track recorder. To use this mode, you first record one track by playing the music keyboard. You then play that track back, while simultaneously recording on track two. You repeat the process until four parts are recorded. Any number of keys can be simultaneously depressed when recording any one track, as long as the total number of notes sounding simultaneously on all four tracks does not exceed eight. It is not possible to form a loop in the 4-Track mode.

The Sequencer is easy and fun to use. Just a few alphanumeric commands enable the musician to start recording, switch over to playback, and change channels. You can call up any of the previously created voices (called "preset masters") and assign them to any of the tracks. You can change octave range, modulation amount, envelope parameters, and the preset masters themselves as the sequence is playing back. The playback tempo can be the same speed as the original recording or can be increased in whole numbers up to 8 times the original speed. Some limitations in the Sequencer's operation may, however, frustrate musicians who have used a conventional four-track recorder. Foremost of these is that no facility for editing a track exists. If you make a mistake, you have to record the whole track over. If you want to change one note at a time, you are out of luck. On a multitrack recorder you can generally "punch in" to erase and rerecord small segments of a single track as it is playing back. It would be nice to have that same facility here. It would also be nice to be able to display the actual

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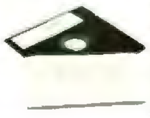

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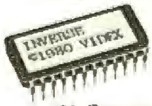

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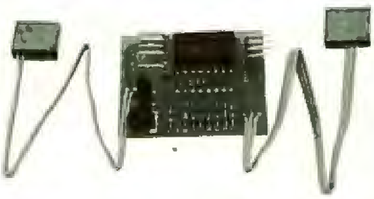

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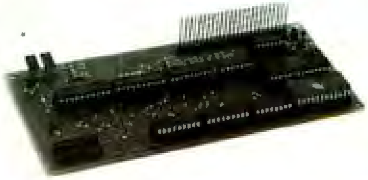

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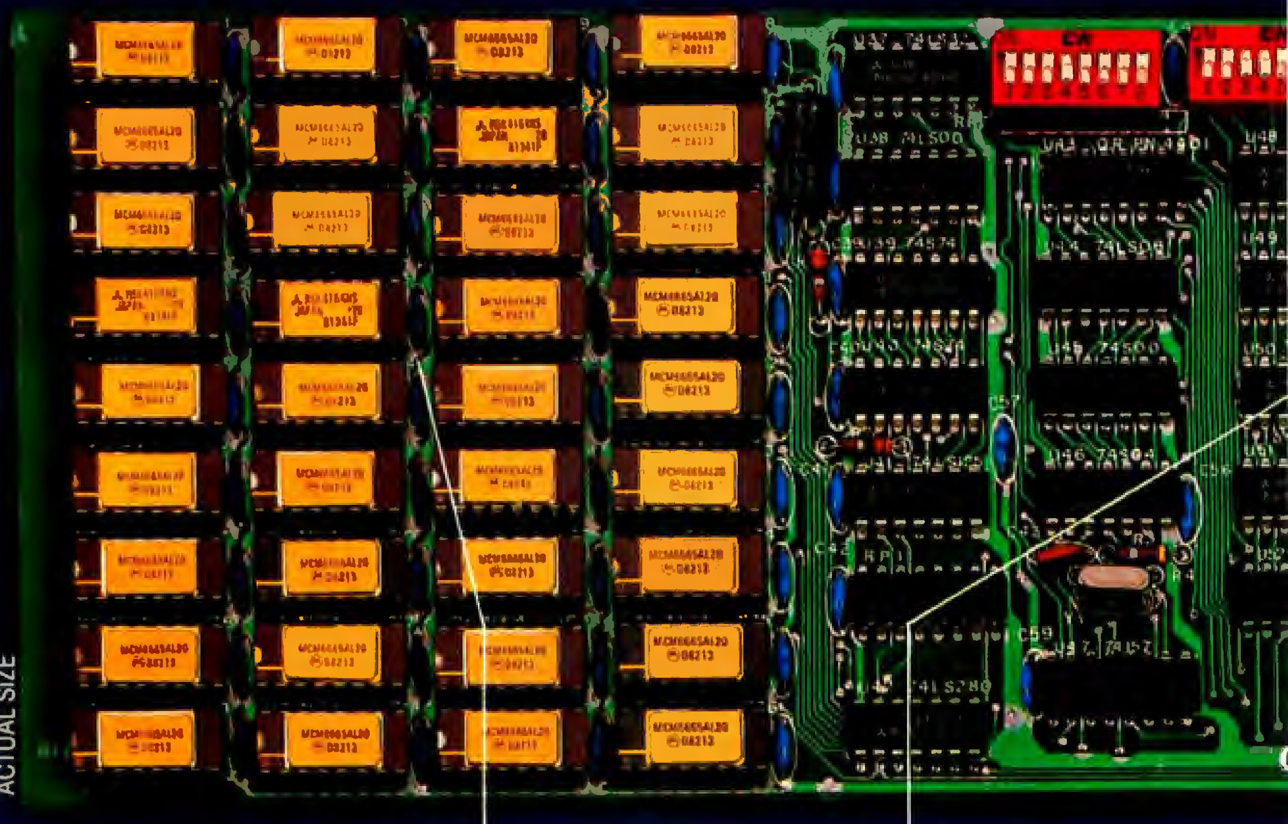

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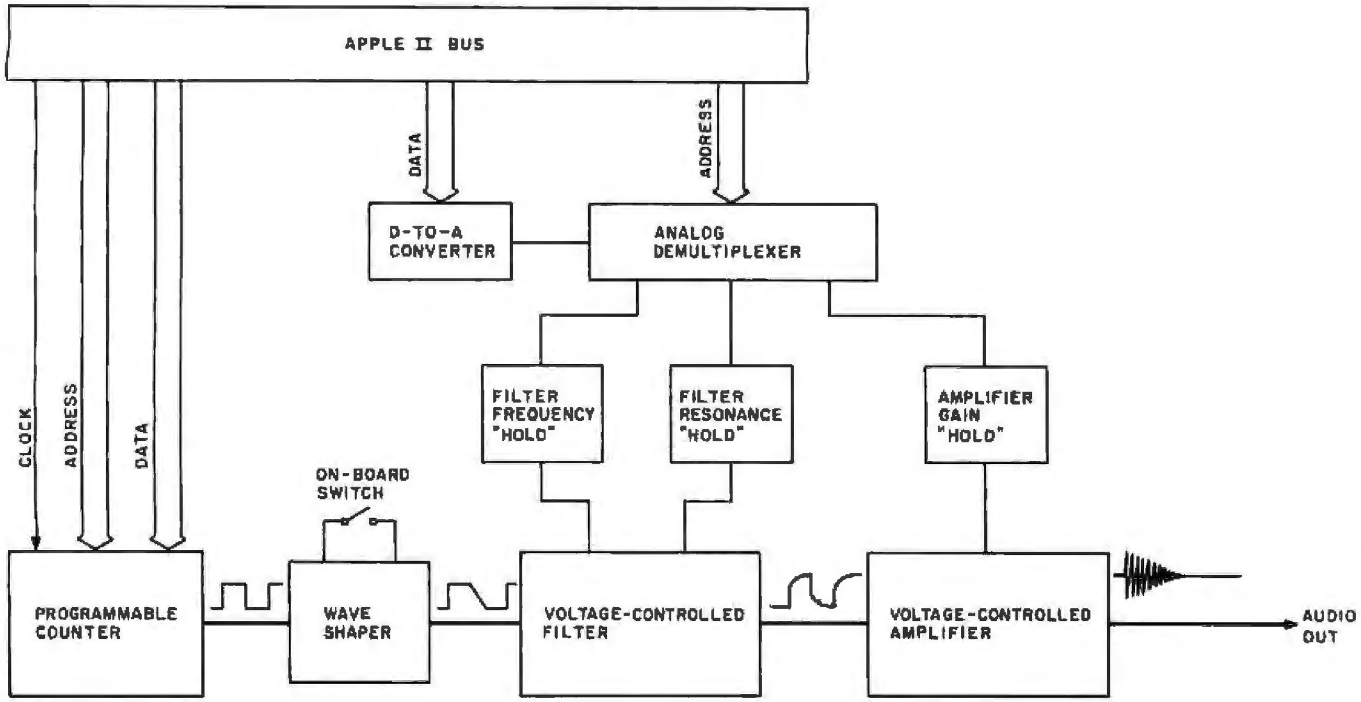

Figure 1: *Block diagram of one of the three audio chains of a Soundchaser Analog voice card, along with its associated control circuits.*

timings of each note in a track (perhaps as a numerical table) and then edit that table. That would give the musician the option of fine-tuning the timing of individual notes without having to punch in and replay just those notes. For Sunday keyboardists like me, that would be an attractive feature. Since the entire Sequencer resides in the system software, these enhancements could presumably be included in software updates.

In addition to the Wavemaker, Performance, and Sequencer sections, the Soundchaser Digital operating system includes a disk section that contains some basic file-management utilities. The three types of files are called Waveform, Master, and Track and correspond to the data entered in the Wavemaker, Performance, and Sequencer sections. Files can be saved on disk, deleted, and loaded from the disk. The Performance section display provides access to the disk section (as well as to any of the other system sections) through a simple, single-character command.

The Soundchaser Analog System

The Analog system sound-producing hardware and operating software are both radically different from those of the Digital system. An Analog system audio card contains three very simple analog sound chains, plus a D-to-A (digital-to-analog) converter and demultiplexing circuitry to receive digital control information from the Apple, convert it to analog control voltages, and distribute it to the control inputs of the analog circuit blocks.

When compared with conventional analog synthesizers, the Soundchaser Analog audio chain has limited capabilities.

Figure 1 shows a single audio chain of the Soundchaser Analog card. The oscillator is a programmable counter that derives the correct frequency by dividing the Apple clock frequency by a software-generated number. The output waveform is a square wave, a shape that produces a hollow, clarinetlike tone. A simple waveshaping circuit changes the overtone content slightly in order to produce a more stringlike quality. This circuit is activated by one of four small switches on the circuit board itself; it is not under software control. The filter is a standard voltage-controlled "24-dB/oct [decibels per octave] lowpass-resonant" design. (This is the type of filter that most people have in mind when they say, "It sounds like a synthesizer.") The filter's cutoff frequency (the frequency above which the overtones are reduced in strength) and resonance (how strongly the filter emphasizes the overtones whose frequencies are near the cutoff frequency) and the amplifier's gain (amount of amplification) are the three parameters that are under software control through the D-to-A converter.

When compared with conventional analog synthesizers, the Soundchaser Analog audio chain has limited capabilities. With only one waveform per voice, chorus and ensemble effects are not possible. The waveshape choice is meager and inconvenient to implement. The range of filter cutoff frequency and resonance settings seems hardware-limited; you can't produce musically interesting effects, such as very low or very high cutoff frequency and high resonance. Finally, the control signals emerging from

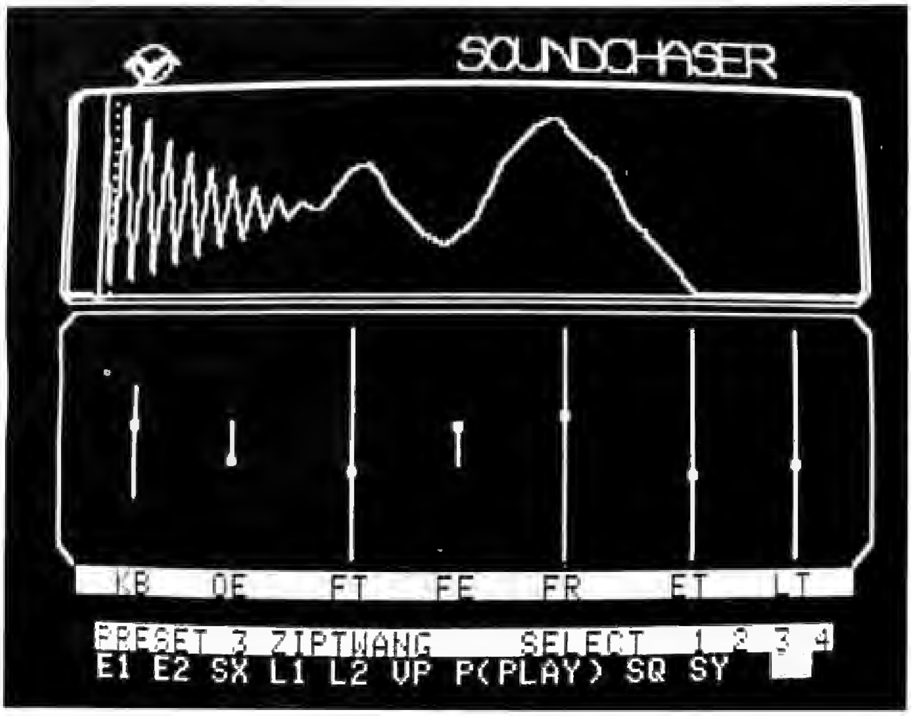

Photo 4: *Screen display of a voice panel display of the Soundchaser Analog system. The pattern at the top is a user-defined contour, one of four that is associated with each voice. Below the contour display are the "switches" and "sliders" that are set by use of the game paddle.*

the demultiplexer carry rapid fluctuations that affect the overall tone quality.

The Soundchaser Analog "control panel" provides some novel and musically useful control modes. Photo 4 shows the video presentation. The top part of the display provides access to two envelopes (E1 and E2) and single cycles of two repeating modulation patterns (L1 and L2). You can define or edit any of these contours by moving a cursor with a game paddle, a process that takes a steady hand. The latest software version has provision for editing by spotting end points of line segments, then computing the lines themselves. This editing method is more manageable than freehand drawing with the game paddle.

Below the contour display is a series of soft switches and sliders. They control aspects of pitch range: from left to right, whether or not E2 sweeps the oscillator, filter cutoff frequency, whether or not E2 sweeps the filter, filter resonance, overall time scale of E1 and E2, and overall time scale of L1 and L2. You move the software "knobs" with the game paddle, first bringing the cursor to the control, then pressing the game paddle button while turning the game paddle knob to move the software "knob" up and down. The process takes two hands, so you can't do it while you're playing the keyboard. However, it is a fairly natural and easy way to enter data. For people used to hard control panels, one drawback of this display is that you cannot change a control, then immediately hear what that change sounds like. You have to go back and forth from the panel-setting mode to the keyboard-playing mode, a process that requires typing a couple of alphanumeric commands.

The ability to draw control contours of any shape, then stretch or compress them with a few simple commands, is a facility that electronic musicians have long dreamed of. Each envelope and repeating waveform shape has its own sound. Of course, it takes a lot of experience to know what shape contours to draw in order to get the desired effect. However, once you get something you like, you can store it on disk. Soon you'll have a library of effects that you can draw on to add variety and interest to your music.

The Sequencer section of the Soundchaser Analog system allows you to record a short (128 notes or chords) keyboard performance, then play it back while simultaneously playing another tone color on the keyboard. This Sequencer is much more limited than the 4-Track Sequencer of the Soundchaser Digital system, which I described in the first half of the article. However, it has some potential use in providing simple effects during live performance or programmed instructions. Like the Digital system Sequencer, this one doesn't have editing facilities either; you get what you play.

Like the Digital system, the Analog system contains basic file-maintenance functions. File types are Preset (all data to define a tone color), Sequence (a keyboard performance), and Orchestra (a collection of four presets and four sequences). By recording presets and sequences in separate files, you can easily try different tone colors in a given keyboard performance, a facility that is absolutely impossible with audio tape recorders. You can save, delete, and load files for future use or editing.

Optional Software

The Musictutor is a collection of ear-training routines that combine the Soundchasers' (both Analog and Digital systems) accurate-pitch programming and production capabilities with easy-to-read displays in conventional music notation and plain English. The routines, which include interval and melody drill in several degrees of difficulty, plus performance evaluation and grading, seem well thought out. Music students and teachers alike should find Musictutor easy to use. I haven't been subjected to an ear-training class for some 35 years, but I can remember that my fellow students and I squirmed and sweated, one by one, as our bored teacher played intervals and scowled until we came up with the right answer. Contrasted with that less-than-pleasant memory is my experience with Musictutor. I picked one of the exercises at random and was sucked in. I managed to tear myself away after an hour of drill, during which time I found out where the tarnished edges of my golden ears were.

Notewriter transcribes the keyboard performance of a monophonic musical line into conventional musical notation—of sorts. The problem of transcribing music with all the conventions that musicians expect is difficult. Notewriter sets up the screen with staff lines and key signature, then produces a series of beeps for rhythmic reference. The notes appear as you play them but without refinements such as triplets, accents, and similar standard musical markings. The current version of Notewriter has provisions for editing which allow you to "clean up" the notation. Notewriter also has provision for transposing keys. The software package may find some use in its present form, but for most applications, musicians will find it easier to transcribe single musical lines by hand.

Conclusions

When a musician uses an instrument to make music, the interaction that takes place between the two is as intense and complex as in any man/machine system. When the instrument is a computer music system with some intelligence of its own, the criteria for efficient interaction are especially stringent. Computer music systems must continue to evolve in order for their developers to incorporate all of the refinements that will make them truly efficient and "friendly" tools for musicians. After all, the violin evolved over centuries and the acoustic piano took generations to reach its present musical excellence. We have no reason to believe that the ultimate computer music system, whether it costs $1000 or $50,000, is close at hand.

The Soundchasers are evolutionary systems. That is, they have been developed and introduced while computer musical instrument technology is still very young. While some of their features go far beyond those available from older technologies, other features will, we can assume, seem crude to musicians of the future. Thus, in summarizing the Soundchasers, my listing of shortcomings is intended more as a recommendation for further development than as criticism.

The Soundchaser Digital system, with its Mountain Computer Musicsystem digital oscillator, constitutes a musically useful polyphonic recording and performance system. The Musicsystem provides a wide variety of pleasing tone colors, while the system software provides adequate routines for specifying envelopes and frequency modulation waveforms. I would like to see more finely defined, faster envelopes and frequency modulation that affected all pitches equally. The Sequencer section is easy to use for four-part music but definitely needs provision for editing.

The Soundchaser Analog system uses voice cards that resemble "barebones" analog synthesizers. As audio-tone generators, they are not impressive. The software's strong points are the abilities to draw arbitrary envelopes and modulation waveforms, then use simple commands to stretch or compress these contours in time. The Sequencer section of the Analog system is less useful than that of the Soundchaser Digital system.

The music keyboard (used in both systems) is four octaves long and not touch-sensitive and incorporates no real-time "player" controls. It is adequate for experimental work and teaching but will limit musicians who are used to larger keyboards or who wish to impart expressive nuance to their music.

The Musictutor software package is a well-developed set of computer-aided ear-training routines. Notewriter is a monophonic transcribing routine that, in its present form, has limited usefulness and needs further development.

Written documentation is complete and adequate, if not top-notch. Several appendixes provide welcome background documentation on operating principles and software structure.■

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A Brief Introduction to Electronic Music Synthesizers

Robert A. Moog
Big Briar Inc.
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Most of today's popular music, as well as a growing amount of jazz, classical, and experimental music, owes its very existence to electronic technology. The electric guitar and bass, those war-horses of rock and roll, are vying with a dazzling array of new keyboard-controlled electronic musical instruments for the attention of today's music makers. Foremost among these new instruments is the electronic music synthesizer, an instrument that allows musicians to build and shape sounds from their component parts.

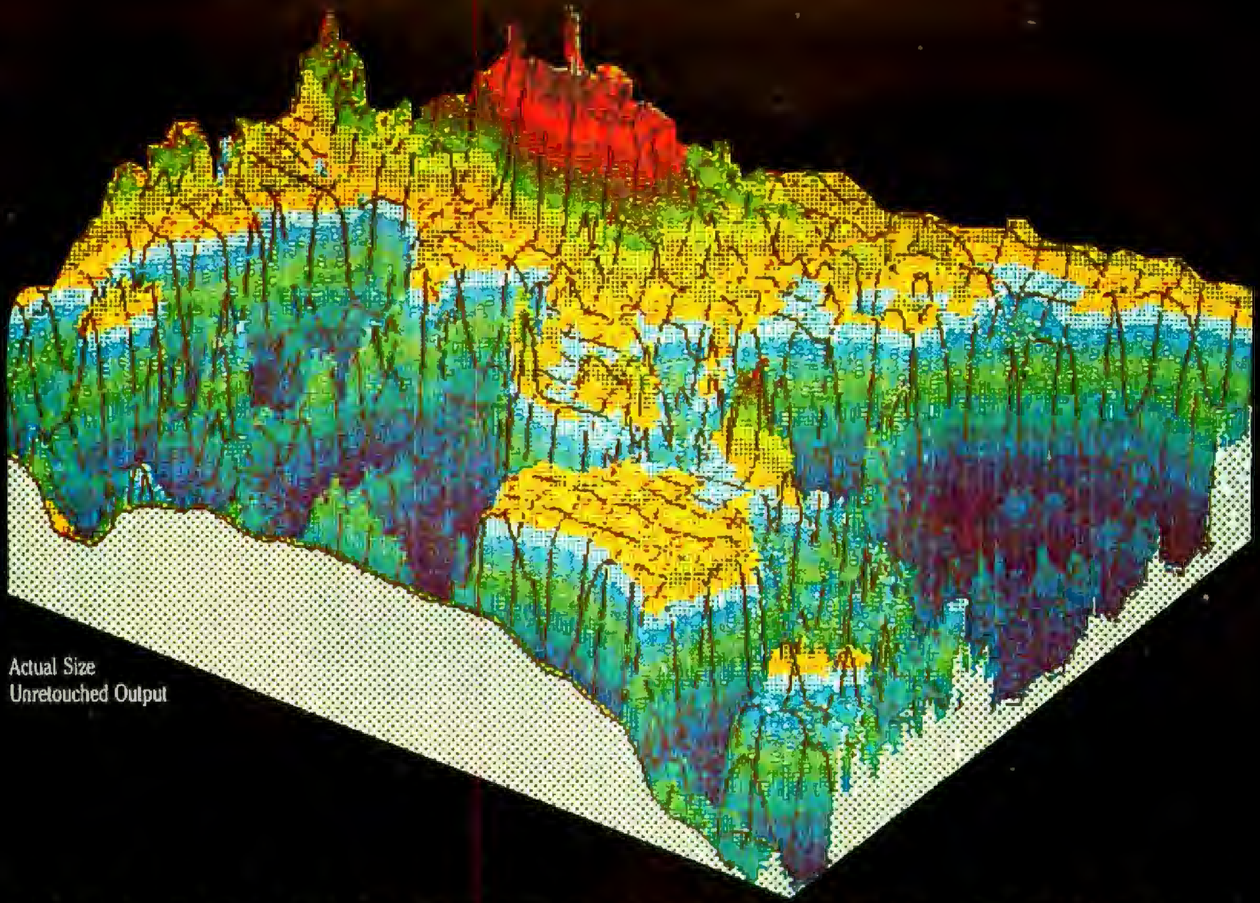
Synthesists deal with modules and patches (links), with interfaces and processors, with sequences, controls, and data paths. If these terms sound familiar, it is for a good reason: modern-day synthesizers are direct descendents of analog computers, those venerable monsters with vacuum-tube hearts and patch-cord brains that solved algebraic and differential equations with voltages instead of numbers. The analog computer scientist's function generators, adders, and multipliers have become the synthesist's tone oscillators, mixers, and voltage-controlled amplifiers. The vacuum tubes have yielded to complex integrated circuits, and the patch cords (short cables with plugs at both ends for making temporary connections) now live out their lives under stage lights instead of in the cool of the laboratory. Of course, digital computers have completely replaced their analog ancestors in science and industry. In the arts, however, and especially in music, the smoothly continuous signals and uniquely versatile hardware of analog computers live on.

In music, the smoothly continuous signals and uniquely versatile hardware of analog computers live on.

What Is a Synthesizer?

Analog synthesizers have existed as experimental curiosities for more than half a century and as commercial products since 1964. At present, hundreds of thousands are in existence, in sizes as small as a candy bar and almost as large as a mission control center. Most of these incorporate a set of basic features, just as most digital computers, from the hand-held to the mainframe, have a processor, memory, clock, and input and output ports. We can divide the innards of a typical analog synthesizer into "ranks" or "voices," each of which produces a single musical tone, like a trumpet or an organ pipe. Small synthesizers have 1 rank; larger instruments have upwards of 16.

The core of a synthesizer rank is the audio chain, a circuit block that generates and processes the tone itself. A typical audio chain, shown in the lower half of figure 1, consists of one to four oscillator-waveshapers, one or two filters, and an amplifier. Each oscillator produces a single repeating waveform, which is generally heard as a musical pitch. Having more than one oscillator per voice enables the musician to produce ensemble sounds, chords, and many other musically interesting effects. The waveform's frequency of repeti-



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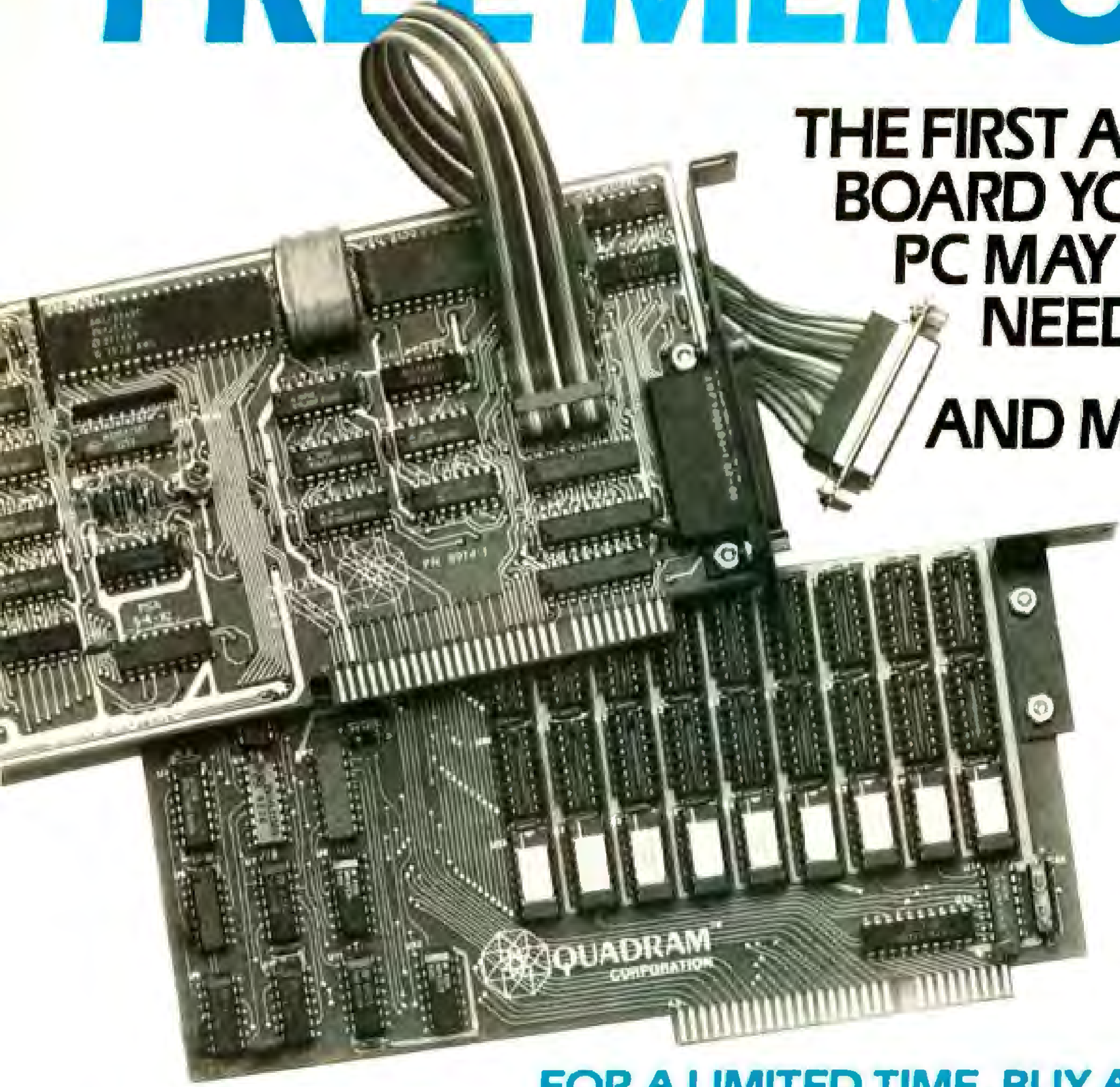

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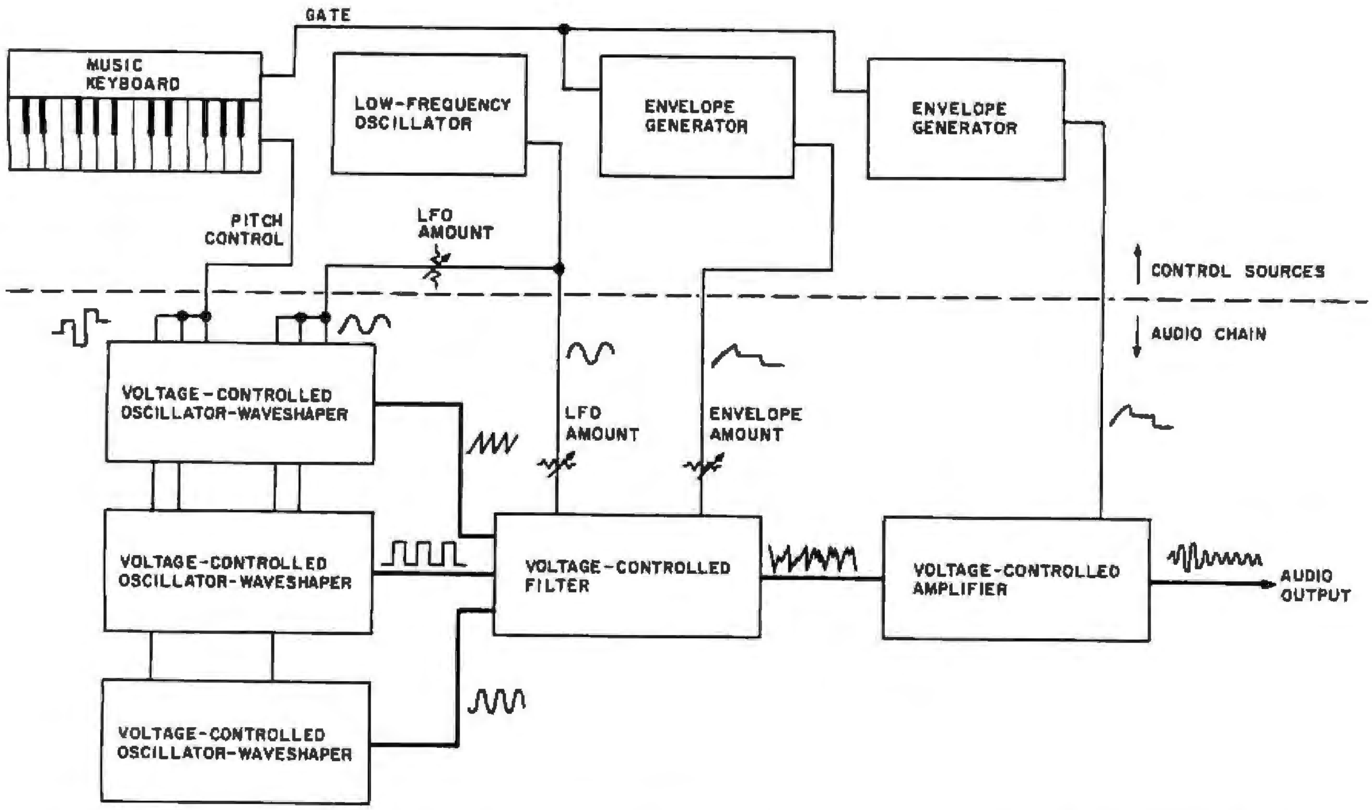

Figure 1: *Block diagram of a simple analog music synthesizer. The audio (sound-producing) section lies below the dotted line, while the control (shaping and articulating) section lies above the dotted line.*

tion is related to the perceived pitch: when the frequency doubles, the pitch goes up an octave. The shape of the wave determines the overtone content. A signal's overtones are a set of frequencies that are whole-number multiples of the wave's fundamental frequency (the frequency of repetition). We do not hear overtones as distinct pitches but rather as a coloration of the tone's perceived quality. The overtone content, or spectrum, of a signal is related to its waveshape by a mathematical algorithm called the Fourier transform.

The filter alters the oscillator waveform's shape so as to emphasize some overtones and reduce others. A filter is thus a spectrum shaper. Filtering is a powerful way of modifying a sound's tone color. Finally, the amplifier in the audio chain determines the final amplitude, or overall size, of the waveform and thus affects our perception of the sound's loudness.

Voltage Control

Oscillators, filters, and the amplifier in a synthesizer audio chain are generally voltage controlled. This means that their operating points may be changed by applying varying voltages to the circuits' control inputs. As examples, a series of voltage steps applied to an oscillator's frequency-control input will result in a series of abrupt frequency changes that we hear as a scale; a continuously varying voltage applied to the same control input will give a pitch glide. A control voltage applied to the filter's frequency-control input will move the filter's frequency response back and forth across the audio spectrum, varying the sound's overall brightness, while a control signal applied to the bandwidth input will change the shape of the filter's frequency response, making the sound more or less "vocal" or "nasal." Finally, signals applied to the amplifier's gain-control input will impart dynamic variations to the sound's overall loudness.

Control signals are never heard directly but instead impart motion and texture to the sounds that the audio chain produces. Control signals often influence a sound's tone color (timbre) more than the static properties (initial frequency, initial waveform, and initial amplitude) of the audio chain. This is because we hear changes in sound much more easily than we hear the average or steady properties of the sound.

Three of the most common sources of control signals are the music keyboard, which produces voltage steps; the generator of low-frequency periodic signals (called an LFO, or low-frequency oscillator), which imparts periodic variations such as vibrato; and the generator of transient signals (called an envelope generator or a contour generator), which provides overall shape to individual notes. The upper half of figure 1 shows a typical complement of control functions. The keyboard changes the oscillator's pitches and may also move the filter's cutoff frequency. The LFO varies either the oscillators or the filter to produce a wide variety of effects that musicians call by names such as vibrato, tremolo, trill, and growl. One of the envelope generators moves the filter frequency response to produce hornlike, plucked-string-like, or vocal ("wah-wah") effects, while the other opens and closes the amplifier

Photo 1: *W. Carlos's electronic music production studio in 1968. There Carlos produced the recording "Switched-on Bach." At right is the modular Moog synthesizer. At left is a multitrack recorder, which was used to record the music one line at a time. Below the synthesizer is a 10-input mixer designed and built by Carlos.*

to give the sound its overall loudness shape. Generally, the envelope generators are triggered each time a new key is depressed.

Synthesizer Programming

Academic and experimental composers first used synthesizers to explore new ways of making music electronically. In 1968 "Switched-on Bach," a fine recording of the music of J.S. Bach, performed by W. Carlos and B. Folkman, achieved widespread popularity. Carlos and Folkman used a modular Moog synthesizer (see photo 1) to produce all of the recording's sounds and assembled the music on a multitrack tape recorder, one line at a time. Since then, hundreds of synthesizer records have graced the shelves of record stores, and countless television and film scores, commercials, and dramatic presentations have been made by techniques that were pioneered by Carlos and her colleagues.

In Carlos's synthesizer, each circuit function is a separate modular piece of hardware. The musician connects the modules together with audio patch cords and then adjusts the panel controls for the desired operating points (tone color). Synthesists call this process *programming*. It is differentiated from *performing*, which is actually producing a succession of sounds by playing a music keyboard or similar device. Programming is a problem for many musicians because it takes so long. Worse than that, modular analog synthesizers have no practical way of storing and recalling programs, so a musically interesting, complex tone color or sound pattern may be difficult if not impossible to recreate exactly. Because of these limitations, conventional modular synthesizers are generally not suitable for live performance. Studio musicians who work with tape recorders can afford to spend time getting the right tone colors, but musicians who perform before an audience must have immediate access to their sound palettes.

To meet the needs of live performers, "compact performance synthesizers," featuring quick, accurate access to sound parameters, were introduced in the early 1970s. They were *monophonic* (capable of producing only one or, at most, two notes at a time). Some of the instruments had presets, like vending machines for sounds, while others

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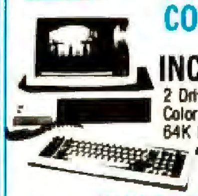

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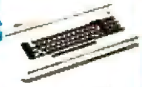

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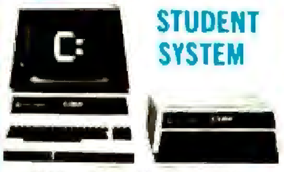

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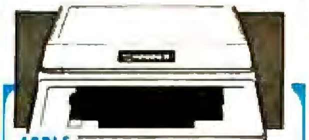

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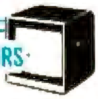

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reduced the functions of modular instruments to the bare essentials, then replaced patch cords with fast-acting switches.

The biggest programming breakthrough came when microcomputers were built into performance synthesizers. In many late-model synthesizers, microcomputers scan the control panel to store the control setting as digital information for instant, accurate recall, scan the music keyboard to find out what keys the musician is holding down, and assign the pitch values of these keys to the instrument's ranks. In one stroke, the microprocessor-controlled synthesizer thus solved two big equipment problems: (1) rapid access to a wide variety of user-defined tone colors and (2) how to "play" a limited number of voices from a music keyboard with several dozen keys. Today, the microprocessor-controlled *polyphonic* (chord-playing) synthesizers with analog voice circuitry dominate the more expensive end of the electronic keyboard instrument market. They have 4 to 16 analog voices, 1 or 2 keyboards, and a panel full of committed, "hard" controls and switches. They sell at prices from 2 to 70 "kilobucks." Most musicians agree that they sound very good.

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Electronic musical instrument designers are currently embroiled in a debate over whether digital or analog audio circuitry is more "musical." The current widespread popularity of electronic keyboard instruments is due in no small degree to the simple fact that, during the past few decades, we engineers have learned how to make some really fine-sounding analog audio circuitry. Can a digitally generated waveform, consisting of smoothed-out discrete steps, compete for the musician's ears with a continuously generated waveform from an analog circuit? The answer, of course, is yes, if the steps are small enough. We are talking about the steps not only in the audio waveform itself but also in the values of the control parameters that define the musical qualities of the waveform. For instance, a gliding pitch (called *portamento* by musicians) produced by a conventional analog synthesizer is stepless. One does not hear abrupt steps in pitch because there are none. In a tone produced by a *digital* oscillator or programmable counter, on the other hand, pitch glides are produced by periodically updating the number that specifies the frequency. If these frequency changes are too great, or if the time interval between them is too long, then we hear steps. If, however, the time between updates is very short, then the glide will sound smooth. In between, we may not actually hear discrete pitch changes, but the sound may have a roughness or muddiness that we barely perceive. Acousticians and musical instrument designers don't really know how rapidly parameters have to change or how fine the change has to be in order for it to be perceived as truly continuous. For this reason, both approaches have their loyal followers. At today's state of the art, both may easily be put under computer control.■

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The 8051 single-chip microcomputer, and its other versions in the MCS-51 family, is a recent development of the Intel Corporation (see figure 1). It is a complete 8-bit computer fabricated on a single silicon die. Intel claims that the MCS-51 family "is the highest performance microcomputer family in the world and outperforms all microprocessors and microcomputers in control-oriented applications." It achieves a tenfold function/speed improvement over its predecessor, Intel's 8048, by packing 60,000 transistors onto a silicon die about 230 mils square.

The 8051 is designed for applications in the high end of the single-device computer market. It is intended for use in sophisticated real-time instrumentation, industrial controls, and intelligent computer peripheral devices.

The 8051 packs 60,000 transistors on a single silicon die for enhanced performance.

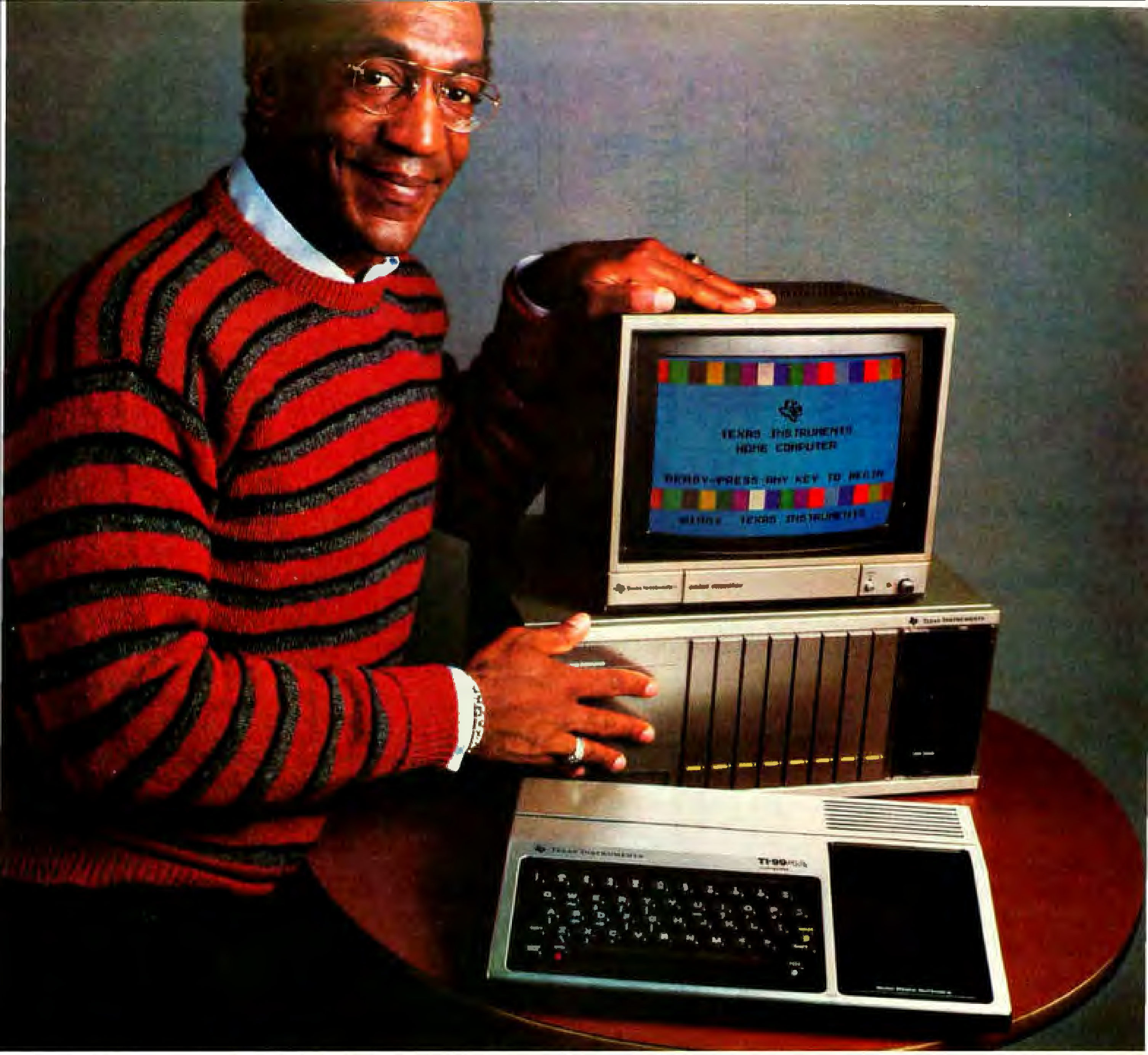
Three versions of this microcomputer exist (collectively, this is the MCS-51 family):

- The 8031 has no on-chip program memory. It can address 64K bytes of external program memory, in addition to 64K bytes of external data memory.
- The 8051 has its lower 4K bytes of program memory filled with on-chip mask-programmable ROM (read-only memory).
- The 8751 has those 4K bytes occupied by EPROM (erasable programmable read-only memory).

Each version can be expanded to 64K bytes of program memory, and/or 64K bytes of data memory, using standard memories and byte-oriented peripheral devices. All three have 128 bytes of internal on-chip data memory and 128 bytes assigned as SFRs (special-function registers), some of which are reserved for future assignment; effectively, there are 256 bytes of internal data memory.

In this article, we shall first broadly describe the unique hardware and software features of the 8051 that make it such a powerful device and

This article is based on the book The 8051: Programming, Interfacing, and Applications. 81 Hands-On Experiments with Intel's SDK-51 *by Howard Boyet and Ron Katz, MTI Publications (14 East 8th St., New York, NY 10003, [212] 473-4947), 1982, 396 pages, $19.95.*
Mr. Katz's work relative to this article was not sponsored by Bell Telephone Laboratories.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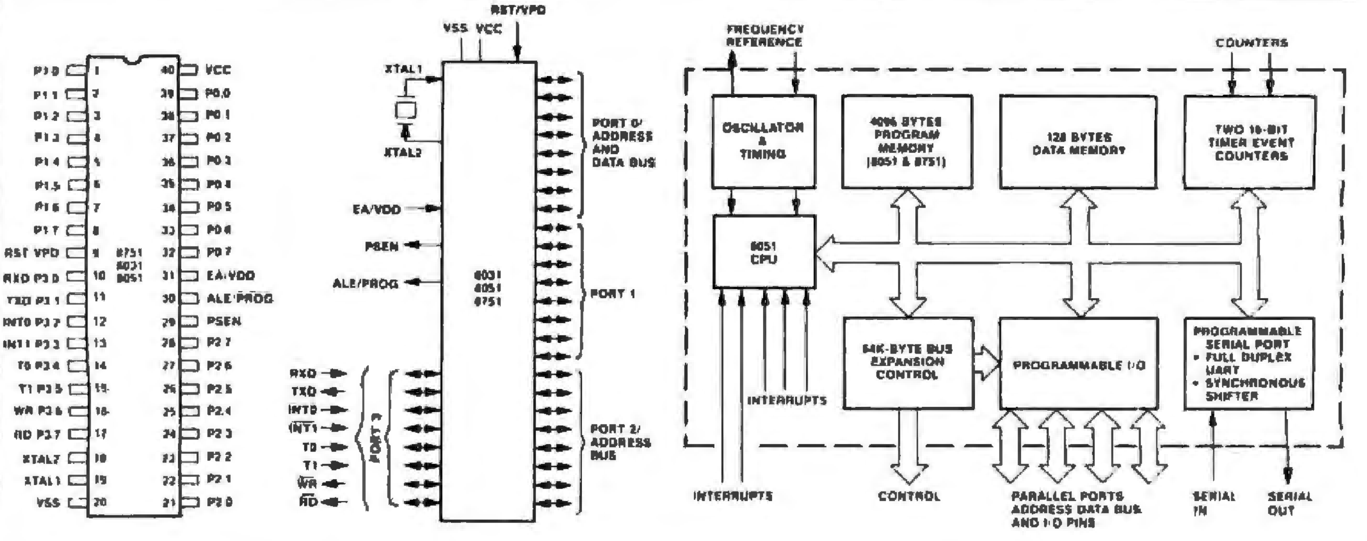


8051 Family Pin Description

V_{SS}
Circuit ground potential.

V_{CC}
+5V power supply during operation, programming and verification.

PORT 0
Port 0 is an 8-bit open drain bidirectional I/O port. It is also the multiplexed low-order address and data bus when using external memory. It is used for data input and output during programming and verification. Port 0 can sink/source two TTL loads.

PORT 1
Port 1 is an 8-bit quasi-bidirectional I/O port. It is used for the low-order address byte during programming and verification. Port 1 can sink/source one TTL load.

PORT 2
Port 2 is an 8-bit quasi-bidirectional I/O port. It also emits the high-order address byte when accessing external memory. It is used for the high-order address and the control signals during programming and verification. Port 2 can sink/source one TTL load.

PORT 3
Port 3 is an 8-bit quasi-bidirectional I/O port. It also contains the interrupt, timer, serial port and $\overline{RD}$ and $\overline{WR}$ pins that are used by various options. The output latch corresponding to a secondary function must be programmed to a one (1) for that function to operate. Port 3 can sink/source one TTL load. The secondary functions are assigned to the pins of Port 3, as follows:
—FXD/data (P3.0). Serial port's receiver data input (asynchronous) or data input/output (synchronous).
—TXD/clock (P3.1). Serial port's transmitter data output (asynchronous) or clock output (synchronous).
—$\overline{INT0}$ (P3.2). Interrupt 0 input or gate control input for counter 0.
—$\overline{INT1}$ (P3.3). Interrupt 1 input or gate control input for counter 1.
—T0 (P3.4). Input to counter 0.
—T1 (P3.5). Input to counter 1.
—$\overline{WR}$ (P3.6). The write control signal latches the data byte from Port 0 into the External Data Memory.
—$\overline{RD}$ (P3.7). The read control signal enables External Data Memory to Port 0.

RST/V_{PD}
A low to high transition on this pin (at approximately 3V) resets the 8051. If V_{PD} is held within its spec (approximately +5V), while V_{CC} drops below spec, V_{PD} will provide standby power to the RAM. When V_{PD} is low, the RAM's current is drawn from V_{CC}. A small internal resistor permits power-on reset using only a capacitor connected to V_{CC}.

ALE/ $\overline{PROG}$
Provides Address Latch Enable output used for latching the address into external memory during normal operation. Receives the program pulse input during EPROM programming.

$\overline{PSEN}$
The Program Store Enable output is a control signal that enables the external Program Memory to the bus during normal fetch operations.

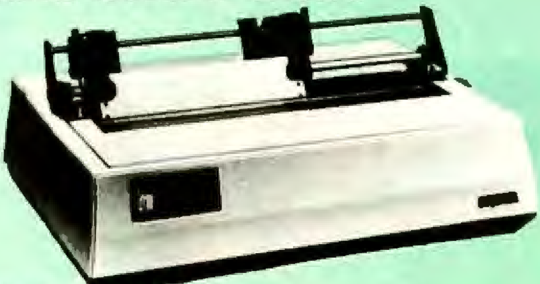
$\overline{EA}$ /VDD
When held at a TTL high level, the 8051 executes instructions from the internal ROM/EPROM when the PC is less than 4096. When held at a TTL low level, the 8051 fetches all instructions from external Program Memory. The pin also receives the 21V EPROM programming supply voltage.

XTAL1
Input to the oscillator's high gain amplifier. A crystal or external source can be used.

XTAL2
Output from the oscillator's amplifier. Required when a crystal is used.

Figure 1: *Physical aspects of the Intel 8051. These three drawings show the pin description, the logic symbol, and the block diagram. (This figure is reproduced by permission of Intel Corporation from reference 3.)*

Microline 83A



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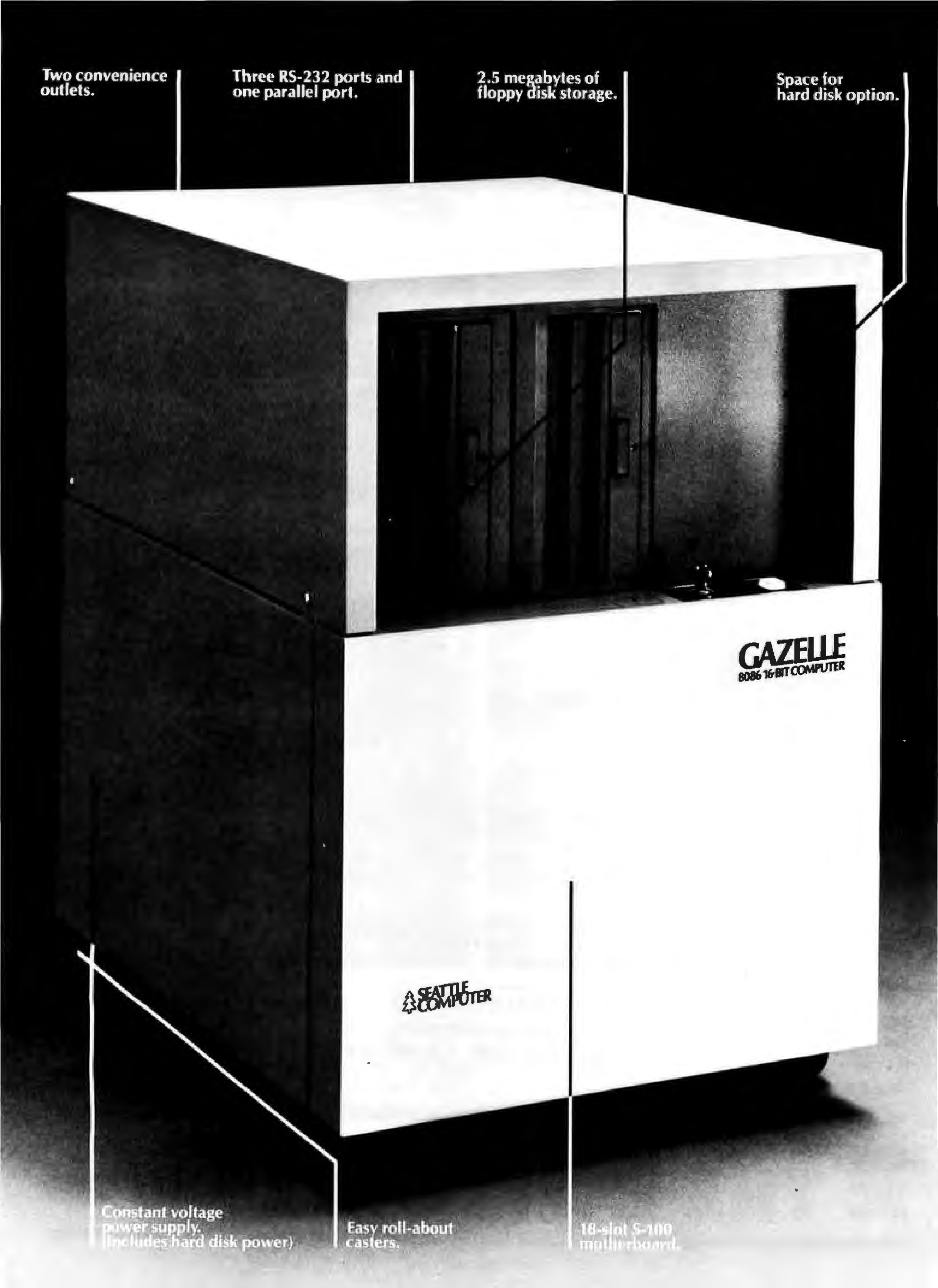
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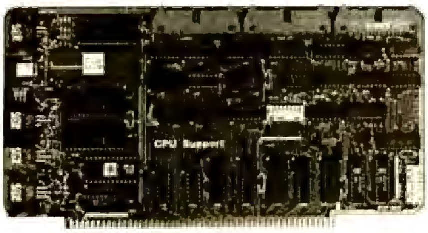

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set it apart from other 8-bit byte-oriented microprocessors. We shall then illustrate some of these features with specific examples of 8051 use in which small but concrete programs are given. (Please note that the term 8051 as used here refers to all three members of the MCS-51 family, except where specific differentiation must be made based on memory differences. The instruction sets are identical for all the members.)

Features of the 8051

The 8051 contains:

- 256 bytes of RAM (random-access read/write memory), including the 128 8-bit special-function registers
- 4K bytes of EPROM (8751) or ROM (8051)
- a central processing unit
- four programmable I/O (input/output) ports (32 I/O lines total)
- two 16-bit timer/event counters
- a serial I/O port with serial control (full duplex, UART [universal asynchronous receiver/transmitter], and synchronous shifter)
- internal oscillator and timing circuitry
- five interrupt lines (two from external sources and three from internal ones: the internal interrupts emanate from internal timer 0, timer 1, and the internal serial I/O port), each with a two-level priority capability
- four banks of registers (eight registers per bank)

One of the four I/O ports mentioned above (P3) is comprised of the following eight pins:

- RXD (the serial port's asynchronous receiver-data input or synchronous data input/output)
- TXD (serial port's asynchronous transmitter-data output or synchronous clock output)
- INT0 (interrupt 0 input or gate-control input for timer/counter 0)
- INT1 (interrupt 1 input or gate-control input for timer/counter 1)
- T0 and T1 (test or event counter inputs to timer/counters 0 and 1)
- $\overline{WR}$ (write-control signal that latches a data byte from port 0 into the external data memory)
- $\overline{RD}$ (read-control signal that enables external data memory to port 0)

It should be mentioned that RXD and TXD are not only involved in UART, multiprocessor communications, and bus protocol, but can also be used to implement I/O port expansion.

The MCS-51 instruction set can be divided as follows: 55 percent are 1-byte instructions, 36 percent are 2-byte, and 9 percent are 3-byte; 58 percent of the instructions execute in 1 microsecond (μs), 40 percent in 2 μs, and 2 percent in 4 μs (with a 12-megahertz [MHz] clock). The 4-μs execution times are associated with the 8051's multiply and divide instructions. Direct memory-to-memory transfer instructions are within the 256 bytes of on-chip memory. Because of the memory-mapped nature of these transfer instructions, a register's contents can be moved directly to one of the four I/O ports or vice versa. This stems from the fact that each of the four ports is itself an SFR with an on-chip address. The bit-addressing feature allows a bit on any 8051 I/O pin to be moved to any other I/O pin via the "Boolean accumulator" (the carry bit). I/O pins have individual addresses; in fact, any addressable bit in on-chip RAM can be moved to an I/O pin or vice versa. Of course, every one of the 210 addressable bits can be tested. Decisions (e.g., conditional jumps) can then be made on the basis of their status. The contents of any of the 256 locations in on-chip memory can be pushed onto the stack and then popped back. The 8051 also features fast (4-μs) multiply and divide instructions that use 8-bit operands.

One of the unique features of the 8051 is its Boolean (bit) processing capability. It is both a Boolean (bit) and byte processor. As a bit processor, the bit accumulator is the carry bit. Examples of bit-manipulation instructions are: CLR C; CLR bit

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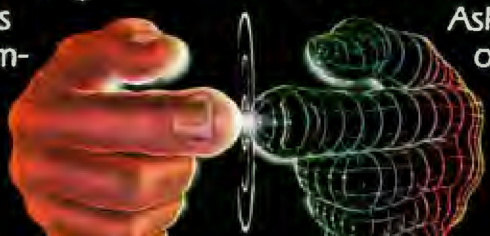

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addr; SETB C; SETB bit addr; CPL C; CPL bit addr; ANL C, bit addr; ANL C,/bit addr; ORL C, bit addr; ORL C,/bit addr; MOV bit addr, C; MOV C, bit addr; JB bit addr, code addr; and JNB bit addr, code addr.

By way of explanation, CLR clears the carry bit or the bit at a bit address; SETB sets those bits; CPL complements those bits; ANL performs the Boolean logic AND on the carry bit and the bit in the designated address (or with the complement of the bit if /bit addr is used) and leaves the resulting bit in the carry bit; ORL does the same with respect to the Boolean logic OR operation; the bit-oriented MOV instructions move the bit in the designated address (it can be an I/O pin) into the carry bit or vice versa; and the JB and JNB instructions are powerful features allowing a conditional jump (decision) to be made based on whether the bit (again, it can be one of 32 I/O pins or any addressable bit in on-chip RAM or SFRs) is a 1 (JB) or a 0 (JNB). The jump is made to the address in the program specified by "code addr" appended in the instruction. These bit-oriented instructions are, in part, responsible for the unique power of the 8051 as a microcontroller.

The number of bit addresses in the 8051 totals 210, including the 32 bit-addressable I/O pins at ports P0, P1, P2, P3, and the bits in 7 other of the 20 SFRs (each 8 bits wide). Sixteen on-chip memory locations, other than the SFRs and the 32 registers in the four banks, are also bit-addressable and thus account for 128 of the 210 bit addresses (the 11 bit-addressable SFRs make up the rest).

You can appreciate that the Boolean-processing capabilities, with the ability to manipulate and control addressable bits, make the 8051 ideal for controlling items such as contacts, indicators, motors, and digital-type on-off I/O devices in all sorts of controller applications, as well as for realization of Boolean output versus input-transfer functions (Boolean combinatorial-logic problems). Thus, contact, relay, switch, TTL (transistor-transistor logic) gate, and other hardware implementations of many combinatorial-logic-type applications (switching and relay systems, etc.) can now be realized simply and efficiently with the 8051 microcontroller, including all the well-known advantages that a software "black box" can have relative to its hardware-filled counterpart.

It should be noted that the 8051 is also possessed with powerful arithmetic capability, stemming in part from its fast multiply and divide instructions. This is a definite asset and advantage over many other processors in signal-processing and real-time applications (e.g., as a digital filter).

The computational and numerical needs of a controller also require strong arithmetic capabilities to help achieve that control. The 8051, therefore, excels both as a "bit-banger" and as a byte-oriented "number-cruncher."

A word now about the special-function registers (sometimes designated by Intel as the hardware/peripheral registers). Twenty of them are located in on-chip RAM. All of them are byte-addressable; 11 are, in addition, bit-addressable. Those 11 are P0 (port 0), P1 (port 1), P2 (port 2), P3 (port 3) (eight I/O lines per port), TCON (timer-control register), SCON (serial-port control register), IE (interrupt-enable control register), IP (interrupt-priority control register), PSW (program status word), ACC (accumulator with a direct address), and B (B register). Register B is a special register used together with ACC in multiply and divide instructions. The remaining byte-addressable SFRs are SP (stack pointer), DPL and DPH (data pointer—low, high bytes), TMOD (timer mode register), TL0 (timer 0 low byte), TL1 (timer 1 low byte), TH0 (timer 0 high byte), TH1 (timer 1 high byte), and SBUF (serial port data buffer).

A working knowledge of the SFRs, in addition to the 8051's instruction set and the structure of its on-chip memory, is essential to mastering the 8051. For a more extensive treatment of the SFRs, refer to our book and the references at the end of this article.

Here are some examples of the SFRs: port 3 is at hexadecimal address

0B0. The eight pins of port 3 on the 8051 are mapped onto the 8 bits of this SFR so that bit 0 of address 0B0 is RXD, bit 1 (address 0B1) is TXD, bit 2 (address 0B2) is INT0, bit 3 (address 0B3) is INT1, bit 4 (address 0B4) is T0 (timer/counter 0 external flag), bit 5 (address 0B5) is T1 (timer/counter 1 external flag), bit 6 (address 0B6) is $\overline{WR}$ (write data to external data memory), and bit 7 (address 0B7) is $\overline{RD}$ (read data from external data memory). These bits are also referred to as P3.0 (bit 0), P3.1 (bit 1), . . . P3.7 (bit 7).

Note that pins T0, T1, INT0, and INT1, having bit addresses, can be treated as four ordinary input pins that can be tested and decisions made accordingly. In the case of INT1 and INT0, the interrupt system must be disabled. The organization of some important SFRs and the definitions of their bits are shown in table 1, reproduced from the Intel 8051 literature by permission of the Intel Corporation. A careful study of that material should give you a good feeling for the role of the SFRs in working with the 8051 and how they can be manipulated for your desired ends. All but one (TMOD) of the seven SFRs detailed in table 1 are bit-addressable, as well as byte-addressable.

Setting or clearing certain individual SFR bits by software will achieve many user requirements (programmable) for the control application:

- setting or clearing RS1 or RS0 (PSW.4 or PSW.3 in the program status word register) will specify one of the four register banks to be worked with
- setting or clearing $C/\overline{T}$ in TMOD specifies timer or counter mode of operation for the timer/counter
- setting or clearing the M1 or M0 bits in TMOD specifies the type of timer/counter (8-bit, 16-bit, auto reload, 5-bit prescalar, etc.)
- setting or clearing the GATE bit in TMOD serves to determine whether or not gating is used with the timer/counter
- setting or clearing the TR1 or TR0 bits in TCON determines whether

SFR	Description	Hexadecimal Byte Address	Hexadecimal Bit Addresses
PORT 3	Eight I/O lines	0B0	0B0 through 0B7
PSW	Program status word	0D0	0D0 through 0D7 (0D1 reserved)
TCON	Timer/counter control	88	88 through 8F
SCON	Serial-port control	98	98 through 9F
IE	Interrupt-enable control	0A8	0A8 through 0AF (2 bits reserved)
IP	Interrupt-priority control	0B8	0B8 through 0BC (3 bits reserved)
TMOD	Timer/counter mode control	89	——

(MSB)							(LSB)
RD	WR	T1	T0	INT1	INT0	TXD	RXD

Symbol	Position	Name and Significance
RD	P3.7	Read data control output. Active low pulse generated by hardware when external data memory is read.
WR	P3.6	Write data control output. Active low pulse generated by hardware when external data memory is written
T1	P3.5	Timer/counter 1 external input or test pin.
T0	P3.4	Timer/counter 0 external input or test pin
INT1	P3.3	Interrupt 1 input pin. Low-level or falling-edge triggered
INT0	P3.2	Interrupt 0 input pin. Low-level or falling-edge triggered
TXD	P3.1	Transmit Data pin for serial port in UART mode. Clock output in shift register mode
RXD	P3.0	Receive Data pin for serial port in UART mode. Data I/O pin in shift register mode

P3—Alternate Special Functions of Port 3

(MSB)							(LSB)
CY	AC	F0	RS1	RS0	OV	—	P

Symbol	Position	Name and Significance
CY	PSW 7	Carry flag. Set/cleared by hardware or software during certain arithmetic and logical instructions.
AC	PSW 6	Auxiliary Carry flag. Set/cleared by hardware during addition or subtraction instructions to indicate carry or borrow out of bit 3.
F0	PSW 5	Flag 0. Set/cleared/tested by software as a user-defined status flag.
RS1	PSW 4	Register bank Select control bits 1 & 0. Set/cleared by software to determine working register bank (see Note)
RS0	PSW 3	
OV	PSW 2	Overflow flag. Set/cleared by hardware during arithmetic instructions to indicate overflow conditions
	PSW 1	(reserved)
P	PSW 0	Parity flag. Set/cleared by hardware each instruction cycle to indicate an odd/even number of "one" bits in the accumulator, i.e., even parity.

Note— the contents of (RS1, RS0) enable the working register banks as follows:

(0,0)	Bank 0	(00H-07H)
(0,1)	Bank 1	(08H-0FH)
(1,0)	Bank 2	(10H-17H)
(1,1)	Bank 3	(18H-1FH)

PSW—Program Status Word Organization

(MSB)							(LSB)
GATE	C/T	M1	M0	GATE	C/T	M1	M0
TIMER 1				TIMER 0			

GATE	Gating control. When set, Timer/counter "x" is enabled only while "INTx" pin is high and "TRx" control bit is set. When cleared, timer/counter is enabled whenever "TRx" control bit is set.
C/T	Timer or Counter Selector. Cleared for Timer operation (input from internal system clock). Set for Counter operation (input from "Tx" input pin)

M1	M0	Operating Mode
0	0	MCS-48 Timer "TLx" serves as five-bit prescaler
0	1	16-bit timer/counter. "THx" and "TLx" are cascaded; there is no prescaler
1	0	8-bit auto-reload timer/counter. "THx" holds a value which is to be reloaded into "TLx" each time it overflows
1	1	(Timer 0) TL0 is an eight-bit timer/counter controlled by the standard Timer 0 control bits. TH0 is an eight-bit timer only controlled by Timer 1 control bits
1	1	(Timer 1) Timer/counter 1 stopped

TMOD—Timer/Counter Mode Register

Table 1: *Descriptions of some SFRs (special-function registers) in the 8051. (This table is reproduced by permission of Intel Corporation from reference 3.)*

Table 1 continued on page 301

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Table 1 continued:

(MSB)							(LSB)
TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0

Symbol	Position	Name and Significance
TF1	TCON 7	Timer 1 overflow Flag. Set by hardware on timer/counter overflow. Cleared when interrupt processed.
TR1	TCON 6	Timer 1 Run control bit. Set/cleared by software to turn timer/counter on/off.
TF0	TCON 5	Timer 0 overflow Flag. Set by hardware on timer/counter overflow. Cleared when interrupt processed.
TR0	TCON 4	Timer 0 Run control bit. Set/cleared by software to turn timer/counter on/off.
IE1	TCON 3	Interrupt 1 Edge flag. Set by hardware when external interrupt edge detected. Cleared when interrupt processed.
IT1	TCON 2	Interrupt 1 Type control bit. Set/cleared by software to specify falling edge/low level triggered external interrupts.
IE0	TCON 1	Interrupt 0 Edge flag. Set by hardware when external interrupt edge detected. Cleared when interrupt processed.
IT0	TCON 0	Interrupt 0 Type control bit. Set/cleared by software to specify falling edge/low level triggered external interrupts.

TCON—Timer/Counter Control/Status Register

(MSB)							(LSB)
SM0	SM1	SM2	REN	TB8	RB8	TI	RI

Symbol	Position	Name and Significance
SM0	SCON 7	Serial port Mode control bit 0. Set/cleared by software (see note).
SM1	SCON 6	Serial port Mode control bit 1. Set/cleared by software (see note).
SM2	SCON 5	Serial port Mode control bit 2. Set by software to disable reception of frames for which bit 8 is zero.
REN	SCON 4	Receiver Enable control bit. Set/cleared by software to enable/disable serial data reception.
TB8	SCON 3	Transmit Bit 8. Set/cleared by hardware to determine state of ninth data bit transmitted in 9-bit UART mode.
RB8	SCON 2	Receive Bit 8. Set/cleared by hardware to indicate state of ninth data bit received.
TI	SCON 1	Transmit Interrupt flag. Set by hardware when byte transmitted. Cleared by software after servicing.
RI	SCON 0	Received Interrupt flag. Set by hardware when byte received. Cleared by software after servicing.

Note-- the state of (SM0,SM1) selects:
(0,0) Shift register I/O expansion
(0,1) 8 bit UART, variable data rate
(1,0) 9 bit UART, fixed data rate
(1,1) 9 bit UART, variable data rate

SCON—Serial Port Control/Status Register

(MSB)							(LSB)
EA	—	—	ES	ET1	EX1	ET0	EX0

Symbol	Position	Name and Significance
EA	IE.7	Enable All control bit. Cleared by software to disable all interrupts, independent of the state of IE.4-IE.0.
—	IE.6	(reserved)
—	IE.5	(reserved)
ES	IE.4	Enable Serial port control bit. Set/cleared by software to enable/disable interrupts from TI or RI flags.
ET1	IE.3	Enable Timer 1 control bit. Set/cleared by software to enable/disable interrupts from timer/counter 1.
EX1	IE.2	Enable External interrupt 1 control bit. Set/cleared by software to enable/disable interrupts from INT1.
ET0	IE.1	Enable Timer 0 control bit. Set/cleared by software to enable/disable interrupts from timer/counter 0.
EX0	IE.0	Enable External interrupt 0 control bit. Set/cleared by software to enable/disable interrupts from INT0.

IE—Interrupt Enable Register

(MSB)							(LSB)
—	—	—	PS	PT1	PX1	PT0	PX0

Symbol	Position	Name and Significance
—	IP.7	(reserved)
—	IP.6	(reserved)
—	IP.5	(reserved)
PS	IP.4	Serial port Priority control bit. Set/cleared by software to specify high/low priority interrupts for Serial port.
PT1	IP.3	Timer 1 Priority control bit. Set/cleared by software to specify high/low priority interrupts for timer/counter 1.
PX1	IP.2	External interrupt 1 Priority control bit. Set/cleared by software to specify high/low priority interrupts for INT1.
PT0	IP.1	Timer 0 Priority control bit. Set/cleared by software to specify high/low priority interrupts for timer/counter 0.
PX0	IP.0	External interrupt 0 Priority control bit. Set/cleared by software to specify high/low priority interrupts for INT0.

IP—Interrupt Priority Control Register

timer/counters 1 and 0 are on or off

- *setting* or clearing the IT1 or IT0 bits in TCON specifies whether the external interrupt INT1 or INT0 will be of the falling-edge or low-level-triggered type
- setting or clearing the SM0 or SM1 bits in SCON selects the mode of the serial port (to implement port expansion or choice of 8- or 9-bit UART communication, fixed or variable data rate)
- setting or clearing the EX1 or EX0 bits in the IE register enables or disables interrupts from INT1 or INT0 sources
- setting or clearing the ET1, ET0, or ES bits in IE enables or disables interrupts from timer/counters 1 or 0, or from the serial port (when the latter's buffer has transmitted or received a byte)
- setting or clearing bits 0 through 5 in the IP register specifies high or low priority of interrupts from INT0, timer/counter 0, INT1, timer/counter 1, and serial port

and so on.

Some of the bits in the SFRs are set or cleared by hardware:

- the overflow flag (OV, PSW.2, bit address 0D2) is set or cleared by hardware to indicate the presence or absence of an arithmetic overflow condition
- the P (parity flag) bit 0D0 in PSW (PSW.0) is set or cleared by hardware to indicate an odd or even number of 1 bits in ACC
- TF1 (TCON.7) is set by hardware on timer/counter 1 overflow—it is cleared when that timer 1 interrupt is processed (hence, TF1 is the timer 1 interrupt flag)
- RI (SCON.0) is set by hardware when a byte is received into SBUF at the serial port—it is cleared by software after servicing
- TI (SCON.1) is set by hardware when a byte is transmitted out of SBUF—it is cleared by software after servicing (RI and TI are thus the received and transmit interrupt flags)

As hardware flags, they can be polled easily, as they have bit addresses in most cases, and thereby reveal the status of, for example, SBUF (serial port data buffer—byte received or transmitted), parity, overflow, carry, timer interrupts (made or not), type of interrupt detected (edge or level), etc. All told, you can see that the SFRs and their bit-addressing feature provide a great deal of potential and power to the user.

Working with the 8051

We shall now present several concrete examples that illustrate working with the 8051 and at the same time show just a few of the applications for which it is ideally suited. Naturally, we cannot go very far here in this endeavor. The reader is referred to our book cited at the outset and to the references given at the end of the article. These publications give an in-depth treatment and study of many programming and interfacing applications with the 8051. Because of space, we will choose examples with rather short and succinct programs. (All mnemonics are copyright 1979 and 1981 by the Intel Corporation.)

Using the Boolean Accumulator

We first demonstrate pin-to-pin mapping (bit transfer). Consider port 1 (SFR 90): its eight I/O lines have hexadecimal addresses 90 through 97. Suppose, for example, we wish to have the bit state at pin 97 appear also at pin 90. With the 8051, whenever a pin is to be read, a 1 must first be sent to that pin before reading its state. Thus, we use the following program steps:

```
SETB 97
MOV C, 97
MOV 90, C
```

The first line writes a 1 to bit 97, which can now be read. The second line reads the value into the carry bit, and the third line transfers the value from the carry bit to bit 90 (bit 0 of SFR 90, i.e., bit 0 of port 1).

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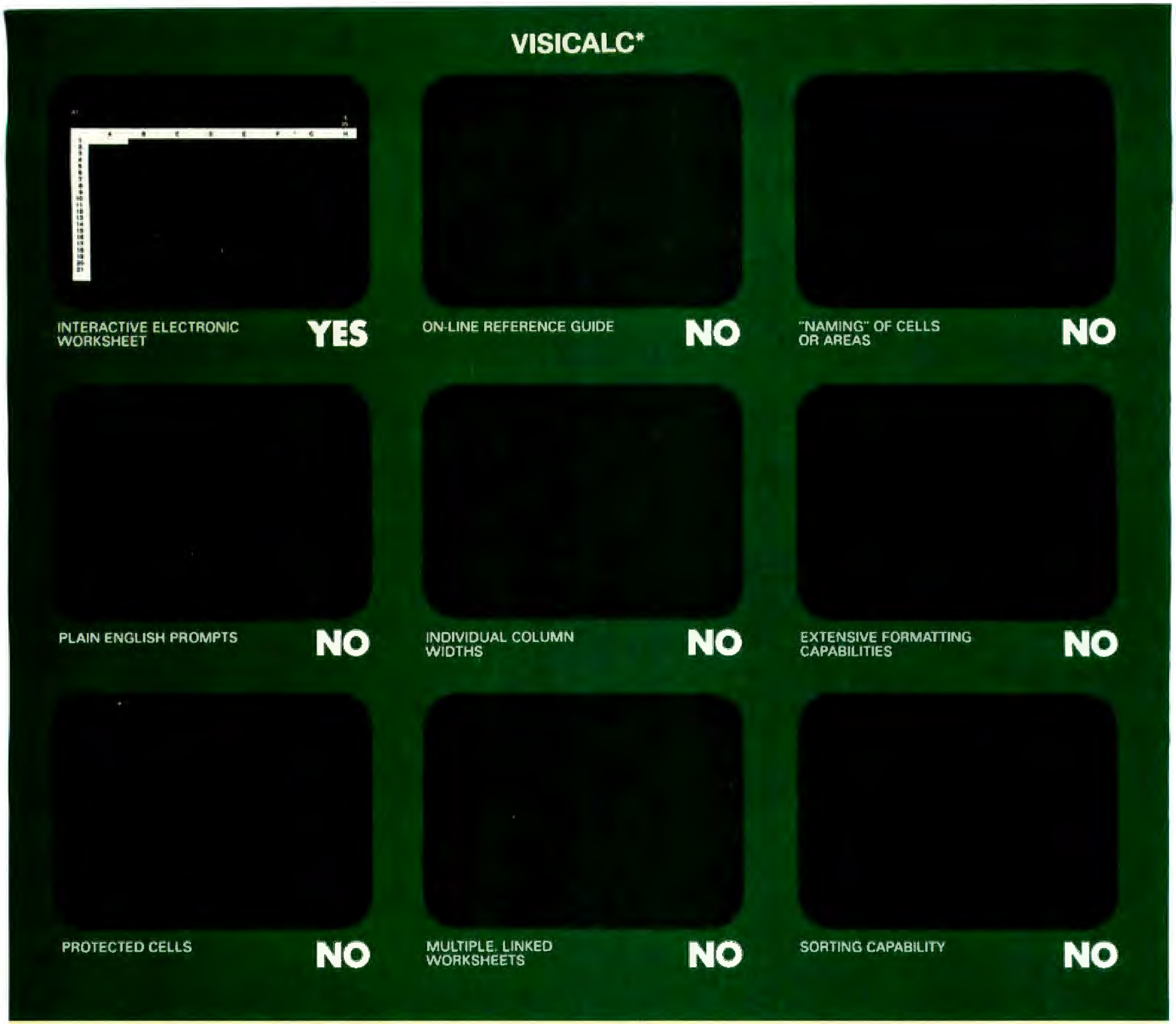

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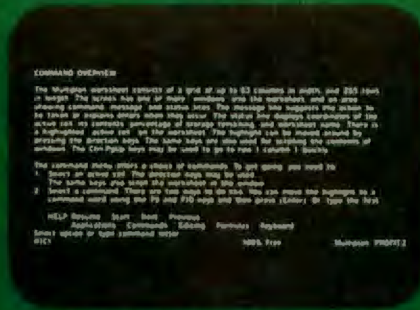

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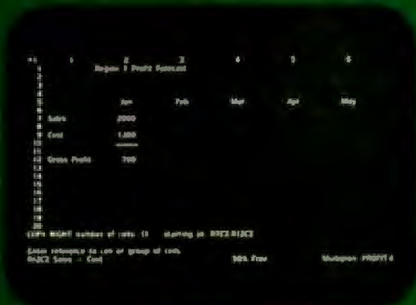

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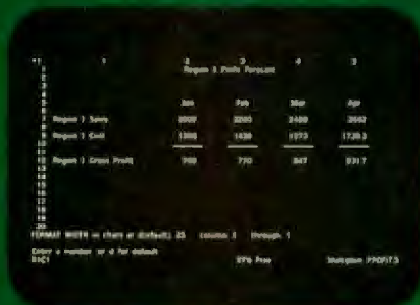

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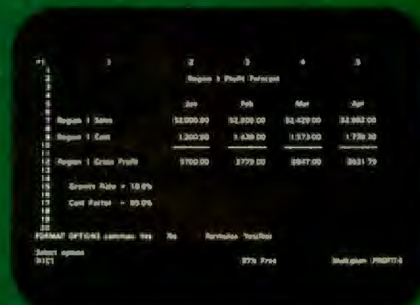

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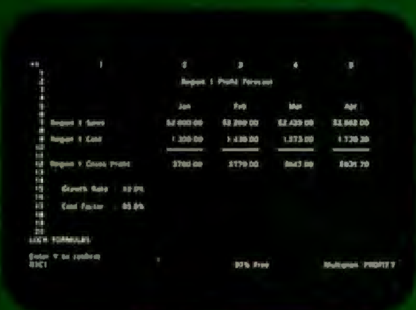

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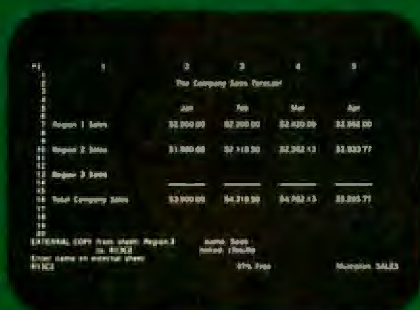

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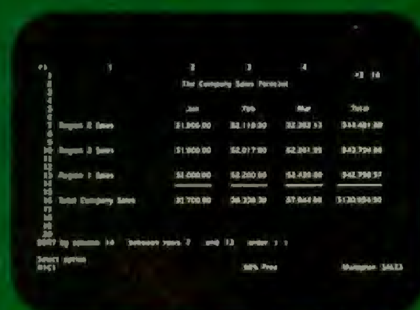

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with the 8051 was carried out with Intel's SDK-51 (System Design Kit) (see reference 5). Our programs generally began at address 0050 hexadecimal in that system. These are the addresses you will see in this and other programs in these examples. Remember, too, that the SDK-51 has only an in-line assembler. Hence, the appearance of absolute jump addresses below instead of labels. We shall assume input pin to be I/O line 97, and alarm to be output I/O line 90. Both are pins of port 1 (SFR 90). Again, a 1 must be written to pin 97 before reading it. Bits 97 and 90 are the only ones of interest to us here at port 1; the others are not used:

```
0050  MOV 90, #80
0053  JB 97, 58
0056  SJMP 50
0058  SETB 90
005A  SJMP 53
```

The first line moves the hexadecimal value 80 to port 1, thus writing a 1 to pin 97 and also turning off pin 90 (the alarm). In the second line, if pin 97 is high, jump to hexadecimal address 0058. The third line causes a jump to address 0050 because pin 97 is low, thus keeping or putting the alarm off. The fourth line puts alarm (bit 90) on because input pin bit 97 was high. The fifth line jumps to address 0053 to poll input pin 97 again.

The SJMP (short jump) instruction, when employed, branches unconditionally to the specified address (here, hexadecimal 0050 in one case, 0053 in the other). It is a 2-byte instruction and can be used whenever the intended destination is either 128 bytes or less preceding the next instruction or 127 bytes or less following the next instruction. The AJMP (absolute jump) instruction is used whenever the destination is within the same 2K-byte block of program memory as the first byte of the instruction following AJMP. If the LJMP (long jump) instruction is used, the destination may be anywhere in the full 64K bytes of program memory.

Do not confuse port 90 (byte) with *pin* 90 (address bit). The context of the instruction will make the distinction clear. One refers to port 1 (byte), the other to bit 0 of port 1. Thus, MOV 90, #80 refers to SFR 90 (port 1) and SETB 90 to bit address 90.

Note the use of the JB (jump if bit set) instruction. If the indicated bit address (here, 97) is a 1, a jump is made to the indicated address (hexadecimal 0058). Otherwise, the next instruction is executed. JB inputs the desired bit and tests it before the jump is made based on its value. Since JB is associated with a read of a bit address, a 1 is first written to that address (at hexadecimal 0050 in the program).

Memory-to-Memory Move Instruction

Suppose that on-chip memory address 25 hexadecimal contains a byte that we wish to send to port 1 (at address 90 hexadecimal):

```
0050  MOV 90, 25
0053  SJUMP 53
```

The first line will move the contents of address 25 hexadecimal to port 1. The second line causes a jump to itself (effectively, a halt).

Boolean ANDs, ORs, and External Interrupts

The intent of the program that follows is to demonstrate the employment of both the ORL (Boolean logical OR) and the ANL (Boolean logical AND), as well as the 8051's interrupt facility (in this case, INT1):

```
0050  ORL, 0A8, #84
0053  SETB 8A
0055  MOV 90, #0F
0058  SJMP 58
```

The first line performs a Boolean logical OR on the contents of location 0A8 hexadecimal (the interrupt enable register) with the value 84 hexadecimal. This sets the EA and EX1 bits in the IE register, thus enabling the INT1 line. The SETB instruction sets bit 8A (IT1 in the TCON SFR), specifying that INT1 will be triggered by a high-to-low transition. Then, the program moves hexadecimal 0F into port 1, and repeats the instruction at hexadecimal 58, waiting for an interrupt.

When an interrupt occurs, control is transferred to the following routine:

```
0013  ANL 90, #05
0016  RETI
```

Listing 1: *Demonstration of the table-jump instruction. The first instruction calls a routine in the monitor to get a character from the keyboard (the ASCII character is stored in the accumulator). Then, the value hexadecimal 100 is moved to DPTR, and control is transferred to the address that is the sum of DPTR with the contents of the accumulator. This listing shows that the possible addresses, 0130, 0134, or 0138, form a table and are loaded with short routines to move a special value to port 1.*

```
0050  LCALL 0E009
0053  MOV DPTR, #100
0056  JMP @ A+DPTR
0130  MOV 90, A
0132  AJMP 0050
0134  MOV 90, A
0136  AJMP 0050
0138  MOV 90, A
013A  AJMP 0050
```

Here, the first line performs a Boolean logical AND of the value 05 hexadecimal with the contents of the port at address 90 hexadecimal (the result of the operation, 05, is stored there, too). The second line causes a return of control to the program that was running when the interrupt occurred.

The result of this program is the outputting of hexadecimal 0F to port 1. This is maintained until an interrupt (INT1) occurs when 0F at port 1 changes to 05. The masking of bits 1 and 3 at P1 has been accomplished. If ORL 90, #05 were employed as the first line of the service routine, the result after an interrupt would be 0F at port 1. If in the latter case the byte 0F in the MOV instruction at 0055 were changed to 00, the output at port 1 would first be 00 and the result of an interrupt would again be 05 at that port. Note INT1's vector address: 0013. Vector addresses of RESET, INT0, timer/counter 0, timer/counter 1, and serial I/O port interrupts with the 8051 are, respectively, 0000, 0003, 000B, 001B, and 0023.

Example of Indirect Jumps

The useful table-indexing instruction JMP @ A+DPTR (see listing 1) adds the contents of the 16-bit DPTR (data-pointer register) with that of A (accumulator) and places the sum into the PC (program counter). The program, therefore, next executes the instruction at the address formed by that sum. In the following program, we are using a routine called UCI at address 0E009 hexadecimal in the SDK-51's monitor that, when called (a "long call," LCALL, is needed because UCI resides more than 2K bytes away from our program), waits for the reading of a key and then returns with the ASCII (American Standard Code for Information Interchange) character of the key in the accumulator. We shall press keys 0, 4, or 8 only (key codes 30, 34, or 38).

As a result of the JMP @ A+DPTR instruction, the program will then jump to either 0130, 0134, or 0138, where a table of short routines is located. The routine invoked will, naturally, depend on the contents of the accumulator (the key pressed). For simplicity and illustrative purposes only, we shall have the routine at 0130 output 30 (key 0) to port 1, the routine at 0134 will output 34 (key 4) to port 1, and the routine at 0138 will output 38 to port 1.

Depending on the key pressed (either 0, 4, or 8), port 1 will exhibit 30, 34, or 38. There certainly is a shorter and much more direct routine to output the key code in the accumulator to port 1. The program above, as mentioned before, is for illustrative purposes only. Jumps to more involved routines, or to tables, could be implemented at 0130, 0134, and 0138. The AJMP is used because the span from 0134 back to 0050 exceeds 128 bytes.

The Multiply and Divide Instructions

The MUL AB instruction multiplies the unsigned 8-bit integers in registers A (ACC) and B. The low-order byte of the 16-bit product is left in A and the high-order byte in B. The arithmetic is binary. Thus, if hexadecimal 32 is in B and hexadecimal 53 is in A, MUL AB will yield hexadecimal values 76 in A and 16 in B. DIV AB divides the unsigned 8-bit integer in register A by the unsigned 8-bit integer in register B. The integer part of the quotient is stored in A and the remainder in B. Dividing by 00 will leave undefined results in A and B. Thus, if hexadecimal 5A is placed in A and hexadecimal 32 in B, the result will then yield 01 in A and hexadecimal 28 in B. Routines employing the MUL and DIV instructions abound in the references cited at the end of the article. It should be noted that with MUL AB, if the product exceeds 255 (0FF hexadecimal), OV (overflow) flag is set; otherwise, it is cleared. The carry flag is always cleared. With DIV AB, the carry flag is always cleared, but OV is set only when division by 00 is attempted, useful in detecting possible contamination of data (noise) and the propagation of same.

Solution to a Combinatorial-Logic Problem

The Boolean processing capability of the 8051 makes it ideal for implementing software solutions to combinatorial-logic equations. When hardware solutions to such problems result in many gates, relays, switches, contacts, etc., and speed is not a constraint, the advantages of a simple software approach, which eliminates much of the hardware, makes that approach very attractive. For illustrative purposes only, we are going to consider a simple Boolean logic problem and implement its solution using the Boolean bit-processing capabilities of the 8051. We are not suggesting that for such simple problems you should go the microcomputer route. But the problem and its microcomputer solution will illustrate the simplicity and directness of approach, and indicate the great advantages to be reaped in more complicated logic-array implementation situations.

Consider, for example, a truth table involving one digital output (dependent) variable F and three digital input (independent) variables S6, S5, and S4. Here, S6, S5, and S4 will represent the states of digital inputs (here, switches) at bit addresses 96, 95, and 94 of port 1 (SFR 90), and F will drive output bit address 90 (bit 0 of port 1). The latter may drive a relay, machine, alarm, or any other bit-oriented device to be controlled. Assume the truth table is such that after Boolean-algebra realization and minimization, the following combinatorial-logic equation results:

$$F = \overline{S6} \cdot S5 \cdot S4 + S6 \cdot \overline{S4}$$

Listing 2 shows how we can implement this equation with the 8051 and its instruction set.

As the switches S6, S5, and S4 are varied through their eight possible combinations, the F bit at pin 90, driving the device, will take on the proper 1 or 0 (on/off) values in exact accordance with the Boolean-logic equation given above that defined the relationship; this is straightforward and requires no intermediate hardware.

Listing 2: *Solving of a Boolean equation. The first instruction sends 1s to switches S4, S5, and S6 (so that they can be read), and also clears output bit 0 of port 1. The next instructions perform logical operations on the switch values in this sequence: move the value of switch 5 to C (the carry bit); AND C with the complemented value of switch 6 (result remains in C); AND switch 4 with C (result remains in C); move the value of C to bit address 20; move the value of switch 6 to C; AND C with the complemented value of switch 4 (result remains in C); OR C with the value stored at address 20 (result remains in C); and move the contents of C (i.e., F) to port 1. This is the output solution to the problem* $F = \overline{S6} \cdot S5 \cdot S4 + S6 \cdot \overline{S4}$.

```
0050   MOV 90, # 0F0
0053   MOV C, 95
0055   ANL C, /96
0057   ANL C, 94
0059   MOV 20, C
005B   MOV C, 96
005D   ANL C, /94
005F   ORL C, 20
0061   MOV 90, C
0063   SJMP 53
```

Conclusion

Time and space do not permit further exploration of the numerous examples and applications demonstrating the controller power of the 8051 (see figure 2). We have restricted ourselves to some of the simpler examples. Timer/counter, serial I/O, arithmetic, and many other controller-type applications are areas that show the versatility of the 8051. We suggest that you consult the references that follow. The 81 experiments with the 8051 performed on Intel's SDK-51, in our book cited earlier, cover a large number of practical topics, features, areas, and applications not possible here. The 8051 is a remarkable 8-bit microcomputer, very possibly the most powerful microcontroller at this time. Its philosophy, instruction set, and architecture have opened a new frontier and dimension in the control world. Can it be that the 8051 will replace a number of 8-bit byte-oriented microprocessors as well as microcomputers, as we now know them, in the not-too-distant future? It may be. Keep your eye on it.

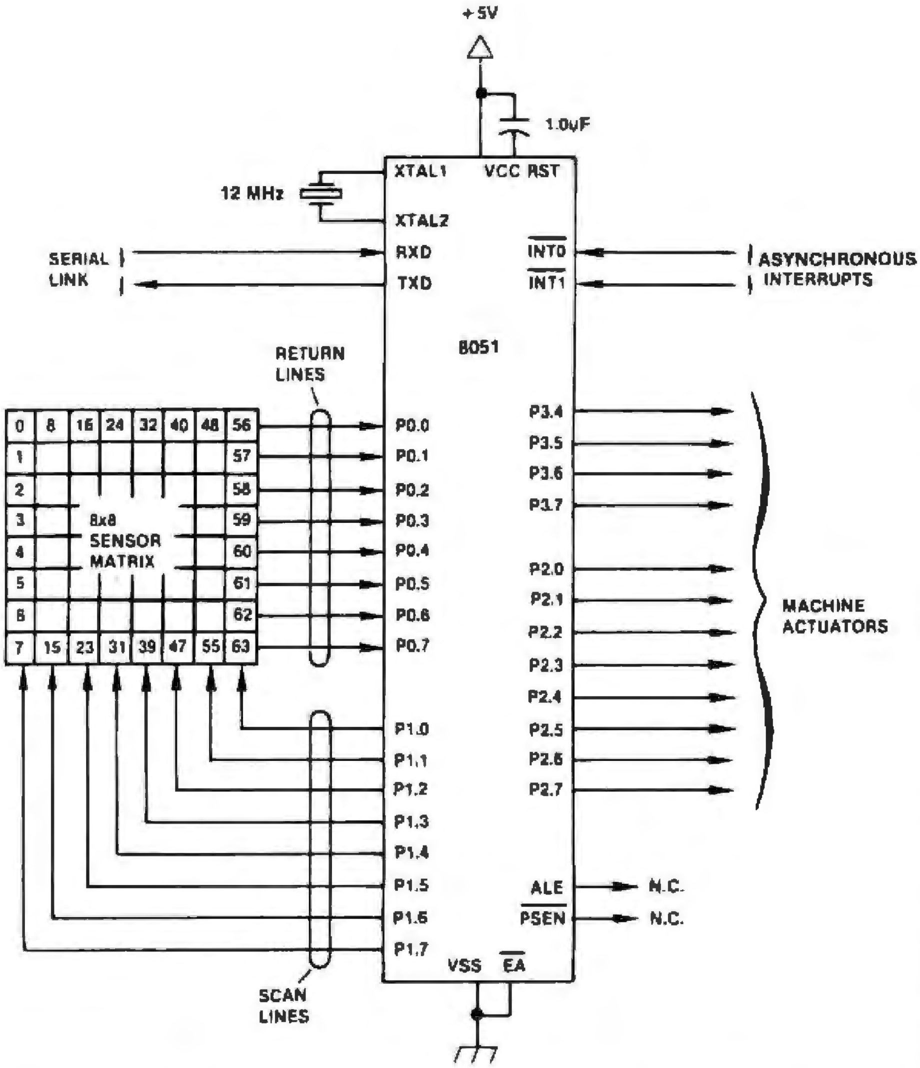

Figure 2: *Block diagram for a programmable industrial controller. The system uses 64 input sensors, 12 output signals, remote communications with a host processor (via a high-speed, full-duplex serial link), two prioritized interrupts, and internal real-time and time-of-day clocks. (This figure is reproduced by permission of Intel Corporation from reference 6.)*

For control applications, where operating and standby power must be held to a minimum, the 8051 is also available in a CHMOS (high-density complementary metal-oxide semiconductor) version. The Intel high-level language PL/M 51 is available to support development of system software for the MCS-51 series of microcontrollers. Intel is also marketing its iPDS portable 8-bit personal-development system to lend powerful and user-friendly development support for 8051- and 8088-based systems, among others.

Second sources of the 8051 are AMD, Siemens, and Signetics, and of the 80C51, GE-Intersil. ■

References

1. *An Introduction to the Intel MCS-51 Single-Chip Microcomputer Family* by John Wharton. Intel Corporation Applications Note 69, May 1980.
2. *8051 Single-Chip Microcomputer Architectural Specification and Functional Description* by Bob Koehler. Intel Corporation, May 1980.
3. *MCS-51 Family of Single-Chip Microcomputers User's Manual*. Intel Corporation, July 1981.
4. *MCS-51 Macro Assembler User's Guide*. Intel Corporation, 1979.
5. *SDK-51 MCS-51 System Design Kit User's Guide*. Intel Corporation, 1981.
6. *Using the Intel MCS-51 Boolean Processing Capabilities* by John Wharton. Intel Corporation Applications Note 70, May 1980.

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What Is POL Input?

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Most question-and-answer or menu-type inputs require a numeric response, even if it represents a word or phrase choice, because it is easier to use numbers in a program. Question-and-answer sessions are frequently rigid in sequence, and a single error in question 36 can require restarting a 10-minute question-and-answer session.

POL simplifies the input process, thus reducing some of the tedium involved in using computers.

The menu format may be somewhat more forgiving of errors, but it still has to ask many questions, each with a separate answer, leading to a long, boring session. Finally, the thought processes of the person using the program are interrupted by the constant need to read and answer repeated questions.

In contrast, a POL session uses standard terms familiar to the user. This makes the order of entry for the input more flexible. Finally, POL input is easier to use because it matches more closely the user's thoughts. Fewer interruptions in thinking are required because more information can be put into a single entry.

POL gives a programmer the opportunity to develop a new language that is closely suited to the problem. The words in this new language will preferably be those most often used to describe the problem or topic covered. If the topic is structural engineering, words like "beam," "column," and "load" are used.

Since graphics are often a part of many technical programs, and since graphic images are easily understood, I'll begin by using another graphic example to show how the words of the language are chosen and defined. Consider the following instructions (the results are shown in figure 1):

1. Draw a new graph with all parameters reset to default values.
2. The x axis is linear (default) with values from 0 to 4.
3. The y axis is logarithmic with values from 1 to 100.
4. Draw four major (numbered) divisions with marks (called tics) with

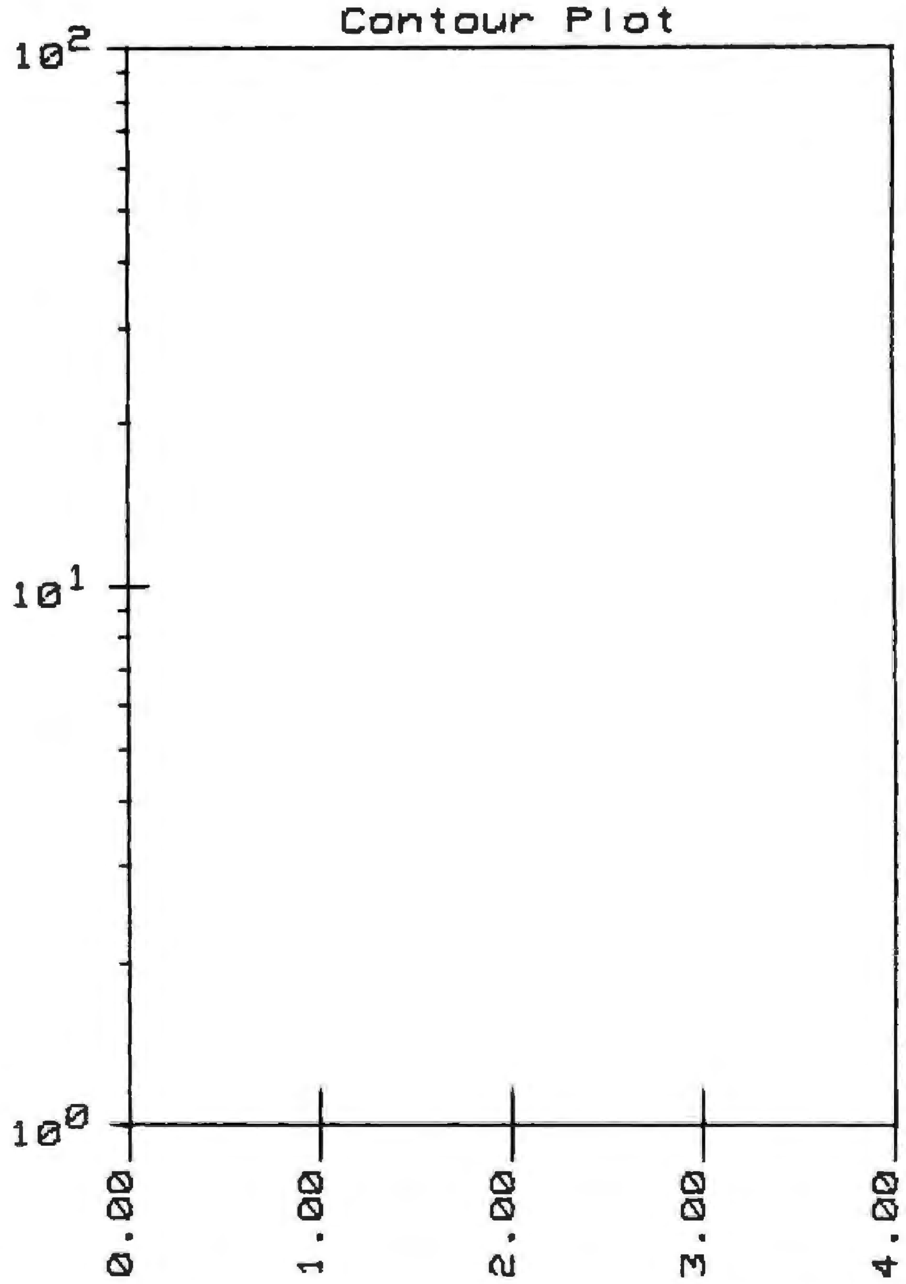

Figure 1: *Producing such a graph usually requires an extensive set of instructions and a great deal of user input. The resulting program cannot be easily used for other purposes.*

a length of ¼ inch above and below the x axis.

5. Frame the graph (draw lines on the two sides that are not the axes).
6. Title the graph "Contour Plot" and center (default) the title.
7. Draw the graph after the above parameters are set.

Other parameters could be set (e.g., margin, page size, subtitles, x and y axes titles, legends, grid lines, and other characteristics of graphs). Giving the user control over all these characteristics in a question-and-answer session or by menu can lead to long sessions at the terminal.

The first step in planning a POL system program to draw this graph is to write the input in a logical and readable format:

Draw a graph, with X from 0 to 4, Y axis logarithmic, Y from 1 to 100, X tics major 4 size .25", frame the graph, title "Contour Plot", execute.

This is readable and reasonably similar to the user's thinking. The in-

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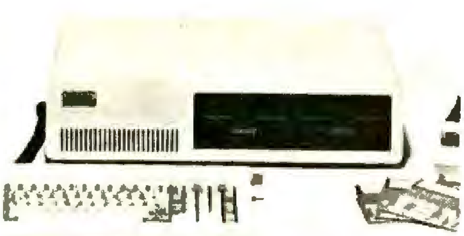

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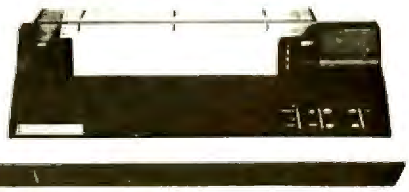

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.s smaller than the initial list of .tions because some choices are assumed to have specific values and other information in the first list was for explanation only. The order of input is relatively unimportant and the sections separated by commas can be reordered; only "draw a graph" and "execute" cannot be moved.

This initial format should be used to determine the keywords in the language and their hierarchy. For example, "size" may apply to the tic size, the axis numerical values, and various labels. The hierarchy is necessary to determine which size is being specified. Keywords should also be selected on the basis of spelling; significant letters will be capitalized. This allows similar words to be distinguished from one another. It also helps eliminate spelling errors in long words. Four letters is my preference, but programming needs may dictate more or less. A space may be included after the word to distinguish between similar words such as "are" and "area." Significant spaces are shown by an underscore. The previous example of an input may now be written as:

DRAW an XY graph with X_ FROM 0 TO_ 4, Y_ axis LOGarithmic, Y_ FROM 1 TO_ 100, X_ TICS MAJOr are 4 SIZE = .25, FRAMe the graph, TITLe 'Contour Plot', EXECute

The capitalized portions are significant as keywords. Also, a number of filler words (shown in lowercase) must be allowed for by the programmer.

The programmer developing this new language uses a number of examples like the one given above to construct a tree structure of all the keywords that will be used as a guide in doing the actual programming. The tree structure for drawing the *xy* axes is given in listing 1. Later, the programmer will also write a help routine (which contains the words of the language, their definitions, and proper usage) for each major section of the program. This help routine is stored on a disk and can be called from within the program for assistance as it is needed. Since the portion of the program used to draw the axes is a major section, it has its own help routine (shown in listing 2). This is an actual part of a graphics module.

The language used to solve a problem is built up from several sections. For example, a modeling package might be built up using a differential equation section, an integration section, a regression section, and the graphics section given above. In this manner, a "modeling language" would be built up. Similarly, other languages can be developed for other problems, such as structural design in

Listing 1: *Tree structure of the keywords used in drawing the graph shown in figure 1. This is used as a guide in developing a particular modeling language.*

```
DRAW XY (CONTinue)
                    NO
                         X
                              LINEs
                              LOG
                         Y
                              LINEs
                              LOG
                         GRID
                         FRAMe
                         LOG
                    X       (flag=1)
                    Y       (flag=2)
                         LOG
                         LINEs

                         TICS
                              SIZE ##.#
                              SPACe ##.#
                              MAJOr ##
                              MINOr ##
                              VALUes
                                        SIZE ##.#
                                        PERPendicular
                                        PARAllel
                                        DECImal ##
                         FROM ##.# TO ##.#
                         POSItion LEFT ##.# RIGHT ##.#
                         POSItion TOP ##.# BOTTom ##.#
                         MARGin LEFT ##.# RIGHT ##.#
                         MARGin BOTTom ##.# TOP ##.#
                         LABEl
                              SIZE ##.#
                              JUSTify
                                     LEFT(or TOP)
                                     CENTer
                                     RIGHt(or BOTTom)
                              POSItion ##.#
                              ORIEntation
                                     VERTical
                                     HORIzontal
                              LENGth ##.#
                              'string1','string2'
                    PAGESIZE ##.## ##.#
                    GRID
                    FRAMe
                    LOG
                    MAXImum (LABEl) (LINEs) ##
                    CLEAr
                    EXECute
```

```
TITLe (1)
SUBTitle (2)
          SIZE ##.#
          JUSTify
                 LEFT
                 CENTer
                 RIGHt
          POSItion ##.#
          LENGth ##.#
          'string1','string2',.....
LEGEnd
          POSItion ##.# ##.#
          BORDER
          BORDERLess
          SIZE ##.#
          WIDTh ##.#
          HEIGht ##.#
          JUSTify
                 TOP
                 VERTical CENTer
                 BOTTom
                 LEFT
                 HORIzontal CENTer
                 RIGHt
          choice1 'string1', choice2 'string2,....
                 CIRCle
                 SQUAre
                 TRIAngle
                 STAR
                 DIAMond

                 LINE
                 DOTTed
                 DASH
                 LONG DASH
                 DOT DASH
                 DOT DOT DASH
                 DOT DOT DOT DASH
                 DOT LONG DASH
                 DOT DOT LONG DASH
                 DOT DOT DOT LONG DASH
                 DASH LONG DASH
                 DOT DASH LONG DASH
                 DOT DOT DASH LONG DASH
                 DOT DOT DOT DASH LONG DASH
```

civil engineering, reaction kinetics in chemical engineering, or simple coordinate geometry for high school mathematics.

A POL programming system should:

- be able to break an input line into words, variable names, numbers, special characters, and strings
- be able to match word or variable names
- be able to extract numbers, determine permitted range, and return proper values
- be able to extract strings intact
- allow line continuations for long input sequences
- be able to read stored input sequences from a file
- be as automatic at run-time as possible
- allow changing of special control characters
- allow comments (not processed for keywords)
- allow paging and switching of program sections
- allow for input of numbers or strings at run-time to keyword sequences stored on disk files
- allow for output to the terminal
- allow graphical coordinates or real values to be input from the plotter
- allow automatic skipping of common filler words or characters

These capabilities should be part of any package that claims to have POL input. However, all that has been presented so far is just another—though fancier—way to input data and control information. Problem Oriented Language opens a door to far more than this.

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Text continued on page 328

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Listing 2: *Output from the HELP routine. These explanations of the various commands can be called by the user as needed.*

```
DRAW plots the axis for the graph.  The format is :

     DRAW XY CONTinue OPTION,OPTION.....
          POLar
          CARTesian

        where XY implies the XY coordinate system
              POLar implies a polar coordinate system, and
              CARTesian implies a Cartesian coordinate system.


  If CONTinue is not used, all parameters are reset to their default values.
Do not use CONTinue the first time DRAW or REDRaw is used, or an error will
result.  Use REDRaw if the parameters are to be preserved but the pen position
is to be reset for a new graph.

  The following words are always skipped over at any place in the line:
     A
     AN
     THE
     FOR
     AND
     EQUAL
     EQUALS
     IS
     ARE
     OF
     GRAPH
  Commas(,) and equivalence signs(=) are also skipped.


  The following options are available for OPTION:

     PAGESIZE ##.# ##.#

        Enters the size of the page (in inches) for the plotter.  The first
        number is the width, and the second number is the height.  Default
        for the Diablo printer is 8.5 and 11.

     MAXImum (LABEl) (LINEs) ##

        Sets the maximum number of lines (4 is default) for each of TItle,
        SUBTitle, X LABEl, Y LABEl, or LEGEnd.  This command automatically
        deletes all labels and resets all label parameters to default values.
        If it is used, use it before any label values or strings are entered.

     X LINEs draws vertical lines from the major tics on the X axis
     Y LINEs draws horizontal lines from the major tics on the Y axis
     GRID draws both horizontal and vertical lines from the major tics
     NO X LINEs does not draw the vertical lines
     NO Y LINEs does not draw the horizontal lines
     NO LINEs (or NO GRID) does not draw either vertical or horizontal lines

     Default is NO LINEs



     X LOG makes the X axis logarithmic
     Y LOG makes the Y axis logarithmic
     LOG makes both axes logarithmic
     NO X LOG makes the X axis linear
     NO Y LOG makes the Y axis linear
     NO LOG makes both axes linear

     Default is NO LOG



     FRAMe puts a frame (top and right) around the graph
     NO FRAMe does not put the frame around the graph

     Default is NO FRAMe



     X TICS PARAMETER
     Y TICS PARAMETER
Where PARAMETER can be:

       SIZE ##.#
          ##.# gives the length of the major tics in inches (minor tics are
               half as long.  Default is .125).  Each axis is set separately.

       SPACe ##.#
          ##.# gives the length between major tics in inches
          Not implemented on Diablo modules.

       MAJOr ##
          ## gives the number of intervals along the given axis for major
               tics (Default is 1).  MAJOr is automatically set for
               logarithmic axes.
```

Listing 2 continued on page 324

Listing 2 continued.

```
  MINOr ##
      ## gives the number of intervals between major tics(Default is 1)
         MINOr is automatically set for logarithmic axes.

  VALUes PARAMETER
      applies to the numbers for the tic marks along each axis
      where PARAMETER can be:

    SIZE ##.#
      ##.# is the size of the letters in inches from line to line
        (Default is .25)(sets both axes at the same time)

    PERPendicular
      sets the numbers perpendicular to the axis(is the default case)
    PARAllel
      sets the numbers parallel to the axis

    DECImal ##
      ## sets the number of decimal places in the numbers along
      non-logarithmic axes (sets both axes at the same time--Default is 3)

X FROM ##.# TO ##.#
Y FROM ##.# TO ##.#

    determines the minimum and maximum values respectively along the
    stated axis.  These will be modified to selected values unless XTICs
    (or YTICs) MAJOr is specified.

X POSItion LEFT ##.# RIGHT ##.#
Y POSItion TOP ##.# BOTTom ##.#

    sets the distance in inches from the edge of the page to the
    respective side of a framed graphical area.  This command can be
    used to position multiple graphs on the same page.

X MARGin LEFT ##.# RIGHT ##.#
Y MARGin BOTTom ##.# TOP ##.#

    sets the amount of clear space(no labels or numbers)in inches around
    the edges of the page(Default is 1 inch on all four sides).  This
    command can be used to position multiple graphs on the same page.

X LABEl
Y LABEl

    where the options under each category are:

      SIZE ##.#

        determines size in inches from line to line(default is .25 on
        each category).  The actual height of the typical capital letter
        is about .7 of the number entered.

      JUSTify LEFT(or TOP)
              CENTer
              RIGHt(or BOTTom)

        determines the position indicator relative to the string in the
        category(Default is CENTer for each category)

      POSItion ##.#

        ##.# is a fraction from 0.0 to 1.0 indicating the relative
        location of the position indicator along the side from left(or
        top) to right(or bottom).  Default is 0.5(which will center the
        label if JUSTify is CENTer).

      ORientation VERTical
                  HORIzontal

        determines whether letters are vertical or horizontal.  Default
        is VERTical for XAXIs and HORIzontal for YAXIs.

      LENGth ##.#

        ##.# is a number(between 1 and 10)used to expand the
        length of a label(Default is 1.0).  2.0 means the label appears
        twice as long as normal.

      'string1','string2',....

        the strings contain the actual labels.  The latest set of
        consecutive strings are the ones for that label.  Do not insert
        any other command words between the strings for a specific
        label.

CLEAR

    resets all parameters to default values, clears screen, or expects
    a new sheet of paper to be inserted.

EXECUTE

    causes the axes to be drawn using the current parameters.
```

Listing 2 continued on page 326

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Listing 2 continued:

```
TITLe     option,... (for title at the top of the page)
SUBTitle  option,... (located immediately below the title section)

    where the options under each category are:

      SIZE ##.#

        determines size in inches from line to line(default is .25 on
        each category).  The actual height of the typical capital letter
        is about .7 of the number entered.

      JUSTify LEFT
              CENTer
              RIGHt

        determines the position indicator relative to the string in the
        category(default is CENTer for each category)

      POSItion ##.#

        ##.# is a freaction from 0.0 to 1.0 indicating the relative
        location of the position indicator along the top of the graph
        from left to right.  Default is 0.5 (which will center the
        label if JUSTify is CENTer).

      LENGth ##.#

        ##.# is a number(between 1 and 10)used to expand the

        length of a label(Default is 1.0).  2.0 means the label appears
        twice as long as normal.

      "string1","string2",....

        the strings contain the actual labels.  The latest set of
        consecutive strings are the ones for that label.  Do not insert
        any other command words between the strings for a specific
        label.

LEGEnd

  the options are:

      POSItion ##.# ##.#

        gives the position of the legend relative to the X axis and Y axis
        respectively.  Values from 0 to 1 keep the legend with the framed
        area of the graph.  Values greater than 1 for one or both numbers
        will locate the legend immediately outside the framed area at the
        right or top respectively.  Default is 1.0 1.0, which will place
        the legend at the upper right corner of the framed graph area.

      BORDER
      BORDERLess

        determine whether there will be a frame around the legend.  Default
        is BORDER.

      SIZE ##.#

        sets the distance between lines in the legend.  The actual height
        of the typical capital letter is about .7 of the number given.

      WIDTh ##.#

        increases the width of the legend without increasing the letter
        size.  Values are multiples of the normal width.

      HEIGht ##.#

        increases the height of the legend by increasing space between
        lines without increasing letter size.  Values are multiples of
        the normal height.

      JUSTify
             TOP
             VERTical CENTer
             BOTTom
             LEFT
             HORIzontal CENTer
             RIGHt

        sets the location within the legend of the position given by
        POSItion.  Default is VERTical CENTer, HORIzontal CENTer.

        choice1 "string1", choice2 "string2",.....

          where the choices may be line patterns and/or symbols (line
          patterns must be given first)

            LINE
            DOT
            DASH
            DOT DASH
            DOT DOT DASH
            DOT DOT DOT DASH
            LONG DASH
```

Listing 2 continued on page 328

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Listing 2 continued:

```
DOT LONG DASH
DOT DOT LONG DASH
DOT DOT DOT LONG DASH
DASH LONG DASH
DOT DASH LONG DASH
DOT DOT DASH LONG DASH
DOT DOT DOT DASH LONG DASH

CIRCle
SQUAre
TRIAngle
DIAMond
STAR

Each time a new set of consecutive option 'string' sequences is
encountered, the entries are reset to contain only the current
entries.  All entries must be consecutive and contain no other
commands embedded in the sequence.
```

Text continued from page 320

does not allow complete control of the process. Compare the input of other published programs for graphics to that allowed by listing 3. It is much easier to include graphics in a POL package (as will be demonstrated in part 3 of this series) than to make the traditional subroutine calls with, for example, FORTRAN.

A second area of development is complete packages. Advertisements in microcomputer magazines show a number of technical program packages, especially for statistics and civil engineering. These packages solve a certain type of problem quite well, but using portions of these programs for solving different types of problems is difficult because most packages are not modular (i.e., designed so that parts can easily be rearranged or used in different programs).

A third area is the technical program packages of routines available for mainframe computers (e.g., IBM's Scientific Subroutines package that contains the source listings). However, these packages are usually in FORTRAN, and the programs utilizing these routines frequently strain the capacity of the current generation of microcomputers. The main-line programs written to incorporate these subroutines must also set numerous values required by the subroutines and handle *all* the input and output of the program. This places a heavy burden on the programmer.

The POL system will provide a framework for designing modules that will:

- be easy to combine into large programs
- reduce the load on the programmer writing the main-line program
- be more flexible in use by using Problem Oriented Language input
- provide a large library of modules that can be used in many programs
- make it easy to integrate *plotter-independent* graphics into the program
- be written in BASIC, the language generally used in microcomputers
- not exceed the capacity of current-generation microcomputers, while providing capabilities normally found only in programs run on larger machines

The POL system will make problem solving easier because it will encourage the development of a large library of modules. The modules can then be used to quickly assemble a package to solve specific problems.

What Is Available

A number of program packages on the market have POL input, but many of these packages are not development systems; in other words, they do not allow additional programs or modules to be linked to the current set of programs in order to use the package to solve problems different from those originally envisioned.

At the University of Kansas, two POL development systems are available to me—POLO and GRIP. POLO (Problem Oriented Language Organizer) was developed at the University of Illinois and an application package—called POLO-FINITE—is used in the Department of Civil Engineering on structural-analysis problems. POLO is oriented toward the

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manipulation of large amounts of data (a million items or more) and operates in a batch environment.

GRIP (General Routines for Interactive Processing), developed at the University of Kansas by Rick Hilst and Dr. Kenneth Bishop of the Department of Chemical and Petroleum Engineering, is a set of routines for linking GRIP-compatible modules together and requires a minimum of program writing to do so. In chemical engineering, much work is on a trial-and-error basis that requires the flexibility of POL to reduce the amount of input on the successive attempts. Much of the output is best analyzed in the form of graphs. Therefore, graphic output of data is desirable rather than drawing results by hand.

My own thesis involves the development of a process control simulator for the senior-level class on process control. This package will use GRIP routines for POL input and will assist students in their work by avoiding much of the tedious transformation of large equations. Much of the output will be in the form of graphs. Some of the input will involve a graphic representation of the system being modeled (a block diagram).

POL for Microcomputers

POL packages or systems are often written in FORTRAN and are designed to run on large mainframe computers. Typical program packages begin at 200,000 bytes when compiled. POLO program packages will have from 50,000 to 250,000 lines of FORTRAN code. This is obviously too large for today's microcomputers based on the Z80 and similar microcomputers. However, my goal is to allow the major portion (80 percent or more) of the capabilities of mainframe POL packages to be available on microcomputers. To do this, I use a BASIC interpreter and a paging technique.

A BASIC interpreter is required because:

- The program to be interpreted—especially the graphics portion—can be written to occupy less space than a compiled program.
- The paging technique used requires dynamic allocation of memory.
- The paging technique in BASIC is much easier to master than trying to learn how to overlay in FORTRAN.
- Dynamic modification of the program is allowed (introduced in part 2), which simplifies *interactive* processing of equations.

Microsoft BASIC 5.0 was chosen for the following reasons:

- It is written for many machines, making the system transportable.
- Its CHAIN includes MERGE, DELETE, and starting line options.
- Both random and sequential files are supported.
- The sequential records are of variable length and format.
- Multiple logical records may be written in a sector, conserving disk space.
- String variables are dynamically allocated and not preset in length, also conserving memory space.
- It has a LINE INPUT command to treat a single line as a string.

System Required

The minimum computer system recommended to run POL/PS is:

1. *CP/M operating system*
2. *Microsoft BASIC-80*
3. *At least 20K bytes of programmable memory above BASIC*
4. *Dual disks*
5. *An appropriate plotter if graphics are used*

The recommended organization of POL/PS on disk is to place POL-80 and the graphics routines (if used) on the "logged-in" drive (since different plotters require different CP/M configurations). The application modules and their main-line programs should be on the other drive so that applications packages can be changed without starting over. Changing plotters can be done by connecting the new plotter, inserting a different CP/M disk (with a different graphics module), and starting again. All communications between application and graphics modules will be done by means of a disk file whose format is independent of the plotter being used.

This program was developed on a Vector Graphic System B (Z80) with two 300K-byte minidisks and a Diablo 1650 printer as a plotter. Most Diablo and Diablo-compatible printers are capable of 60 horizontal and 48 vertical spaces per inch in a graphics mode. (Check the specific model for its capability. The Diablo uses an "Escape-3" to turn on graphics and either a "Carriage Return" or "Escape-4" to turn off graphics. I simply use "space", "linefeed", "backspace", ".", and "escape-linefeed" for up.) All the figures in this series were produced using this equipment.

The disks should be of high capacity because there may be more space used by files associated with the module than is used by the actual program. HELP files, error message files, and graphics intermediate files can quickly consume space.

Disk speed is also very important. A page transfer on the Micropolis minidisks takes about 30 seconds by the time all the variables and files are restored. Faster disks—8-inch floppies or Winchester hard disks—can reduce program running time where several pages are involved.

The POL Programming System

I said earlier that the programs customarily run using POL are large. The graphics package is often in itself several times larger than the memory available on a microcomputer unless the size of the program is decreased by making it inflexible. The normal method of handling such large programs is by overlays (on most large machines) or by paging (on virtual memory machines). The POL Programming System (POL/PS) presented here is closer to the paging system because it changes only portions of the program at a time and is relatively easy to implement. Figure 2 shows a diagram of this system.

The block at the top is almost

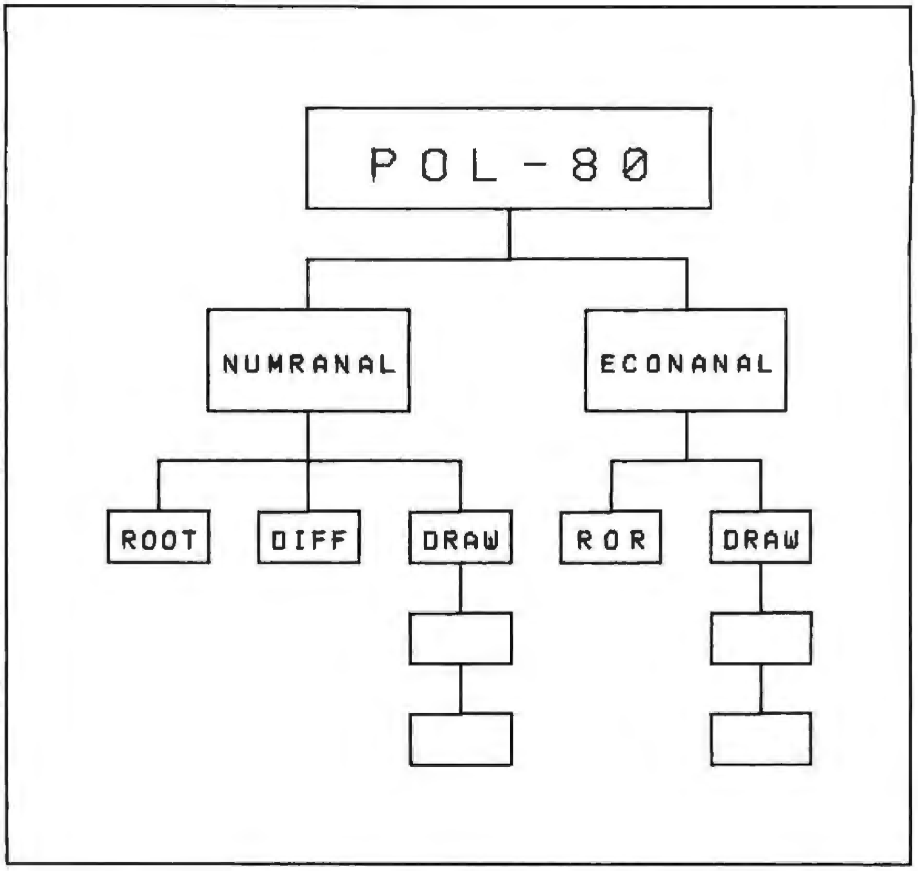

Figure 2: *A diagram of the POL system and the interaction between the different modules.*

always in the computer's memory and consists of standard subroutines that control the paging of the program and handle the POL input. The next level down represents major application packages. Examples of these are a numerical-analysis package (NUMRANAL) and an economics package (ECONANAL). Each of these consists of a main program. The first four characters of the name form a common prefix for all programs in this application package (e.g., NUMR for numerical analysis, or ECON for economics analysis). At the third level are branches representing the modular subprograms (within each package) that handle the computations and actually make the decisions. Each of these programs may have several pages, which are usually called on sequentially to perform the computations. One example of this is the *xy* axes portion of the graphics package (see listing 1), which has three pages: one to handle the input, one to compute all the locations on the page (based on the input), and one to actually draw the axes.

To make such a paging scheme work, *one rigid rule must be followed concerning line numbers*. Lines 1 to 2999 are reserved for the input and paging routines and future development. Lines 3000 to 9999 are reserved for user-written programs. Both line 3000 and line 9999 *must* be used in the user-written program, even if only for remarks, because these line numbers are references in CHAINs.

The set of routines to handle POL input—called POL-80—is given in listing 3. The variables are in listing 4. Naming conventions used in POL-80 are given in listing 5. The program listing is well documented and a summary of the capabilities is given below. (Much more detail can be found in the *POL/PS User's Manual*.)

The primary purpose of these routines is input, parsing, and matching. Input is accepted from either the ter-

Text continued on page 362
Listings 3, 4, and 5 are on pages 334-360

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Listing 3: *This set of routines handles user input. POL-80 is written in Microsoft BASIC 5.0.*

```
1 REM PROBLEM ORIENTED LANGUAGE INPUT ROUTINES (POL-80)
2 REM COPYRIGHT MARK FINGER 1981
******************************************************************************

SET UP ARRAYS AND INITIALIZE REQUIRED VALUES

******************************************************************************
20 DEFINT F,I,J,N
   :DEFSTR A
   :DEFDBL D
   :DIM AART(20)
   :DIM ACOM(10)
******************************************************************************

SET UP DEFAULT VALUES

     NOTE THAT ALL FLAGS ARE SET TO "0"
          (FART,FAXES,FCOM,FENT,FEOC,FERR,FFIL,FTR,ICON,NART,NCOM)

******************************************************************************
30 ADEC="890245767771711711111111112777777333333333333333333333337777773333333
          3333333333333333333377777"
40 AEOC=":"
   :AEOL="&"
   :AOUT="$"
   :AP="@"
   :ASTR="^"
   :ATER="%"
   :ACON="&"
   :AR="|"
   :AINB="["
   :AINE="]"
   :OPEN "O",#1,"READTEMP"
   :CLOSE#1
   :OPEN "I",#1,"READTEMP"
******************************************************************************

PROCESSES INITIAL INPUT COMMAND
      (MUST BE A PLOTTER OR PROGRAM DECLARATION COMMAND)

******************************************************************************
50 OPEN "R",#3,"MLPERR",80
   :FIELD #3,80 AS AERR
60 GOSUB 1050
   :GOSUB 500
   :IRET=60
70 IF AB=AP AND NT=7
      THEN GOTO 100
      ELSE NERR=1010
           :GOSUB 1200
           :FERR=1
           :GOTO 60
******************************************************************************

PLOTTER OR PROGRAM DECLARATION HANDLING

THE FORMAT IS:
     @PRG 'NAME'     NAME--FILENAME CONTAINING THE MAINLINE PROGRAM TO BE
                           RUN(AN EXAMPLE OF NAME IS 'B:NUMPANAL' FOR THE
                           NUMERICAL ANALYSIS PACKAGE)

     @PLT 'NAME'     NAME--CONTAINS THE DISK DESIGNATION AND A 3-LETTER
                           CODE FOR THE PLOTTER TO BE USED(AN EXAMPLE OF
                           NAME IS 'A:DIA' FOR THE DIABLO TYPEWRITER)

******************************************************************************
100 AT=LEFT$(AN,3)
    :AN=RIGHT$(AN,LEN(AN)-3)
150 IF AT<>"PLT" GOTO 170
155 FENT=1
    :GOSUB 500
    :IF NT<>6
        THEN NERR=1037
             :GOSUB 1200
             :GOTO 60
160 IF MID$(AB,2,1)=":"
       THEN APLT=LEFT$(AB,5)
       ELSE APLT=LEFT$(AB,3)
165 CHAIN MERGE APLT+"GRIN",IRET,ALL,DELETE 2500-2999
170 IF AT<>"PRG"
       THEN NERR=1034
            :GOSUB 1200
            :FERR=1
            :GOTO 60
180 GOSUB 500
    :IF NT<>6
        THEN NERR=1021
             :GOSUB 1200
             :GOTO 60
        :ELSE IF MID$(AB,2,1)=":"
                 THEN APRG=MID$(AB,3,4)
                      :ADISK=LEFT$(AB,2)
                :ELSE ADISK="A:"
                      :APRG=LEFT$(AB,4)
```

Listing 3 continued on page 339

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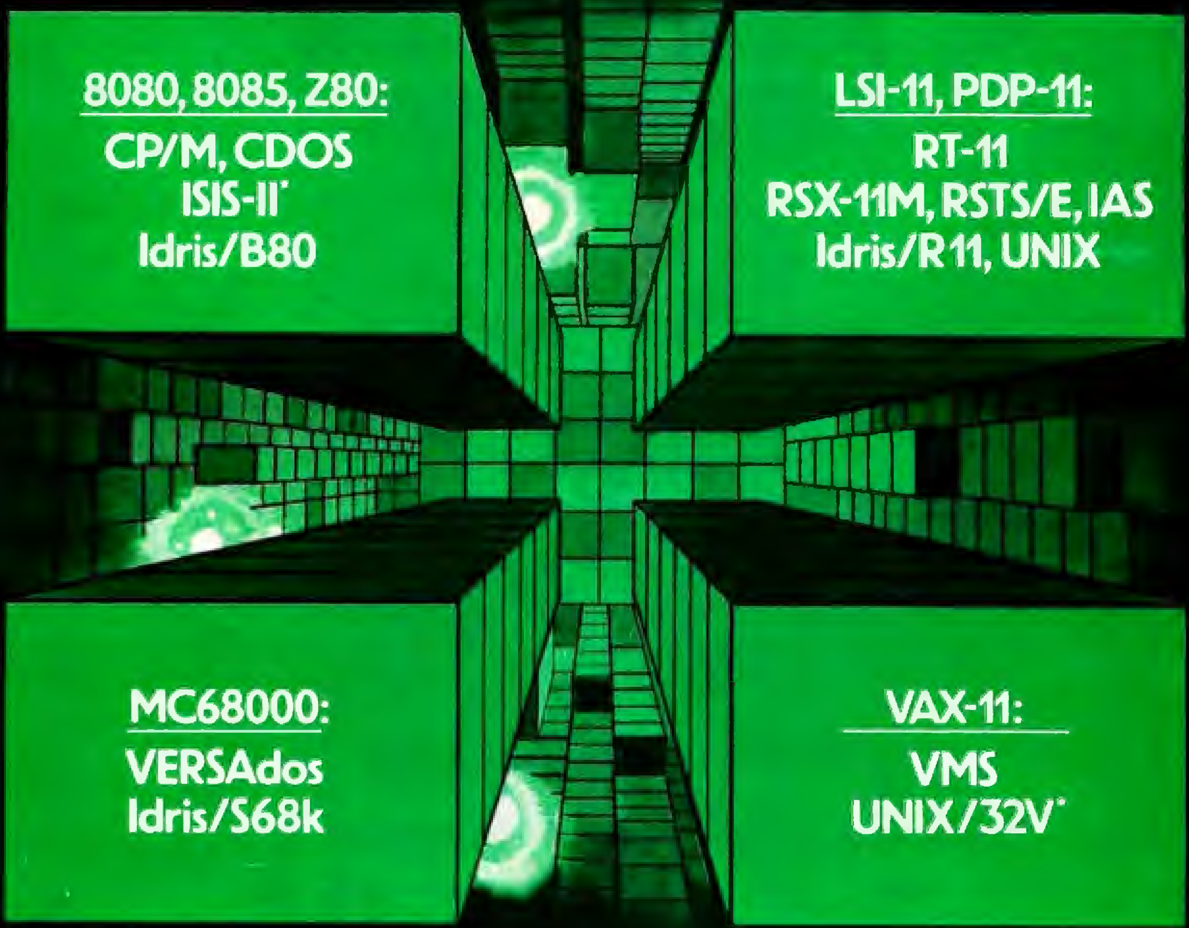

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Circle 373 on inquiry card.

Listing 3 continued.

```
185 FART=0
     :FCOM=0
     :NART=3
     :NCCM=0
     :FENT=1
     :GOSUB 1400
190 CHAIN MERGE AB,3000,DELETE 3000-9999
************************************************************************

MISCELLANEOUS CONTROL HANDLING
      (CONTROL CHARACTER CHANGES, INPUT FILE DECLARATIONS, & TRACING)

THE FORMAT IS AS FOLLOWS:

     !FEC #      0--IMPLIES END OF COMMAND IS END OF LINE OR END-OF-COMMAND
                    CHARACTER(DEFAULT IS :)
                 1--IMPLIES END OF COMMAND IS END-OF-COMMAND CHARACTER ONLY

     !PRG C      C--CHARACTER TO INDICATE THE BEGINNING OF PROGRAM OR PLOTTER
                    CHANGE COMMANDS(DEFAULT IS @)

     !REA C      C--CHARACTER TO INDICATE THE BEGINNING OF A READER OR
                    MISCELLANEOUS CONTROL COMMAND(DEFAULT IS !)

     !EOC C      C--CHARACTER TO INDICATE THE END OF A COMMAND(DEFAULT IS :)

     !EOL C      C--CHARACTER USED TO INDICATE THAT THE REMAINDER OF THE LINE
                    IS COMMENTS(DEFAULT IS #)

     !INB C      C--CHARACTER USED TO INDICATE THE BEGINNING OF A REQUEST FOR
                    GRAPHICAL INPUT(DEFAULT IS |)

     !INE C      C--CHARACTER USED TO INDICATE THE END OF A REQUEST FOR
                    GRAPHICAL INPUT(DEFAULT IS ])

     !CON C      C--CHARACTER USED TO INDICATE COMMAND LINE CONTINUATION
                    (DEFAULT IS &)

     !OUT C      C--CHARACTER USED TO ENCLOSE MESSAGES TO BE OUTPUT TO THE
                    TERMINAL(DEFAULT IS $)

     !STR C      C--CHARACTER USED TO ENCLOSE INPUT STRINGS ON A COMMAND LINE
                    (DEFAULT IS ')

     !TER C      C--CHARACTER USED TO REQUEST INPUT FROM THE TERMINAL DURING
                    EXECUTION OF THE LINE(DEFAULT IS %)

     !FIL 'NAME' NAME--NAME OF A SEQUENTIAL FILE CONTAINING A SET OF COMMANDS
                    IN THE PROPER FORMAT TO USE AS INPUT(AN EXAMPLE OF NAME
                    IS 'B:EXAMPLE'

     !TON        TURNS ON THE INTERNAL TRACER IN NLP-80

     !TOF        TURNS OFF THE INTERNAL TRACER LIN NLP-80

      (NOTE--NEVER USE QUOTES (") AS ANY OF THE ABOVE CONTROL CHARACTERS.
             THEY WILL GET CHEWED UP DURING CHAINING OF PROGRAMS.)

      (NOTE--ONE OF THE EASIEST WAYS TO REDUCE THE PROGRAM SIZE IS TO REMOVE
             THIS SECTION (IF DEFAULT PARAMETERS ARE ALWAYS ACCEPTABLE AND
             FILE INPUT OR TRACING ARE NOT REQUIRED) --THIS ELIMINATES ABOUT
             1K OF PROGRAM (ABOUT 15%)

             TO DO THIS:
               1.  DELETE LINES 200-495
               2.  IN THE STRING IN LINE 30, CHANGE THE "9" (POSITION 2)
                   TO A "7"
               3.  IN LINE 520, ELIMINATE ",200" (THE LAST LINE NUMBER
                   REFERENCE)
              LESSER AMOUNTS (INDIVIDUAL LINES) MAY BE ELIMINATED IF STEPS 2
              AND 3 ARE NOT DONE.  FOR EXAMPLE, LINES 210-320 CAN BE ELIMINATED,
              AND THE FILE INPUT AND TRACING FUNCTIONS ARE STILL AVAILABLE, BUT
              THE PROGRAM IS ABOUT 700 BYTES SHORTER.)

************************************************************************
200 AB=MID$(AN,2,3)
     :AN=RIGHT$(AN,LEN(AN)-4)
210 IF AB="FEC"
       THEN GOSUB 500
            :IF NT=1
               THEN FEOC=IV
                    :GOTO 500
               :ELSE NERR=1036
                    :GOTO 495
220 IF AB="PRG"
       THEN GOSUB 500
            :IF NT=7
               THEN AP=AB
                    :GOTO 500
               :ELSE NERR=1033
                    :GOTO 495
230 IF AB="REA"
       THEN GOSUB 500
            :IF NT=7
               THEN MID$(ADEC,ASC(AB)-31,1)="7"
```

Listing 3 continued on page 340

Circle 77 on Inquiry card.

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	TI787 Portable KSR, 120 CPS	2,195	211	117	80
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	TI820 KSR Printer	2,195	211	117	80
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	ADM5 CRT Terminal	645	62	35	24
	ADM32 CRT Terminal	1,165	112	65	42
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	CIT-161 Color CRT	2,675	257	143	97
	CIT-427 Color Graphic CRT	3,095	297	165	112
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	925 CRT Terminal	850	82	46	31
	950 CRT Terminal	1,075	103	57	39
NEC SPINWRITER	Letter Quality, 7715 RO	2,695	259	144	98
	Letter Quality, 7725 KSR	3,195	307	171	115
GENERAL ELECTRIC	2030 KSR Printer 30 CPS	1,195	115	67	43
	2120 KSR Printer 120 CPS	2,195	211	117	80
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Listing 3 continued.

```
                    :AP=AB
                    :MID$(ADEC,ASC(AB)-31,1)="9"
                    :GOTO 500
                :ELSE NERR=1022
                    :GOTO 495
240 IF AB="EOC"
      THEN GOSUB 500
          :IF NT=7
              THEN AEOC=AB
                    :GOTO 500
                :ELSE NERR=1023
                    :GOTO 495
260 IF AB="EOL"
      THEN GOSUB 500
          :IF NT=7
              THEN MID$(ADEC,ASC(AEOL)-31,1)="7"
                    :AEOL=AB
                    :MID$(ADEC,ASC(AEOL)-31,1)="2"
                    :GOTO 500
                :ELSE NERR=1025
                    :GOTO 495
270 IF AB="INB"
      THEN GOSUB 500
          :IF NT=7
              THEN AINB=AB
                    :GOTO 500
                :ELSE NERR=1026
                    :GOTO 495
280 IF AB="INE"
      THEN GOSUB 500
          :IF NT=7
              THEN AINE=AB
                    :GOTO 500
                :ELSE NERR=1027
                    :GOTO 495
290 IF AB="CON"
      THEN GOSUB 500
          :IF NT=7
              THEN ACON=AB
                    :GOTO 500
                :ELSE NERR=1028
                    :GOTO 495
300 IF AB="OUT"
      THEN GOSUB 500
          :IF NT=7
              THEN MID$(ADEC,ASC(AOUT)-31,1)="7"
                    :AOUT=AB
                    :MID$(ADEC,ASC(AOUT)-31,1)="4"
                    :GOTO 500
                :ELSE NERR=1029
                    :GOTO 495
310 IF AB="STR"
      THEN GOSUB 500
          :IF NT=7
              THEN MID$(ADEC,ASC(ASTR)-31,1)="7"
                    :ASTR=AB
                    :MID$(ADEC,ASC(ASTR)-31,1)="6"
                    :GOTO 500
                :ELSE NERR=1030
                    :GOTO 495
320 IF AB="TER"
      THEN GOSUB 500
          :IF NT=7
              THEN MID$(ADEC,ASC(ATER)-31,1)="7"
                    :ATER=AB
                    :MID$(ADEC,ASC(ATER)-31,1)="5"
                    :GOTO 500
                :ELSE NERR=1032
                    :GOTO 495
330 IF AB="FIL"
      THEN GOSUB 500
          :IF NT=6
              THEN AFIL=AB
                    :FFIL=1
                    :JFIL=0
                    :OPEN "I",#2,AFIL
                    :GOTO 500
                :ELSE NERR=1031
                    :GOTO 495
340 IF AB="TOM"
      THEN FTR=1

          :GOTO 500
350 IF AB="TOP"
      THEN FTR=0
      :GOTO 500
490 NERR=1035
495 GOSUB 1200
     :TEOC=1
     :RETURN
```

Listing 3 continued on page 342

Circle 469 on inquiry card.

Circle 192 on inquiry card.

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Listing 3 continued:

```
************************************************************************

SUBROUTINE PARSER
     CALLED WHENEVER ANOTHER ENTITY IS REQUIRED
     (USED ONLY BY OTHER SUBROUTINES WITHIN NLP-80)

     EXTRACTS THE ENTITY(ENTITY STORED IN "AB")FROM THE CURRENT COMMAND LINE
     AND CLASSIFIES IT IN "NT" AS FOLLOWS:

        NT=1--INTEGER NUMBER
           2--REAL NUMBER(CONTAINS A DECIMAL OR A FRACTIONAL PORTION)
           3--WORD CONTAINING LETTERS ONLY
           4--WORD CONTAINING LETTERS AND NUMBERS, BUT BEGINS WITH A LETTER
           5--NOT IMPLEMENTED
           6--STRING
           7--SPECIAL CHARACTER(ANY CHARACTER OTHER THAN A LETTER, NUMBER,
              QUOTE("), OR BLANK SPACE)

************************************************************************
500 AB=""                                              **INITIALIZE
    :DV=0                                                THEN CHECK IF AN ERROR
    :IV=0                                                CONDITION EXISTS
    :AT=""
    :FENT=0
    :IF PERR=1
       THEN RETURN
505 IF IEOC=1                                          **CHECKS IF AT THE END OF
       THEN RETURN                                       A COMMAND
510 IF LEN(AN)=0                                       **CHECKS IF END OF CURRENT
    THEN IF NOT(EOF(1)) OR FEOC=1                        LINE--WILL AUTO FEED IF
             THEN GOSUB 1055                             CONTINUATION OR IF END OF
             :ELSE IEOC=1                                LINE IS NOT END OF COMMAND
                  :NT=7
                  :RETURN
515 AT=LEFT$(AN,1)                                     **EXTRACTS CURRENT CHARACTER
    :NT=VAL(MID$(ADEC,ASC(AT)-31,1))                     AND CLASSIFIES IT
520 ON NT                                              **DECISION TABLE
       GOTO 640,                                         PROBABLE NUMBER
            535,                                         COMMENTS
            600,                                         WORDS
            540,                                         TERMINAL OUTPUT STRING
            545,                                         TERMINAL INPUT
            530,                                         STRING
            550,                                         SPECIAL CHARACTER
            580,                                         BLANK
            200                                          PARAMETER CHANGE PHRASE
530 IE=INSTR(2,AN,AT)                                  **STRING INPUT

    :IF IE=0
       THEN NERR=1050
            :GOSUB 1200
            :PERR=1
            :AB=""
            :RETURN
       :ELSE AB=MID$(AN,2,IE-2)
            :AN=RIGHT$(AN,LEN(AN)-IE)
            :RETURN
535 AT=""                                              *COMMENTS(GOTO END OF COMMAND)
    :IEOC=1
    :RETURN
540 IE=INSTR(2,AN,AT)                                  **OUTPUT STRING
    :IF IE=0                                             TO THE TERMINAL
       THEN NERR=1051
            :GOSUB 1200
            :PERR=1
            :AB=""
            :RETURN
       :ELSE AB=MID$(AN,2,IE-2)
            :AN=RIGHT$(AN,LEN(AN)-IE)
            :PRINT AB
            :GOTO 510
545 LINE INPUT "?";AT                                  **REQUEST FOR
    :AN=AT+RIGHT$(AN,LEN(AN)-1)                          INPUT FROM THE TERMINAL
    :GOTO 510
550 AN=RIGHT$(AN,LEN(AN)-1)                            **IF THIS POINT IS REACHED,
    :IF FCOM<>1                                          THE CHARACTER BEING TESTED
       THEN GOTO 560                                     IS SOME OTHER
554 ICOM=0                                               CHARACTER--WE WILL CHECK
555 IF AT=ACOM(ICOM)                                     IF IT IS A FILLER CHARACTER
       GOTO 510                                          AND SKIP OVER ANY SUCH ONES
556 ICOM=ICOM+1
    :IF ICOM<NCOM
       GOTO 555
560 AB=AT
    :RETURN
580 AN=RIGHT$(AN,LEN(AN)-1)                            **SKIP OVER SPACES
    :GOTO 510
************************************************************************

THIS SECTION OF THE PARSER EXTRACTS CATEGORY 3 OR 4 WORDS

************************************************************************
600 IF AT>="a" AND AT<="z"                             **CONVERT LOWER CASE TO UPPER
       THEN AT=CHR$(ASC(AT)-32)                          CASE
602 AB=AB+AT                                           **BEGIN BUILDING THE WORD
605 AN=RIGHT$(AN,LEN(AN)-1)                            **GET THE NEXT CHARACTER
```

Listing 3 continued on page 347

The UniFLEX™ Operating System extracts every last drop

from the 8 bit 6809 microprocessor allowing it to outperform many 16 bit systems

With the UniFLEX™ Operating System, the 8 bit 6809 microprocessor can perform as well as larger CPUs in a multi-user, multi-tasking environment.

Independently developed from the ground up, UniFLEX™ closely models the features found in the UNIX™ Operating System. And in two years of use, UniFLEX™ has proven the abilities of the 6809 to perform large system functions when incorporated into a properly designed mainframe.

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- hierarchical file systems
- device independent I/O
- four Gigabyte disk capacities
- full file protection
- inter-task communication via pipes
- I/O redirection
- task swapping for efficient memory usage
- full random-access files
- comprehensive shell command language
- foreground-background jobs
- electronic mail and printer spooling
- system accounting facilities

The support software currently available for use under UniFLEX™ is extensive. A sampling of the programs available includes:
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- native Pascal compiler
- FORTRAN 77 ANSI Subset compiler
- COBOL compiler with ISAM files, Report Writer & Sort/Merge
- Extended BASIC interpreter
- Extended BASIC precompiler
- text editing and processing software
- enhanced printer spooler
- variety of absolute and relocatable assemblers
- debug and diagnostic packages

Technical Systems Consultants, Inc. also offers a line of single user FLEX™ software products for 6800 and 6809 processors. For those having an absolute need for a 16 bit processor, UniFLEX™ will be available through OEM licensing arrangements for the 68000 microprocessor. Please call or write for additional information on individual products or OEM licensing arrangements.

UNIX™ is a trademark of Bell Laboratories. FLEX™ and UniFLEX™ are trademarks of Technical Systems Consultants, Inc.

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Circle 435 on inquiry card.

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• Whether operations require the "Ram-Disc 128" to operate as a floppy replacement or as a high speed data acquisition system is solely dependent on single system configuration.

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"Rom-Disc" $289

• The "Rom-Disc-128" is a direct replacement for floppy disc drives used for the purpose of booting the CP/M operating system. Further the "Rom-Disc-128" is a direct replacement for floppy disc drives used to load and store applications programs.

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• Under popular CP/M utilities the "Rom-Disc-128" appears as a simple disc drive.

• With CP/M configured in the S.D. Rom format, systems boot in less than 1/10 of a second.

• Equipped with a high speed RS-232 serial port the "Rom-Disc-128" will accommodate data transfer to and from the host.

• The "Rom-Disc-128" in conjunction with the previously described "Ram-Disc-128" provide true system portability and independence from floppy disc drives.

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Tandon's TM100 series of 5-inch mini-floppy disk drives all feature Tandon's patented read/write head design.

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TM100-2 double-sided, 40 track per side, 5.25-inch floppy-disk drive with a storage capacity of 500K bytes unformatted and a track-to-track access time of 5-milliseconds 269.00

TM100-3 A single-sided, 80 track, 5.25-inch floppy-disk drive with a storage capacity of 500K bytes unformatted and a track-to-track access time of 3-milliseconds 250.00

TM100-4 A double-sided, 80 track per side, 5.25-inch floppy-disk drive with a storage capacity of 1000K bytes unformatted and a track-to-track access time of 3-milliseconds 369.00

Tandon's TM848 "Thinline" series of 8-inch floppy-disk drives all feature Tandon's patented read/write head design. The unique "Thinline" design allows two drives to be installed in the same space as a single conventional drive.

Available in two models:

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TM848-2 A double-sided, 77 track per side floppy-disk drive with a storage capacity of 1.2 megabytes double density (IBM format), and it has a 3-millisecond track-to-track access time 490.00

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Alpha Byte COMPUTER PRODUCTS

31245 LA BAYA DRIVE
WESTLAKE VILLAGE, CA 91362

Circle 25 on inquiry card.

Circle 295 on inquiry card.

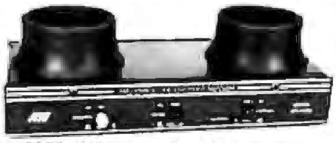
Listing 3 continued:

```
     :AT=LEFT$(AN,1)
     :IF MID$(ADEC,ASC(AT)-31,1)="3"                   **TEST WHETHER IT IS A LETTER
         GOTO 600
610 IF AT>="0" AND AT<="9"                             **OR A NUMBER(CATEGORY 4)
       THEN IF NT=3                                      AND ADDS IT TO THE WORD
              THEN NT=4
                    :GOTO 600

              :ELSE GOTO 500
615 AB=AB+" "                                          **WHEN THE WORD IS DONE, A
     :IART=0                                             SPACE IS ADDED AT THE END
     :IF FART=0                                        **IF FILLER WORDS ARE TO BE
         THEN RETURN                                     SKIPPED, THE WORD IS
620 IF AB=AART(IART)                                     COMPARED WITH THE LIST
       GOTO 500
625 IART=IART+1
     :IF IART<NART
         GOTO 620
630 RETURN
*****************************************************************************

THIS SECTION OF THE PARSER EXTRACTS CATEGORY 1 OR 2 NUMBERS

*****************************************************************************
640 AN=RIGHT$(AN,LEN(AN)-1)
     :IF AT="+" OR AT="-"                              **TESTS WHETHER + OR - ARE
        THEN IF NOT(((LEFT$(AN,1)=".")AND(MID$(AN,2,1)>="0"      IMMEDIATELY
                  AND MID$(AN,2,1)<="9"))OR(LEFT$(AN,1)>="0"    FOLLOWED BY A
                  AND LEFT$(AN,1)<="9"))                         NUMBER
              THEN NT=7
                    :GOTO 550
645 IF AT="."                                          **TESTS WHETHER . IS A LEADING
       THEN IF NOT(LEFT$(AN,1)>="0" AND LEFT$(AN,1)<="9")        DECIMAL
              THEN NT=7
                    :GOTO 550
650 FD=0                                               **INITIALIZE DECIMAL AND
     :FE=0                                               EXPONENT FLAGS AND BEGIN
     :IF AT="+"                                          BUILDING THE WORD
        GOTO 654
651 IF AB="."
       THEN FD=1
            :AB="+."
            :GOTO 656
654 AB=AT
656 AT=LEFT$(AN,1)                                     **GET NEXT CHARACTER
660 IF AT>="0" AND AT<="9"                             **NUMBER?
       GOTO 705
665 IF AT="." AND FD=0 AND FE=0                        **DECIMAL POINT?
       THEN FD=1
            :GOTO 705                                  **SIGN AS PART OF EXPONENT?
670 IF (AN="+" OR AT="-")AND(RIGHT$(AB,1)="E" OR RIGHT$(AB,1)="D")
       GOTO 705
675 IF NOT(AT="E" OR AT="D")                           **EXPONENT LETTER?
       GOTO 695
678 IF PE=1                                            **THESE ARE FURTHER TESTS ON
       GOTO 595                                          WHETHER D AND E ARE PART OF
679 IF LEN(AN)<2                                         AN EXPONENT OR PART OF A
       GOTO 695                                          NEW WORD
680 IF MID$(AN,2,1)>="0" AND MID$(AN,2,1)<="9"
       THEN FE=1
            :GOTO 705
685 IF NOT(MID$(AN,2,1)="+" OR MID$(AN,2,1)="-")
       GOTO 695
689 IF LEN(AN)<3
       GOTO 695
690 IF MID$(AN,3,1)>="0" AND MID$(AN,3,1)<="9"
       THEN FE=1
            :GOTO 705
695 NT=2                                               **ENTITY IS COMPLETE(DETERMINE
     :DV=VAL(AB)                                         WHETHER THE COMPLETE ENTITY
     :IF ABS(DV)>32767                                   IS AN INTEGER OR A REAL
         THEN IV=SGN(DV)*32767                           NUMBER
         ELSE IV=DV
696 IF FD=0 AND DV=IV
       THEN NT=1
700 RETURN
705 AB=AB+AT                                           **THIS ADDS ACCEPTABLE CHAR-
     :AN=RIGHT$(AN,LEN(AN)-1)                            ACTER TO THE STRING AND GETS
     :IF LEN(AN)=0                                       NEXT CHARACTER FOR TESTING
         GOTO 695
710 AT=LEFT$(AN,1)
     :GOTO 660
*****************************************************************************

SUBROUTINE GET_WORD
     USER-ACCESSIBLE SUBROUTINE(LINE 750)FOR MATCHING ENTITIES
     (EXCEPT CATEGORY 6--STRINGS)
     FOR NUMBERS, NORMALLY USE SUBROUTINE 850 OR 950

   INPUT
     AM--THE STRING TO BE MATCHED AGAINST THE CURRENT ENTITY
          (FOR CATEGORY 3 OR 4 MATCHES, IT MAY INCLUDE ONE TRAILING BLANK)
     NLET--THE NUMBER OF LETTERS BEGINNING AT THE LEFT TO BE MATCHED
          (CATEGORY 7 IS ALWAYS "NLET=1")
```

Listing 3 continued on page 348

MODEM
$129.95

No other acoustic modem gives you all these features at this low price.



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921 Louisville Road, Starkville, MS 39759

Listing 3 continued:

```
  OUTPUT
      FLAG--INDICATES THE SUCCESS OF THE MATCH
           1--SUCCESSFUL MATCH
           0--UNSUCCESSFUL MATCH

*****************************************************************************
750 IF FENT=1
        THEN GOSUB 500
753 IF FTR=1
        THEN PRINT "MATCHING ENTITY ";AB;" WITH ";AM
755 FLAG=0
    :IF NT<>6
         THEN IF LEFT$(AB,NLET)=LEFT$(AM,NLET)
                THEN FLAG=1
                     :FENT=1
760 RETURN
*****************************************************************************

SUBROUTINE STRING?
     USER-ACCESSIBLE SUBROUTINE(LINE 800)TO TEST FOR STRINGS(CATEGORY 6)

  INPUT--NONE

  OUTPUT
      FLAG--INDICATES THE SUCCESS OF THE MATCH
           1--SUCCESSFUL MATCH
           0--UNSUCCESSFUL MATCH
      AB--CONTAINS STRING

*****************************************************************************
800 IF FENT=1
        THEN GOSUB 500
803 IF FTR=1
        THEN PRINT "CHECKING IF ";AB;" IS A STRING"
805 FLAG=0
    :IF NT=6
         THEN FLAG=1
              :FENT=1
810 RETURN
*****************************************************************************

SUBROUTINE INTEGER?
     USER-ACCESSIBLE SUBROUTINE(LINE 850)TO TEST FOR INTEGERS

  INPUT
      FT--CODE FOR ACCEPTABLE VALUES
           1--ACCEPT ANY REAL NUMBER OR INTEGER; CONVERT TO INTEGER
           2--ACCEPT ANY REAL NUMBER OR INTEGER; CONVERT TO INTEGER; IF OUTSIDE
              BOUNDS, SET TO NEAREST BOUND
           3--ACCEPT ANY REAL NUMBER OR INTEGER WITHIN THE BOUNDS(REJECT OTHERS);
              CONVERT TO INTEGER
          -1--ACCEPT ONLY INTEGERS(ANY VALUE)
          -2--ACCEPT ONLY INTEGERS; IF OUTSIDE BOUNDS, SET TO NEAREST BOUND
          -3--ACCEPT ONLY INTEGERS WITHIN THE BOUNDS
      BB1--LOWER BOUND
      BB2--UPPER BOUND
        (NOTE--BOTH BOUNDS MUST BE ENTERED IF CATEGORIES 2,3,-2, OR -3 ARE
              CHOSEN)

  OUTPUT
      FLAG--INDICATES THE SUCCESS OF THE TEST
           1--SUCCESSFUL TEST
           0--UNSUCCESSFUL TEST
      IV--CONTAINS THE INTEGER VALUE IF TEST IS SUCCESSFUL

  NOTE
      ABSOLUTE VALUES GREATER THAN 32767 WILL BE REDUCES TO 32767 OR -32767
      IF THIS ROUTINE IS USED TO CHECK FOR THE VALUES--USE SUBROUTINE 950
      IF VERY LARGE NUMBERS MAY BE INVOLVED

*****************************************************************************
850 GOSUB 900
852 IF FTR=1
        THEN PRINT "CHECKING IF ";AB;" IS AN INTEGER"
853 IF FLAG=0
        THEN RETURN
855 IF FT>0
        THEN FENT=1
             :RETURN
860 IF NT=1
        THEN FENT=1
             :RETURN
865 FLAG=0
    :RETURN
*****************************************************************************

COMMON SUBROUTINE FOR BOTH INTEGER AND REAL NUMBER TESTING

*****************************************************************************
900 FLAG=0
    :IF FENT=1
        THEN GOSUB 500
905 IF NT=7 AND AT=AINB,                            **INPUT OF GRAPHICAL VALUES
        THEN FENT=1                                   (REQUIRES GRAPHICS
             :GOSUB 500                               SUBROUTINE AT LINE 2500)
             :IF NT<>3
                 THEN NERR=1055
```

Listing 3 continued on page 350

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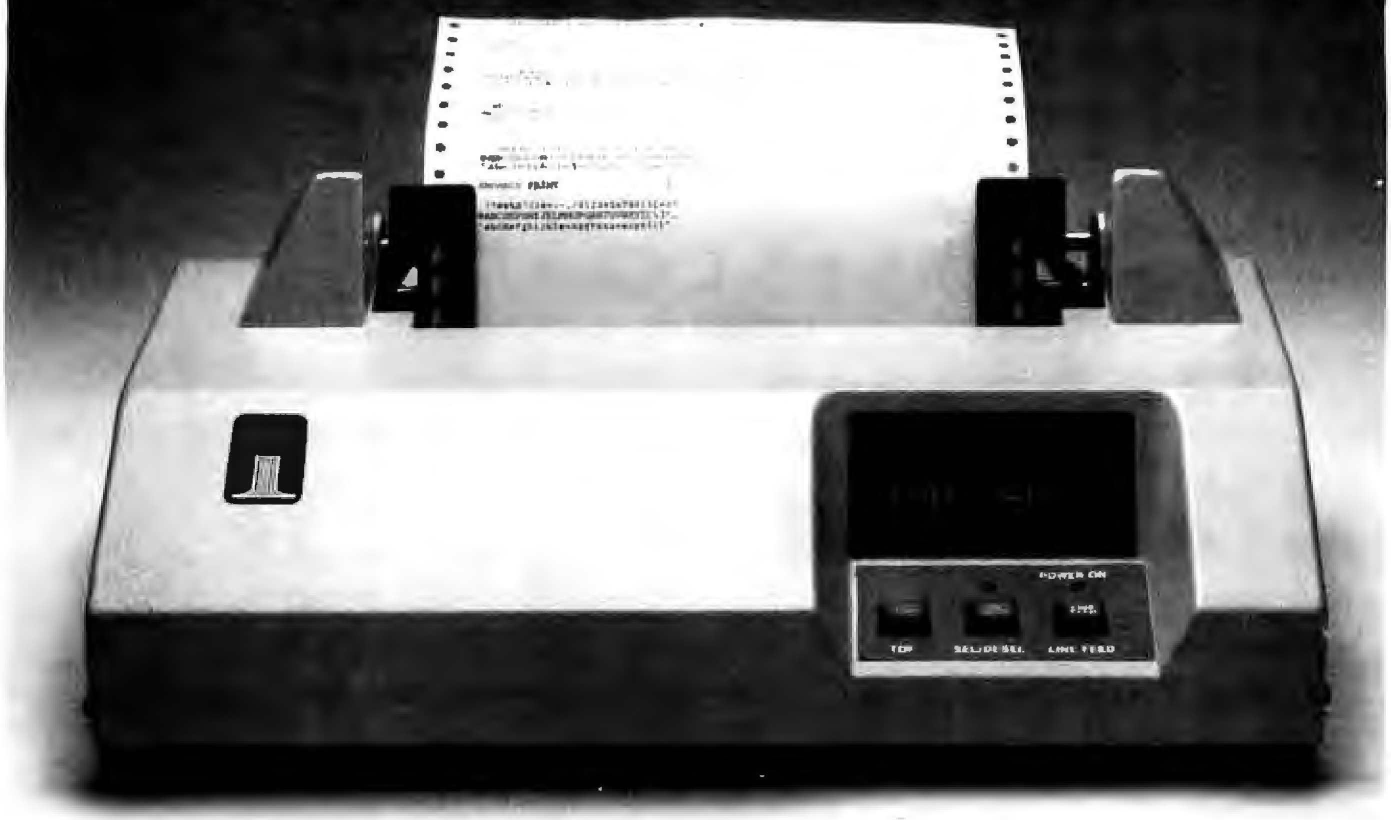

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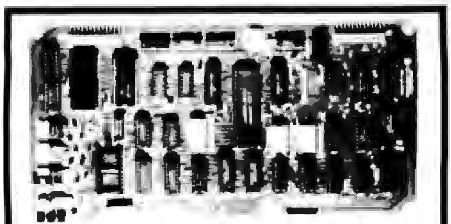
Circle 444 on Inquiry card.



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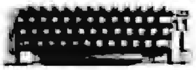

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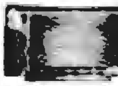

S-100 Prototype. Double sided glass with gold plated and numbered S-100 contacts. Matrix of 75 x 78 solder plated donuts on .15" x .1" spacing. Locations for headers and regulators.
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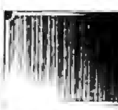

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Listing 3 continued:

```
                    :GOSUB 1200
                    :FERR=1
                    :RETURN
               :ELSE IE=INSTR(1,AN,ATNE)
                    :IF IE=0
                        THEN NERR=1056
                             :GOSUB 1200
                             :FERR=1
                             :RETURN
                        :ELSE AN=RIGHT$(AN,LEN(AN)-IE)
                             :GOSUB 2500
910 IF NT<>1 AND NT<>2                                  **NUMBER?
        THEN RETURN
915 IF BB2<BB1 AND ABS(FT)<>1                           **ARE BOUNDS ACCEPTABLE?
        THEN NERR=1052
             :GOSUB 1200
             :RETURN
920 IF ABS(FT)=3                                        **WITHIN BOUNDS FOR FT=ABS(3)?
        THEN IF DV<=BB2 AND DV>=BB1
                THEN FLAG=1
                     :RETURN
             :ELSE RETURN
930 FLAG=1
     :IF ABS(FT)=1
        THEN RETURN
935 IF FT=2                                             **SET TO NEAREST BOUND?
        THEN IF DV<=BB1
                THEN DV=BB1
                     :TV=BB1
             :ELSE IF DV>=BB2
                     THEN TV=BB2
                          :DV=BB2
940 IF FT=-2
        THEN IF DV<BB1
                THEN IF NT=1
                        THEN TV=BB1

                        ELSE DV=BB1
             ELSE IF DV>BB2
                     THEN IF NT=1
                             THEN TV=BB2
                             ELSE DV=BB2
945 RETURN
****************************************************************************************

SUBROUTINE REAL NUMBER?
     USER-ACCESSIBLE SUBROUTINE(LINE 950)TO TEST FOR REAL NUMBERS

  INPUT
     FT--CODE FOR ACCEPTABLE VALUES
         1--ACCEPT ANY REAL NUMBER OR INTEGER; CONVERT TO REAL NUMBER
         2--ACCEPT ANY REAL NUMBER OR INTEGER; CONVERT TO REAL NUMBER; IF
              OUTSIDE BOUNDS, SET TO NEAREST BOUND
         3--ACCEPT ANY REAL NUMBER OR INTEGER WITHIN THE BOUNDS(REJECT OTHERS);
              CONVERT TO READ NUMBER
        -1--ACCEPT ONLY REAL NUMBERS(ANY VALUE)
        -2--ACCEPT ONLY REAL NUMBERS; IF OUTSIDE BOUNDS, SET TO NEAREST BOUND
        -3--ACCEPT ONLY REAL NUMBERS WITHIN THE BOUNDS
     BB1--LOWER BOUND
     BB2--UPPER BOUND
        (NOTE--BOTH BOUNDS MUST BE ENTERED IF CATEGORIES 2,3,-2, OR -3 ARE
              CHOSEN)

  OUTPUT
     FLAG--INDICATES THE SUCCESS OF THE TEST
         1--SUCCESSFUL TEST
         0--UNSUCCESSFUL TEST
     DV--CONTAINS THE REAL NUMBER VALUE IF TEST IS SUCCESSFUL

****************************************************************************************
950 GOSUB 900
952 IF PTR=1
        THEN PRINT "CHECKING IF ";AB;" IS A REAL NUMBER"
953 IF FLAG=0
        THEN RETURN
955 IF FT>0
        THEN FENT=1
             :RETURN
960 IF NT=2
        THEN FENT=1
             :RETURN
965 FLAG=0
     :RETURN
****************************************************************************************

SUBROUTINE NEW COMMAND
     USER-ACCESSIBLE SUBROUTINE(LINE 1050)TO SET UP "AN" SO THAT THE LEFT ENTITY
     IN A NEW COMMAND IS THE LEFT ENTITY IN "AN"

  INPUT--NONE

  OUTPUT--NONE OF CONCERN TO THE USER

****************************************************************************************
1050 FERR=0
     :IEOC=0
     :IE=INSTR(1,AN,AEOC)
     :IF IE>0
        THEN AN=RIGHT$(AN,LEN(AN)-IE)
```

Listing 3 continued on page 353


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Listing 3 continued:

```
               :FENT=1
               :RETURN
          :ELSE IF NOT(EOF(1))
                    THEN GOSUB 1055
                         :GOTO 1050
1051 IF FEOC<1
        THEN GOSUB 1055
             :FENT=1
             :RETURN
1052 GOSUB'1055
     :GOTO 1050
************************************************************************************

SUBROUTINE FOR READING A CONTINUATION LINE FROM THE CONTINUATION FILE OR A NEW
     LINE FROM THE TERMINAL OR INPUT FILE

************************************************************************************
1055 IF NOT(EOF(1))                                        **CONTINUATION LINE?
        THEN LINE INPUT#1,AN
             :JCON=JCON+1
             :RETURN
1060 CLOSE#1                                               **NO!  GET NEW LINE
     :OPEN "O",#1,"READTEMP"
1065 IF PFIL=1
        THEN LINE INPUT#2,AN
             :JFIL=JFIL+1
          :ELSE LINE INPUT "?";AN
1067 IF INSTR(AN,CHR$(34))<>0
        THEN NERR=1053
             :AB=""
             :GOSUB 1200
             :GOTO 1060
1068 IF FTR=1
        THEN PRINT "READING A LINE"
             :PRINT AN
1070 AT=ACON                                               **TEST FOR CONTINUATION LINE
     :GOSUB 1080
     :IF FLAG=1
        THEN PRINT#1,AN
             :GOTO 1055
          :ELSE IF PFIL=1                                  **TEST FOR END OF FILE INPUT
                    THEN IF EOF(2)
                         THEN PFIL=0
                              :CLOSE #2
1075 PRINT#1,AN                                            **PUT LINE IN CONTINUATION
     :CLOSE#1                                                FILE AND THEN SET FOR INPUT
     :OPEN "I",#1,"READTEMP"                                 FROM CONTINUATION FILE
     :FLAG=0
     :JCON=0
     :GOTO 1055
1080 IF RIGHT$(AN,1)=" "                                   **TESTING ROUTINE FOR
        THEN AN=LEFT$(AN,LEN(AN)-1)                          CONTINUATION AND END OF FILE
             :IF LEN(AN)>0                                   CHARACTERS
                  THEN GOTO 1080
1085 IF RIGHT$(AN,1)=AT
        THEN AN=LEFT$(AN,LEN(AN)-1)
             :FLAG=1
             :RETURN
          :ELSE FLAG=0
             :RETURN
************************************************************************************

SUBROUTINE SKIP
     USER-ACCESSIBLE SUBROUTINE(LINE 1150)TO SKIP OVER CURRENT ENTITY TO THE
     NEXT ONE UNLESS IT IS THE END OF A COMMAND

  INPUT--NONE

  OUTPUT
     FLAG--INDICATES SUCCESS OF THE SKIP
          1--SUCCESSFUL SKIP--THERE IS MORE TO THE COMMAND
          0--UNSUCCESSFUL SKIP--THIS IS THE END OF THE COMMAND

************************************************************************************
1150 FLAG=0
     :IF IEOC=1
        THEN RETURN
        ELSE IF LEFT$(AB,1)=AEOC AND NT=7
                  THEN IEOC=1
                       :RETURN
1155 IF AN="" AND FEOC=0
        THEN IEOC=1
             :RETURN
1160 FLAG=1
     :FENT=1
     :RETURN
************************************************************************************

SUBROUTINE ERROR
     USER-ACCESSIBLE SUBROUTINE(LINE 1200)TO PRINT ERROR MESSAGE

  INPUT
     NERR--THE NUMBER OF THE ERROR
```

Listing 3 continued on page 354

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Listing 3 continued:

```
  OUTPUT
     TO THE TERMINAL--GIVES ERROR#, MESSAGE, AND THE CURRENT ENTITY

*******************************************************************************
1200 GET#3,NERR
     :PRINT "ERROR #";NERR;" ";AERR
1205 PRINT "THE CURRENT ENTITY IS ",AB
     :RETURN
*******************************************************************************

SUBROUTINE HELP AND VOCAbulary
     USER-ACCESSIBLE SUBROUTINE(LINE 1250)FOR HANDLING MATCHING ON THE WORDS
     "VOCAbulary", "HELP", AND "HELPL"

  INPUT--NONE

  OUTPUT
     FLAG--INDICATES THE SUCCESS OF THE MATCH
         1--SUCCESSFUL MATCH
         0--UNSUCCESSFUL MATCH
     TO THE TERMINAL--THE DESIRED INFORMATION
         (OUTPUT IS DIRECTED TO THE LINE-PRINTER BY HELPL--DO NOT USE IF
         USING THE LINE-PRINTER PORT FOR A PLOTTER)

*******************************************************************************
1250 AM="VOCA"                                          **TESTING FOR "VOCABULARY"
     :NLET=4
     :GOSUB 750
     :IF FLAG=0
        THEN GOTO 1270
        ELSE PRINT "The command words are:"
             :OPEN "I",#4,ADISK+"VOCA"+APRG
1260 IF EOF(4)
       THEN CLOSE#4
            :RETURN
       :ELSE INPUT#4,AVOC
            :PRINT AVOC
            :GOTO 1260
1270 AM="HELP"                                          **TESTING FOR "HELP"
     :NLET=4
     :GOSUB 750
     :IF FLAG=0
        THEN RETURN
        ELSE OPEN "I",#4,ADISK+"VOCA"+APRG
             :IH=0
             :IF AB="HELPL "                            **DO YOU WANT A PRINTOUT ON
                THEN IH=1                                 ON THE LINE PRINTER?
1275 IHELP=0                                            **IS IT "HELP ALL"?
     :AM="ALL "
     :NLET=4
     :GOSUB 750
1280 IF FLAG=0
       GOTO 1290
1285 IF EOF(4)
       THEN CLOSE#4
            :RETURN
       :ELSE INPUT#4,AVOC
            :GOSUB 1300
            :GOTO 1285
1290 IF EOF(4)                                          **MATCHING FOR AN INDIVIDUAL
       THEN CLOSE#4                                       COMMAND
            :NERR=1054
            :GOSUB 1200
            :AB="VOCA"
            :GOTO 1250
       :ELSE AM=LEFT$(AVOC,4)
            :NLET=4
            :GOSUB 750
            :IF FLAG=1
               THEN GOSUB 1300
                    :CLOSE#4
                    :RETURN
               :ELSE GOTO 1290
1300 OPEN "I",#5,ADISK+APRG+LEFT$(AVOC,4)
1310 IF EOF(5)
       THEN CLOSE#5
            :RETURN
       :ELSE LINE INPUT#5,AHLP
            :IF IH=0
               THEN PRINT AHLP
                    :GOTO 1310
               :ELSE LPRINT AHLP
                    :GOTO 1310
*******************************************************************************

SUBROUTINE SAVE VARIABLES
     USER-ACCESSIBLE SUBROUTINE(LINE 1400)FOR SAVING NLP-80 VARIABLES BEFORE
     CHAINING NEW PAGE(IF "ALL" IS NOT AN OPTION IN "CHAIN")

  INPUT--NONE

  OUTPUT--NONE

*******************************************************************************
1400 OPEN "O",#7,"SAVENLP"
     :WRITE#7,AB,ACON,ADEC,ADISK,AEOC,AEOL,AFIL,AINB,AINE,AOUT,AP,APLT,APRG,
              AR,ARET,ASTR,AT,ATER
```

Listing 3 continued on page 356

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Listing 3 continued:

```
     :WRITE#7,AN
     :WRITE#7,DV,FART,FAXES,FCOM,FENT,FEOC,FERR,FFIL,FTR,IEOC,IRET,IV,JCON,
            JFIL,NART,NCOM,NERR,NT
1410 FOR IART=0 TO NART
        :WRITE#7,AART(IART)
     :NEXT IART
1420 FOR ICOM=0 TO NCOM
        :WRITE#7,ACOM(ICOM)
     :NEXT ICOM
1430 CLOSE
     :RETURN
********************************************************************************

SUBROUTINE RESTORE VARIABLES
     USER-ACCESSIBLE SUBROUTINE(LINE 1450)TO RESTORE THE VARIABLES AFTER
     CHAINING THAT WERE SAVED BY SUBROUTINE 1400

  INPUT--NONE

  OUTPUT--NONE

********************************************************************************

1450 OPEN "I",#7,"SAVENLP"
     :INPUT#7,AB,ACON,ADEC,ADISK,AEOC,AEOL,AFIL,AINB,AINE,AOUT,AP,APLT,APRG,
            AR,ARET,ASTP,AT,ATER
     :INPUT#7,AN
     :INPUT#7,DV,FART,FAXES,FCOM,FENT,FEOC,FERR,FFIL,FTR,IEOC,IRET,IV,JCON,
     JFIL,NART,NCOM,NERR,NT
1460 FOR IART=0 TO NART
        :INPUT#7,AART(IART)
     :NEXT IART
1470 FOR ICOM=0 TO NCOM
        :INPUT#7,ACOM(ICOM)
     :NEXT ICOM
1475 CLOSE #7
********************************************************************************

ALTERNATE ENTRY POINT(LINE 1480)TO SUBROUTINE RESTORE VARIABLES
     USED IF "ALL" WAS AN OPTION IN "CHAIN"
     RESTORES SEQUENTIAL INPUT AND CONTINUATION FILES AND OPENS THE RANDOM
     ERROR FILE

  INPUT--NONE

  OUTPUT--NONE

********************************************************************************
1480 OPEN "I",#1,"READTEMP"
     :IF JCON>0
         THEN FOR IDUM=1 TO JCON
                 :LINE INPUT#1,ADUM
              :NEXT IDUM
1481 IF FFIL=1
        THEN OPEN "I",#2,AFIL
             :IF JFIL>0
                 THEN FOR IDUM=1 TO JFIL
                         :LINE INPUT#2,ADUM
                      :NEXT IDUM
1482 OPEN "R",#3,ADISK+APRG+"ERR",80
     :FIELD #3,80 AS AERR
     :RETURN
1499 REM
********************************************************************************

RESERVED FOR FUTURE DEVELOPMENT(LINES 1500-2499)

********************************************************************************
1500 REM
2499 REM
********************************************************************************

RESERVED FOR PLOTTER-DEPENDENT GRAPHICAL INPUT ROUTINES(LINES 2500-2999)

********************************************************************************
2500 PRINT "YOU HAVE NOT DESIGNATED A PLOTTER TYPE"
     :FERR=1
     :GOTO 500
2999 REM END GRAPH
3000 REM BEGIN APPLICATION PROGRAM
9999 REM END APPLICATION PROGRAM
```

Listing 4: *The variables and their descriptions as used in the POL-80 program.*

VARIABLE	DESCRIPTION	EXAMPLE
AART(20)	Array--list of filler words to be skipped	AART(0)="A "
AB	Current entity string	
ACOM(10)	Array--list of characters(not letters or numbers)to be skipped in input	ACOM(0)=","

Listing 4 continued:

ACON	Character for "continuation of input"	Default is "&"
ADEC	Contains the classifications of characters for the decision table	See program line 30
ADISK	Disk unit prefix for current program file	Default is "A:"
AEOC	Character for "end for command"	Default is ":"
AEOL	Character for "end of line"(remainder of line is comments)	Default is "#"
AERR	Error message to be printed on terminal	
AFIL	Filename used for input of commands instead of terminal	
AINB	Character for "graphical input" beginning	Default is "!"
AINE	Character for "graphical input" ending	Default is "!"
AM	Entity for comparison with AN(supplied by user program)	
AN	Remaining portion of input string not yet tested	
AOUT	Character for "output to terminal" from the command line	Default is "$"
AP	Character for "program exchange"	Default is "@"
APLT	String identifying the plotter being used	"DIA" or "A:DIA" for DIABLO
APRG	Current program name(first 4 letters)	"NUMR"
AR	Character for "input control"	Default is "!"
ARET	Return filename for use in some CHAIN statements	
ASTR	Character for "string delimiter in input"	Default is "'"
AT	Current character or string being tested	
ATER	Character for "input from terminal"	Default is "%"
AVOC	String for command words under VOCAbulary	
BB1	Lower boundary in number matching routine (supplied by user program)	
BB2	Upper boundary in number matching routine (supplied by user program)	
DV	Real value of number in input	
FART	Flag--whether to keep or skip over filler words(articles)	0--keep 1--skip
FAXES	Flag--whether axes are drawn	0--no 1--yes
FCOM	Flag--whether to keep or skip over some special characters(like commas)	0--no 1--yes
FD	Flag--decimal found in extracting number	0--no 1--yes
FE	Flag--exponent(D or E) found in extracting number	0--no 1--yes
FENT	Flag--whether to get the next entity(i.e., call the parser)	0--no 1--yes
FEOC	Flag--determines what is the end of a command	0--":" and CR 1--":" only
FERR	Flag--shows error has been made(omit the rest of the current command)	0--no 1--yes
FFIL	Flag--source of input	0--terminal 1--file(AFIL)
FLAG	Flag--indicates result from matching routines	0--failed 1--success
FT	Flag--indicates types and range of values acceptable to number matching routines	see remarks at lines 850 & 950
FTR	Flag--trace progress through the input	0--off 1--on
IART	Counter used in deleting filler words listed	

Listing 4 continued on page 360

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Listing 4 continued:

```
               in AART

ICOM           Counter used in deleting characters listed in
               ACOM

IDUM           Counter used in resetting the continuation file
               and AFIL

IE             Location of a character within a string

IEOC           Flag--end of command(get new command)

IH             Flag--used to direct HELP output                 0--terminal
                                                                1--line printer

IHELP          Counter used in HELP routine

IK             Counter used in VOCAbulary routine

IRET           Line number to return to when using a CHAIN
               statement

IV             Integer value(rounded)of number in input

JCON           Number of lines read from the line continuation
               file(used to reset file after CHAINs)

JFIL           Number of lines read from file AFIL(used to
               reset file after CHAINs)

NART           Subscript of the last filler word(articles)in
               the current list(array AART)

NCOM           Subscript of the last character(like commas)
               in the current list(array ACOM)

NERR           Number of the error message to be printed

NLET           Number of letters to be matched in subroutine
               750

NT             Class of current entity
                   1--integer
                   2--real number
                   3--word having letters only
                   4--word having letters and numbers, begins with letter
                   5--word having letters and numbers, begins with number
                      (not currently implemented)
                   6--string
                   7--special character(!@#$%^&*_-+=[]{}";:/?.>,<)
```

Listing 5: *Filenames and conventions used in the POL-80 program.*

```
Filenames:

POL-80.BAS        The program file for POL-80, stored in ASCII format

READTEMP          The continuation file used by POL-80

POLERR            The random file containing error messages for POL-80

____ERR           The random file containing error messages for a mainline
                  program(for example:  NUMRERR for NUMRANAL)

NUMRANAL.BAS      The mainline program stored in ASCII format

NUMR____.BAS      A module called by NUMRANAL, stored in ASCII format

NUMR____          A HELP file for the command given by ____(4 letters)

VOCANUMR          File used by VOCAbulary, giving the list of main command
                  words for NUMRANAL

SAVEPOL           File used to store POL variables during some CHAINS

___GRIN.BAS       The plotter input routines(Lines 2500-2999) for the
                  plotter given by ___(3 letters), stored in ASCII format

(Note:  Do not store programs in compressed or protected format or they will
not work in the CHAINs used in NLP-80)


File Number Assignments:

#1       READTEMP    (the continuation file)                 sequential

#2       ________    (the input file if using file input)    sequential

#3       ____ERR     (the error message file)                random

#4       VOCA____    (command word list)                     sequential

#5       ________    (HELP files)                            sequential

#6-7                 (user files)
                     (3 required when using graphics)
```

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Text continued from page 332:
minal or a prepared command file. (Such a file, designated file #2, is opened by the !FIL 'filename' inserted in a previous input command.) The input can consist of more than one physical line—each line containing up to 250 characters—if a continuation character (&) is included at the end of each line. More than one command can exist on a single physical line if the commands are separated by an end-of-command character (:). A call to subroutine 1050 sets the pointer to the beginning of the next command on the line currently in the buffer (AN). If there is no line in the buffer, subroutine 1055 is called to get a line from the continuation buffer (file #1). If the continuation buffer is empty, however, one or more new lines are read from the input source (the terminal or file #2) and placed in the continuation buffer.

When the command line is in the buffer (AN), the user's application program can attempt to extract information from it by using subroutines 750, 800, 850, and 950. These subroutines allow the program to ask the following questions:

- Is the current entity a specific word or character (e.g., "DRAW" or ":")?
- Is the current entity a string?
- Is the current entity an integer within a certain range of values?
- Is the entity a real number within a certain range of values?

An answer of "yes" to the current question sets FLAG=1 and lets the program go to the next entity in the line.

The actual extracting and categorizing of the current entity is done by subroutine 500 (the parser). It prepares the current entity for matching or examination, while also handling other embedded items within the line.

No process works as smoothly as desired every time. Possible errors in input can always occur. Therefore, subroutine 1200 is provided to output an error message identifying the source and type of error. The error messages for POL-80 are given in listing 6. An example of an error is found in line 70.

Since there will sometimes be filler words that were not planned for, a "skip" subroutine (line 1150) is provided to get the next entity for further processing. This skip routine should be used sparingly as it may lead to extracting the wrong number, etc., causing invalid or confusing results.

Finally, there is an assistance routine (HELP and VOCAbulary—line 1250). If it is invoked and finds a match on the current entity, VOCAbulary gives the list of highest-level command words for each main program, and HELP prints the explanation that was stored on the disk for the desired word. The code for this subroutine gives a preview of the theme of the next part of this series.

In addition to the minimum levels of input handling indicated above, some additional capabilities are included. One—reading stored commands from a file—has already been mentioned. This is especially useful where long sets of commands are frequently used—as in drawing standard, but complicated, axes for a graph.

Another capability allows input to the command from the terminal *as the line is being parsed*. This is especially useful for making minor changes in values in input being read from a prepared command file. Such changes are indicated by inserting a percent sign wherever a word, character, phrase, string, or value is to be inserted later.

A third addition allows a message from the command to be output to the terminal by enclosing the message between dollar signs.

These three capabilities—reading from a file of commands, parsing time input from a terminal, and messages to the terminal—can be used to make a POL program appear to have question-and-answer input. Listing 7 shows a set of commands that can be stored in a file ,that will produce a question-and-answer session. This

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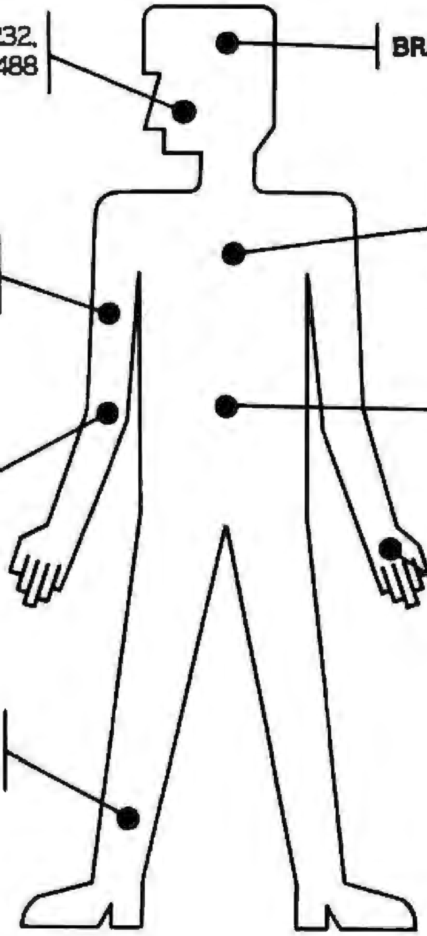

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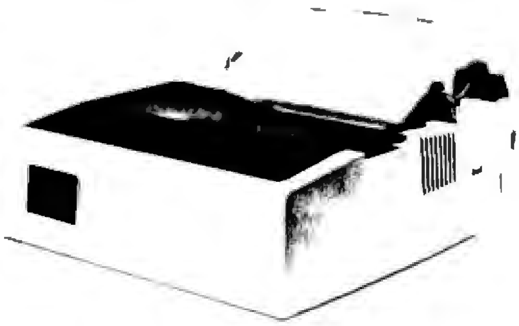

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Listing 6: *Error messages that can be used with a POL program. These messages can be incorporated into POL-80.*

```
1010,"First commands must be control level until an application program is called"
1021,"No filename (in apostrophes) after PRG"
1022,"No character after REA"
1023,"No character after ROC"
1025,"No character after ROL"
1026,"No character after INR"
1027,"No character after INE"
1028,"No character after CON"
1029,"No character after OUT"
1030,"No character after STR"
1031,"No filename(in apostrophes)after FIL"
1032,"No character after TER"
1033,"No character after PRG"
1034,"Incorrect or no keyword after program exchange level character"
1035,"Incorrect or no keyword after control character level character"
1036,"Missing integer after FEC"
1037,"Missing plotter declaration (in apostrophes) after PL""
1050,"Unbalanced string delimiters"
1051,"Unbalanced delimiters of output to screen"
1052,"Lower boundary for numbers larger than upper boundary"
1053,"Used a quote character (ascii 34) in input"
1054,"Missing option or incorrrect command word after HELP"
1055,"Missing X, Y, or Z on graphical input"
1056,"Failed to have closing graphical character"
9999,"*******Last line must always be Line 9999 in error list***********"
```

Listing 7: *Sample input for a POL program in the question-and-answer format.*

```
DRAW XY &
        X FROM $Enter lower bound of X axis$ \ &
          TO   $Enter upper bound of X axis$ \ &
        Y FROM $Enter lower bound of Y axis$ \ &
          TO   $Enter upper bound of Y axis$ \ &
        TITLE  $Enter the lines of the title, each enclosed in apostrphes$ \ &
        EXECUTE
```

Listing 8: *Sample input to produce a contour plot. This input produced figure 3.*

```
DRAW XY PAGESIZE 11 11 &
        MAXIMUM LABEL LINES 6 &
        FRAME &
        X FROM -2 TO 3 &
        Y FROM -2 TO 3 &
        X TICS SIZE .3 &
              MINOR 4 &
              VALUES SIZE .3 &
        Y TICS SIZE .2 &
              MINOR 4 &
              VALUES SIZE .3 &
        TITLE SIZE .5 &
              POSITION .4 &
              LENGTH 1.5 &
              'Contour Plot' &
              'of' &
              'an Equation' &
        SUBTITLE JUSTIFY LEFT &
              POSITION .6 &
              'by Mark Finger' &
              'May, 1981' &
        X AXIS LABEL 'X axis' &
        Y AXIS LABEL 'Y axis' &
                     '(Units unknown)' &
        LEGEND SIZE .25 &
              HEADING 'Values' &
              POSITION 1.0 0.0 &
              DOTTED ' 1' &
              DASH ' 5' &
              LONG DASH '10' &
              DOT DASH '20' &
              LINE '50' &
        EXECUTE
CONTOURS BOUNDARIES -2,-2 3,3 &
         INTERVALS BOTH 30 &
         ISOPOTENTIALS 1 DOTTED &
                       5 DASHED &
                      10 LONG DASH &
                      20 DOT DASH &
                      50 LINE &
         EQUATION 'Z=100*(ABS(Y-X*X))^2+(ABS(1.0-X))^2' &
         PLOT
```

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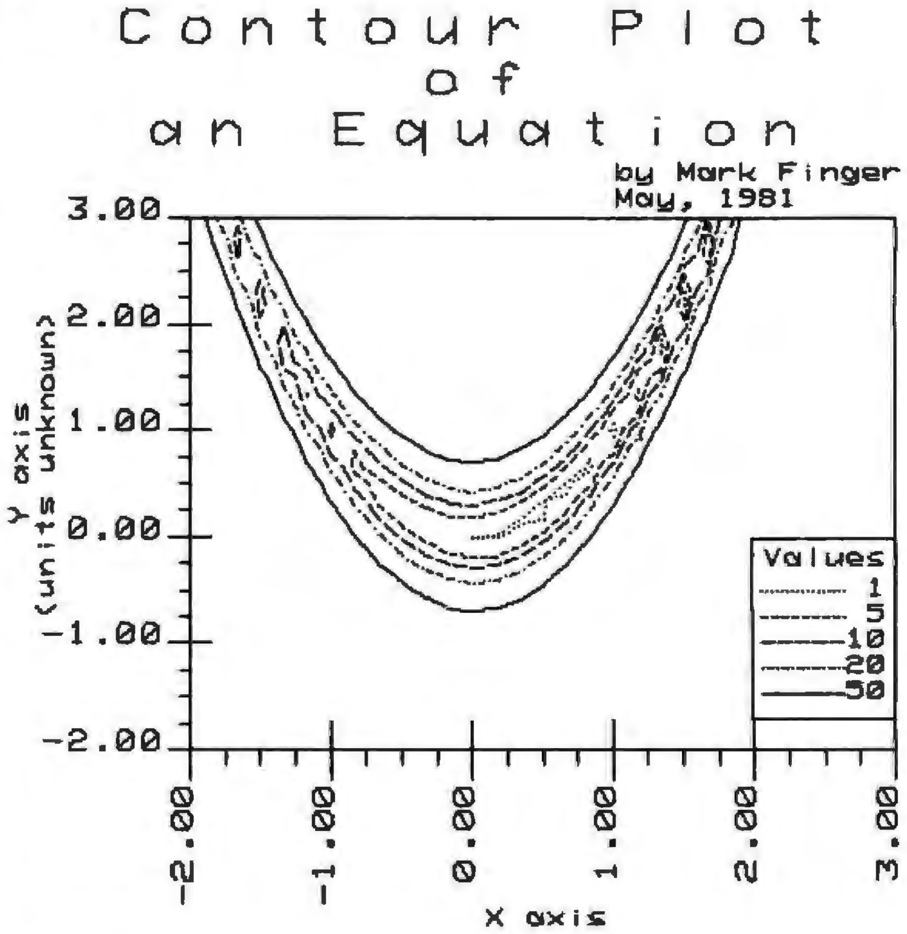

Figure 3: *The resulting output from the input of listing 8.*

can be an advantage because it allows inexperienced users to be led through a program, while users familiar with POL can use the full range of capabilities.

Another useful function allows remarks, especially in prepared command files. Anything within the current command appearing after a number sign is considered a remark.

Finally, direct graphic coordinate input from a plotter is allowed. Most intelligent plotters have some method of moving the pen to a point on the current graph and passing either virtual or screen coordinates to the program. This feature is explained more fully in the graphics package since the program to implement this capability is not included in this series.

A second major portion of POL-80 concerns program control and paging—lines 1 to 200 and 1400 to 1500. The latter portion will frequently be called from within user programs, as will be demonstrated in parts 2 and 3.

Lines 1 to 200 initialize the program and declare major program or plotter packages to be used. The format for this is more rigid (to conserve program size) than in normal input, and each reference to this section must be the only command on a line. (See listing 3 for further explanations.)

Listing 8 shows most of the capabilities of this input for a sample session that produces a contour plot. The format shown here was chosen for its readability and in a normal session would be input as five or six lines. Figure 3 shows the output for this input. It should be noted that this is but a small portion of an interactive session. An optimizer could be used on this graph to locate the minimum value for Z. A second equation could be plotted for comparison, or a numerical integration could be performed, with that equation plotted on a new graph.

An additional capability, *interactive* entry of equations, is a powerful tool in POL/PS. In listing 8, an equation was entered and stored as a sub-

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routine within the module. (The procedure involved will be presented in part 2.)

Another helpful function is a trace—!TON and !TOF. The trace indicates the use of POL-80 routines in processing the current line of input by detailing the tests used on each entity. This is especially useful when checking the various input branches in a new module.

The last item is the ability to change the various control characters (see lines 200 to 490). A character may sometimes be required to assume another meaning within a module or a command line (for example, to allow an apostrophe in a graph title). This capability is allowed to prevent problems with duplicate definitions.

Summary

I have presented the reason for POL input and have shown some of its useful applications. I have also illustrated a framework for the POL/PS within which technical applications programs can be written. The primary goals of this framework are to encourage the development of a technical program base for microcomputers and to relieve the programmer of some of the difficulties of writing large program packages to solve problems.■

References

1. Hilst, R.W. "Development and Use of GRIP, the Generalized Routine for Interactive Processing, in the Computer Solution of Chemical Engineering Problems." Master's thesis, University of Kansas, August 1982.
2. Hilst, R.W. and K.A. Bishop. "Recent Advances in the Development and Use of GRIP—A Problem Oriented Language." In *Summer Computer Simulation Conference*, pages 29-35. Seattle, August 1980.
3. Hilst, R.W. and K.A. Bishop. "The Use of GRIP, a Problem Oriented Language, in Chemical Engineering Education." Paper presented at the 87th National AIChE Meeting in Boston during August 1979.
4. Lopez, L.A. "POLO: Problem-Oriented Language Organizer." *Journal of Computers and Structures*, vol. 2, pages 555-572.
5. Lopez, L.A. *POLO II, Programmer's Guide*. Urbana, IL: Engineering Document Center, University of Illinois, February 1973.

The following items are available from the author:

1. *The* POL/PS User's Manual *and the* ROOTs User's Manual *for $20. These manuals generally supplement but do not duplicate the material presented here. Topics include: detailed rules of input, theory and examples of operation, and programming rules and hints.*
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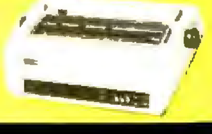

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Sanyo DM8112 CX 12" Mn -Pro. Text	149.99
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Sayno DMC6113 13" Prof Mon	549.99
Sayno VMC7013	319.99
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Electronic Protection Devices Lime	44.99
Elec Protection Devices Orange	69.99
Elec. Protection Devices Peaches	52.99
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BMC 13" Color CRT	229.00
NEC 12" Green CRT	169.00
D. C. Hayes Micromodem II	279.00
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Microsoft Z-80 Softcard	279.00

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Hitachi CT 1928 19" Color TV Rem	425.99
Hitachi CT 1929 19" Color TV Rem	499.99
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Hitachi VT 15A Video Tape Recorder	654.99
Hitachi VT 9701 Video Tape Recder	899.99
Hitachi VT 66P VTR - Port	724.99
Hitachi VT 68P VTR - Port	899.99
RCA AGR054-W B&W 13" TV	114.99
RCA ARGI20-W B&W 12" TV	81.99
RCA EGR333-W 13" Color TV	249.99
RCA FGR430 19" Color TV	299.99
RCA FGR460-WR 19" Color TV	379.99
RCA VGT200 Video Cassette Recder	469.99

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Hewlett Packard HP 41C Sci. Calc.	169.99
Hewlett Packard HP 12C Sci. Calc.	109.99
Hewlett Packard HP 10C Sci. Calc.	54.99
Royal 4-HPD Palm Size Calculator	24.99
Royal 316-PD Desk Top Calculator	64.99
Olivetti 920 - PD Calculator	119.99

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Olivetti Praxis 35 Typewriter	449.99
Royal Century 2000 Port. Elec. Type	219.99

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Olympus S-802 Pearlcorder	74.99
Olympus S-902 Pearlcorder	84.99
Olympus S-801 Pearlcorder	129.99
Olympus SR-11 Micro Cass. w/Head	129.99
Olympus X-01 Pearlcorder	149.99
Olympus XR Basic Pearlcorder	189.99
Olympus XR Standard Pearlcorder	229.99
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Hitachi TRK 7100H Master Ctrs AM-FM Cass Recorder	61.99
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Pioneer SK-300 Stero Radio Cassette	119.99
Pioneer SK-31 Stero Radio Cassette	169.99
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Electra FF 550 Cordless Phone	99.99
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COMPUTER SYSTEMS

NEC PC-8001A $725

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16K RAM Card for Apple II .... $ 68
Microsoft Premium Pack .... $ 525
BISON Add-on Disk Drive
100% Apple Compatible .... $ 279
Parallel Printer Card with Cable .... $ 72
Apple Compatible Parallel Interface ...... $ 65
D C Hayes Micromodem II .... $ 279
Graphics Interface for NEC, Epson .... $ 129
Microsoft Z80 Softcard with CP/M* ...... $ 279
Videx 80 Column Videoterm .... $ 249
Videx Enhancer .... $ 119
Videx Function Strip .... $ 59
Saturn System Ram Boards 32K .... $ 195
Saturn System Ram Boards 64K .... $ 359
Saturn System Ram Boards 128K .... $ 499
Expand 80 - 80 Column for VisiCalc ..... $ 99
Corvus Hard Disk Drives
5 Megabyte $2495
10 Megabyte $3825
20 Megabyte $4575
For Corvus Mirror ADD .... $ 595

For more Apple information circle reader service card #66

PRINTERS

BISON carries all of the major brands of printers. If you need help choosing the proper printer for your needs, call and talk to one of our support technicians

EPSON MX-80 F/T Type III w/Graftrax ..... $ 460
EPSON MX-100 with Graftrax .... $ 625
NEC PC-8023A Fric. & Trac. w/Graph ..... $ 485
NEC 7710-1 .... $2095
NEC 7715-1 .... $2095
NEC 7720-1 .... $2445
NEC 7725-1 .... $2445
Okidata Microline 82A w/Trac - 80 Col ... $ 399
Okidata Microline 83A w/Trac. - 100 Col .. $ 549
Okidata Microline 84P - Parallel .... $ 925
Okidata Microline 84PS - 200 cps P/S .... $ 999
C Itoh Prowriter I - Parallel .... $ 485
C Itoh Prowriter - I Serial .... $ 425
C Itoh Prowriter - Parallel/Serial .... $ 525
C Itoh Prowriter II - Parallel .... $ 625
C Itoh Prowriter II - Parallel/Serial ...... $ 675
C Itoh F-10 Starwriter - Parallel - 40 cps .. $1225
C Itoh F-10 Starwriter - Serial - 40 cps ... $1225
Comrex Daisy Wheel Printer - Parallel .... $ 735
Comrex Daisy Wheel Printer - Serial ...... $ 785
Comrex Tractor Feed .... $ 195

For more printer information circle reader service card #67

MONITORS

BMC International

* 12" Green monitor with P-31 phospher
* 15 Mhz* Excellent for 80 column display

BMC 12" Green Monitor .... $ 89

* 13" Color Monitor* Audio and Video
* 270 Line resolution

BMC 13" Color Monitor .... $ 229

MONITORS

AMDEK Monitors

* 12" Green Phospher
* Non-Glare

AMDEK Video 300 .... Call for Price

* 13" Color Monitor* RGB Input
* For IBM/NEC/Apple

AMDEK Color II .... Call for Price
AMDEK Color I .... Call for Price
AMDEK Color III .... Call for Price

NEC

NEC 12" Green Monitor .... $ 169
NEC 13" Color Monitor .... $ 325
NEC 13" RGB Color Monitor .... $ 815

ZENITH

Zenith 12" Green Monitor .... $ 115

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TELEVIDEO PRODUCTS

TeleVideo computer terminals and desktop computer systems-high price features at low prices

TeleVideo TS-802 Computer system

* 64K, 4 Mhz Z-80A, CP/M*
* Dual Floppies, 720K Total
* Same CRT and Keyboard as Televideo 950 Terminal
* Network Expansion Capabilities

TeleVideo TS-802 .... $2645
TeleVideo TS-802H Same as TS-802
with one floppy and 5-Meg Hard Disk $4695
TeleVideo TVI-925 Terminal .... $ 695
TeleVideo TVI-950 Term - Top-of-Line ... $ 875

For more information circle reader service card #69

SOFTWARE

BISON carries software for all business and personal computer systems. Just select the software you want and call us for our current price. Here are some examples of BISON'S Low Prices:

MicroPro Software

See Left Hand Page for Prices

Apple Software

All APPLE Game and Business software. Select the program you want and call for price
Save up to 60% off list

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G/L .... $ 385
G/L, A/R .... $ 745
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G/L, A/R, A/P, P/R, INV $1875
G/L, A/R, A/P, P/R, POS, INV $2140
G/L, A/R, A/P, P/R, S/O, INV $2140
G/L, A/R, A/P, P/R, P/O, INV $2140
G/L, A/R, A/P, P/R, P/O, S/O, INV $2435
All 8 Modules $2695

SOFTWARE

For Apple II
Pick the Apple Combination you need

G/L .... $ 276
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G/L, INV .... $ 553
G/L, A/R, A/P .... $ 649
G/L, A/R, INV .... $ 649
G/L, A/P, INV .... $ 649
VisiCalc .... $ 199
VisiFile .... $ 199
dBASE II for 8" or Apple .... Call for Lowest Price

S-100 PRODUCTS

Sierra Data Sciences

S-100 Master/Slave Single Board Computers
Master - 4 Mhz, Z 80A .... $ 690
Slave - 4 Mhz, Z 80A .... $ 625
Sierra Data CP/M .... $ 160
Sierra Data BIOS .... $ 100
Sierra Manual .... $ 25
Sierra Data - Winchester Adaptor .... $ 145
Sierra Data Turbo DOS .... $ 750

QT-Systems Mainframes

S-100 Mainfame and 8" Drive Enclosures

* S-100 Power +8V/16A +16V/3A -16V/3A
* Drive Power +5V/1A -5V/6A +24V/6A
* Keyed Power Switch
* EMI Filter * Filtered Fan
* 2 Switched Power Outlets
* 15 - DB25 Cutouts
* DB37 Cutout * IDS 50 Cutout
* Hard Disk Power Supply
* Shielded Motherboard * Rugged Card Cage
* 9⅝" x 17" x 21" (H x W x D)

QT 6-Slot, Dual 8" Drives .... $ 530
QT 8-Slot, Dual 8" Drives .... $ 560
QT 12-Slot, Dual 8" Drives .... $ 620

S-100 Mainframe and 5¼" Drive Enclosures

* Similar to 8" Mainframe
* 7" x 17" x 20" (H x W x D)

QT 6-Slot, Dual 5¼" Drives .... $ 455
QT 8-Slot, Dual 5¼" Drives .... $ 595
QT 12-Slot, Dual 5¼" Drives .... $ 560

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Changeable faceplate allows use of all standard 8" floppy and hard disk drives including.

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* Qume * Mitsubishi
* Tandon (Up to 4 Thin-Line)

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List Price $395 .... BISON PRICE $295

DISK DRIVES

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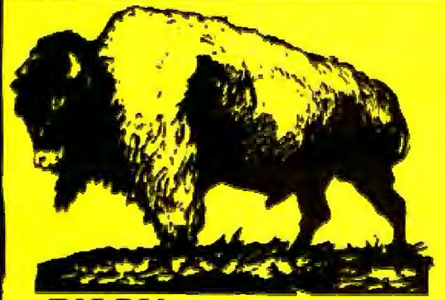
Tandon Thin 8" Sngl.-Side Dbl.-Density ... $ 382
Tandon Double-Density .... $ 465

WABASH FLOPPY DISKS

Single-Sided Single Density
Box of 10 8" or 5¼" .... $ 19



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Practical Dynamic-Memory System Design

A straightforward look at design with dynamic devices.

Rob Belics
9746 Twincrest Dr.
St. Louis, MO 63126

Many a computer experimenter has gotten sweaty palms at the thought of having to tackle the design of a dynamic-memory board. Dynamic memories are notoriously difficult to work with because of the special attention that must be paid to timing relationships. Although using static memory may make small increases in memory size easy, the power consumption of most inexpensive static devices is prohibitive for large systems. With the price of 16K by 1-bit dynamic-memory devices now around two dollars, their price-to-performance ratio is difficult to beat. In this article, I will describe the design of a dynamic-memory system; it's really no harder than any other interfacing job you may have taken on in the past, just more detailed.

The Trade-offs

In addition to their price-to-performance ratio, dynamic memories have an advantage over most static memories because of their simpler structure: one transistor and one capacitor form a basic dynamic bit cell. On the other hand, a static bit is a clocked flip-flop like those in a 7474-type TTL (transistor-transistor logic) device. Each flip-flop is composed of several logic gates that in turn are composed of several transistors and resistors. Because many transistors and resistors use up a great deal of power, generating a large amount of heat, and because they take up a lot of space, only so many flip-flops can fit on an integrated circuit. This is why static memory rarely approaches the density of dynamic memory.

Of course, you never get something for nothing. The most popular and inexpensive memory device today, the 4116-type 16K by 1-bit dynamic RAM (random-access read/write memory), requires specially developed clocking and timing signals, as well as three separate power-supply voltages that must first be applied in a certain order. Compared to static memories, dynamic memories have slower data-access times (although they are more than fast enough for the average microcomputer). And we've all heard of an insidious problem called *refresh*, haven't we? That dynamic cell's capacitor can't hold a charge forever—it will all leak out if you don't give it a boost every so often. With a little planning, though, these disadvantages are easily overcome and dynamic memories do provide more storage in less space for less money.

What's Inside?

A 4116-type memory contains two identical arrays of cells, each arranged in 128 rows of 64 columns. To access (read or write) one of the cells, an address must be supplied to the memory. It takes a 14-bit address to select 1 bit out of the 16,384 on the chip. The address is multiplexed onto 7 pins to cut down on the size of the DIP (dual-inline package) that houses the chip. This means that we first give the memory 7 row-address bits (A0 through A6), and then we give it the 7 column-address bits (A7 through A13). Thus, the 4116 fits in a 16-pin package instead of a 24-pin package (see figure 1).

To tell the memory which address is which, there is a strobe signal for each part of the address. $\overline{\text{RAS}}$ (row-address strobe) is applied when the row address is available to the memory, so that an on-chip decoder can pick one of the 64 rows; $\overline{\text{CAS}}$ (column-address strobe) is applied to tell another on-chip decoder to pick one of the 128 columns, as well as selecting which array will be used. A signal called $\overline{\text{WRITE}}$ tells the memory whether to read the bit stored at the address or to write a new value there. Making sure that the strobe signals get sent at the right time is the

Merry Christmas from asap computer products, inc.

Modems

Manufacturer	Model #	Price
Novation	CAT	$159.00
Novation	d-CAT	$170.00
Novation	Auto-Cat	$229.00
DC Hayes	Smart Modem	$215.00
DC Hayes	Micro Modem II (Apple)	$320.00
DC Hayes	Micro Modem 100	$320.00
Signalman	Mark I	$89.00
UDS	UDS 103 LP (300 Bd)	$185.00
UDS	UDS 202 LP (1200 Bd)	$245.00
UDS	UDS 212 LP (1200 Bd)	$495.00
UDS	UDS 212 ALP (1200 Bd)	$650.00

Monitors

Manufacturer	Model #	Price
Amdek	100/12" B&W	$110.00
Amdek	300G/Green	$165.00
Amdek	Color-1/13"	$325.00
Sanyo	DM5109CX/9" Grn.	$175.00
Sanyo	DM 5012/12" B&W	$215.00
Sanyo	DM 5112ex/12" Grn.	$225.00
Sanyo	DM C6013/13" Color	$425.00
Zenith	ZVM-121/12" Grn.	$115.00
BMC	BM-12EN 12" Grn.	$145.00
NEC	JB1260 12" Grn.	$129.00
NEC	JC1201C 13" Color	$310.00

Terminals

Manufacturer	Model #	Price
Televideo	TVI 910	$625.00
Televideo	TVI 912C	$725.00
Televideo	TVI 925	$825.00
Televideo	TVI 950C	CALL

CABINET AND SUBSYSTEMS

CAB5V	Single cabinet only (vertical mounting)	$ 75.00
CAB5V/10	Single cabinet with 1 Qume DT-5	$ 375.00
CAB8H	Dual cabinet for 8" (horizontal)	$ 260.00
CAB8V	Cabinet for 8" (vertical)	$ 275.00
CAB8V+1S	Dual cabinet with Shugart 801R (vertical)	$ 705.00
CAB8H+1S	Dual cabinet with Shugart 801R (horizontal)	$ 690.00
CAB8V+2S	Dual cabinet with two Shugart 801R (vertical)	$1,080.00
CAB8H+2S	Dual cabinet with two Shugart 801R (horizontal)	$1,065.00
CAB8V+1M	Dual cabinet with Mitsubishi 8" (vertical)	$ 680.00
CAB8H+1M	Dual cabinet with Mitsubishi 8" (horizontal)	$ 665.00
CAB8V+2M	Dual cabinet with two Mitsubishi 8" (vertical)	$1,140.00
CAB8H+2M	Dual cabinet with two Mitsubishi 8" (horizontal)	$1,125.00
CAB8V+1Q	Dual cabinet with Qume DT-8 (vertical)	$ 750.00
CAB8H+1Q	Dual cabinet with Qume DT-8 (horizontal)	$ 735.00
CAB8V+2Q	Dual cabinet with two Qume DT-8 (vertical)	$1,235.00
CAB8H+2Q	Dual cabinet with two Qume DT-8 (horizontal)	$1,220.00

CABINET DIMENSIONS:
Horizontal — 6½"H x 17¼"W x 22"L
Vertical — 9½"H x 11½"W x 21"L

All cabinets come complete with power supply, fan and internal cables.

DISK DRIVES

Qume DT-5	ANSI 5¼" compatibility	$295.00
Qume DT-8	IBM compatibility	$465.00
Shugart 801	Standard floppy	$400.00
Shugart 850	Double-sided floppy	$600.00
Mitsubishi M2894-63	8" double-sided, double-density	$435.00
Mitsubishi M4853	5¼" 96 TPI, 1MB	$450.00
Mitsubishi M4854	5¼" double-sided, 1.5MB	Call for price.

All drives include manual.

DISKETTES from ASAP

Verbatim 5¼" Diskettes

Part #	Sector	Price
MD525-01	Soft	10/$27.50
MD525-10	Hard 10	10/$27.50
MD525-16	Hard 16	10/$27.50

Memorex 5¼" Diskettes

MEM 3481	1/DBL	Soft	10/$27.50
MEM 3483	1/DBL	Hard 10	10/$27.50
MEM 3485	1/DBL	Hard 16	10/$27.50

Memorex 8" Diskettes

MEM 3060	1/Sgl	Soft	10/$35.00
MEM 3090	1/Dbl	Soft	10/$40.00
MEM 3102	2/Dbl	Soft	10/$45.00

Scotch 3M 5¼" Diskettes

Part #	Side/Dens	Sector	Price
744-0	1/Sgl	Soft	10/$30.00
744-10	1/Sgl	Hard 10	10/$30.00
744-16	1/Sgl	Hard 16	10/$30.00
745-0	2/Dbl	Soft	10/$43.00
745-10	2/Dbl	Hard 10	10/$43.00
745-16	2/Dbl	Hard 16	10/$43.00

Maxell 5¼" Diskettes

Part #	Side/Dens	Sector	Price
MD1	1/Sgl	Soft	10/$28.00
MD2D	2/Dbl	Soft	10/$41.00
MH1	1/Sgl	Hard 16	10/$35.00
MH2D	2/Dbl	Hard 16	10/$48.00

8" Diskettes

FD1-128	1/Sgl	Soft	10/$39.00
FH1-32	1/Sgl	Soft 32	10/$39.00
FD2-XD	2/Dbl	Soft	10/$48.00

Elephant Memory Systems 5¼" Diskettes

Part #	Side/Dens	Sector	Price
EMS 1	1/Sgl	Soft	10/$25.00
EMS 2	1/Dbl	Soft	10/$27.50
EMS 3	1/Dbl	Hard 10	10/$27.50
EMS 4	1/Dbl	Hard 16	10/$27.50
EMS 5	2/Dbl	Soft	10/$33.00
EMS 6	2/Dbl	Hard 10	10/$33.00
EMS 7	2/Dbl	Hard 16	10/$33.00

SRW Media Storage Cases

Part #	Size	Price
SRW-5	5¼"	$2.50 ea
SRW-8	8"	$3.25 ea

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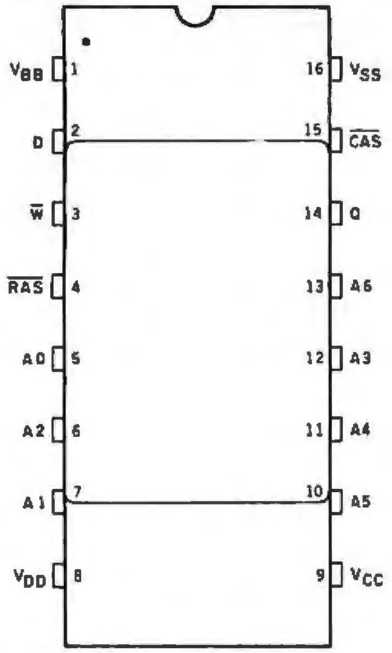
Pin Assignments



Capacitance	Parameter	Typ	Max	Unit
$C_i(A)$	Input capacitance, address inputs	4	5	pF
$C_i(D)$	Input capacitance, data input	4	5	pF
$C_i(RC)$	Input capacitance, strobe inputs	8	10	pF
$C_i(W)$	Input capacitance, write enable input	8	10	pF
C_o	Output capacitance	5	7	pF

Pin Nomenclature

A0-A6	Address Inputs	$\overline{W}$	Write Enable
$\overline{CAS}$	Column address strobe	V_{BB}	−5-V power supply
D	Data input	V_{CC}	+5-V power supply
Q	Data output	V_{DD}	+12-V power supply
$\overline{RAS}$	Row address strobe	V_{SS}	ground

Typical Characteristics

	Parameter	TMS 4116-25 Min	Max	Unit
$t_{c(P)}$	Page mode cycle time	275		ns
$t_{c(rd)}$	Read cycle time	410		ns
$t_{c(W)}$	Write cycle time	410		ns
$t_{c(RW)}$	Read, modify-write cycle time	515		ns
$t_{w(CH)}$	Pulse width, column address strobe high (precharge time)	100		ns
$t_{w(CL)}$	Pulse width, column address strobe low	165	10,000	ns
$t_{w(RH)}$	Pulse width, row address strobe high (precharge time)	150		ns
$t_{w(RL)}$	Pulse width, row address strobe low	250	10,000	ns
$t_{w(W)}$	Write pulse width	75		ns
t_T	Transition times (rise and fall) for $\overline{RAS}$ and $\overline{CAS}$	3	50	ns
$t_{su(AC)}$	Column address setup time	−10		ns
$t_{su(AR)}$	Row address setup time	0		ns
$t_{su(D)}$	Data setup time	0		ns
$t_{su(rd)}$	Read command setup time	0		ns
$t_{su(WCH)}$	Write command setup time before $\overline{CAS}$ high	100		ns
$t_{su(WRH)}$	Write command setup time before $\overline{RAS}$ high	100		ns
$t_{h(ACL)}$	Column address hold time after $\overline{CAS}$ low	75		ns
$t_{h(AR)}$	Row address hold time	35		ns
$t_{h(ARL)}$	Column address hold time after $\overline{RAS}$ low	160		ns
$t_{h(CRL)}$	$\overline{CAS}$ hold time after $\overline{RAS}$ low	250		ns
$t_{h(DCL)}$	Data hold time after $\overline{CAS}$ low	75		ns
$t_{h(DRL)}$	Data hold time after $\overline{RAS}$ low	160		ns

	Parameter	TMS 4116-25 Min	Max	Unit
$t_{h(DWL)}$	Data hold time after $\overline{W}$ low	75		ns
$t_{h(rd)}$	Read command hold time	0		ns
$t_{h(WCL)}$	Write command hold time after $\overline{CAS}$ low	75		ns
$t_{h(WRL)}$	Write command hold time after $\overline{RAS}$ low	160		ns
t_{CHRL}	Delay time, column address strobe high to row address strobe	−20		ns
t_{CLRH}	Delay time, column address strobe low to row address strobe high	165		ns
t_{CLWL}	Delay time, column address strobe low to $\overline{W}$ low (read, modify-write cycle only)	125		ns
t_{REF}	Refresh period		2	ms
t_{RLCL}	Delay time, row address strobe low to column address strobe low (maximum value specified only to guarantee access time)	35	85	ns
t_{RLWL}	Delay time, row address strobe low to $\overline{W}$ low (read, modify-write cycle only)	200		ns
t_{WLCL}	Delay time, $\overline{W}$ low to column address strobe low (early write cycle)	−20		ns
$t_{a(C)}$	Access time from column address strobe		165	ns
$t_{a(R)}$	Access time from row address strobe		250	ns
t_{PXZ}	Output disable time	0	60	ns

Figure 1: *Data sheet for a typical 4116-type dynamic-memory device. The sheet shows pin assignments and gives its characteristics and timing information.*

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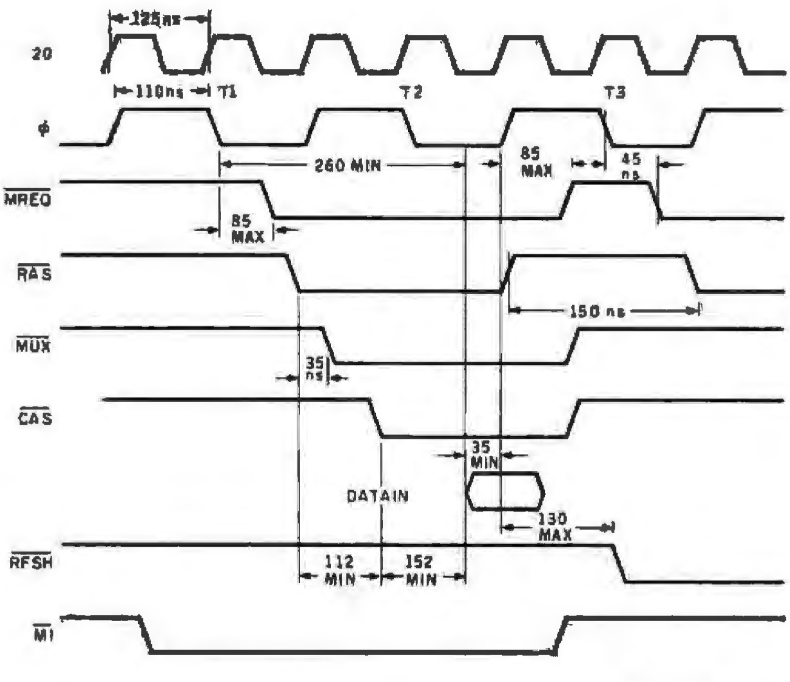

Figure 2: *Timing relationships of important memory-control signals. This diagram shows the signals found in a 4-MHz Z80 system; each T-cycle is 250 ns long. Note the delays between RAS, MUX, and CAS, and also their relationship to the time period allowed for data.*

name of the game.

When the storage capacitor of a dynamic bit cell is read, its voltage level is compared to a reference charge on a MOS (metal-oxide semiconductor) transistor. Because this charge is drained with each read, it must be replenished before the next operation. This means that RAS and CAS must be held high for a certain length of time to provide *precharge*.

Refresh is an entirely different headache. Each row of storage capacitors must be recharged to the proper level every 2 milliseconds (ms) because the charge leaks out. The dynamic memory is constructed so that a *row* of capacitors is refreshed every time it is addressed and RAS goes low. Obviously, every time we read or write to memory, we refresh the row that is accessed.

Getting Started

The first step in any design is to become aware of the limitations of the components used. The 4116s come in many different speeds: the access times usually range from 150 nanoseconds (ns) to 250 ns (although faster and slower versions exist). Also, although most devices are rated by their access time, this does not tell the whole story. Most dynamic memories require a recovery period after each access. This is usually not a problem, but if it must be taken into consideration in your system, the extra interval is reflected in a memory device's cycle time. It's quite common to pick the slowest or least expensive 4116s available, and then design the rest of the system to the memories' specifications.

Most 8-bit microprocessors can be made to work with 250-ns devices. You'll find that Zilog's Z80 microprocessor is the easiest 8-bit microprocessor to interface to dynamic memory; its signaling is timed just right, and it has its own built-in refresh circuitry. Intel's 8085 has excellent support devices for use with dynamic memory, if you care to pay extra for them.

The Z80 makes refresh easy by providing a refresh signal for us, timed just perfectly. It has an internal refresh counter whose output is placed on the lower seven (or row) address lines while the Z80's refresh signal is active. This counter increments after every op-code fetch until it has refreshed all 128 rows, then it starts over. This guarantees that all rows will be refreshed; what's more, the refresh occurs while the processor is busy with internal matters (op-code fetches) and is not using the buses. This is called "hidden refresh." (Be careful when using an extended wait state on a Z80, because this may not allow the processor to refresh memory properly.)

You need to decide first how fast your dynamic-memory system must respond. This is determined by the fastest read time that the memory must work with, combined with the delays introduced by other components in the data, address, and control paths. To calculate this read time, get out the data sheet on the microprocessor you're using and look for a signal that indicates the start of a memory access; this is an indication of when the address-bus signals are valid and stable. For Zilog's Z80, the signal to consider is MREQ; Intel's 8085 uses ALE, while the Motorola 6800 uses VMA. This "start" signal will eventually become our RAS.

Make note of the shortest period of time during an op-code fetch from the start signal to the time that valid data must be available (see figure 2). For example, on a Z80 running at 2.5 MHz, each clock cycle (T-cycle) is 400 ns long. MREQ goes low a maximum of 100 ns after clock cycle T1 falls, and data must be available to the Z80 at least 50 ns before the rise of T3. This means that the processor will allow at least 450 ns between providing an address and expecting valid data from the memory. This will not be the access time of the memory devices! Quite a number of delays will be experienced in getting RAS and addresses to the memory, and in getting the data back. In order to find out how much delay is involved, we must look at the circuitry necessary between the processor and the memory.

Developing the Control Signals

The 4116 requires a number of control signals to discover what is expected of it. Each memory device needs to know what portion of the address is being sent, whether the ad-

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dress is meant for some other device, and whether data is to be stored or retrieved.

Most microprocessors present all 16 bits to the address bus at one time. We must multiplex the 14 least significant of these as two groups of 7 for use by the memory devices. (In a 64K-byte design, the 2 most significant address bits are used to select one of the four banks of memory devices; the other 14 address bits select the particular address on the individual devices.) The most common method is to use several 2-to-1-line multiplexers (74LS157 TTL devices that are the digital equivalent of a four-pole, double-throw switch).

By connecting the 7 least significant bits (the row address) to the "B" inputs of the multiplexer, and the 7 most significant bits (the column address) to the "A" inputs, the row address will be passed to the memory when the multiplexer's Select line is high; the column address will be passed to the memory when the Select line is low. It's easy to see how the multiplexer's Select signal will be related to the $\overline{\text{RAS}}$ and $\overline{\text{CAS}}$ signals; we'll develop a special signal called $\overline{\text{MUX}}$ to control the multiplexers. (Intel has developed a device, the 3242, that is used solely for controlling dynamic memory. It includes a multiplexer and a refresh counter, which we'll discuss later, on one device; a similar device is also available from Intel. These devices, however, are the more expensive way to go.)

You already know that $\overline{\text{RAS}}$ is nothing more than the low-active start signal ($\overline{\text{MREQ}}$, $\overline{\text{VMA}}$, or $\overline{\text{ALE}}$, depending on the processor used). $\overline{\text{MUX}}$ and $\overline{\text{CAS}}$ are delayed versions of the same signal. The timing of these signals is very important; and it varies according to the speed of the memory devices used.

According to the 4116's data sheet, to read data from the memory we must have the row address on the memory's address pins before $\overline{\text{RAS}}$ goes low (this is specified as the value t_{w}AR). After $\overline{\text{RAS}}$ is activated, the row address must be stable for at least 35 ns (t_{h}AR). Following this interval, the multiplexer's Select line can be switched so that the column address is available to the memory; another interval of at least 10 ns (t_{w}AC) should be allowed before bringing $\overline{\text{CAS}}$ low. No more than 165 ns later (t_{CAC}), data becomes available from the memory. In order to meet the 250-ns access-time requirement, the $\overline{\text{RAS}}$-to-$\overline{\text{CAS}}$ time should be no more than 85 ns (t_{RCD}). (One interesting point is that you can wait up to 10 microseconds before bringing $\overline{\text{CAS}}$ low [t_{s}CL].)

Once $\overline{\text{CAS}}$ is low, the output data will remain on the 4116's Dout (data output) pin until $\overline{\text{CAS}}$ goes high. On some dynamic memories, Dout is actually latched, remaining available until $\overline{\text{CAS}}$ is clocked again; but it is safer to assume that Dout signals are not valid unless $\overline{\text{CAS}}$ is low. The 4116-type memories have three-state outputs, so that the output pins of several can be connected together. We will use this feature to simplify the wiring of the memory system; corresponding output bits in each of the four banks will drive their data-bus line through a single output buffer. Only one of the four banks will be active at one time, however.

You can direct the $\overline{\text{WRITE}}$ output of any of the microprocessors mentioned to the dynamic memory without altering the signal's timing. $\overline{\text{CAS}}$ and $\overline{\text{WRITE}}$ are related: $\overline{\text{WRITE}}$ is active only when $\overline{\text{CAS}}$ is low, and need be held low for only 75 ns after $\overline{\text{CAS}}$ goes low. Of course, data must be present for valid information to be stored.

Design

Knowing what we now know, we can select the most appropriate method for generating the control signals. The approaches open to us are:

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input of from 2 ns to 25 ns. Because it's mainly a low-pass filter, the rise and fall times of signals sent through a delay line are terrible; often, delay lines are available with taps that have Schmitt-trigger circuits to "square up" the output signal. Of course, delay lines with this feature cost twice as much as those without it. Both types of delay line are hard to get in single quantity.

•**Gate delays.** It's possible to calculate the delay through TTL gates and use them just as you would use a delay line. For example, where we need a 20-ns delay, we might try using part of a 7408 quad AND gate. It has a maximum high-to-low delay of 19 ns, which would work; but there's the rub: the typical delay value is 12 ns, and the minimum delay value will be about 6 ns. If you use this gate as your delay, you could get anywhere from 6 ns to 19 ns, instead of 20 ns. Although you might be able to handpick a couple of these gates for the desired delay (if you are building one board for yourself), in most cases this wide variation in delay cannot be tolerated.

•**Clocked systems.** This method gives the most accurate and repeatable results because it uses logic gates arranged to make use of the computer system's clock signals. Obviously, designing a clocked system requires some thought and additional hardware. Trying to come up with a general procedure for solving the problem by this method is not easy. Signals available on one microprocessor are often quite different from those on another. In general, however, the start signal is still developed into $\overline{RAS}$; then, it may be fed to a flip-flop so that on the next edge of some clock $\overline{MUX}$ appears. $\overline{MUX}$ is then used as an input for another flip-flop to give $\overline{CAS}$. The length of time between clock edges must be considered carefully.

•**Combination.** A combination of clocked and gate-delay methods is also possible. An accurate $\overline{RAS}$, $\overline{CAS}$, or $\overline{MUX}$ signal could mean we can be "sloppy" with the timing of the other signals. If we talk first about building a delay-line system, most of what we learn can be used in designing the other systems.

In a Real System

You may never have had to consider this before, but it's critical now: any signal passing through any integrated circuit is delayed some number of nanoseconds before it reaches the output. The amount of delay through a device is listed in most TTL data books as a chart of the device's *switching characteristics*. To find the delay of a signal that is changing from low to high, look at the number listed as t_pLH; for the delay of a high-to-low transition signal, look at t_pHL.

The delay times are given assuming that the device is driving a certain capacitive load, usually 15 picofarad (pF) or 50 pF. A standard TTL gate has about 5-pF input capacitance. Because the capacitance takes a small amount of time to charge or discharge (about 0.05 ns per picofarad), the more circuitry we have between the processor and the dynamic memory, the longer the delays are. One thing to remember is that inputs on complex integrated circuits (such as the Select signal on a 74LS157 quad 2-to-1-line multiplexer) often consist of more than one gate. In this case, you must add 1.5 pF for each additional on-chip connection. (The internal connection of these devices is shown on their data sheets.)

Externally, the devices must be connected to the rest of a computer in the fashion shown in the block diagram of figure 3. This shows where items such as address lines, drivers, and multiplexers must go, without getting too specific about the makeup of each one. The control signals are shown being generated by a block that we'll discuss later. Using this block diagram, we can make assumptions about the circuit we'll eventually build. This will allow us to figure out most of the delays involved and will also help us to come up with a final design.

Using TTL to control memory devices made with MOS technology causes an impedance mismatch. The outputs of most TTL devices are low impedance, and they are feeding the high impedance represented by the

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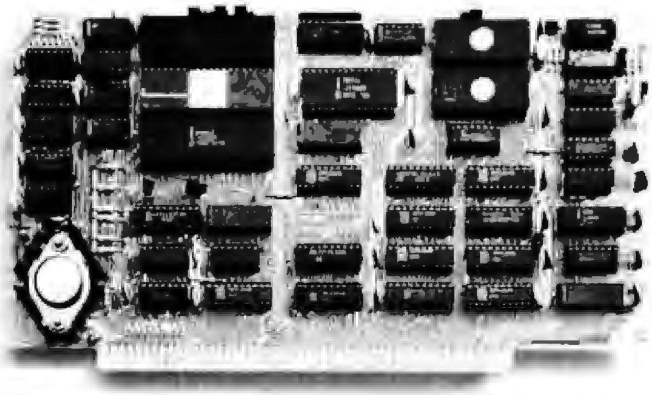

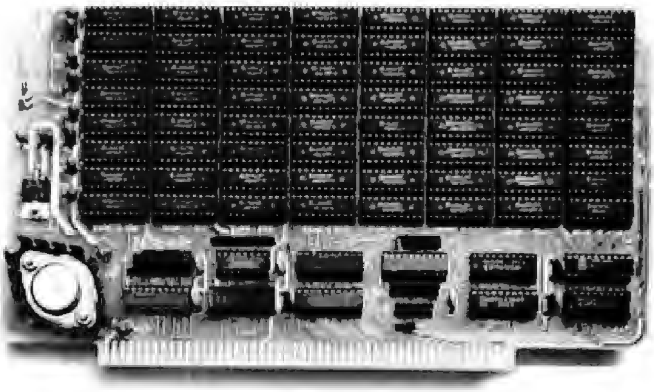

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memories' MOS inputs. The inputs to 4116-type memories use very little current—on the order of 10 microamperes. To the high current put out by the TTL, it's like running into a brick wall; the current bounces off the MOS device and is reflected back to the TTL driver. It will continue to bounce back and forth at a high frequency until it is dissipated by the resistance in the wire.

This "ringing" could cause the memory devices to falsely perceive triggering on $\overline{RAS}$ or $\overline{CAS}$, or make an address look low when it's high. Even worse, the reflected signal may actually make an input go negative, thus destroying the device! For this reason, we should install a series resistor in each of the lines leading to memory-device input pins; the resistors greatly reduce the amount of power reflected. A good starting point is 22 ohms. The actual value might best be chosen experimentally by looking at the signals on an oscilloscope. If your system is using only 16K bytes of 4116-type memory, you might get by without these resistors. With 32K bytes or more, however, the number of reflections increases.

Unfortunately, inserting the series resistor might cause other problems. MOS inputs represent pure capacitance. The added resistance slows down the charging rate of the capacitance, thus affecting the effective speed of the memory. To calculate the effect this has on the device's inherent delay, we need the time-constant formula

$$T = R \times C$$

from which we will derive the relationships

$$t_pLH = 0.92RC \text{ and } t_pHL = 1.6RC$$

In the second and third equations, R will equal the value of the series resistor plus the impedance of the line driver. The impedance of S-series (Schottky) TTL devices is 114 ohms (when you need speed, Schottky is the way to go); for LS-series (low-power Schottky), impedance is about 225 ohms. C equals the total capacitance on the line plus the capacitance of the circuit board itself.

(3a)

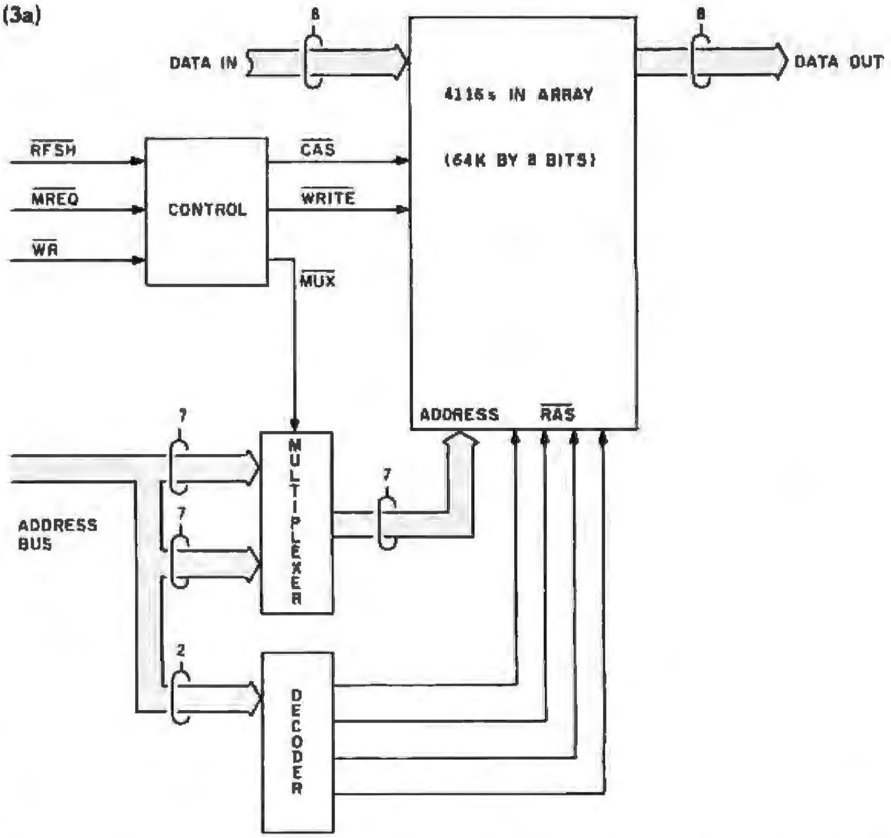


Figure 3: *Memory-system diagrams. The block diagram of figure 3a shows generally how the address bus is multiplexed for use by the 4116s, and that the memory-control signals are developed from signals provided by the Z80 processor. In figure 3b, we see a specific diagram of the circuit to accomplish this.*

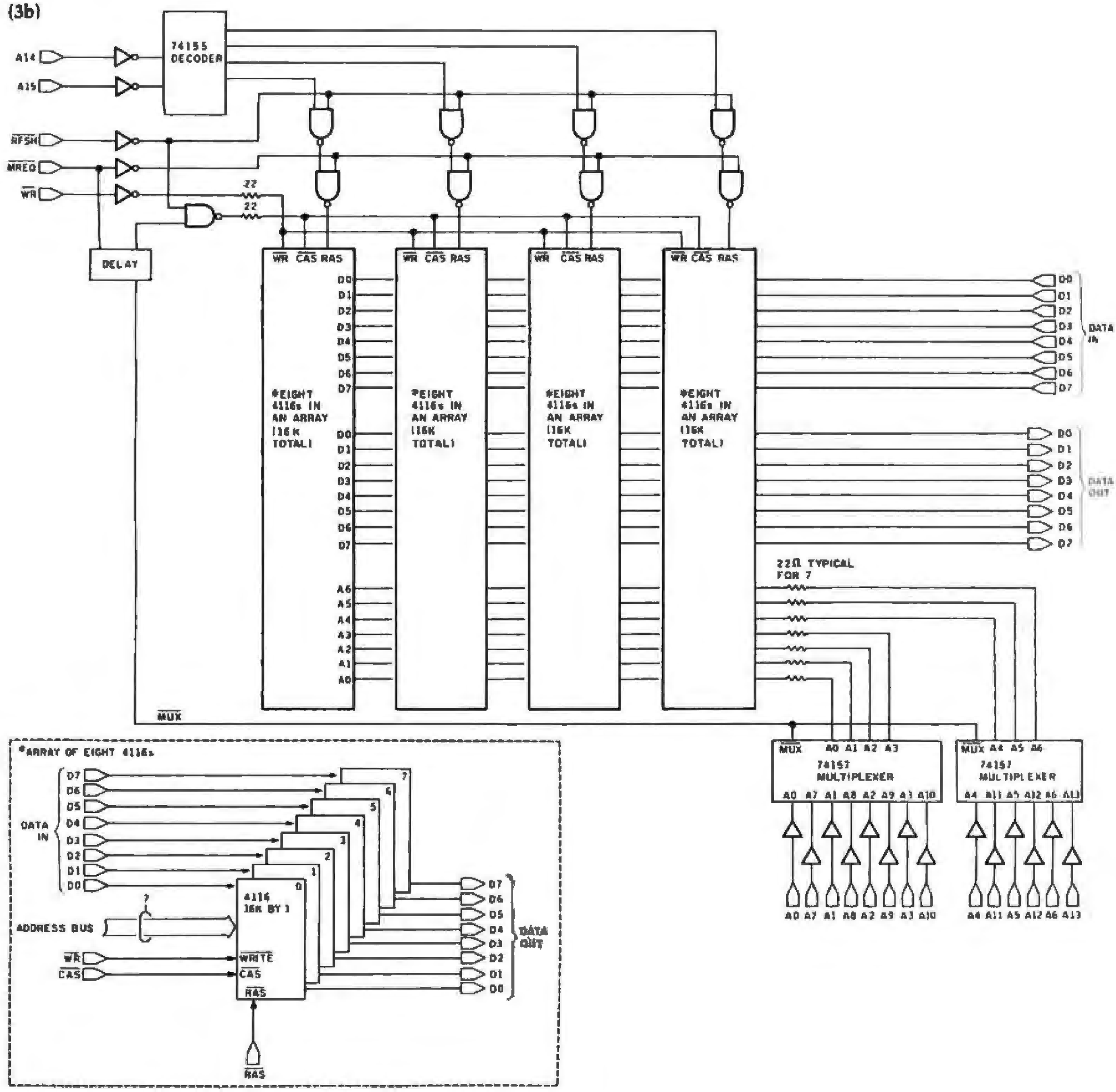
Let's use the above equations to calculate the rise time of any signal on a bus line for one bank of eight devices—or 16K bytes of memory. Involved are 225 ohms of driver impedance, 22 ohms of series resistance, and 32 pF of capacitance (ignoring board capacitance). Therefore, 247 ohms times 32 pF times 0.92 equals 7.3 ns. The fall time of any signal will be 1.6 times 247 ohms times 32 pF, or 12.7 ns. Remember that address-line capacitance is 4 pF per device, while capacitance on the $\overline{RAS}$, $\overline{CAS}$, and $\overline{WRITE}$ lines will be about 8 pF per device (on these nondata lines, t_pLH equals 1.15RC). The typical input-capacitance value is used because the probability of having nothing but worst-case capacitance on the same line is very, very small.

Timing It Right

Let's explore timing relationships of the control signals by considering the circuit in figure 3b, developed from the block diagram. How long does it take for an address originated by the microprocessor to reach the dynamic memory? First, we'll calculate the delay the address experiences in getting to the memory; we'll then proceed with the $\overline{RAS}$ and $\overline{CAS}$ signals. Several other things must be considered too, not the least of which is what specifications to pay attention to on the data sheet. Typical times are of little value to us because temperature and load changes will vary the delay time. Minimum times are as important as worst-case times, but they are not always specified in data books; however, you can consider them to be half the typical times. We'll use minimum times in a later part of the design.

Assuming that the data, address, and control lines are buffered by a 74LS244-type line driver or similar device, the maximum delay presented is 18 ns with a capacitive load of 45 pF. It's probably best to use the

(3b)



worst-case capacitance because you may later decide to expand the system, adding more gates and increasing the actual capacitance.

Address: The buffered address bus is connected directly to the address multiplexers described earlier. The worst maximum time from the multiplexer's input to its output is 14 ns (the minimum is 5 ns). These times are listed with a capacitive load of 15 pF (CL=15pF), while the input capacitance of a 4116 dynamic-memory address line is 5 pF. Because each address line feeds eight memory devices, the total capacitance is 40 pF. The delay time changes at the rate of 0.05 ns per picofarad. Therefore, to find the actual delay, we find the difference between 15 pF and 40 pF, multiply this result by 0.05, and discover an additional delay of 12.5 ns, for a total of 26.5 ns. The circuit-board traces (or wire-wrap wire) travel over long paths and can act as a transmission line with inductance and capacitance. To account for this, you must add 1.5 pF per inch—or 2 ns a foot—measured from the driver to the farthest device.

Adding all the delays together (18 ns for the line driver, plus 14 ns for the multiplexer, plus 7.3 ns and 12.7 ns [the rise and fall times]) gives a total of 52 ns (worst case). This is a considerable delay for only eight devices; therefore, removing the series resistor is recommended. For larger systems, switching to

Schottky-type 74LS157 multiplexers will reduce the overall delay, as will using smaller resistors.

RAS: Specifications say that the address from a Z80 microprocessor is stable at least 120 ns before MREQ. Since MREQ is our RAS signal, the address will reach the dynamic memory at least 68 ns (120 ns minus the 52-ns delay) before MREQ goes low. MREQ is delayed even more by the 74LS04 inverter and the OR gate shown in the diagram. Its total delay is 68 ns initially, plus 15 ns for the inverter, plus 16 ns for the OR gate, plus 10 ns for the 192-pF load. Thus, RAS goes low 109 ns after the address. The address setup time required by the 4116s before RAS goes low is zero (t_{ss}AR), so no problem exists here.

CAS: After RAS, the row address must be stable at least 35 ns (t_{h}AR) before switching to the column address. We can use a delay line to switch the multiplexers by delaying RAS for 40 ns. For a 48K-byte system, the maximum switch delay will be 8 ns for the device plus 5 ns for the load, or 13 ns. The address will be stable 53 ns after RAS goes low. It must be held 10 ns before CAS (t_{ss}AC); therefore, we can create CAS by using the tap on the delay line that delays RAS 60 ns. Because the load on CAS will also be 192 pF, the signal is actually delayed another 10 ns. This is 17 ns after the column address is stable. Data appears at the memories' output 165 ns later, delayed an additional 18 ns by a buffer. The Dout pin goes into high-impedance mode when CAS is high. Thus, output-line driving buffers may not be necessary. Dout by itself will drive two standard TTL loads.

We kept track of the minimum gate delays because if a device is operating at top speed, it may expect signals that are not yet available.

The Total: If you add up all the times from RAS, you'll see that data is available in just under the 250-ns maximum time the manufacturer specifies for the memory device. If you include the delay interval from MREQ to RAS, the time is under 300 ns. This leaves you plenty of leeway because the Z80 op-code fetch time, as we discovered earlier, is 450 ns (assuming a 2.5-MHz clock).

The reason that we kept track of the minimum gate delays is that, even though the circuit is faster than the maximum delays encountered, if a device is operating at top speed, it may expect signals that are not yet available. You must allow for this situation. If, for example, CAS shows up too soon, the column address may not have had a chance to stabilize. For this reason, you should also go through your circuit to make sure that it meets all the minimum setup and hold times. Again, you can handpick the integrated circuits to give you the timing that works in your system.

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Circuit Details

You need three voltages to run a dynamic memory: +5 V, +12 V, and −5 V. The +5 V is used only to power the data-output buffers on the memory devices; it can actually be removed by feeding it through a pass transistor and shutting it down when you are not performing a memory read.

Whether you wire-wrap or lay out a printed-circuit board, a good, heavy ground bus is recommended. Be generous with decoupling capacitors! For the +5-V supply, it is necessary to use only one 0.01-microfarad (μF) to 0.1-μF decoupling capacitor for every eight devices. The +12-V supply should be decoupled with a 0.1-μF capacitor at every second device (put a 0.1-μF decoupling capacitor for the −5-V supply on all the ICs in between). A tantalum 22-μF decoupling capacitor should be included for every 16 devices on the +12-V supply, and also where the −5-V supply comes onto the board.

Do not take decoupling lightly! Dynamic RAMs switch a lot of current around at radio frequencies. Therefore, noise is going to be a big problem. Ideally, the bus drivers should be in the center of the memory array if possible; this will keep the length of the leads as short as possible, minimizing the transmission-line effect.

Onward

What do you do if you don't have a Z80? Dynamic-memory interfacing is still possible using the methods just described, but some extra hardware and thinking are involved. Several semiconductor manufacturers are now coming out with dynamic-memory controllers. These devices provide many or all of the needed signals, and some can control up to 128K bytes of memory. Intel's 3242 can be used as the multiplexer and also contains a refresh counter; Intel has a device called the 8202 that also handles most of the necessities for dynamic memory. As you might expect, however, the cost is extremely high compared to what you can do on your own. If you want hidden refresh, you must find or create a "hole" in your processor's bus accesses (the 6800 and 6502 microprocessors have no such holes).

Fortunately, the 8085 has a good instruction set and even leaves a hole in its op-code fetch just like the Z80: no external operation is being performed during the fourth clock cycle of a fetch. Using a counter, you could watch the status lines for a fetch and count the number of cycles until it's time to start refresh.

The best method for the 6800 and 6502 (it could also work for the 8085) is "burst-mode" refresh: refreshing all the rows one at a time in a short period. Usually, this is done with a counter or timer, such as a 555, that times out about every 1.47 ms, then puts the processor on hold. You then clock the refresh counter and the $\overline{RAS}$ signal until all 128 rows are recharged. This slows down your system throughput somewhat, but it's easier to do than trying to find a hole in the timing. ■

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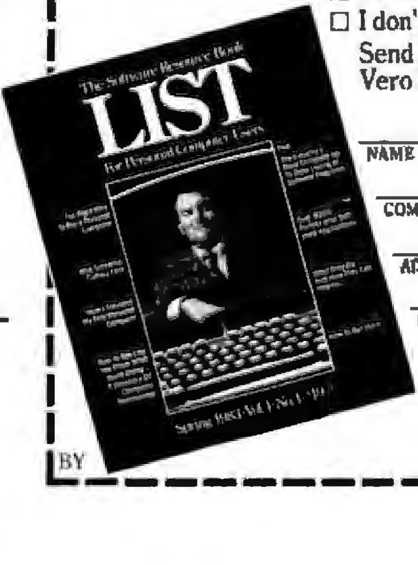

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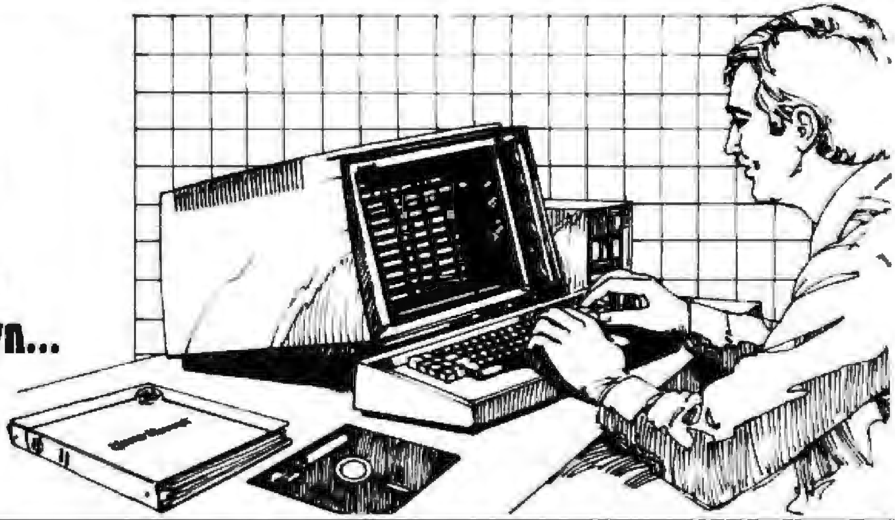

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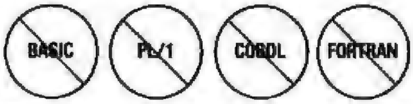

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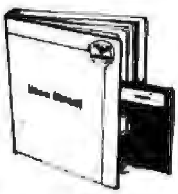

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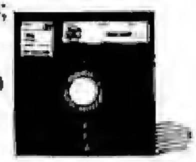

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Book Reviews

8080/Z80 Assembly Language: Techniques for Improved Programming

Alan R. Miller
John Wiley & Sons Inc.
New York, 1981
318 pages, softcover
$9.95

Reviewed by
Philip E. Bond
27 Sharon Dr.
Spring Valley, NY 10977

If you've ever been faced with customizing the BIOS on your CP/M system, you've participated in what I'd call a "learning experience." And if you want that experience to be successful, a good reference text is crucial. When I started tinkering with the BIOS, Alan Miller's *8080/Z80 Assembly Language* became my guide to assembly-language programming and its relationship to CP/M.

While the author only briefly discusses the fundamentals of assembly language and input and output transfers, he does provide several clear examples of each element of hardware and software. Miller makes specific references to typical 8080/Z80 microprocessors as well as to CP/M. He explains the development of a CP/M-compatible system monitor in great detail. Beginning with the most basic functions, he shows how to write and debug a useful monitor that uses fewer than 1K bytes and will fit into common PROMs. By the time you finish this section of the book, you should be able to make a custom monitor if the standard one doesn't suit you.

The information in chapter 10 alone is worth the purchase price of the book. Under the heading "Linking Programs to the CP/M Operating System," Miller discusses key elements for customizing the BIOS and explains how to implement IOBYTE. In addition, he provides one routine that gives you access to any memory location and another to list ASCII disk files with date and time.

In keeping with its purpose as a reference text, the book's ten appendixes include the ASCII character set, 8080 and Z80 instructions and a cross-reference, and an explanatory list of abbreviations and acronyms.

8080/Z80 Assembly Language fills in information other reference materials—including Digital's—leave out. The author states that the subject of his book is not the use of CP/M, but anyone thinking of implementing CP/M would do well to look here for methods and answers. ■

BYTE's Bugs

Address Correction

The address given for Apparat, the supplier of NEWDOS/80 Version 2.0 as presented in our review (BYTE June 1982, page 376) is incorrect. The correct address is Apparat Inc., 4401 South Tamarac Parkway, Denver, CO 80237. ■

The Lobo Max-80

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4927 North Rockwell St.
Chicago, IL 60625

Lobo Drives International has a recipe for a successful microcomputer system: Take a "vanilla" 64K-byte Z80-based CP/M system, add every popular disk interface, throw in a parallel printer port and a couple of serial ports, provide TRS-80 emulation through the powerful LDOS operating system, call the machine the Max-80, then offer to sell the entire package for about $1000.

I got a prototype of the Max-80, which gave me a chance to use it as a CP/M system and experiment with some of its many features. I was not able to use the TRS-80 emulation, however, because some of the software was still being developed. Still, after spending many hours with this microcomputer system, I am impressed!

Primary Features

The Max-80 is housed in a compact keyboard unit (see photo 1) with a metal baseplate and a Norell plastic top. The concave keyboard has a comfortable feel, 75 keys, and enough space below the keys to rest your palms. A numeric keypad, arrow keys, and individual Control and Escape keys round out the keyboard package. The keyboard can generate the full ASCII (American Standard Code for Information Interchange) character set.

At a Glance

Product
Lobo Max-80

Manufacturer
Lobo Drives International
354 South Fairview
Goleta, CA 93117
(805) 683-1576

Price
Max-80 with CP/M, $820
high-resolution green-screen monitor, $175
LDOS option, $69 with system purchase; $129 separately
second bank of 64K memory, $95. All prices include shipping.

Features
5¼- and 8-inch floppy-disk interface, hard-disk interface, two serial ports, TRS-80-type bus, parallel printer port, and 64K memory. Runs with a 5-MHz Z80 processor and comes with battery-backed real-time clock.

Audience
General hobby and business users

Lobo has a reputation for building excellent quality hardware. The Max-80 is clear evidence of that reputation, as well as indicative of the firm's experience in interfacing peripherals. On the back panel, you will find all of the interface card edges and DB-25 connectors for the RS-232C port. The Max-80 is equipped with a DIP (dual-inline package) switch that lets you select which drive is used to boot the system. Standard interfaces for 5¼- and 8-inch floppy-disk drives are provided as well as a SASI

About the Author
Tim Daneliuk is an electrical engineer involved in research and product development for the medical electronics industry. T&R Communications Associates is a company he founded to provide technical writing and consulting services for the electronics industry.

Photo 1: *The Max-80 from Lobo Drives International is a 64K-byte computer system offering both CP/M and LDOS. It costs about $1000.*

(Shugart Associates Standard Interface) for a hard disk. Both single- and double-density and single- and double-sided disk operations are supported. In addition, you are provided with two RS-232C ports, a parallel Centronics-compatible printer port, and a buffered TRS-80 Model 1-type expansion bus.

The heart of the Max-80 is a 5-MHz Z80 processor. This extra bit of clock speed, as opposed to the usual 4 MHz, ensures reliable data transfer when using fast double-density 8-inch floppy disks and hard-disk systems. If you have been using the TRS-80, the increased speed is clearly evident. The video scrolling on the Max-80 is so rapid that one of the four function keys comes preprogrammed to slow the scroll rate so as to make the display readable. A real-time clock with a battery backup is built into this computer (the battery backup is a long overdue standard feature for microcomputers). You can remove the primary power from the Max-80 for more than 50 days and the clock/calendar will remain accurate.

The I/O (input/output) sections of this machine are similar to the memory-mapped I/O of the TRS-80 Model I. Under software control, the 4K-byte I/O space moves into high memory for CP/M and into low memory for LDOS. This permits the Max-80 to offer both 56K-byte CP/M operation and true TRSDOS (TRS-80) compatibility. Taken together, these two operating systems provide the majority of current 8-bit software. This compatibility may make the Max-80 the best supported 8-bit machine.

This microcomputer outputs a standard composite-video signal, and the display is designed to be used with either CP/M or LDOS. Under CP/M, the display format is 24 lines by 80 columns, while under LDOS it is 16 lines by 64 columns. For each operating system, a low-resolution mode is available, making the display 24 lines by 40 columns with CP/M and 16 lines by 32 columns with LDOS. The video circuitry is synchronized to the clock, and the video twinkling that plagued the TRS-80 is noticeably absent. Each video character is programmable, so you can display a variety of fonts and sizes. Lobo also provides an 18-MHz, high-resolution green-phosphor monochromatic monitor for use with the Max-80. The monitor's dot resolution and clarity are excellent, and a low-reflection nylon-mesh screen cover reduces the glare from ambient light. Because the video display is a separate unit, you can position it for the most comfortable viewing.

Inside the Max-80, you will find two main printed-circuit boards constructed of double-sided fiberglass with plated-through holes. The bottom board is mounted on the metal base and contains the majority of the processor and interface electronics. The top board is mounted on the Norell cover and connects the keyboard, the printer interface, and the hard-disk interface to the rest of the system. The easily accessible electronics should please the hardware enthusiast. Each main piece of electronics can be removed without having to desolder anything.

Perhaps one of the nicest aspects of the Max-80 hardware is that everything is contained in one compact unit. The typical cable tangle is greatly reduced because you simply connect the power, the video display, and the disk-storage system to the back panel of the machine.

Selling Points

Its ability to run both the CP/M and LDOS operating systems gives the Max-80 a degree of software portability that, when combined with its low cost, makes it an excellent system for the novice, the hobbyist, and the small-business user.

Lobo intends to market the Max-80 directly rather than through a dealer network, and the system's low cost is a result of this decision. Having experienced both local dealer support and Lobo's mail-order marketing, I believe that consumers will benefit the most from this approach. The support people at Lobo are knowledgeable, experienced, and consistently more helpful than the dealers I have encountered. The only negative aspect of Lobo's marketing approach is the inevitable delay between ordering and receiving. However, the cost savings are your compensation for the wait.

In my opinion, the Max-80 will be a big seller for Lobo. Although most of the microcomputing press touts the new 16-bit machines, the vast majority of applications software resides in the 8-bit world. Rather than introduce a product based on the newest technology, Lobo gives us a functional, cost-effective product developed from a combination of mature hardware and software. ■

Multidos

A New TRS-80 Disk Operating System

Rowland Archer
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Hillsborough, NC 27278

Something about the Radio Shack TRS-80 microcomputer seems to inspire people to write disk operating systems for it. A DOS, of course, is a collection of programs responsible for managing other programs and data stored on floppy disks. And judging by the ads I've seen, there seem to be more DOSes for the TRS-80 Models I and III than for any other microcomputer.

Multidos, from Cosmopolitan Electronics Corporation, is the latest candidate to vie for a share of the TRS-80 Model I/III DOS market. It was written by Vernon Hester, the author of an earlier TRS-80 DOS called Ultrados, and is a good value for its price.

Product Overview

Multidos is actually a package of several useful programs, but the most outstanding component of this package is the DOS itself.

The name Multidos refers to the ability of the system to read, write, and copy both single- and double-density disks created by other popular TRS-80 DOSes, a list of which is shown in table 1. It certainly is an impressive programming feat, but the fact that it is needed at all is a sad commentary on the incompatibility of these systems.

I tested the ability of Multidos to read and write disks created by all the Model I/III operating systems listed in table 1 except for DOSPLUS, which I do not own. In all instances it performed as claimed. Unfortunately, the reverse is not necessarily true; other operating systems are not always able to access a Multidos disk.

Also, there is some danger in the careless use of Multidos's ability to read and write disks created by "foreign" disk operating systems. This happens because it is impossible to predict what other DOS authors will do in the future. The fact that Multidos can read and write disks created by the current version of XYZ DOS is no guarantee that it will be able to handle disks created by the next version. This is not a fault of Multidos; it is just that the new version of a disk operating system may store data differently than the previous version did.

As an illustration of this, my copy of Multidos crashed while attempting to read the directory of a TRSDOS 2.3B disk. (TRSDOS 2.3B is a new version of TRSDOS that Radio Shack is distributing only with its Compiler BASIC, COBOL, and Series I editor/assembler packages.) I asked Hester about this problem, but he indicated that he had not heard of TRSDOS 2.3B.

The bottom line is that you should never use Multidos to read or write a disk created by a DOS that is not specifically mentioned in the Multidos manual as compatible.

For TRS-80 Model I users, a special hardware attachment is still needed in order to use double-density disks. This hardware is usually in the form of an add-on board for the expansion interface unit. Such products are available from:

- Aerocomp (POB 24829, Dallas, TX 75224)
- LNW Research (2630 Walnut, Tustin, CA 92680)
- Percom Data (11220 Pagemill Rd., Dallas, TX 75243)

All these modifications are compatible with Multidos.

[**Editor's Note:** *Recently, Radio Shack released its own version of a Model I double-density add-on board. Vernon Hester informs us that the current version of Multidos has been modified so that it will be compatible with this new enhancement. . .* **.R. M.**]

DBLDOS from Percom Data Company
DOSPLUS from Micro Systems Software
(single- and double-density, Model I and III)
LDOS from Logical Systems Inc.
(single- and double-density, Model I and III)
NEWDOS 2.1 from Apparat
NEWDOS/80 Version 1.0 from Apparat
(single- and as patched for double-density; maximum 2-granule directory)
NEWDOS/80 Version 2.0 from Apparat
(read and write single-density, read only double-density)
TRSDOS from Radio Shack
(Model I only)
Ultrados from Level IV Products
VTOS from Virtual Technology
(single- and as patched for double-density)

Table 1: *Multidos can read, write, and copy disks created by any of these TRS-80 disk operating systems.*

File	Size (grans)	Description
BACKUP/CMD	3	Disk-backup utility
BASIC/CMD	4	SUPERBASIC
BBASIC/CMD	5	SUPERBASIC plus BOSS
COPY/CMD	1	File-copy utility
CREF/SYS	1	BASIC cross-reference utility
DIR/SYS	2	Disk directory
DOS/SYS	3	Multidos kernel
DOS0/SYS through DOS7/SYS	12	Multidos overlays
EA/CMD	7	Disk-based Z80 editor/assembler
EDIT/SYS	1	BASIC program global editor
ERROR/SYS	1	Error messages
FORMAT/CMD	3	Disk formatter
GR/CMD	1	Graphics keyboard driver
HELP/CMD	4	Help command processor
RENUM/SYS	1	BASIC program-renumber utility
RS/CMD	1	RAM Scan memory-search utility
SKIP/CMD	1	Read 40-track disk from 80-track drive
SPOOL/CMD	1	Line-printer spooler utility
VFU/CMD	2	File copy, purge utility

Table 2: *A list of the files contained on the Multidos disk. The size of each file is measured in grans, where one gran equals five 256-byte sectors or 1280 bytes. Total size is 54 grans or 69K bytes.*

Multidos also includes two versions of Disk BASIC (one has some very powerful debugging features—the best I've ever seen), a disk-based editor/assembler for creating assembly-language programs, and several utility programs. Table 2 lists the files that come on a Multidos disk.

Features

Although Cosmopolitan Electronics is stressing the "multi-DOS" read/write ability in its advertising, the system has many other noteworthy capabilities. Table 3 lists some features of Multidos that are not found in TRSDOS 2.3. My favorites include:

- Automatic recognition of disk density (single or double), type, and track count. For example, to copy a file from a double-density LDOS disk in drive 1 to a Multidos disk in drive 0, just load the disks and execute the COPY command—you don't have to indicate in any way that the disk in drive 1 is an LDOS or double-density disk.
- By pressing the : and ; keys simultaneously, you enter the "Mighty Multi" command processor. Mighty Multi lets you view disk directories and kill, list, and copy files. When you are through, you can return to the program that you were previously running with nothing changed. Mighty Multi can be accessed from most programs, as long as they use the standard keyboard routines and leave all the interrupts enabled. Unfortunately, this does not include Radio Shack's Scripsit word processor, which uses its own keyboard driver.
- By typing HELP followed by the name of a Multidos command, you get a brief message telling how to use that command. There is usually enough information to jog your memory—assuming you have read the manual.

Multiple DOS commands can be entered on a single line, and the last DOS command can be repeated by pressing ENTER.

The FORMAT command can format a disk in either single-, double-, or Percom-density. Percom-density, of course, is used by Percom Data's DBLDOS. Although Multidos can create and access disks in any of these formats, the BACKUP command cannot back up a disk in one density to a disk in a different density. However, you can use the Versatile File Utility (VFU, which will be described later) to copy all the files from any density disk to any other density disk, as long as a Multidos disk is in drive 0.

Because of this restriction on the BACKUP command, you cannot create a new Multidos system disk at a different density than the one you bought. You could copy all the files using VFU, but the new disk would not work as a system disk. Multidos expects system files to be in particular places, and VFU doesn't copy the files into these exact places. Cosmopolitan Electronics handles this by letting you purchase additional copies of Multidos, in the density of your choice, for $15 each.

The Editor/Assembler

Radio Shack's original tape-based editor/assembler program for writing assembly-language programs was modified for disk by Apparat. It has now been modified once more by Hester and is included with Multidos. Most of the commands added by Hester, however, are redundant to features available under the Mighty Multi DOS feature described earlier. One new feature, however, allows you to run the editor/assembler after an accidental exit and to recover whatever was in the text buffer.

Command	Description
JKL	Simultaneous pressing of J, K, and L keys causes contents of screen to be sent to printer. The Break key will terminate JKL. Graphics characters are converted to periods.
HJK	Like JKL, but also sends graphics characters to printer.
: ;	Pressing : and ; simultaneously enters Mighty Multi command mode.
AUTO	Allows specification of one or more commands to be executed when a disk is booted. TRSDOS allows only one.
BOOT	Reboots the computer as if the Reset button had been pressed.
BREAK	Enables or disables the Break key.
BUILD	Creates a file of commands to be executed by DO (below).
CLEAR	Sets all bytes in nonprotected RAM from hexadecimal address 5200 to TOPMEM to 0. TOPMEM is the address pointed at by the contents of hexadecimal address 4049.
CONFIG	Sets the default disk-drive parameters to be used when the system is booted. Parameters are single- or double-density and track-to-track head-stepping rate. Multidos automatically distinguishes single- and double-density disks, no matter what the setting of CONFIG is.
DEAD	Reboots the computer as if power had been turned on.
DIR	Displays disk directory in alphabetical order. Options to send directory to printer and to list killed files.
DO	Reads a disk file and executes the commands in it as if they were typed at the keyboard.
FORMS	Sets number of columns per line and number of lines per page for printout.
FREE	Shows total free space on all disks, as well as individual statistics.
HASH	Gives the hash code of a file name. See text for description.
KEYBRD	Sets attributes of keyboard: lowercase, blinking cursor, automatically repeating keys, graphics codes, and cursor character. Enables or disables the Clear key.
LINK	Everything sent to the screen is sent to the printer as well, or vice versa.
LOAD	Allows loading files as low as hexadecimal address 5200.
ROUTE	Sends everything to the screen instead of the printer, or vice versa.
SKIP	Allows a 40-track disk to be read on an 80-track drive.
TOPMEM	Sets or displays protected memory pointer.

Table 3: *Some significant features of Multidos that are not found in TRSDOS 2.3.*

Note that the only parts of the editor/assembler that are mentioned in the documentation are the enhancements that Hester made. The manual states that you will need to purchase Radio Shack's original Model I tape-based editor/assembler to obtain the complete documentation. Unfortunately, this program is becoming increasingly difficult to find, as it has been replaced with Radio Shack's new Series 1 editor/assembler.

By the way, the Multidos manual inadvertently left out the commands to load and save assembler source code using the editor/assembler. I contacted Hester and he supplied them as follows:

L D=*filespec*	Load source file from disk
L T=*filespec*	Load source file from tape
W D=*filespec*	Write source file to disk
W T=*filespec*	Write source file to tape

Utilities

The Versatile File Utility lets you copy and purge disk files. First, a menu of files is displayed, containing the disk's directory in alphabetical order. You then move a cursor around, marking files to be copied or deleted. When you have finished, the specified action is performed on all the marked files. VFU's menu orientation makes it easy to use, and it is a good user interface.

VFU lets you execute any machine-language or BASIC program on the disk from the disk-directory display. It will also send a copy of the disk directory to your printer in a format that fits neatly inside (or onto) the disk jacket.

Another utility included with Multidos is called RAM Scan. It allows you to search any portion of RAM (random-access read/write memory) for a byte or word of your choice. What makes RAM Scan unique is that you can tell it to search for the specific Z80 machine-language instructions that reference the word of your choice.

GR is a graphics keyboard driver that lets you enter all the standard TRS-80 graphics characters directly from the keyboard.

A SPOOL utility lets you set aside any amount of memory to be used as a buffer for output to the printer. Hester, by the way, claims that SPOOL stands for "simultaneous peripheral operation on-line." By using the SPOOL command, your relatively fast computer doesn't have to wait for your relatively slow printer. Anything that would normally go to the printer, via an LPRINT or LLIST command from BASIC, will be put into the memory buffer that you set aside with the SPOOL command. SPOOL will "feed" your printer with characters from this buffer at a steady rate while your computer does other work at the same time.

At a Glance

Name
Multidos

Type
Radio Shack TRS-80 Model I and III disk operating system with enhanced Disk BASIC and an editor/assembler

Author
Vernon B. Hester

Distributor
Cosmopolitan Electronics Corporation
POB 234
Plymouth, MI 48170
(313) 397-3126

Price
One 5-inch floppy disk and manual: $79.95 (plus $2.50 postage and handling)

Software
Includes disk operating system, Disk BASIC, editor/assembler, and several utilities

Software Format
Available in single-, double-, and Percom-density for Model I, double-density only for Model III

Computer
TRS-80 Model I or III. 16K bytes of RAM (32K for some functions), one to four disk drives; double-density on Model I requires additional hardware

Documentation
66 pages, offset printed in a 3-ring binder; table of contents, but no index, adequate for technically oriented users, but difficult for beginners

Audience
Programmers in need of a disk operating system that can read, write, and copy files from disks created by popular TRS-80 DOSes; also, programmers in need of a superior BASIC program-development environment

Unfortunately, the SPOOL command will not work with a serial printer. It sends its output directly to the parallel printer port instead of calling the standard ROM (read-only memory) routine that is used to access alternate printer drivers.

Disk BASIC

Multidos comes with two versions of Disk BASIC. The production BASIC is called SUPERBASIC and includes all the features of Radio Shack's Disk BASIC plus many extensions. Table 4 lists some of these new features not included in TRS-80 Disk BASIC.

The second version is called BBASIC; it consists of SUPERBASIC plus BOSS, a very nice program-development and debugging tool. BOSS, which is also written by Hester, has been offered for some time as a separate product. Table 5 lists BBASIC's single-stepping and tracing commands. They are by far the most comprehensive and powerful I have seen. I suggest looking over tables 4 and 5 carefully; the features of SUPERBASIC and BBASIC could by themselves justify most of the cost of this package.

I have developed a substantial amount of code under SUPERBASIC and have found the following features very useful:

- A command, P*n*, that prints a page of BASIC text on the screen starting at line number *n*. If P is again typed, the next page after this page is printed.

Command	Description
BASIC !	Enters SUPERBASIC and leaves intact a BASIC program loaded under an alien operating system.
BASIC #	Enters SUPERBASIC and leaves intact a program loaded under Level II BASIC. Level II must have been entered by typing CMD "X."
, *(comma)*	Edits the current line.
/	Lists the "BREAK in" line.
Shift ↑	Lists first,
↑	previous,
. *(period)*	current,
↓	next, and
Shift ↓	last program lines.
P	Lists a page of BASIC text from current or specified line.
D	Deletes current line.
R	Runs BASIC program.
C	Continues execution of program.
CMD "C"	Deletes unnecessary spaces and linefeeds from BASIC program.
CMD "K"	Zeros out all elements of an array.
CMD "L"	Deletes an array and frees up memory.
CMD "M"	Moves a BASIC program line.
CMD "N"	Duplicates a BASIC program line.
CMD "O"	Allocates a new disk file buffer, in addition to the number specified when BASIC was entered. Defined functions, READ strings, and strings assigned directly in the program, e.g., A$ = "XYZ", are not retained.
CMD "Q"	Fast sort of a string array.
CMD "V"	Lists all active scalar variables.
CMD "X"	Transfer to Level II BASIC, leaving program in memory intact.
CMD *DOS command*	Goes to DOS, executes *DOS command*, then returns to BASIC.
F *string*	Finds all occurrences of *string* in a BASIC program.
- *(hyphen)*	Invokes global editor (see text).
; *target*	Program cross-reference; *target* may be a variable, line number, or constant. ";" with no *target* lists next line containing last *target*.
: *A,B,C,D*	Renumbers BASIC program. New first line number is *A*, increment is *B*. Starts renumbering at existing line *C*, ends at existing line *D*.
NAME *file*	Chaining function. Loads and runs BASIC program *file*, keeping current variables intact, except as noted under CMD "O."

Table 4: *Some significant features of Multidos SUPERBASIC that are not found in Radio Shack BASIC.*

- A fast program-line renumbering command. One drawback is that it cannot move a block of lines.
- A fast program cross-reference command that finds all references to a line number, constant, program variable, or BASIC keyword, and lists them on the screen or the printer.
- Commands to move or duplicate a program line. References to the moved line are not renumbered.

Command	Description
@1	Turns off all trace functions.
@2	Starts writing BASIC line numbers as they are executed in upper right-hand corner of screen. Always displays last four numbers executed.
@3	Sends line-number trace to printer.
@4	Turns off single-step functions.
@5	Single-steps to end of current BASIC line and waits.
@6	Single-steps one BASIC instruction and waits.
@7	Single-steps one BASIC instruction, pauses for specified time, and continues.
@N	Specifies program variables for review by @O command. Nested expressions are allowed, e.g., X(Y,Z).
@O	Shows current values of program variables entered under @N command.

Table 5: *A summary of commands in Multidos BOSS BASIC (BBASIC) for tracing BASIC programs, executing programs by single steps, and examining variables at different points during execution. Using POKE commands, you can set breakpoints anywhere in a BASIC program to invoke the @1-@7 commands.*

- A FIND command that searches a program for any string of characters—even REM statements are searched.
- A global program editor that lets you split and merge adjacent program lines, selectively change variable names and BASIC keywords, and build packed graphics strings automatically. For example, you could change all occurrences of the variable X to Y, all occurrences of PRINT to LPRINT, etc.

The global program editor is very useful, but it is difficult to remember the format of the commands. The editor prompts you with a terse "T = " (T stands for Target). You must respond with, for example, "−" to split a line, "/" to merge lines, and so on. I found it necessary to have the manual very close at hand while using the global editor.

A feature that I have not seen anywhere else allows you to go back and forth between Disk BASIC and Level II BASIC without dumping your program to cassette. This is great for testing programs developed under Disk BASIC to see if they will run under Level II.

Another good feature is the fact that SUPERBASIC leaves you with 40,036 bytes of free memory in a 48K-byte machine, more than any other Disk BASIC I have seen. This is especially impressive considering the fact that SUPERBASIC is so feature-packed.

Performance

One of the claims made for Multidos is that it has the fastest COPY and BACKUP commands of any TRS-80 DOS. In practice, these commands do seem quite responsive and at least as fast as those of any other DOS I have used.

While running the BACKUP command, however, I was concerned because the usual "Verifying track . . ." message does not appear as tracks are copied from one disk to another. Was Multidos getting some of its speed by skipping the verification step of disk backup?

Hester confirmed that Multidos does indeed skip this step. He stated that it is an unnecessary step because the disk surface is checked when it is formatted. He said that once the disk is spinning at the correct speed, writing to properly formatted tracks should be error-free. To be sure that the correct speed is attained, Multidos always waits a full second after turning the disk drive motor on before it starts to write.

Hester also said that BACKUP commands in other

TRS-80 DOSes do not perform a true byte-for-byte comparison of what was read from one disk and what was written to the other; instead, they do only a test for checksum errors. A checksum is a single byte computed by adding all the bytes written to a disk sector. It is written to the disk with the data, and can be compared to the checksum computed when the sector is read back. If the checksums do not match, what is on the disk does not match what is supposed to be written there.

I have never had a problem with disks backed up by Multidos, although most such errors would probably go undetected for a long time anyway. However, I must admit to an uneasy feeling when using the BACKUP command without the verification step. Why would disk controller manufacturers bother to include checksum computation in their hardware if writing to disk was so error-free?

Documentation

The Multidos manual is basically adequate, but it gets sketchy in places. For example, the description of a HASH command contains no discussion of what a hash code is or why you would want to compute one. In case you are wondering, a file's hash code is computed from the characters in its file name, and it is used to speed up the directory search when a file is opened. You would need to compute a hash code only if you were using a disk editor to examine or modify a directory.

In most cases, though, the manual gives you enough information to use the commands if you're willing to do some occasional experimentation. If you have experience with other TRS-80 DOSes, you will find the most frequently used commands familiar enough. But if this is your first DOS and you are not an experienced programmer, you may have some difficulty. The manual uses technical terms quite freely; it reads like it was written by a programmer, not a writer.

A nice touch is the use of different colored paper for the major sections of the manual, an aid in locating the documentation for particular commands. A not-so-nice feature is that although the manual comes in a 3-ring binder, the rings are too small to allow the pages to be easily turned.

Problems

While evaluating Multidos, I ran across several problems that I will now describe. Problems like these, of course, are not uncommon in newly released software products.

I occasionally get a "Drive Not Available" error when I access a disk drive that is in fact available. Hester thinks that this is due to my high-speed clock modification. This may be the case, but I have not noticed this behavior with any other DOS.

In SUPERBASIC, after editing a line that begins with a blank, the next command typed—no matter what it is—results in a "Syntax Error." Hester says that this is due to a ROM error, but this problem is not exhibited by other DOSes.

The TIME and DATE commands accept invalid input; e.g., you can set the time to be 99:99:99 with impunity.

As you can see, these are not major problems, merely annoyances. Fortunately, Hester appears to be interested in fixing the problems and supporting his operating system. He assured me that upgrades will be available at "reasonable prices."

Conclusions

Multidos provides a lot of value for the money. It gives you an opportunity to enjoy a full-featured DOS at a bargain price. Although some aspects of Multidos have the flavor of a "basement enterprise" production, such as occasional misspellings in system messages, the system as a whole seems to stand up well under heavy use.

For those who already own two or more TRS-80 DOSes, Multidos provides a bridge when moving files back and forth between disks created by these systems. Also, if you're planning to buy a disk-based editor/assembler, you could buy Multidos for the same price and get much more. (But take note of my earlier comment about the editor/assembler documentation.)

Finally, SUPERBASIC provides an excellent program-development environment. Global editing, cross-referencing, renumbering, single-stepping or variable speed execution with trace, breakpoint setting, and program variable review are great features that make programming in BASIC considerably more productive.■

GRPRINT: An Apple Utility Program for Dot-Matrix Printers

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Woodbury, MN 55125

With the introduction of numerous dot-matrix printers with graphics capabilities, many Apple II owners have envisioned using such a printer to create the high-resolution graphics screens on paper. For those of you who have gotten bogged down with the Apple's high-resolution screen-addressing technique while attempting to write a program to print the graphics high-resolution screen, or are unfamiliar with assembly-language programming, the GRPRINT program is for you.

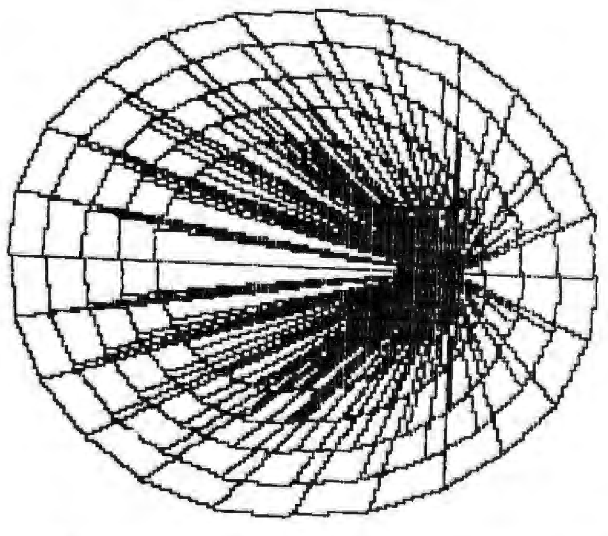

Figure 1: *Output from the HOLE program. It was produced with the Paper Tiger 445G printer.*

One feature of this program is that it is invisible to Applesoft without any use of the LOMEM command. GRPRINT (see listings 1 and 2) fits into the page of memory reserved for machine-language programs, hexadecimal 300 through 3FF. Therefore, Applesoft will not write on top of GRPRINT. Any exisitng Applesoft graphics program can take advantage of GRPRINT by using a DOS BLOAD command within the program, four POKE statements to set parameters, and a CALL statement. Listing 3 (see page 402) includes a sample GRPRINT program that shows you how GRPRINT can be used under program control. (Also see figure 1.)

GRPRINT was written specifically for an Apple II Plus with disks, interfaced to an IDS (Integral Data Systems) Paper Tiger 445G or Epson MX-80/70. The method employed in GRPRINT is general enough for most dot-matrix printers. However, some modifications may be necessary to the instructions sent to the printer for turning on and off the graphics modes and to the program indexes if the number of needles in the print head used in the graphics mode is different from those employed by the Pager Tiger or Epson.

The Apple II represents each dot on the high-resolution screen as a bit of data organized as 7 bits of a byte oriented along the horizontal axis of the screen. Most printer graphics are represented as 6 bits of a byte arranged along a vertical axis with each bit representing a printed dot. GRPRINT merely reconstructs the Apple's bytes bit by bit so that they are positioned along the vertical axis of the screen and compatible with the printer.

Listing 1: *GRPRINT graphics utility program configured for use with an Apple II Plus computer and Integral Data Systems' Paper Tiger 445G printer.*

```
---- NEXT OBJECT FILE NAME IS GRPRINT/IDS.OBJO
0305:                     ORG   $305
0305:              **************************************************************************
0305:              * S/R GRPRINT - TO LOAD UNDER PROGRAM CONTROL IN BASIC YOU MUST INCLUDE  *
0305:              *                  THESE LINES                                            *
0305:              *                  10 D$=CHR$(4)                                          *
0305:              *                  20 PRINT D$;"BLOAD GRPRINT.OBJO"                       *
0305:              *                  OTHERWISE JUST BLOAD GRPRINT.OBJO                      *
0305:              *                  THEN DO A CALL 779 TO INITIATE S/R                     *
0305:              **************************************************************************
0305:              * THE FOLLOWING POKES MUST BE SET                                          *
0305:              *      POKE,768,S  S=STARTING LINE # 0-160 FOR SCR1 + 0-192 SCR2          *
0305:              *      POKE 769,F  F=FINISH LINE WHERE VALUES ARE SAME AS ABOVE           *
0305:              *      POKE 771,C  C=CHAR/INCH (28=LRG, 29=MED, 30=SMLL)       *
0305:              *      POKE 772,P  P=0 FOR SCR1 AND P=1 FOR SCR2
0305:              **************************************************************************
0300:              STRTL    EQU   $300
0301:              FINL     EQU   $301
0302:              LINE     EQU   $302
0303:              CHAR     EQU   $303
0304:              SCREEN   EQU   $304          ;0=SCREEN
001A:              PTR      EQU   $1A
FDED:              COUT     EQU   $FDED
C000:              KBD      EQU   $C000
C010:              CKBDS    EQU   $C010
0305:00 00 00      BUFR     DFB   $00,$00,$00,$00,$00,$00
0308:00 00 00
030B:A9 80                  LDA   #$80          ;DISABLE APPLE
030D:8D 7A 04               STA   $47A          ;VIDEO
0310:A9 11                  LDA   #$11          ;SELECT PRINTER
0312:20 ED FD               JSR   COUT
0315:A9 0D                  LDA   #$0D          ;CLEAR PRINTER BUFFER
0317:20 ED FD               JSR   COUT
031A:AD 03 03               LDA   CHAR          ;SELECT CHAR INCH DENSITY
031D:20 ED FD               JSR   COUT
0320:A9 03                  LDA   #$03          ;SET GRAPHICS
0322:20 ED FD               JSR   COUT          ;MODE
0325:AD 00 03               LDA   STRTL         ;GET STARTING LINE #
0328:8D 02 03               STA   LINE          ;AND STORE
032B:A0 00                  LDY   #$00          ;INITIALIZE
032D:A2 00                  LDX   #$00          ;INDEXES
032F:2C 00 C0      LOOP1    BIT   KBD           ;KEY PRESSED ?
0332:10 07                  BPL   BYPASS        ;NO, BYPASS
0334:A9 84                  LDA   #$84          ;YES, CHECK FOR CNTRL-D
0336:CD 00 C0               CMP   KBD
0339:F0 0F                  BEQ   RESET         ;IF CNTRL-D RETURN TO CALLING PROGRAM
033B:2C 10 C0      BYPASS   BIT   CKBDS         ;CLEAR KEYBD STROBE
033E:AD 02 03               LDA   LINE          ;START LOOP
0341:CD 01 03               CMP   FINL          ;LAST LINE ?
0344:90 1C                  BCC   J1            ;NO,BRANCH AROUND
0346:C0 28                  CPY   #$28          ;LAST COLUMN ?
0348:90 1E                  BCC   J2            ;NO BRANCH AROUND
034A:2C 10 C0      RESET    BIT   CKBDS         ;CLEAR KEYBD STROBE
034D:A9 03                  LDA   #$03          ;RETURN
034F:20 ED FD               JSR   COUT          ;TO
0352:A9 02                  LDA   #$02          ;NORMAL
0354:20 ED FD               JSR   COUT          ;MODE
0357:A9 13                  LDA   #$13          ;DESELECT PRINTER
0359:20 ED FD               JSR   COUT
035C:A9 00                  LDA   #$00          ;TURN ON APPLE
035E:8D 7A 04               STA   $47A          ;VIDEO
0361:60                     RTS                  ;RETURN TO CALLING PROGRAM
0362:C0 28         J1       CPY   #$28          ;TIME TO RESET COLUMN IND?
0364:90 02                  BCC   J2            ;NO CONTINUE
0366:A0 00                  LDY   #$00          ;RESET
                   *************************************************************************
0368:0A            J2       ASL   A             ;START OF BASE LINE HI-RES
0369:0A                     ASL   A             ;ALGORITHYM FROM
036A:29 1C                  AND   #$1C          ;"APPLE-II HI-RES GRAPHICS: RESOLVING THE
036C:85 1B                  STA   PTR+1         ;RESOLUTION MYTH", BOB BISHOP, THE APPLE ORCHARD,
036E:AD 02 03               LDA   LINE          ;VOL 1, NO. 2, FALL 1980
0371:6A                     ROR   A
0372:6A                     ROR   A
0373:6A                     ROR   A
0374:6A                     ROR   A
0375:29 03                  AND   #$03
0377:05 1B                  ORA   PTR+1
0379:09 20                  ORA   #$20
037B:85 1B                  STA   PTR+1
037D:AD 02 03               LDA   LINE
0380:6A                     ROR   A
```

Listing 1 continued on page 400

Listing 1 continued:

```
0381:29 E0                  AND  #$E0
0383:85 1A                  STA  PTR
0385:6A                     ROR  A
0386:6A                     ROR  A
0387:29 1B                  AND  #$1B
0389:05 1A                  ORA  PTR
038B:85 1A                  STA  PTR
            ***********************************************************************
038D:AD 04 03               LDA  SCREEN      ;WHICH SCREEN?
0390:F0 07                  BEQ  J3          ;BRANCH IF SCREEN 1
0392:A5 1B                  LDA  PTR+1       ;GET HIGH BYTE
0394:18                     CLC
0395:69 20                  ADC  #$20        ;ADD FOR SCREEN 2
0397:85 1B                  STA  PTR+1       ;STR HIGH RESULT
0399:B1 1A         J3       LDA  (PTR),Y     ;GET BYTE FROM HI-RES GRAPHICS BUFFER
039B:9D 05 03               STA  BUFR,X      ;STR IN PROCESS BUFFR
039E:EE 02 03               INC  LINE        ;NEXT LINE
03A1:E8                     INX               ;NEXT BUFFR
03A2:E0 06                  CPX  #$06        ;BUFFR FULL ?
03A4:90 89                  BCC  LOOP1       ;NO GET NEXT BYTE
03A6:C8                     INY              ;NEXT COLUMN
03A7:C0 28                  CPY  #$28        ;LAST COLUMN ?
03A9:F0 09                  BEQ  J4          ;YES JUMP AROUND
03AB:AD 02 03               LDA  LINE        ;NO RESET LINE COUNTER
03AE:38                     SEC
03AF:E9 06                  SBC  #$06        ;SUBTRACT
03B1:8D 02 03               STA  LINE
03B4:98            J4       TYA               ;SAVE Y
03B5:48                     PHA
03B6:A0 07                  LDY  #$07        ;LOAD INDEX
03B8:A9 00         J5       LDA  #$00        ;CLEAR ALL BITS
03BA:A2 00                  LDX  #$00        ;RESET   INDEX
03BC:5E 05 03      J6       LSR  BUFR,X      ;PUSH BIT INTO CARRY
03BF:6A                     ROR  A           ;PUSH CARRY INTO A
03C0:E8                     INX
03C1:E0 06                  CPX  #$06        ;ACCUM BYTE FULL ?
03C3:90 F7                  BCC  J6          ;IF BYTE NOT FULL CONTINUE
03C5:4A                     LSR  A           ;SHIFT OVER TWO BITS TO
03C6:4A                     LSR  A           ;GET TO BIT 0
03C7:C9 03                  CMP  #$03        ;CHECK TO MAKE SURE NO CONTROL CHARACTERS ARE SENT
03C9:D0 03                  BNE  J8          ;IF NOT BRANCH
03CB:20 ED FD               JSR  COUT        ;SEND TWICE TO CLEAR CONTROL CHARACTER
03CE:20 ED FD      J8       JSR  COUT        ;SEND BYTE TO PRINTER
03D1:88                     DEY
03D2:D0 E4                  BNE  J5          ;GET NEXT BYTE FOR PRINT
03D4:A2 00                  LDX  #$00        ;RESET BUFFR INDEX
03D6:68                     PLA               ;RETRIEVE COLUMN INDEX
03D7:A8                     TAY               ;AND PUT IN Y
03D8:C0 28                  CPY  #$28        ;IF LAST COLUMN, CR
03DA:90 0A                  BCC  J7
03DC:A9 03                  LDA  #$03
03DE:20 ED FD               JSR  COUT        ;SEND CR TO PRINTER
03E1:A9 0B                  LDA  #$0B
03E3:20 ED FD               JSR  COUT
03E6:4C 2F 03      J7       JMP  LOOP1

*** SUCCESSFUL ASSEMBLY: NO ERRORS
```

Listing 2: *An alternate version of the GRPRINT graphics utility program configured for the Apple II Plus and the Epson MX-70 or MX-80 printer.*

```
----- NEXT OBJECT FILE NAME IS GRPRINT/EPSON.OBJ0
0305:                 ORG   $305
0305:        **************************************************************************
0305:        * S/R GRPRINT - TO LOAD UNDER PROGRAM CONTROL IN BASIC YOU MUST INCLUDE   *
0305:        *                    THESE LINES                                          *
0305:        *                    10 D$=CHR$(4)                                        *
0305:        *                    20 PRINT D$;"BLOAD GRPRINT.OBJ0"                     *
0305:        *                    OTHERWISE JUST BLOAD GRPRINT.OBJ0                    *
0305:        *                    THEN DO A CALL 781 TO INITIATE S/R                   *
0305:        **************************************************************************
0305:        * THE FOLLOWING POKES MUST BE SET                                          *
0305:        *      POKE,768,S  S=STARTING LINE # 0-160 FOR SCR1 + 0-192 SCR2           *
0305:        *      POKE 769,F  F=FINISH LINE WHERE VALUES ARE SAME AS ABOVE            *
0305:        *      POKE 772,P  P=0 FOR SCR1 AND P=1 FOR SCR2                           *
0305:        **************************************************************************
```

Listing 2 continued:

```
0300:                STRTL   EQU  $300
0301:                FINL    EQU  $301
0302:                LINE    EQU  $302
C1C1:                SENSE   EQU  $C1C1        ;PRINTER BUSY LINE
0304:                SCREEN  EQU  $304         ;0=SCREEN
001A:                PTR     EQU  $1A
C000:                KBD     EQU  $C000
C010:                CKBDS   EQU  $C010
0305:00 00 00        BUFR    DFB  $00,$00,$00,$00,$00,$00,$00,$00
0308:00 00 00
030B:00 00
030D:A9 1B                   LDA  #$1B         ;SET LINE SPACING
030F:20 F1 03                JSR  COUT         ;ESC A 8
0312:A9 41                   LDA  #$41
0314:20 F1 03                JSR  COUT
0317:A9 08                   LDA  #$08         ;BINARY 8
0319:20 F1 03                JSR  COUT
031C:A9 0D                   LDA  #$0D         ;CLEAR PRINTER BUFFER
031E:20 F1 03                JSR  COUT
0321:A9 0A                   LDA  #$0A
0323:20 F1 03                JSR  COUT
0326:AD 00 03                LDA  STRTL        ;GET STARTING LINE #
0329:8D 02 03                STA  LINE         ;AND STORE
032C:A2 00                   LDX  #$00         ;CLEAR X INDEX
032E:4C 63 03                JMP  J7           ;JMP TO SET BIT IMAGE MODE
0331:2C 00 C0        LOOP1   BIT  KBD          ;KEY PRESSED ?
0334:10 07                   BPL  BYPASS       ;NO, BYPASS
0336:A9 84                   LDA  #$84         ;YES, CHECK FOR CNTRL-D
0338:CD 00 C0                CMP  KBD
033B:F0 0F                   BEQ  RESET        ;IF CNTRL-D RETURN TO CALLING PROGRAM
033D:2C 10 C0        BYPASS  BIT  CKBDS        ;CLEAR KEYBD STROBE
0340:AD 02 03                LDA  LINE         ;START LOOP
0343:CD 01 03                CMP  FINL         ;LAST LINE ?
0346:90 17                   BCC  J1           ;NO,BRANCH AROUND
0348:C0 28                   CPY  #$28         ;LAST COLUMN ?
034A:90 2D                   BCC  J2           ;NO BRANCH AROUND
034C:2C 10 C0        RESET   BIT  CKBDS        ;CLEAR KEYBD STROBE
034F:A9 1B                   LDA  #$1B         ;RESET LINE SPACING
0351:20 F1 03                JSR  COUT         ;TO
0354:A9 41                   LDA  #$41         ;6 LINES PER INCH
0356:20 F1 03                JSR  COUT
0359:A9 0C                   LDA  #$0C         ;
035B:20 F1 03                JSR  COUT
035E:60                      RTS                ;RETURN TO CALLING PROGRAM
035F:C0 28           J1      CPY  #$28         ;TIME TO RESET COLUMN IND?
0361:90 16                   BCC  J2           ;NO CONTINUE
0363:A0 00           J7      LDY  #$00         ;RESET
0365:A9 1B                   LDA  #$1B         ;PUT PRINTER IN BIT IMAGE
0367:20 F1 03                JSR  COUT         ;MODE BY SENDING ESC K 280
036A:A9 4B                   LDA  #$4B         ;WHERE 280 = # OF DOTS ACROSS SCREEN
036C:20 F1 03                JSR  COUT
036F:A9 18                   LDA  #$18
0371:20 F1 03                JSR  COUT
0374:A9 01                   LDA  #$01
0376:20 F1 03                JSR  COUT
                     **************************************************************************
0379:0A              J2      ASL  A            ;START OF BASE LINE HI-RES
037A:0A                      ASL  A            ;ALGORITHYM FROM
037B:29 1C                   AND  #$1C         ;"APPLE-II HI-RES GRAPHICS: RESOLVING THE
037D:85 1B                   STA  PTR+1        ;RESOLUTION MYTH", BOB BISHOP, THE APPLE ORCHARD,
037F:AD 02 03                LDA  LINE         ;VOL 1, NO. 2, FALL 1980
0382:6A                      ROR  A
0383:6A                      ROR  A
0384:6A                      ROR  A
0385:6A                      ROR  A
0386:29 03                   AND  #$03
0388:05 1B                   ORA  PTR+1
038A:09 20                   ORA  #$20
038C:85 1B                   STA  PTR+1
038E:AD 02 03                LDA  LINE
0391:6A                      ROR  A
0392:29 E0                   AND  #$E0
0394:85 1A                   STA  PTR
0396:6A                      ROR  A
0397:6A                      ROR  A
0398:29 18                   AND  #$18
039A:05 1A                   ORA  PTR
039C:85 1A                   STA  PTR
```

Listing 2 continued on page 402

Listing 2 continued:

```
                 ***********************************************************************
03A1:AD 04 03              LDA   SCREEN     ;WHICH SCREEN?
03A1:F0 07                 BEQ   J3         ;BRANCH IF SCREEN 1
03A3:A5 1B                 LDA   PTR+1      ;GET HIGH BYTE
03A5:18                    CLC
03A6:69 20                 ADC   #$20       ;ADD FOR SCREEN 2
03A8:85 1B                 STA   PTR+1      ;STR HIGH RESULT
03AA:B1 1A        J3       LDA   (PTR),Y    ;GET BYTE FROM HI-RES GRAPHICS BUFFER
03AC:9D 05 03              STA   BUFR,X     ;STR IN PROCESS BUFFR
03AF:EE 02 03              INC   LINE       ;NEXT LINE
03B2:E8                    INX               ;NEXT BUFFR
03B3:E0 08                 CPX   #$08       ;BUFFR FULL ?
03B5:90 37                 BCC   J8         ;NO GET NEXT BYTE
03B7:C8                    INY              ;NEXT COLUMN
03B8:C0 28                 CPY   #$28       ;LAST COLUMN ?
03BA:F0 09                 BEQ   J4         ;YES JUMP AROUND
03BC:AD 02 03              LDA   LINE       ;NO RESET LINE COUNTER
03BF:38                    SEC
03C0:E9 08                 SBC   #$08       ;SUBTRACT
03C2:8D 02 03              STA   LINE
03C5:98           J4       TYA               ;SAVE Y
03C6:48                    PHA
03C7:A0 07                 LDY   #$07       ;LOAD INDEX
03C9:A9 00        J5       LDA   #$00       ;CLEAR ALL BITS
03CB:A2 00                 LDX   #$00       ;RESET   INDEX
03CD:5E 05 03     J6       LSR   BUFR,X     ;PUSH BIT INTO CARRY
03D0:2A                    ROL   A          ;PUSH CARRY INTO A
03D1:E8                    INX
03D2:E0 08                 CPX   #$08       ;ACCUM BYTE FULL ?
03D4:90 F7                 BCC   J6         ;IF BYTE NOT FULL CONTINUE
03D6:20 F1 03              JSR   COUT       ;SEND BYTE TO PRINTER
03D9:88                    DEY
03DA:D0 ED                 BNE   J5         ;GET NEXT BYTE FOR PRINT
03DC:A2 00                 LDX   #$00       ;RESET BUFFR INDEX
03DE:68                    PLA               ;RETRIEVE COLUMN INDEX
03DF:A8                    TAY               ;AND PUT IN Y
03E0:C0 28                 CPY   #$28       ;IF LAST COLUMN, CR
03E2:90 0A                 BCC   J8
03E4:A9 0D                 LDA   #$0D       ;SEND CR TO PRINTER
03E6:20 F1 03              JSR   COUT
03E9:A9 0A                 LDA   #$0A       ;SEND LF TO PRINTER
03EB:20 F1 03              JSR   COUT
03EE:4C 31 03     J8       JMP   LOOP1
                 ***********************************************************************
03F1:            *     S/R FOR CHARACTER OUTPUT TO SLOT 1
                 ***********************************************************************
03F1:8D 90 C0     COUT     STA   $C090      ;SEND BYTE TO CARD IN SLOT 1
03F4:AD C1 C1     BUSY     LDA   SENSE      ;GET PRINTER STATUS
03F7:C9 FE                 CMP   #$FE       ;STILL BUSY
03F9:F0 F9                 BEQ   BUSY       ;YES, CHECK AGAIN
03FB:60                    RTS

*** SUCCESSFUL ASSEMBLY: NO ERRORS
```

Listing 3: *HOLE program. An example of how the GRPRINT program works.*

```
100  REM  HOLE
110 D$ =  CHR$ (4): REM    DOS 3.3 MANUAL PG.29
120  PRINT D$;"BLOAD GRPRINT.OBJ0"
130  HGR : HCOLOR= 3
140  DEF  FN X(I) = 140 + (Z *  COS (I * 6.28 / 360))
150  DEF  FN Y(I) = 80 - (Z *  SIN (I * 6.28 / 360))
160  FOR Z = 40 TO 80 STEP 10
170  FOR I = 0 TO 360 STEP 15
180  HPLOT 180,80
190  HPLOT  TO ( FN X(I)),( FN Y(I))
200  HPLOT ( FN X(I)),( FN Y(I)) TO ( FN X(I - 15)),( FN Y(I - 15))
210  NEXT I
220  NEXT Z
230  POKE 768,0: POKE 769,160
240  POKE 771,30: POKE 772,0
250  CALL 779
260  END
```

To use GRPRINT, you must employ the following commands, which can be entered at the keyboard or under program control (see listing 3, lines 230 through 250):

BLOAD GRPRINT.OBJ0
POKE 768, STARTLINE
POKE 769, FINISHLINE
POKE 771, HORIZSPACE
POKE 772, HSCREEN
CALL 779

The POKE commands control the formatting of the output to the printer, where:

STARTLINE is the vertical line number on the screen where GRPRINT is to start printing
FINISHLINE is the vertical line number on the screen where GRPRINT is to finish printing
HORIZSPACE is 28 for a screen printout of 6½ by 2⁷⁄₁₀ inches for a 280- by 192-dot screen, equal to 29 for a screen printout of 5½ by 2⁷⁄₁₀ inches, or equal to 30 for a screen printout of 4³⁄₁₀ by 2⁷⁄₁₀ inches
HSCREEN is 0 for high-resolution screen 1 or 1 for high-resolution screen 2

Two Versions

GRPRINT for the IDS printer includes commands that put the printer in graphics mode, return it to the text mode, and refer to the number and orientation of the needles in the print head (see listing 1). Lines 27 to 36 put the IDS 445G into graphics mode, and lines 53 through 60 return the printer to text mode. The IDS 445G has six print needles available for use in the graphics mode, in which bit 0 of any byte accesses the uppermost print needle in the head. As a result, lines 26, 99, 106, 114, and 116 are printer-dependent.

In contrast, Epson MX-80 and MX-70 printers have eight print needles in their graphics mode (bit-image mode), in which bit 0 of any byte accesses the lowermost print needle in the head. Consequently, for the Epson (see listing 2), lines 24, 103, 110, 118, and 120 have indexes of 8, and line 118 is ROL A rather than ROR A. Lines 118 through 122 in listing 1 are specific to the IDS printer; they line up the byte to bit 0 (because of a six-needle head) and ensure that no control characters are sent inadvertently. These lines are not needed for Epson printers. Lines 131, 132, 133, and 134 in listing 1 send a carriage return (VTAB) to the printer and again are specific to the IDS 445G. Lines 130 through 133 in listing 2 are the equivalent codes for a carriage return for the Epson printer. Printer reference manuals will provide you with the information you need to make any necessary changes for other printers.

You may find that the Apple output routine (hexadecimal FDED) will generate some unexpected alterations to your output byte. This appears to be the case with the MX-70. Therefore, a character-output routine was added to the Epson listing to send the output bytes directly to the printer-interface card in slot 1 (see lines 135 through 142).

The HOLE program, shown in listing 3, gives an example of how to use the GRPRINT program. First BSAVE the appropriate version of the GRPRINT program onto your floppy disk, then run the HOLE program. In this example, lines 230 through 240 contain the POKE commands that control the format of the output to the IDS 445G printer. The resulting hard copy from the HOLE program is shown in figure 1. Entering a CTRL-D will stop GRPRINT and return you to the program or monitor.

The GRPRINT program is a fast, simple method for getting graphics output from your Apple II Plus and IDS Paper Tiger 445G or Epson MX-80/70 printer. ■

BYTE's Bugs

Power-Supply Diagram Error

A topological gremlin attacked Steve Ciarcia when he was preparing one of the schematic diagrams for his article "Switching Power Supplies: An Introduction" (November 1981 BYTE, page 36).

In figure 6a on page 43, the connections to the Fairchild 78S40 switching regulator are incorrect as shown, and the diode cathode connection is missing. The corrected diagram is shown here as figure 1. ■

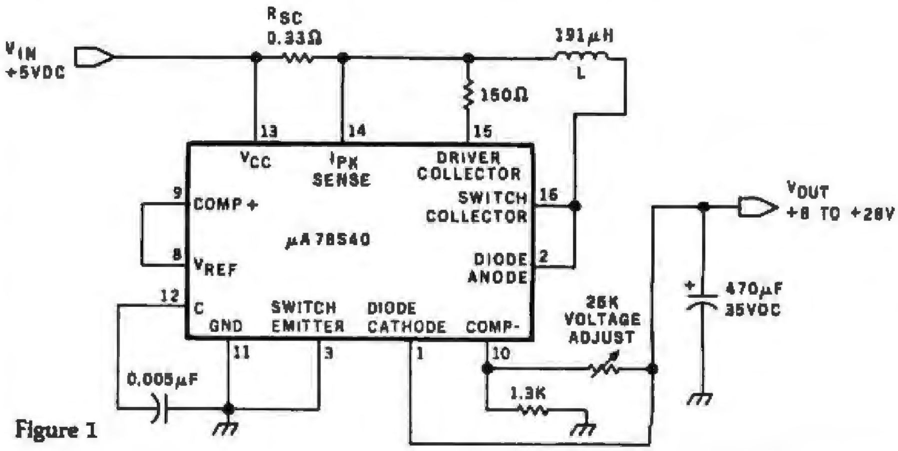

Figure 1

Condor Series 20 DBMS

Jack L. Abbott
8525 North 104th Ave.
Peoria, AZ 85345

At a Glance

Name
Condor Series 20 DBMS, level 3, version 2.09

Type
Database management system

Manufacturer
Condor Corporation
POB 8318
Ann Arbor, MI 48107
(313) 769-3988

Price
$995

Disk Formats Available
8-inch soft-sector (IBM 3740 format),
almost all 5¼-inch formats

Language
Machine language

Computer Needed
Runs on 8080-family and Z80 microprocessors under the CP/M, CDOS, and MP/M-80 operating systems. Also runs on 8086 and 8088 processors under the MS-DOS and CP/M-86 operating systems. Requires 48K bytes or more of RAM, 80-column by 24-line display with clear-screen capability and addressable cursor, two disk drives with at least 300K-byte total capacity, and printer with formfeed and form-length control, preferably with 132-column print capability

Documentation
Approximately 180 pages, loose-leaf

Audience
Anyone with database needs

A typical business microcomputer user may need special-purpose programs such as inventory management, mailing lists, and appointment calendars. One general-purpose program, a database management system (DBMS), can be used to do the work of these application programs. A DBMS will accept data in the format you establish, process this data as you instruct, and output it in the report format that you designate. The reports can be tables, checks, inventory lists, receipts, etc.

Condor Series 20 DBMS is a relational DBMS developed by Condor Computer Corporation of Ann Arbor, Michigan. (For brevity, I will refer to Condor Series 20 DBMS as Condor DBMS.) It requires a Z80 microcomputer or an 8080-family microprocessor with at least 48K bytes of RAM (random-access read/write memory) under the CP/M-80, CDOS, and MP/M-80 operating systems. The Condor DBMS also runs on 8086 and 8088 microprocessors under the MS-DOS and CP/M-86 operating systems. You need a 24-line by 80-column display terminal with screen-erase, line-wrap, and cursor-addressing capabilities. Two floppy-disk drives with a total capacity of at least 300K bytes of memory are needed. Hard-disk drives can be used if they are supported by the operating system. Condor requires a printer, preferably one with 132-column print capability, form feed, and form-length control.

Condor DBMS is available in three levels. Level 3 is the complete system and includes file management and transaction-processing capabilities (the ability to compare files), as well as the ability to join information from several databases. It includes a report writer and indexing, too. Level 2 offers all the above except for the report writer and the indexing capabilities, and Level 1 includes only the file management and transaction-processing capabilities. A purchaser of Level 1 can upgrade to Level 3 and will receive a credit of $245 toward the purchase of the Level 3.

The program documentation is in two sections and totals about 180 pages in length. The first section begins with an explanation of how the Condor DBMS interfaces with CP/M or MP/M operating systems and tells how to make a copy of the master disk. You use the copy, of course, for day-to-day operation. The program examples that follow include building a portion of a general ledger, establishing and maintaining an employee file, and developing a mailing-list program. The second section of the manual is an alphabetical listing of each Condor DBMS command. The material is generally well organized and the presentation clear. If you are a newcomer to computing and are going to use Condor DBMS to develop an application program similar to the examples given, you should have no difficulty. It would be helpful if examples of other types of applications were included. The document is not indexed, and it should be.

Condor is preparing new documentation that will be organized somewhat differently. A separate Installation Guide will be provided for each computer and operating system for which the software is available. Thus, a user purchasing the Condor DBMS for an IBM Personal Computer with MS-DOS would receive a manual written specifically for that configuration. This should greatly ease the burden of initial setup for the inexperienced user.

I used two different database files for program familiarization and checkout. The first is a five-record inventory of mobile homes. Each record contains all the information about one mobile home arranged in eight descriptive sections called fields. All the records taken together make up a file. Condor DBMS can have a maximum of 32,767 records per file and as many as 1024 characters (bytes) per record divided among a maximum of 127 fields. No single field can be longer than 127 alphanumeric characters (letters, spaces, and/or numbers) or 10 digits. Because database management systems sometimes perform differently under different loads, my second database file has 2,150 records of five fields each, for a total of 10,750 data items. Later in this article, I will give you the results of my tests with the larger database file.

You adapt Condor DBMS to your system by selecting one of eight commonly used display terminals from a menu. If your terminal is not listed, you can furnish the program with the appropriate ASCII characters for clear-screen and cursor-addressing functions. After you receive the program package, you must sign and return the license agreement. Condor Computer Corporation will then send you a six-digit license number. You must enter the number every time you use Condor DBMS, or the program will handle only 50 records. I don't like this feature; it is one more number that I must remember.

A Typical Application

The first step in developing the representative mobile home inventory program, named MOBINV, is to define the input data format. To load Condor DBMS, you type in "DBMS". Next you type in the command "DEFINE MOBINV". Condor DBMS then brings up a screen that is blank except for an instruction legend at the bottom. Condor provides full-screen editing; you can move the cursor anywhere on the screen, typing in at the cursor location information like that shown in listing 1. In this example, I aligned each field label on the left margin. Later in this article, you will see an example of a different input data format generated by using this same Define command.

Next you define the attributes of each field. Condor DBMS will display each field label sequentially. You enter whether the field is alphanumeric, alphabetic, numeric, dollar, or Julian (date field). Then you type in field length. Here is an example using the first two lines of the MOBINV input data format:

```
1. RECORD.NUMBR: N,2, -32767,32767,"          "
2. STOCK.NUMBR: AN,15,0,15,"          "
```

Condor DBMS displays RECORD.NUMBR. You enter "N" for numeric, and "2" for 2 bytes in length. Condor DBMS fills out the rest of the line. The quotation marks hold the default value for each field. Because this program uses hexadecimal (base 16) numeric storage, 2 bytes give the capability of storing up to ±32,767 decimal (7FFF hexadecimal). One ASCII number requires 1 byte

Listing 1: *A representation of the Condor DBMS screen display during definition of an input data format. This example defines the format for a mobile homes inventory. Condor DBMS requires placing field labels in brackets and using underscores to show the number of characters in each field.*

```
[RECORD.NUMBR]_ _ _ _ _                   Note: This is the first action
[STOCK.NUMBR]_ _ _ _ _ _ _ _ _ _ _ _ _ _ _      required to define the
[SUPPLIER]_ _ _ _ _ _ _ _ _ _ _ _ _ _ _         input data format.  Field
[MODEL]_ _ _ _ _ _ _ _ _ _                      labels are typed in
[DATE.ORD]_ _ _ _ _ _ _ _                       brackets.  Dashes are the
[DATE.RECVD]_ _ _ _ _ _ _ _                     number of characters.
[COST]:$_ _ _ _ _ _ _ _
[SALE.PRICE]:$_ _ _ _ _ _ _ _

Rep Mode:Ins mode(Ctl A) Abort(Ctl C) End(Ctl E) Refresh Screen(Ctl R)
```

Listing 2: *A representation of the screen display of five records in the MOBINV database of mobile homes. Condor DBMS generated the display in response to the command LIST MOBINV BY RECNR STOCK.NUMBR SUPPLIER MODEL DATE.ORD DATE.REC COST SALE.PRICE.*

```
RECNR STOCK.NUMBR  SUPPLIER     MODEL       DATE.ORD DATE.REC COST     SALE.PRICE

    1 1234557XYZ   PALM HARBOR  3BR2BA60F   01/05/81 02/20/81 14375.00 18000.00

    2 123456XYZ    NASHUA       1BR15BA40F  03/02/81 04/06/81 12789.00 16000.00

    3 23455MNB     LAYTON       2BR1BA40F   01/03/81 02/04/81 14000.00 18585

    4 234567ABCDE  AIRSTREAM    1BR1BA32F   01/06/81 03/06/81 21000.00 24000.00

    5 1RW14578     SKYLINE      2BR1BA79F   04/03/81 05/08/81 24987.65 31650.00
```

for storage. Two hexadecimal numbers can be stored in 1 byte. The largest number Condor DBMS will handle is ±2,148,373,647 decimal. Four bytes are required to store a number of this size. For STOCK.NUMBR, you enter "AN" for alphanumeric and "15" for the maximum number of characters in the field. You define each field in this manner.

After you have defined the input data format, you use the Enter command to get a screen display like the one in listing 1 but without the brackets. You then type in the appropriate data for the five mobile homes in the inventory example. You again have full-screen edit capability available. Condor DBMS stores the entered data in a disk file.

You can display the stored MOBINV records by entering the following command:

LIST MOBINV BY RECNR STOCK.NUMBR SUPPLIER MODEL DATE.ORD DATE.REC COST SALE.PRICE

Listing 2 is a representation of the video display of the five records of the MOBINV database. In this case, I asked Condor *DBMS* to include all the fields in each record of MOBINV. You can specify which fields you want displayed. If you want to print this display, Condor DBMS assumes that you have a 132-column printer and will not provide a linefeed until you reach 132 characters. If the printer has only 80 columns, printing any record over 80 characters in length will cause all characters between 80 and 132 to be overprinted at the beginning of the line. Use of the *screen-format* report output described later in this article will solve this problem.

Using English-like commands, you can have Condor DBMS sort the file on any field desired. You can select records by specifying logical comparisons, including less than, greater than, equals, not equal, equal or less than, and equal or more than. For example, you can ask for mobile homes received after May 1981 by entering the command SELECT MOBINV WHERE DATE.RCVD GE 06/01/81 (GE is greater than or equal to). Those units (records) meeting this criterion will be written to a Result file. You can then select all units in the Result file costing less than $25,000, for example. Again, the mobile homes meeting the selection criterion will be written in a Result file. At any point, you can cause the contents of the Result file to be displayed or printed. An example in the Condor DBMS manual shows how to select wanted names and addresses of customers from a master list. Names of those customers who have not made a purchase

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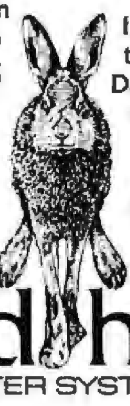

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Listing 3: *A sample invoice generated by Condor DBMS from the database MOBINV.*

```
                    COPPERSTATE MOBILE HOME SALES
                         1425 N. GRAND AVE.
                         PEORIA, AZ. 85345
                           (602)100-3131


STOCK NUMBER       MANUFACTURER       MODEL              SALE PRICE

123456XYZ          NASHUA             1BR15BA40F        $  16000.00
```

Listing 4: *A summary of the attributes of the input data format in the database used to test Condor DBMS. "AN" after each field name stands for alphanumeric. The numbers that follow indicate the length of each field and the minimum and maximum values of the data that the field can hold.*

```
REORDER.FLAG: AN,1,0,1
STOCK.NUMBER: AN,5,0,5
TYPE: AN,2,0,2
QUANTITY: AN,4,0,4
BASE.METAL: AN,3,0,3

Record Size (Bytes) = 16


Total Records = 2150
```

or been contacted within a specified time are placed in a Result file. This data is then used to print mailing labels. Mailing-label printing is limited to one label across; hence, single-label rolls must be used. This is more expensive and slower than using rolls with multiple labels across.

A similar technique can be used to print an invoice when one of the mobile homes is sold. Listing 3 shows an invoice printout example from the MOBINV database. Condor DBMS calls this type of report a *screen format*.

An actual inventory program would include another field in the input data format so that you could flag those units that were sold. (To *flag* a record, you enter a character in a field so that later the record can be selected by testing the field. A "Y" for yes would be entered in a field labeled SOLD.) In our example, I arbitrarily selected the NASHUA as the mobile home that was sold. To extract the record from the database, you type in the command:

A>> SELECT MOBINV WHERE SUPPLIER EQ NASHUA

This action tells Condor DBMS to scan the supplier field of all the records in the MOBINV database and place all records with NASHUA in the supplier field in a Result file. In the MOBINV example, there is only one such record. You can use the screen-format procedure to generate an invoice form called MINVOICE. This form might have the heading "COPPERSTATE MOBILE HOMES" and labels like "STOCK NUMBER," "MANUFACTURER," etc. To set up a format for this form, you would use procedures similar to those that generated the display represented in listing 1. Instead of putting the field labels down the left margin, you can place them wherever you want them on the screen display, and Condor will remember their placement. You can include any other written information that you want on the form. This procedure produces a formatted-report output for invoices, checks, etc. Most database management systems use much more complex procedures for this function.

Next you might type in the command:

B>> PROJECT RESULT BY STOCK.NUMBR SUPPLIER MODEL SALE.PRICE

This command extracts the field data to print on the MINVOICE form. Then you could type the command PRINT MINVOICE to get a result like that shown in listing 3. In this instance, I changed the input-data-form field label from SUPPLIER to MANUFACTURER on the invoice form header. This report will accept field data from only one file at a time. If you want to include the name and address of the purchaser on the example invoice, then you must add data fields that include this information to the MOBINV input data format. You cannot directly select data from one file that contains the names and addresses of customers and another separate MOBINV file that contains the invoice data and combine this data to print out the invoice form.

This example shows what is possible with this kind of report output. In a real-life situation, stock forms would generally be used with printed title and header (label) information. Because changes in stock forms are often forced by circumstances, Condor's easy methods of making such changes are an important feature.

The screen format is one type of report that the Condor DBMS will generate. There are four others:

1. Columnar format—desired fields selected and printed in columns
2. Columnar format with statistics—field maximum, minimum, average, and totals are included for the selected fields
3. Summary format—includes subtotals and totals for selected fields

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4. Statistical format—(see 2 above) no detailed information shown, just summaries of data for groups of records

Listing 4 is an attribute summary of the input data format for my 2150-record test database. This database is a simple vehicle for testing Condor DBMS program functions. The results will vary with different equipment and varying field lengths, record lengths, file sizes, etc. The tests are only intended to determine significant Condor DBMS features and are not extensive enough to be benchmark tests.

ASCII files generated by other programs can be transferred to or from Condor DBMS files. I generated the test file (named TESTDATA) with CBASIC and then transferred the file to Condor DBMS. The STOCK.NUMBER field contains 2150 randomly selected whole numbers (integers) in the range from 0 to 99,999. The QUANTITY field has sequential numbers from 5000 to 7149. The BASE.METAL field contains alphanumeric characters SIL, GOL, or MAG in a random sequence. The other fields contain random numeric data.

In the preceding MOBINV examples, I executed commands one at a time. You could use CP/M's ED (editor) or some word processors to build a command file containing sequenced commands, but knowledge of the Condor DBMS programming language is necessary. The language has an English-like format and is easy to master. Condor DBMS will run the command file on request. I constructed a command file to select and then print 250 TESTDATA records. I specified logical comparisons on the STOCK.NUMBER field to select the records. Condor DBMS took about 55 seconds to run through the command file, select the records, and start to print.

I entered 50 new records in the TESTDATA file. Condor DBMS accepted them as fast as I could type them in. To re-sort the file by STOCK.NUMBER after entering the new records took about 2 minutes and 30 seconds. It is not strictly necessary to sort the file, but most program operations will be faster if it is sorted.

One record can be located by a logical selection anywhere in the file in an average time of 10 seconds. The record can then be printed, displayed, or edited.

This article presents an overview of the capabilities of Condor DBMS. The inventory examples demonstrate only a limited number of the 41 commands available. Several commands are tailored to handle accounting functions. One of these, the Post command, matches records of the first database file with those of a second, then updates the records of the first with field data from the second for specified fields. At the same time, Post creates a third database file called Result containing all of the fields of the first database that matched those of the second.

The Change command changes the data contents of one or more fields of each record of an entire file to new specified values. Because Change does not include logical selection of records to be changed, you must do this with a separate operation.

The Compute command does mathematical operations (addition, subtraction, multiplication, and division) on field data. In a series of mathematical operations, Condor DBMS gives no priority to operands or parentheses. The operations are carried out from left to right. Care must be exercised in setting up the series so that normal mathematical operation priorities are observed and the desired results obtained.

Condor DBMS lets you run most of the CP/M or MP/M operating system commands without leaving the DBMS and returning to the operating system. Condor DBMS provides equivalent commands for several of the few CP/M commands that do not run on Condor DBMS.

Conclusions

- The Condor DBMS is one of the best. It is fast and will handle almost any application. The Condor DBMS is particularly effective in accounting functions and personnel record processing.
- You must learn a new programming language to use Condor DBMS effectively. The language has an English-language format and is easy to master.
- Examples of different types of applications programs should be included in the documentation.
- Condor DBMS makes no provision for database security.
- Formatted reports (including checks, invoices, inventory lists, etc.) are simple to generate.■

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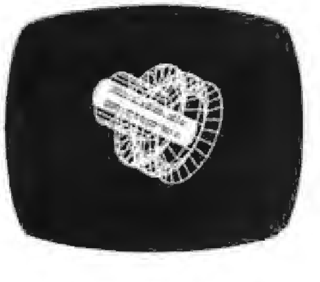

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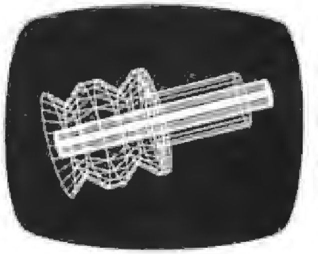

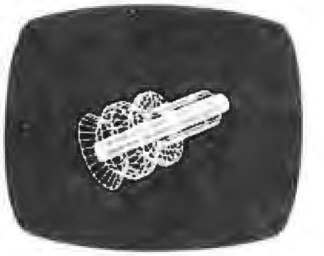

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Test Your Memory Using the Barber-Pole Algorithm

Useful diagnostic information is not hard to obtain, as an example coded for the 8080 processor shows.

H. R. Pinnick Jr.
POB 3604
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Although memory-test programs often indicate the presence of a memory error at a given memory location, they often fail to locate the particular memory component that is malfunctioning. We can learn not only the address of the error, but also sufficient information to indicate which memory device (static or dynamic) is causing the problem, by using a convenient algorithm. This algorithm is fast, aids in flagging memory-decoding problems, and helps distinguish between hard and soft memory errors. Since it is analogous to the rotating barber pole found at many barber shops, it is called the "barber-pole" algorithm. First, a brief discussion of other memory tests is appropriate so that they can be compared with the barber-pole memory test.

About the Author

H. R. Pinnick Jr. has a PhD from Indiana University and is a computer engineer at Applied Automation Inc. He has been involved in the field of electronics for the past 20 years, beginning with the repair of airborne radar systems. His current research interests are interfacing microcomputers to existing chemical instrumentation and the development of new instrumentation based upon microcomputers. His hobbies include flying, chemistry, electronics, and reading.

Memory Tests

Many memory-test programs are available, for example, the walking-address memory test. Starting at a user-given even memory address, the algorithm writes the most significant byte of the address in the even memory location and then verifies the byte's contents. Next, the least significant byte of the address is written in the odd or next memory location and is verified. Last, the program goes back to the starting address and verifies all locations. This memory test is rapid, but it can miss hard memory errors (a bit stuck at 1 or 0).

Memory-decoding problems can be probed if the test pattern is appropriately chosen.

Another test stores the hexadecimal bit pattern 55 (01010101 binary) in the even locations and AA (10101010 binary) in the odd locations, then verifies all locations. The test is repeated, using AA in the even locations and 55 in the odd locations. This rapid test finds both hard and soft errors. (A soft error occurs when the current state of a dynamic-memory bit is changed by ionizing radiation from the plastic or ceramic integrated-circuit package.) This test has no cross-check specifically for soft errors, except by running the test again.

The most extensive memory-test algorithms are probably the galloping-read test and galloping-write test. The galloping-read test clears memory to all zeros in all locations and stores FF hexadecimal (11111111 binary) in a specified starting address. The test reads all other locations and verifies the presence of 00 hexadecimal, except for the memory byte with FF. Next, the byte with FF is cleared, FF is written in the next memory location, and the reading and verification of all locations are repeated until the last memory location is reached.

The galloping-write test clears memory and stores FF in a specified starting address. The test writes 00 hexadecimal to all other locations and verifies each write. The address of FF's location is verified when found. Next, the byte with FF is cleared and moved to the next memory location. The writing and verification of all locations in this manner are repeated until the last memory location is reached.

The latter two memory tests are ex-

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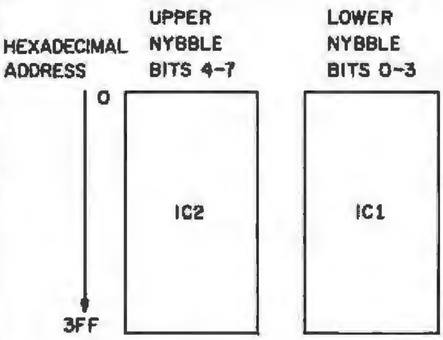

Figure 1: *Memory organization of type-2114 static-memory components. These are organized by nybbles in 8-bit words, for a total of 4K bytes.*

Binary		Hexadecimal
0000	0000	(00)
0001	0001	(11)
0010	0010	(22)
0100	0100	(44)
1000	1000	(88)
1110	1110	(EE)
1101	1101	(DD)
1011	1011	(BB)
0111	0111	(77)

Table 1a: *Barber-pole pattern to test memories organized in 8-bit words by nybbles, such as type-2114 devices, as shown in figure 1. Nine elements are in the table.*

Binary		Hexadecimal
0000	0000	(00)
0000	0001	(01)
0000	0010	(02)
0000	0100	(04)
0000	1000	(08)
0001	0000	(10)
0010	0000	(20)
0100	0000	(40)
1000	0000	(80)
1111	1110	(FE)
1111	1101	(FD)
1111	1011	(FB)
1111	0111	(F7)
1110	1111	(EF)
1101	1111	(DF)
1011	1111	(BF)
0111	1111	(7F)

Table 1b: *Barber-pole pattern to test memories organized in 8-bit words by bits, such as type-4116 devices, as shown in figure 2. Seventeen elements are in the table.*

cellent for the location of memory-overlap problems, but are extremely time-consuming when running a test on previously operational memory. The main limitation of all these tests is their failure to indicate with a high degree of certainty which memory component has a hard error.

Barber-Pole Memory Test

The use of a memory-test program that "barber poles" (rotates by shifting) a binary 1 or 0 across a field of oppositely valued bits in each byte provides for the identification of a defective memory component failing repeatedly as a hard error. Soft errors are not specially flagged, but because of the structure of the error printout, we can surmise that a particular bit error was a soft error. In addition, if the number of elements of the barber pole is appropriately chosen, memory-decoding problems can be probed.

First, let us consider the test of type-2114 static 1024 by 4-bit memories. In a memory configuration using 2114s, one 2114 is the lower nybble of the memory block, and the other is the upper nybble (see figure 1). A pattern that exercises each bit in each chip and provides information about the specific memory chip in error is shown in table 1a. The pattern rotates a binary 1 across a field of four 0s, then rotates a 0 across a field of four 1s.

This is the same approach used for the type-4116 dynamic 16K by 1-bit memories, except that rotation of a 1 or 0 through a field of eight 0s or eight 1s, respectively, is used (see table 1b). The patterns differ because of the different organization of storage in the two memory systems. With this approach, we can determine which memory chip is defective.

Consider the following example. We shall assume that the memory being tested is a group of eight 4116 16K-bit dynamic memories with a storage layout as shown in figure 2, containing an error at address 0000 hexadecimal. The error at 0000 was chosen only to provide the sequence of error messages to be discussed later. The substitution of any other address for address 0000 provides the

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same error messages, but in a different sequence.

If the bit at address 0000 in IC3 (in figure 2) is stuck at 1, an error message can provide us with the information shown in listing 1a. By looking at the bit patterns in the "found value" column of listing 1a, we can tell that bit 2, the third from the right in the binary representation, is always high. If the bit at address 0000 in IC3 in figure 2 is stuck at 0, the error message provides the information shown in listing 1b. The bit pattern of the found value indicates that bit 2 is always low. With the knowledge of the address mapping of the memory components and the found-bit pattern, we can determine exactly which integrated circuit is bad.

Soft memory errors should not give all the error messages in listings 1a and 1b. We would normally expect only one of the nine error messages of listing 1. Memory-decoding errors of the type where two different memory addresses access the same byte or bytes are signified by the odd number of elements (9 or 17), but the exact results of the error-message display are uncertain since I was unable to test this feature specifically.

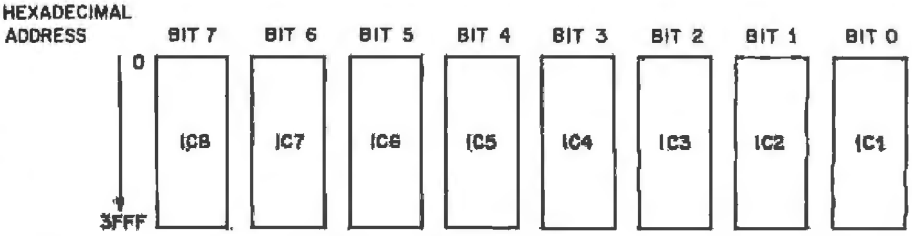

Figure 2: *Memory organization of type-4116 dynamic-memory components. These are organized by bits in 8-bit words, for a total of 16K bytes.*

Memory-Diagnostic Program

The barber-pole test program, shown in listing 2 on pages 422 through 442, is written in assembly language for the Intel 8080 and 8085 microprocessors. It begins with an initialization section to set the stack pointer and zero the error flag. The starting address of the memory test in hexadecimal radix is requested from the user, accepted by the subroutine GETHX, and stored. Next, the ending address of the memory segment to be tested is requested in the same manner. A test is made to ensure that the starting address is less than or equal to the ending address. If not, an error message is sent to the console, and the program asks for the starting and ending addresses again. When valid addresses have been entered, the number of bytes to be tested is computed and stored.

Upon completion of the above, the pattern length (stored in PATLN) and number of cycles (NCYCL) are initialized, and the memory address of

Text continued on page 444

Listing 1a: *Error messages produced by the barber-pole memory-test program when the error being detected is a single bit stuck at the value of 1 in one of the components, IC3 (see figure 2).*

Message									Binary Representation of Found Value	
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	00,	FOUND	04	0000	0100
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	01,	FOUND	05	0000	0101
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	02,	FOUND	06	0000	0110
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	08,	FOUND	0C	0000	1100
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	10,	FOUND	14	0001	0100
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	20,	FOUND	24	0010	0100
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	40,	FOUND	44	0100	0100
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	80,	FOUND	84	1000	0100
MEMORY	ERROR	AT	0000	HEX.	EXPECTED	FD,	FOUND	FF	1111	1111

Listing 1b: *Error messages produced when the error is a bit stuck at 0 in IC3.*

Message									Binary Representation of Found Value	
MEMORY	ERROR	AT	0000	HEX,	EXPECTED	04,	FOUND	00	0000	0000
MEMORY	ERROR	AT	0000	HEX,	EXPECTED	FE,	FOUND	FA	1111	1010
MEMORY	ERROR	AT	0000	HEX,	EXPECTED	FD,	FOUND	F9	1111	1001
MEMORY	ERROR	AT	0000	HEX,	EXPECTED	F7,	FOUND	F3	1111	0011
MEMORY	ERROR	AT	0000	HEX,	EXPECTED	EF,	FOUND	EB	1110	1011
MEMORY	ERROR	AT	0000	HEX,	EXPECTED	DF,	FOUND	DB	1101	1011
MEMORY	ERROR	AT	0000	HEX,	EXPECTED	BF,	FOUND	BB	1011	1011
MEMORY	ERROR	AT	0000	HEX,	EXPECTED	7F,	FOUND	7B	0111	1011

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Listing 2: *The barber-pole memory-test program coded in assembly language for the Intel 8080 and 8085 microprocessors. (Portions of the code are copyright 1977 by the Intel Corporation, provided here through the courtesy of that company.)*

```
;
;*****************************************************************************************
;
TITLE 'MEMORY TEST PROGRAM USING A BARBER POLE 12/14/80 MOD 1.0'
;
;*****************************************************************************************
;
;                                        EQUATE TABLE
;
CHIN            EQU         0ECH            ; CONSOLE INPUT PORT 8251
CHOUT           EQU         0ECH            ; CONSOLE OUTPUT PORT 8251
CONST           EQU         0EDH            ; CONSOLE STATUS INPUT PORT 8251
CR              EQU         0DH             ; ASCII CARRIAGE RETURN CHARACTER
ESC             EQU         1BH             ; ASCII ESCAPE CHARACTER
HCHAR           EQU         0FH             ; MASK FOR REMOVING UPPER NYBBLE
LF              EQU         0AH             ; ASCII LINE FEED CHARACTER
LNPAT           EQU         9               ; PATTERN LENGTH
                                            ; 9 FOR NK x 4 MEMORY COMPONENTS
                                            ; 17 FOR NK x 1 MEMORY COMPONENTS
                                            ; ALSO NEED TO CHANGE PATRN AT END OF
                                            ; THE PROGRAM
NZERO           EQU         0FH             ; NON-ZERO VALUE
PRTYO           EQU         7FH             ; MASK TO CLEAR PARITY BIT FROM CONSOLE
                                            ; CHAR
RBR             EQU         02H             ; MASK TO TEST RECEIVER STATUS
SPLOC           EQU         3F00H           ; STACK POINTER LOCATION
TRDY            EQU         01H             ; MASK TO TEST TRANSMITTER STATUS
;
;*****************************************************************************************
;
                ORG         3000H
;
;*****************************************************************************************
;
; FUNCTION: BEGIN—MAIN ROUTINE
; INPUTS: NONE
; OUTPUTS: NONE
; CALLS: CROUT,ERROR,GETHX,MSGL
; DESTROYS: A,B,C,D,E,H,L,F/F'S
; JUMPS: NONE
; DESCRIPTION:
;               THE PROGRAM DOES A BARBER-POLE TEST ON MEMORY USING THE PATTERN
;               (00H,11H,22H,44H,88H,0EEH,0DDH,0BBH,77H). THE ODD NUMBER
;               IS AN ATTEMPT TO FLAG ANY MEMORY OVERLAP. THIS BARBER POLE WILL WORK
;               FOR NK x 4 MEMORIES. ON NK x 1 MEMORIES, THE USE OF THE PATTERN
;               (00H,01H,02H,04H,08H,10H,20H,40H,80H,0FEH,0FDH,0FBH,0F7H,0EFH,
;               0DFH,0BFH,7FH) WILL AID IN DETERMINING THE SPECIFIC CHIP IN
;               ERROR.
;
;INITIALIZATION SECTION
;
BEGIN:
                DI                          ; DISABLE INTERRUPTS
                LXI         SP,SPLOC        ; LOAD STACK POINTER
                XRA         A               ; ZERO <A>
                STA         ERFLG           ; AND ZERO ERROR FLAG
;
;GET START ADDRESS
;
MAIN1:
                LXI         H,MESG1         ; POINT TO 'ENTER ADDRESS OF MEMORY START
                                            ; IN HEX'
                MVI         B,MESL1         ; LENGTH OF MESSAGE 1
                CALL        MSGL            ; OUTPUT MESSAGE
```

Listing 2 continued on page 422

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Listing 2 continued:

```
                CALL        GETHX           ; GET START ADDRESS
                JNC         MAIN1           ; IF CARRY = 0, INVALID DATA
                MOV         H,B             ; MOVE START ADDRESS TO <HL>
                MOV         L,C
                SHLD        MEMST           ; STORE START ADDRESS
;
;GET END ADDRESS
;
MAIN2:
                LXI         H,MESG2         ; POINT TO 'ENTER ADDRESS OF MEMORY END
                                            ; IN HEX'
                MVI         B,MESL2         ; LENGTH OF MESSAGE 2
                CALL        MSGL            ; OUTPUT MESSAGE
                CALL        GETHX           ; GET END ADDRESS
                JNC         MAIN2           ; IF CARRY = 0, INVALID DATA
                MOV         H,B             ; MOVE END ADDRESS TO <HL>
                MOV         L,C
                SHLD        MEMND           ; STORE END ADDRESS
;
;TEST FOR START ADDRESS > END ADDRESS AND COMPUTE
;THE NUMBER OF BYTES TO BE TESTED
;
                XCHG                        ; MOVE END ADDRESS TO <DE>
                LHLD        MEMST           ; MOVE START ADDRESS TO <HL>
                MOV         A,H             ; TAKE THE 2'S COMPLEMENT OF THE
                CMA                         ; START ADDRESS
                MOV         H,A
                MOV         A,L
                CMA
                MOV         L,A
                INX         H
                DAD         D               ; ADD END ADDRESS TO 2'S COMPLEMENT OF
                                            ; START ADDRESS
                JC          MAIN3           ; IF CARRY = 1, THEN START ADDRESS < = END
                                            ; ADDRESS. JUMP OVER NEXT SECTION
                LXI         H,MESG3         ; POINT TO 'ERROR: MEMORY START ADDRESS
                                            ; > MEMORY END ADDRESS'
                MVI         B,MESL3         ; LENGTH OF MESSAGE 3
                CALL        MSGL            ; OUTPUT MESSAGE
                CALL        CROUT           ; OUTPUT CR AND LF
                JMP         MAIN1           ; START OVER
MAIN3:
                INX         H               ; COMPUTE NUMBER OF BYTES TO BE TESTED
                SHLD        NBYTE           ; STORE NUMBER OF BYTES
;
;SET UP REGISTERS TO ESTABLISH THE BARBER-POLE PATTERN
;
                MVI         A,LNPAT         ; SET PATTERN LENGTH
                STA         PATLN           ; AND STORE PATTERN LENGTH
                STA         NCYCL           ; AND STORE IN NUMBER OF CYCLES
                LXI         B,PATRN         ; LOAD <BC> WITH TOP OF PATTERN TABLE
                PUSH        B               ; AND SAVE ON STACK
MAIN4:
                LHLD        NBYTE           ; MOVE NUMBER OF BYTES TO <HL>
                XCHG                        ; THEN TO <DE>
                LHLD        MEMST           ; LOAD <HL> WITH START ADDRESS
;
;PUT THE BARBER-POLE PATTERN IN R/W MEMORY
;
MAIN5:
                LDAX        B               ; MOVE PATTERN ELEMENT TO <A>
                MOV         M,A             ; AND STORE IN MEMORY
                INX         B               ; POINT TO NEXT PATTERN ELEMENT
                INX         H               ; INCREMENT MEMORY POINTER
                DCX         D               ; DECREMENT NUMBER OF BYTES
                MOV         A,E             ; TEST FOR NUMBER OF BYTES = 0
                ORA         D
```

Listing 2 continued on page 426

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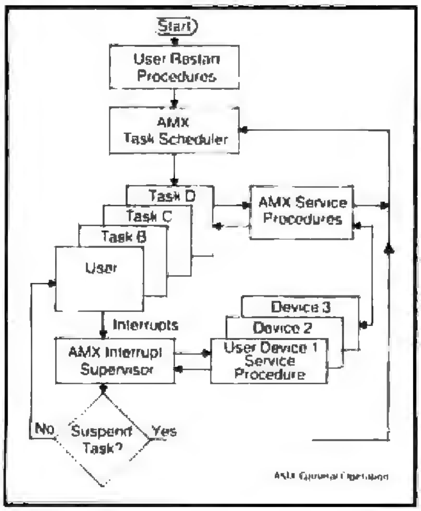

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Research Machines 5¼" ... RH
Research Machines 8" ... A1
Sanco 7000 5" ... RO
Sanyo MBC 1000 ... SY
Sanyo MBC 2000 ... S5
Sanyo MBC 3000 ... A1
Seattle ... E1
Sony ... U1
SD Systems 5¼" ... R3
SD Systems 8" ... A1
Spacebyte ... A1
Tarbell 8" ... A1
TecMar ... E1
TEI 5¼" ... R3
TEI 8" ... A1
Televideo DD/DS ... S5
T.I.P. (Alloy Engineering, Inc.) ... T3
Toshiba T200 ... SF
Toshiba T250 ... A1
Triumph Adler Alphatronic ... SV
TRS Model I + Omikron 5¼" ... RM
TRS Model 1 + FEC Freedom ... RN
TRS-80 Model 1 + Shuffleboard ... A1
TRS-80 Model II ... A1
Vector MZ ... Q2
Vector System 2800 ... A1
Vector System B/VIP ... Q2
Vista V-80 5¼" SD ... R8
Vista V200 5 DD ... P8
Wangwriter ... SE
WORDPLEX ... SZ
XEROX 820, 5¼" ... S6
XEROX 820, 860 8" ... A1
ZEDA 580 ... SH
Zenith Z89 + Magnolia CP/M-80 ... P7
Zenith Z89 + Zenith CP/M-80 ... P7
Zenith DD/SS ... SK
Zenith DD/DS ... SJ
Zilog MC 22-20/25/50 ... A1

All Lifeboat (LB) 8-bit software requires SB-80 (or other CP/M-80 compatible disk operating system) unless otherwise stated.

All products are subject to terms and conditions of sale.

Circle 268 on inquiry card.

Listing 2 continued:

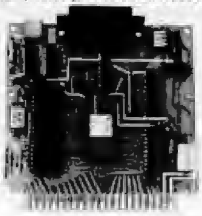
```
                JZ          MAIN6           ; IF ZERO, JUMP TO NEXT SECTION
                LDA         PATLN           ; LOAD <A> WITH PATTERN LENGTH
                DCR         A               ; AND DECREMENT
                STA         PATLN           ; STORE DECREMENTED PATTERN LENGTH
                JNZ         MAIN5           ; IF PATTERN LENGTH <> 0, THEN LOOP
                POP         B               ; RESTORE PATTERN STARTING POINT TO <BC>
                PUSH        B               ; AND PUT BACK ON STACK
                MVI         A,LNPAT         ; SET PATTERN LENGTH
                STA         PATLN           ; AND STORE
                JMP         MAIN5           ; LOOP
;
;SET UP REGISTERS TO TEST THE BARBER-POLE PATTERN
;
MAIN6:
                POP         B               ; RESTORE PATTERN STARTING POINT TO <BC>
                PUSH        B               ; AND PUT BACK ON STACK
                MVI         A,LNPAT         ; SET PATTERN LENGTH
                STA         PATLN           ; AND STORE
                LHLD        NBYTE           ; MOVE NUMBER OF BYTES TO <HL>
                XCHG                        ; THEN TO <DE>
                LHLD        MEMST           ; LOAD <HL> WITH START ADDRESS
;
;TEST THE BARBER-POLE PATTERN
;
MAIN7:
                LDAX        B               ; MOVE PATTERN ELEMENT TO <A>
                CMP         M               ; AND COMPARE TO MEMORY CONTENTS
                CNZ         ERROR           ; IF NOT THE SAME , THEN ERROR
                INX         B               ; POINT TO NEXT PATTERN ELEMENT
                INX         H               ; INCREMENT MEMORY POINTER
                DCX         D               ; DECREMENT NUMBER OF BYTES
                MOV         A,E             ; TEST FOR NUMBER OF BYTES = 0
                ORA         D
                JZ          MAIN8           ; IF ZERO, JUMP TO NEXT SECTION
                LDA         PATLN           ; LOAD <A> WITH PATTERN LENGTH
                DCR         A               ; AND DECREMENT
                STA         PATLN           ; STORE DECREMENTED PATTERN LENGTH
                JNZ         MAIN7           ; IF PATTERN LENGTH <> 0, THEN LOOP
                POP         B               ; RESTORE PATTERN STARTING POINT TO <BC>
                PUSH        B               ; AND PUT BACK ON STACK
                MVI         A,LNPAT         ; SET PATTERN LENGTH
                STA         PATLN           ; AND STORE
                JMP         MAIN7           ; LOOP
;
;SHIFT THE BARBER-POLE PATTERN BY ONE AND TEST FOR
;LAST SHIFT
;
MAIN8:
                POP         B               ; RESTORE PATTERN STARTING POINT TO <BC>
                INX         B               ; SHIFT BARBER-POLE PATTERN BY ONE
                PUSH        B               ; AND PUT BACK ON STACK
                MVI         A,LNPAT         ; SET PATTERN LENGTH
                STA         PATLN           ; AND STORE PATTERN LENGTH
                LDA         NCYCL           ; LOAD <A> WITH NUMBER OF CYCLES
                DCR         A               ; AND DECREMENT
                STA         NCYCL           ; STORE DECREMENTED NUMBER OF CYCLES
                JNZ         MAIN4           ; LOOP FOR THE NEXT BARBER-POLE PATTERN
;
;TEST COMPLETED OUTPUT MESSAGE
;
                LDA         ERFLG           ; LOAD <A> WITH ERROR FLAG
                ORA         A               ; ESTABLISH FLAGS
                JNZ         MAIN9           ; IF NOT ZERO, ERROR CONDITION, JUMP TO
                                            ; NEXT SECTION
                LXI         H,MESG7         ; POINT TO 'SUCCESSFUL TEST'
                MVI         B,MESL7         ; LENGTH OF MESSAGE 7
                CALL        MSGL            ; OUTPUT MESSAGE
```

Listing 2 continued on page 428

Micromint will put both a computer development system and an OEM dedicated controller in the palm of your hand for as little as $127.*

The Z8 Basic Computer/Controller represents a milestone in microcomputer price-performance. The entire computer is 4" by 4½" and includes a tiny BASIC interpreter, 4K bytes of program memory, one RS-232 serial port and two parallel ports plus a variety of other features. The Z8 microcomputer board is completely self-contained and optimized for use as a dedicated controller. Can be battery operated. Comes with over 200 pages of documentation.

Z8 BASIC COMPUTER/CONTROLLER



- Uses Zilog Z8671 single chip microcomputer
- On board tiny BASIC interpreter
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- Just connect a CRT terminal and write control programs in BASIC
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BCC02 Z8 Basic Computer Kit $169.00

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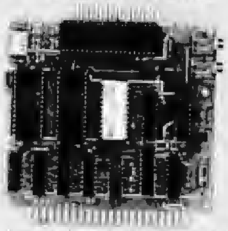
- *4 Channel 115Vac outputs*

20 MA ADAPTER

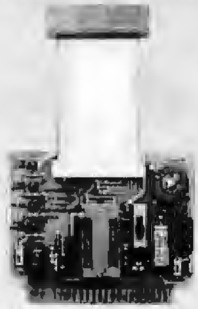
Z8 MEMORY, I/O EXPANSION & CASSETTE INTERFACE



The Z8 Memory, I/O Expansion & Cassette Interface Board (Z8 Expansion Board for short) allows you to add up to 8K of additional memory plus three 8-bit parallel ports to your Z8 Basic Computer/Controller. The memory expansion will support any combination of byte wide RAM memory chips or 2716 or 2732 EPROM. The cassette interface is 300 baud Kansas City Standard (2400Hz/1200Hz).

BCC03 Z8 Expansion Board w/4K memory $140.00
BCC04 Z8 Expansion Board w/8K memory .. $170.00

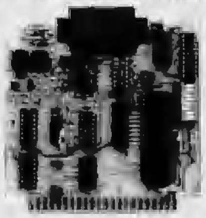
Z8 EPROM PROGRAMMER



The EPROM Programmer board allows you to transfer application programs in BASIC or Assembly language directly from RAM to either 2716 or 2732 EPROMS. Requires Z8 Basic Expansion Board for operation.
NOTE: We recommend the higher current UPS03 or UPS04 power supply when using the EPROM Programmer.

BCC07 Z8 EPROM Programmer Assembled & Tested ... $145.00

Z8 SERIAL EXPANSION BOARD



The Serial Expansion Board adds an additional RS-232C serial port to the Z8 system. It runs at 75 to 19,200 baud in all standard protocols. The 20 ma. current loop is opto-isolated for reliability and protection.

BCC08 Z8 Serial Board Assembled & Tested ... $180.00

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UPS03 Assembled and Tested .... $ 60.00
UPS04 Kit .... $ 50.00

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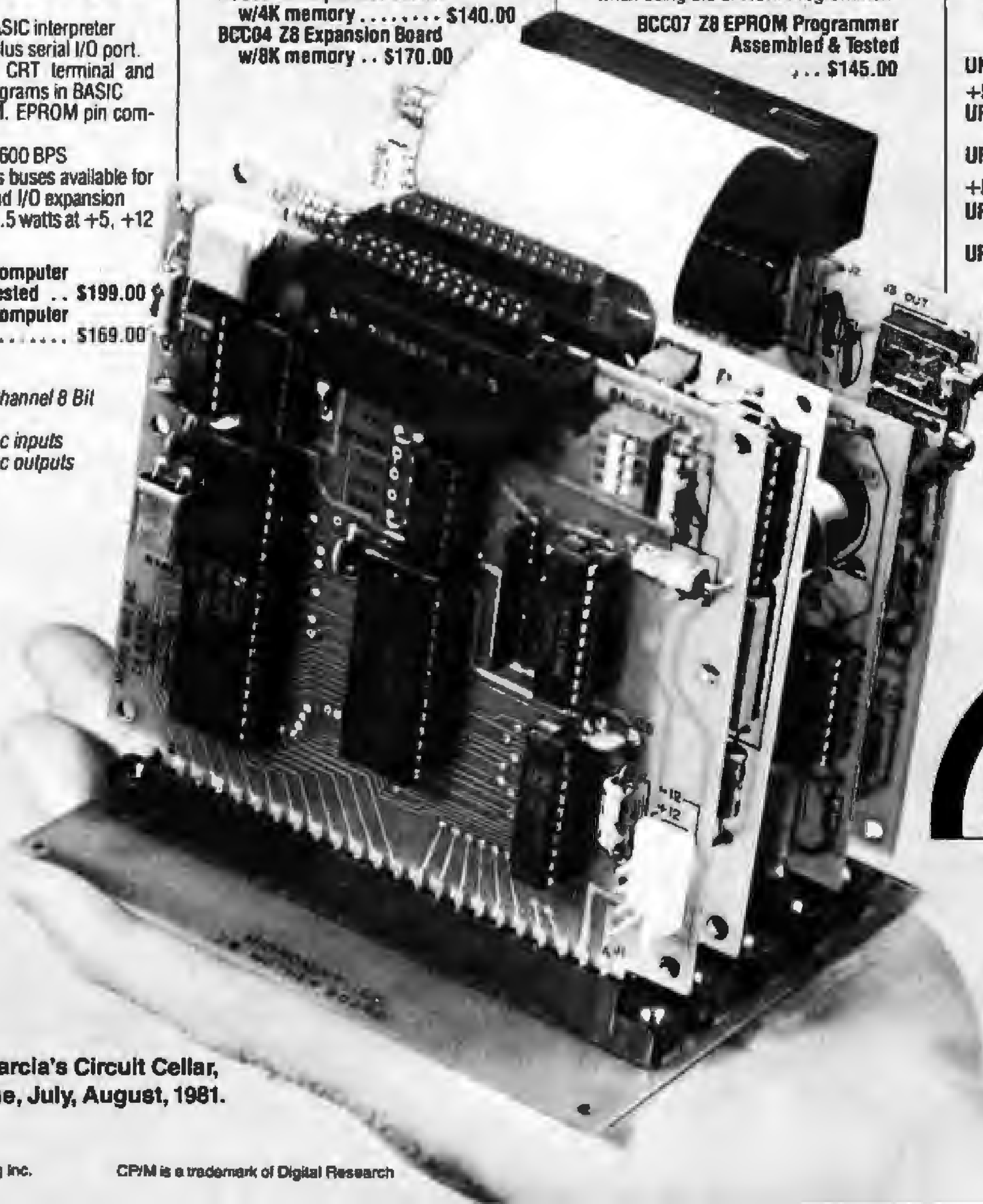
XAS02 For TRS-80 Mod III $ 75.00
XAS03 For CP/M-8" $150.00
FROM MICRO RESOURCES
MR01 CP/M-8" Diskette . $ 75.00
MR02 APPLE II CP/M 5¼" $ 75.00



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s featured in Ciarcia's Circuit Cellar, Byte Magazine, July, August, 1981.

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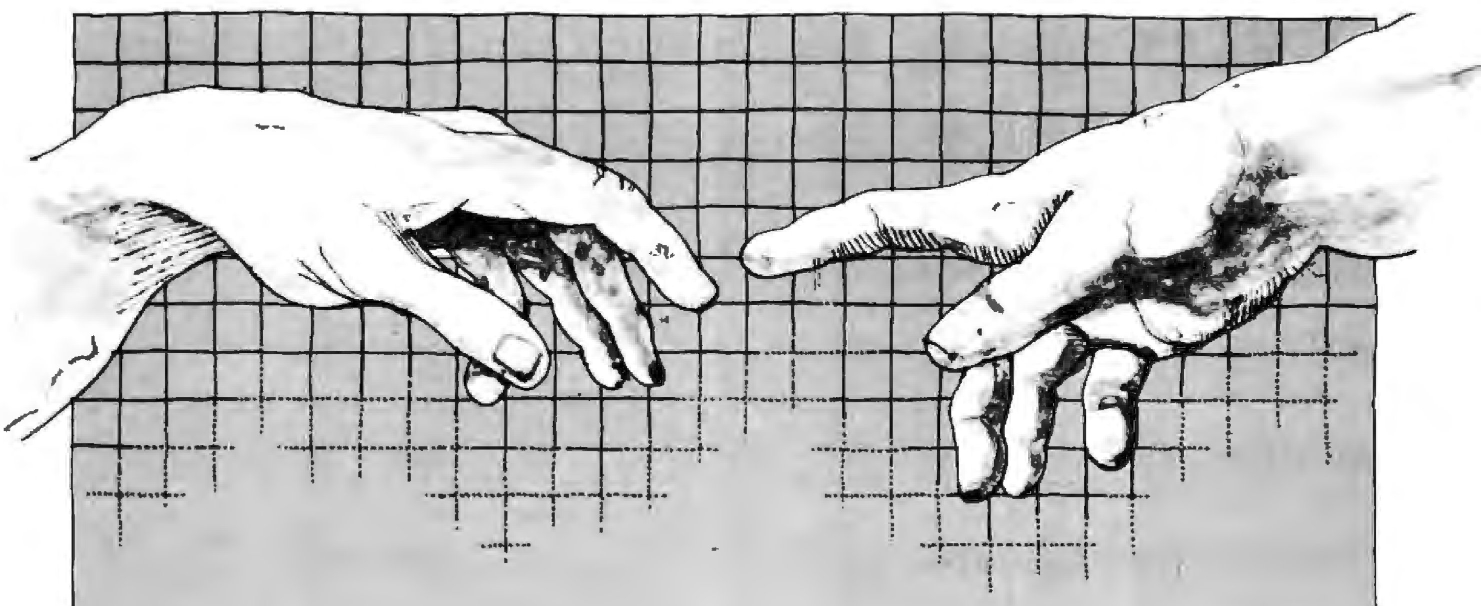
*In quantities of 100

```
                CALL        CROUT           ; OUTPUT CR AND LF
                RST         1               ; RETURN TO MONITOR
MAIN9:
                LXI         H,MESG8         ; POINT TO 'UNSUCCESSFUL TEST'
                MVI         B,MESL8         ; LENGTH OF MESSAGE 8
                CALL        MSGL            ; OUTPUT MESSAGE
                CALL        CROUT           ; OUTPUT CR AND LF
                RST         1               ; RETURN TO MONITOR
;
;*******************************************************************************
;
; FUNCTION: CI
; INPUTS: NONE
; OUTPUTS: A—CHARACTER FROM CONSOLE
; CALLS: NOTHING
; DESTROYS: A,F/F'S
; JUMPS: NONE
; DESCRIPTION: CI WAITS UNTIL A CHARACTER HAS BEEN ENTERED AT THE
;              CONSOLE AND THEN RETURNS THE CHARACTER, VIA THE A
;              REGISTER, TO THE CALLING ROUTINE.
;
CI:
                IN          CONST           ; GET STATUS OF CONSOLE = 0EDH
                ANI         RBR             ; CHECK FOR RECEIVER BUFFER READY = 02H
                JZ          CI              ; NOT YET—WAIT
                IN          CHIN            ; READY SO GET CHARACTER = 0ECH
                RET
;
;*******************************************************************************
;
; FUNCTION: CNVBN
; INPUTS: C—ASCII CHARACTER '0'-'9' OR 'A'-'F'
; OUTPUTS: A—0 TO F HEXADECIMAL
; CALLS: NOTHING
; DESTROYS: A,F/F'S
; JUMPS: NONE
; DESCRIPTION: CNVBN CONVERTS THE ASCII REPRESENTATION OF A HEXADECIMAL
;              CHARACTER INTO ITS CORRESPONDING BINARY VALUE. CNVBN
;              DOES NOT CHECK THE VALIDITY OF ITS INPUT.
;
CNVBN:
                MOV         A,C
                SUI         '0'             ; SUBTRACT CODE FOR '0' FROM ARGUMENT
                CPI         10              ; WANT TO TEST FOR RESULT OF 0 TO 9
                RM                          ; IF SO, THEN ALL DONE
                SUI         7               ; ELSE, RESULT BETWEEN 17 AND 23 DECIMAL
                RET                         ; SO RETURN AFTER SUBTRACTING BIAS OF 7
;
;*******************************************************************************
;
; FUNCTION: CO
; INPUTS: C—CHARACTER TO OUTPUT TO CONSOLE
; OUTPUTS: C—CHARACTER OUTPUT TO CONSOLE
; CALLS: NOTHING
; DESTROYS: A,F/F'S
; JUMPS: NONE
; DESCRIPTION: CO WAITS UNTIL THE CONSOLE IS READY TO ACCEPT A CHARACTER
;              AND THEN SENDS THE INPUT ARGUMENT TO THE CONSOLE.
;
CO:
                IN          CONST           ; GET STATUS OF CONSOLE = 0EDH
                ANI         TRDY            ; SEE IF TRANSMITTER READY = 01H
                JZ          CO              ; NO—WAIT
                MOV         A,C             ; ELSE, MOVE CHARACTER TO A REGISTER FOR
                OUT         CHOUT           ; OUTPUT AND SEND TO CONSOLE = 0ECH
                RET
```

Listing 2 continued on page 430



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Listing 2 continued:

```
;
;**************************************************************************************
;
; FUNCTION: CROUT
; INPUTS: NONE
; OUTPUTS: NONE
; CALLS: ECHO
; DESTROYS: A,B,C,F/F'S
; JUMPS: NONE
; DESCRIPTION: CROUT SENDS A CARRIAGE RETURN (AND HENCE A LINE
;              FEED) TO THE CONSOLE.
;
CROUT:
        MVI     C,CR
        CALL    ECHO        ; OUTPUT CARRIAGE RETURN TO USER TERMINAL
        RET
;
;**************************************************************************************
;
; FUNCTION: ECHO
; INPUTS: C—CHARACTER TO ECHO TO TERMINAL
; OUTPUTS: C—CHARACTER ECHOED TO TERMINAL
; CALLS: CO
; DESTROYS: A,B,F/F'S
; JUMPS: NONE
; DESCRIPTION: ECHO TAKES A SINGLE CHARACTER AS INPUT AND, VIA
;              THE MONITOR, SENDS THAT CHARACTER TO THE USER
;              TERMINAL. A CARRIAGE RETURN IS ECHOED AS A
;              CARRIAGE RETURN/LINE FEED, AND AN ESCAPE
;              CHARACTER IS ECHOED AS $.
;
ECHO:
        MOV     B,C         ; SAVE ARGUMENT
        MVI     A,ESC       ; ESC = 1BH
        CMP     B           ; SEE IF ECHOING AN ESCAPE CHARACTER
        JNZ     ECHO5       ; NO—BRANCH
        MVI     C,'$'       ; YES—ECHO AS $
ECHO5:
        CALL    CO          ; DO OUTPUT THROUGH MONITOR
        MVI     A,CR        ; CR = 0DH
        CMP     B           ; SEE IF CHARACTER ECHOED WAS A CARRIAGE RETURN
        JNZ     ECH10       ; NO—NO NEED TO TAKE SPECIAL ACTION
        MVI     C,LF        ; YES—WANT TO ECHO LINE FEED (= 0AH),
        CALL    CO          ; TOO
ECH10:
        MOV     C,B         ; RESTORE ARGUMENT
        RET
;
;**************************************************************************************
;
; FUNCTION: ERROR
; INPUTS: HL—CURRENT MEMORY POINTER
;         BC—CURRENT PATTERN POINTER
; OUTPUTS: NONE
; CALLS: CROUT, MSGL, NMOUT
; DESTROYS: NONE
; JUMPS: NONE
; DESCRIPTION: OUTPUTS AN ERROR MESSAGE AND THE MEMORY LOCATION
;              OF THE BAD MEMORY CELL
;
ERROR:
        PUSH    PSW         ; SAVE ALL REGISTERS
        PUSH    D
        PUSH    H
        PUSH    B
        XCHG                ; MOVE MEMORY POINTER TO <DE>
        LXI     H,MESG4     ; POINT TO 'MEMORY ERROR AT'
        MVI     B,MESL4     ; LENGTH OF MESSAGE 4
```

Listing 2 continued on page 432

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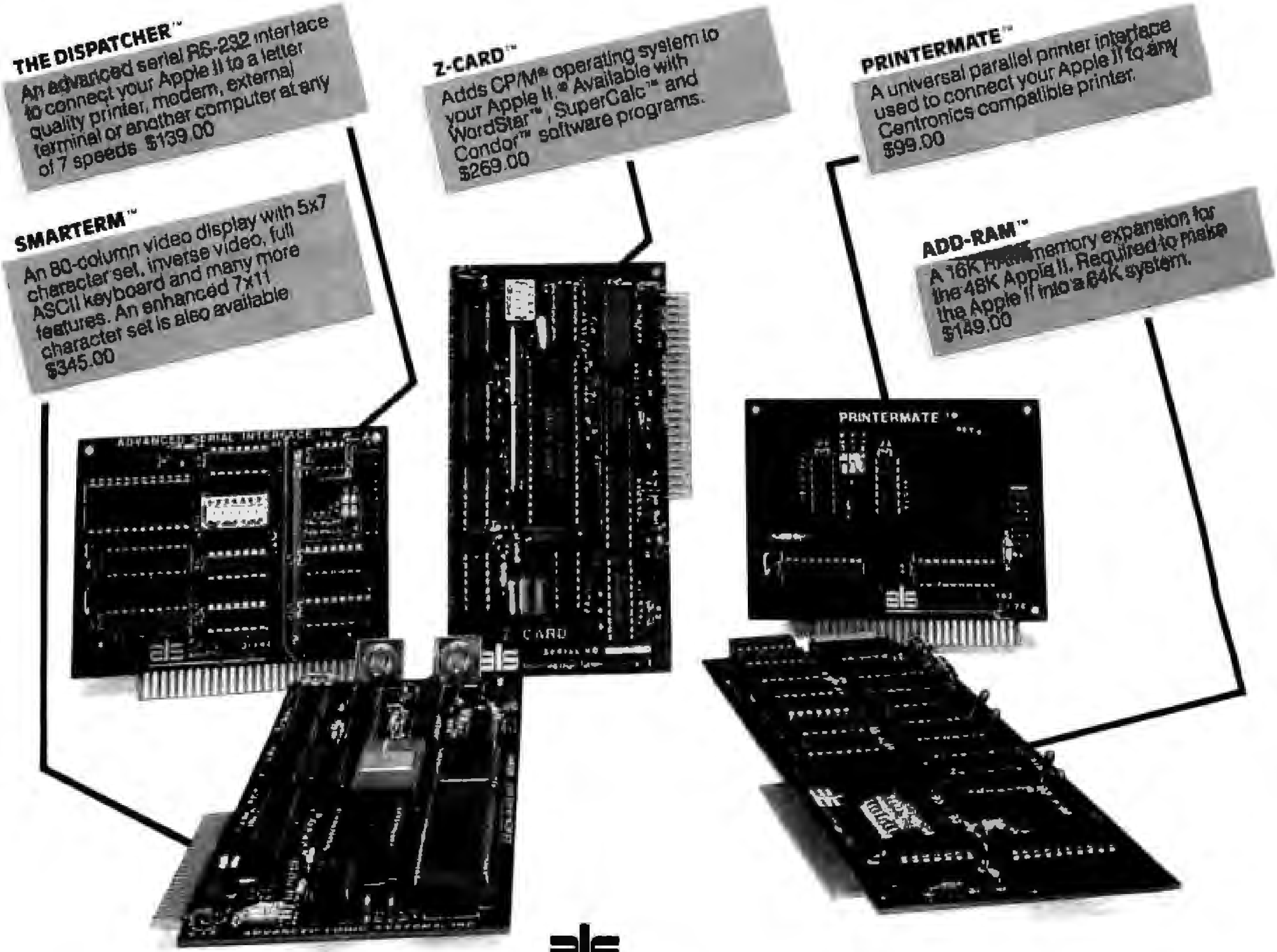

Advanced Logic Systems

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Circle 544 on inquiry card.

```
        CALL    MSGL            ; OUTPUT MESSAGE
        MOV     A,D             ; MOVE UPPER ADDRESS BYTE TO <A> AND
        CALL    NMOUT           ; OUTPUT TO THE CONSOLE
        MOV     A,E             ; MOVE LOWER ADDRESS BYTE TO <A> AND
        CALL    NMOUT           ; OUTPUT TO THE CONSOLE
        LXI     H,MESG5         ; POINT TO 'HEX, EXPECTED'
        MVI     B,MESL5         ; LENGTH OF MESSAGE 5
        CALL    MSGL            ; OUTPUT MESSAGE
        POP     B               ; RESTORE CURRENT PATTERN POINTER
        PUSH    B               ; AND PUT BACK ON STACK
        LDAX    B               ; MOVE EXPECTED PATTERN ELEMENT TO <A>
        CALL    NMOUT           ; AND OUTPUT TO THE CONSOLE
        LXI     H,MESG6         ; POINT TO 'FOUND'
        MVI     B,MESL6         ; LENGTH OF MESSAGE 6
        CALL    MSGL            ; OUTPUT MESSAGE
        XCHG                    ; MOVE MEMORY POINTER TO <HL>
        MOV     A,M             ; MOVE FOUND MEMORY VALUE TO <A> AND
        CALL    NMOUT           ; OUTPUT TO THE CONSOLE
        CALL    CROUT           ; OUTPUT CR AND LF
        MVI     A,NZERO         ; MOVE NON-ZERO VALUE TO <A>
        STA     ERFLG           ; SET ERROR FLAG TO NON-ZERO VALUE
        POP     B               ; RESTORE REGISTERS
        POP     H
        POP     D
        POP     PSW
        RET
;
;****************************************************************************
;
; FUNCTION: FRET
; INPUTS: NONE
; OUTPUTS: CARRY—ALWAYS 0
; CALLS: NOTHING
; DESTROYS: CARRY
; JUMPS: NONE
; DESCRIPTION: FRET IS JUMPED TO BY ANY ROUTINE THAT WISHES TO
;              INDICATE FAILURE ON RETURN. FRET SETS THE CARRY
;              FALSE, DENOTING FAILURE, AND THEN RETURNS TO
;              THE CALLER OF THE ROUTINE INVOKING FRET.
;
FRET:
        STC                     ; FIRST SET CARRY TRUE
        CMC                     ; THEN COMPLEMENT IT TO MAKE IT FALSE
        RET                     ; RETURN APPROPRIATELY
;
;****************************************************************************
;
; FUNCTION: GETCH
; INPUTS: NONE
; OUTPUTS: C—NEXT CHARACTER IN INPUT STREAM
; CALLS: CI
; DESTROYS: A,C,F/F'S
; JUMPS: NONE
; DESCRIPTION: GETCH RETURNS THE NEXT CHARACTER IN THE INPUT STREAM
;              TO THE CALLING PROGRAM.
;
GETCH:
        CALL    CI              ; GET CHARACTER FROM TERMINAL
        ANI     PRTYO           ; TURN OFF PARITY BIT IN CASE SET BY CONSOLE
                                ; PRTYO = 7FH
        MOV     C,A             ; PUT VALUE IN C REGISTER FOR RETURN
        RET
;
;****************************************************************************
;
; FUNCTION: GETHX
; INPUTS: NONE
; OUTPUTS: BC—16-BIT INTEGER
```

Listing 2 continued on page 436

Deciding Which Computer to Buy

Of the 1.9 million people who bought small computers last year, over 20,000 of them bought the wrong computer for their needs. And no wonder. New products are introduced into the market at a breathtaking pace. The language question. The terminology problem -RAMs, ROMs, bits, bytes, bauds, protocols and processors. What's important? What's standard and what's optional? Even the dealers are confused.

To help you tackle this problem, we pulled together many of our sources -including leading experts in the field, manufacturers, marketing analysts, computer dealers and customers. In addition, we utilized computer user groups, clubs and associations throughout the United States, contacts in Japan and numerous industry and business publications. COMPUTER GUIDE 1983 is the natural result of learning from the knowledge and mistakes of more than one million people.

The following steps will help you with your computer shopping -whether you're buying your first computer, or updating the one you have. COMPUTER GUIDE 1983 can help you make the right decision.

1. What is the computer to be used for?

You may want to use it for entertainment, financial planning, learning how to speak a foreign language, office work, drawing and many other tasks a computer does well. The possible uses of a computer are as varied as human activities.

2. Which program will do the best job?

There are thousands of application programs on the market to consider. It is the program that gives you the power to control the actions of the computer. You must choose the right application program.

The first section of COMPUTER GUIDE 1983 surveys each of the application programs available with computers today. Similar programs are grouped together and compared -one against another. COMPUTER GUIDE 1983 contains over 2,000 application programs, grouped in over 100 categories -including programs for accounting, management, professional uses, word processing, graphics, research, games, learning and special applications. Programs are described using comparison charts -listing for each application program: the program name, computer(s) and system configuration(s) required, the documentation available and the price.

COMPUTER GUIDE 1983 provides you with a quick and efficient way of deciding which application program and which computer and options for that computer can do the right job for you.

3. The language?

You cannot get a computer to do anything useful unless you know how to talk to it. This is no easy task. But, COMPUTER GUIDE 1983 can help.

The second section of COMPUTER GUIDE 1983 guides you in selecting the right language. Different dialects of languages are grouped in their generic category. The BASIC language, for example, is a generic name and has many dialects -including Microsoft Basic, Atari Basic, Basic Plus and Basic-80.

Each of these languages have their own machine requirements. COMPUTER GUIDE 1983 provides the name, machine and machine requirements, documentation and price of over 500 dialects, for over 50 languages. COMPUTER GUIDE 1983 helps you solve the language problem.

4. What about the machine?

Depending on your needs, there will probably be several computers still in the running. Now the decision is based on the guts of the machines (hardware). COMPUTER GUIDE 1983 compares machine characteristics in an easy to follow format. You don't have to be an electrical engineer to make an intelligent decision.

The solution is to work top down and not to go any further down than is needed. Your uses for the computer determines which machine characteristics are important. COMPUTER GUIDE 1983 divides the machine into five areas -the keyboard, video display, printer, other peripherals and I/O, processor and memory and direct access storage. These five areas correspond to your basic machine needs. For example, an accountant needs a keyboard with a numeric keypad; word processing requires a printer; games utilize a video display; a mathematician wants a very fast machine; lots of memory is best when using the LISP language; and so on, as the hardware combines with the application program to develop a complete computer system.

COMPUTER GUIDE 1983 contains machine descriptions for over 250 computer systems, produced by over 150 manufacturers. Information is displayed in spreadsheets -allowing you to get the information you need. You don't have to bother with extraneous details and cumbersome text. COMPUTER GUIDE 1983 can accommodate millions of people in making the right decision, as varied as those decisions will be.

5. Where to buy the chosen computer system.

COMPUTER GUIDE 1983 lists hundreds of vendors, by geographical location, and by the products they sell. It also provides additional consumer information. The first ship date, the ship rate, the number installed to date, prices and what that includes, purchasing terms and warranties. COMPUTER GUIDE 1983 contains the names, addresses and phone numbers of hundreds of manufacturers, dealers and stores throughout the United States.

No one wins when you buy the wrong computer or computer product. Make the right decision. Use COMPUTER GUIDE 1983.

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Listing 2 continued:

```
;               CARRY—1 IF FIRST CHARACTER NOT DELIMITER
;                    —0 IF FIRST CHARACTER IS DELIMITER, OR INVALID DIGIT
; CALLS: CNVBN,ECHO,GETCH,VALDG,VALDL
; DESTROYS: A,B,C,D,E,F/F'S
; JUMPS: FRET,SRET
; DESCRIPTION: GETHX ACCEPTS A STRING OF HEX DIGITS FROM THE INPUT
;               STREAM AND RETURNS THEIR VALUE AS A 16-BIT BINARY
;               INTEGER. IF MORE THAN 4 HEX DIGITS ARE ENTERED,
;               ONLY THE LAST 4 ARE USED. THE NUMBER TERMINATES WHEN
;               A CARRIAGE RETURN IS ENCOUNTERED. ILLEGAL
;               CHARACTERS (NOT HEX DIGITS OR DELIMITER) CAUSE AN
;               ERROR INDICATION. IF THE FIRST (VALID) CHARACTER
;               ENCOUNTERED IN THE INPUT STREAM IS NOT A DELIMITER,
;               GETHX WILL RETURN WITH THE CARRY BIT SET TO 1;
;               OTHERWISE, THE CARRY BIT IS SET TO 0 AND THE CONTENTS
;               OF BC ARE UNDEFINED.
;
GETHX:
                PUSH    H               ; SAVE HL
                LXI     H,0             ; INITIALIZE RESULT
                MVI     E,0             ; INITIALIZE DIGIT FLAG TO FALSE
GHX05:
                CALL    GETCH           ; GET A CHARACTER
                CALL    ECHO            ; ECHO THE CHARACTER
                MOV     A,C             ; MOVE TO REG. A
                CPI     CR              ; SEE IF CR
                JNZ     GHX10           ; NO—BRANCH
                PUSH    H
                POP     B               ; MOVE RESULT TO BC
                POP     H               ; RESTORE HL
                MOV     A,E             ; GET FLAG
                ORA     A               ; SET F/F'S
                JNZ     SRET            ; IF FLAG NON-ZERO, A NUMBER HAS BEEN FOUND
                JZ      FRET            ; ELSE, DELIMITER WAS FIRST CHARACTER
GHX10:
                CALL    VALDG           ; IF NOT DELIMITER, SEE IF DIGIT
                JNC     GHX15           ; IF NOT A VALID DIGIT, RETURN
                CALL    CNVBN           ; CONVERT DIGIT TO ITS BINARY VALUE
                MVI     E,0FFH          ; SET DIGIT FLAG NON-ZERO
                DAD     H               ; *2
                DAD     H               ; *4
                DAD     H               ; *8
                DAD     H               ; *16
                MVI     B,0             ; CLEAR UPPER 8 BITS OF BC PAIR
                MOV     C,A             ; BINARY VALUE OF CHARACTER INTO C
                DAD     B               ; ADD THIS VALUE TO PARTIAL RESULT
                JMP     GHX05           ; GET NEXT CHARACTER
GHX15:
                CALL    CROUT           ; OUTPUT CR AND LF
                POP     H               ; RESTORE RP HL
                JMP     FRET            ; RETURN WITH CARRY = 0
;
;*******************************************************************************
;
; FUNCTION: MSGL
; INPUTS: B—COUNTER FOR CHARACTERS IN MESSAGE
;         HL—ADDRESS OF MESSAGE
; OUTPUTS: NONE
; CALLS: CO
; DESTROYS: A,B,C,H,L,F/F'S
; JUMPS: NONE
; DESCRIPTION: OUTPUTS A MESSAGE AS DETERMINED BY INPUTS.
;
MSGL:           MOV     C,M             ; FETCH NEXT CHARACTER TO C REGISTER
                CALL    CO              ; SEND IT TO TERMINAL
                INX     H               ; POINT TO NEXT CHARACTER
                DCR     B               ; DECREMENT BYTE COUNTER
```

Listing 2 continued on page 438

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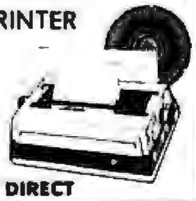

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Listing 2 continued:

```
            JNZ         MSGL            ; RETURN FOR NEXT CHARACTER
            RET
;
;*****************************************************************************
;
; FUNCTION: NMOUT
; INPUTS: A—8-BIT INTEGER
; OUTPUTS: NONE
; CALLS: ECHO, PRVAL
; DESTROYS: A,B,C,F/F'S
; JUMPS: NONE
; DESCRIPTION: NMOUT CONVERTS THE 8-BIT, UNSIGNED INTEGER IN THE
;              A REGISTER INTO 2 ASCII CHARACTERS. THE ASCII CHARACTERS
;              ARE THE ONES REPRESENTING THE 8 BITS. THESE 2
;              CHARACTERS ARE SENT TO THE CONSOLE AT THE CURRENT PRINT
;              POSITION OF THE CONSOLE.
;
NMOUT:
            PUSH        PSW             ; SAVE ARGUMENT
            RRC
            RRC
            RRC
            RRC                         ; GET UPPER 4 BITS TO LOW 4-BIT POSITIONS
            CALL        PRVAL           ; CONVERT LOWER 4 BITS TO ASCII
            CALL        ECHO            ; SEND TO TERMINAL
            POP         PSW             ; GET BACK ARGUMENT
            CALL        PRVAL
            CALL        ECHO
            RET
;
;*****************************************************************************
;
; FUNCTION: PRVAL
; INPUTS: A—INTEGER, RANGE 0 TO F
; OUTPUTS: A—ASCII CHARACTER
; CALLS: NOTHING
; DESTROYS: NOTHING
; JUMPS: NONE
; DESCRIPTION: PRVAL CONVERTS A NUMBER IN THE RANGE 0 TO F HEX TO
;              THE CORRESPONDING ASCII CHARACTER, 0-9, A-F. PRVAL
;              DOES NOT CHECK THE VALIDITY OF ITS INPUT ARGUMENT.
;
PRVAL:
            ANI         HCHAR           ; MASK OUT UPPER 4 BITS—WANT 1 HEX CHAR
                                        ; HCHAR = 0FH
            ADI         90H             ; SET UP A SO THAT A-F CAUSE A CARRY
            DAA                         ; ADJUST CONTENTS OF A REGISTER
            ACI         40H             ; ADD IN CARRY AND ADJUST UPPER 4 BITS
            DAA                         ; ADJUST CONTENTS OF A REGISTER AGAIN
            MOV         C,A             ; MOVE ASCII CHARACTER TO C
            RET                         ; ALL DONE
;
;*****************************************************************************
;
; FUNCTION: SRET
; INPUTS: NONE
; OUTPUTS: CARRY = 1
; CALLS: NOTHING
; DESTROYS: CARRY
; JUMPS: NONE
; DESCRIPTION: SRET IS JUMPED TO BY ROUTINES WISHING TO RETURN INDICAT-
;              ING SUCCESS. SRET SETS THE CARRY TRUE AND THEN RE-
;              TURNS TO THE CALLER OF THE ROUTINE INVOKING SRET.
;
SRET:
            STC                         ; SET CARRY TRUE
            RET                         ; RETURN APPROPRIATELY
```

```
;
;...........................................................................................
;
;
; FUNCTION: VALDG
; INPUTS: C—ASCII CHARACTER
; OUTPUTS: CARRY—1 IF CHARACTER REPRESENTS VALID HEX DIGIT
;                —0 OTHERWISE
; CALLS: NOTHING
; DESTROYS: A,F/F'S
; JUMPS: FRET,SRET
; DESCRIPTION: VALDG RETURNS INDICATING SUCCESS IF ITS INPUT
;              ARGUMENT IS AN ASCII CHARACTER REPRESENTING A VAL-
;              ID HEX DIGIT (0-9,A-F), AND FAILURE OTHERWISE.
;
VALDG:
        MOV     A,C
        CPI     '0'         ; TEST CHARACTER AGAINST '0'
        JM      FRET        ; IF ASCII CODE LESS, CANNOT BE VALID
                            ; DIGIT
        CPI     '9'         ; ELSE, SEE IF IN RANGE '0'-'9'
        JM      SRET        ; CODE BETWEEN '0' AND '9'
        JZ      SRET        ; CODE EQUAL '9'
        CPI     'A'         ; NOT A DIGIT—TRY FOR A LETTER
        JM      FRET        ; NO—CODE BETWEEN '9' AND 'A'
        CPI     'G'
        JP      FRET        ; NO—CODE GREATER THAN 'F'
        JMP     SRET        ; OKAY—CODE IS 'A' TO 'F', INCLUSIVE
;
;...........................................................................................
;
```

Listing 2 continued on page 442

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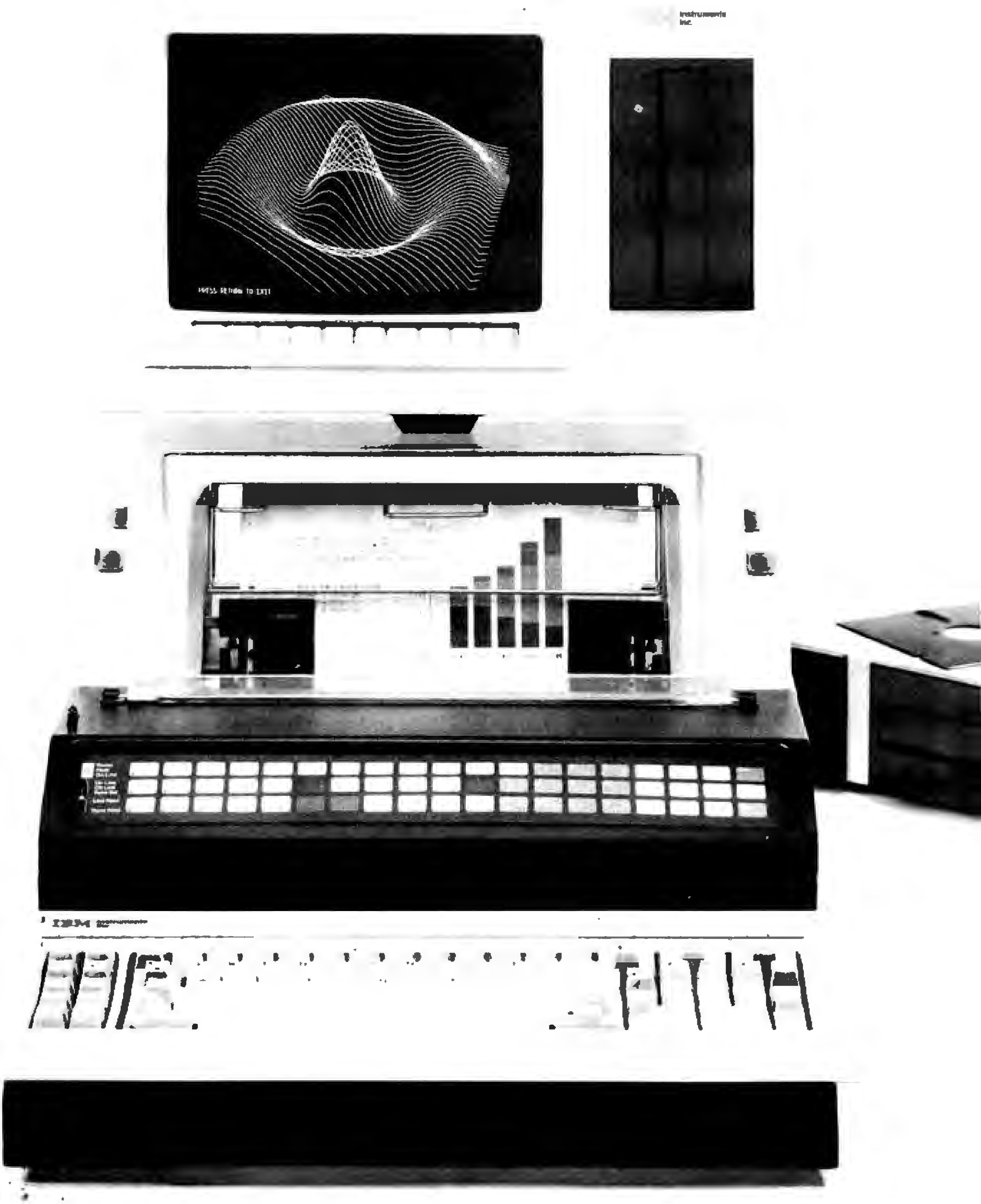

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Circle 509 on inquiry card.

Listing 2 continued:

```
; BARBER POLE PATTERN FOR NK × 4 MEMORY COMPONENTS
;
PATRN:          DB          00H,11H,22H,44H,88H,0EEH,0DDH,0BBH,77H
                DB          00H,11H,22H,44H,88H,0EEH,0DDH,0BBH,77H
;
; BARBER-POLE PATTERN FOR NK × 1 MEMORY COMPONENTS
;
;PATRN:         DB          00H,01H,02H,04H,08H,10H,20H,40H,80H
;               DB          0FEH,0FDH,0FBH,0F7H,0EFH,0DFH,0BFH,7FH
;               DB          00H,01H,02H,04H,08H,10H,20H,40H,80H
;               DB          0FEH,0FDH,0FBH,0F7H,0EFH,0DFH,0BFH,7FH
;
;.........................................................................................
;
; MESSAGES
;
MESG1:          DB          'ENTER ADDRESS OF MEMORY START IN HEX  '
MESL1           EQU         $-MESG1
MESG2:          DB          'ENTER ADDRESS OF MEMORY END IN HEX  '
MESL2           EQU         $-MESG2
MESG3:          DB          'ERROR: MEMORY START ADDRESS > MEMORY END ADDRESS'
MESL3           EQU         $-MESG3
MESG4:          DB          'MEMORY ERROR AT  '
MESL4           EQU         $-MESG4
MESG5:          DB          '  HEX, EXPECTED  '
MESL5           EQU         $-MESG5
MESG6:          DB          ', FOUND  '
MESL6           EQU         $-MESG6
MESG7:          DB          'SUCCESSFUL TEST'
MESL7           EQU         $-MESG7
MESG8:          DB          'UNSUCCESSFUL TEST'
MESL8           EQU         $-MESG8
;
;.........................................................................................
;
;DATA STORAGE
;
ERFLG:          DS          1                   ; STORAGE LOCATION FOR ERROR FLAG
                                                ; ZERO—NO ERROR DURING TEST
                                                ; NON-ZERO—ERROR DUING TEST
MEMND:          DS          2                   ; STORAGE LOCATION FOR END ADDRESS
MEMST:          DS          2                   ; STORAGE LOCATION FOR START ADDRESS
NBYTE:          DS          2                   ; STORAGE LOCATION FOR NUMBER OF BYTES
NCYCL:          DS          1                   ; STORAGE LOCATION FOR NUMBER OF CYCLES
                                                ; SHIFTS OF THE BARBER POLE
PATLN:          DS          1                   ; STORAGE LOCATION FOR PATTERN LENGTH
                END
```

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Text continued from page 418:
the top of the pattern table (PATRN) is placed on the stack for future use. The number of bytes (NBYTE) and starting memory address (MEMST) are loaded into the DE and HL register pairs, respectively. Next, the barber-pole pattern is loaded into memory.

This is accomplished by using the BC register pair as the pattern-table pointer, the HL pair as the memory-address pointer, and the DE pair as the number of bytes remaining to be loaded. When DE is decremented to zero, the program jumps to the next section, which tests the integrity of the barber-pole pattern.

If DE is not zero, PATLN is decremented. If PATLN is not zero, the program loops to write another pattern element in memory. If PATLN is zero, the BC pair is set to point to the top of the pattern table. PATLN is set to the length of the pattern table, and the program loops to write another pattern element in memory.

With DE equal to zero, the BC register pair is set to the address of the top of the pattern table, PATLN is set to the appropriate length, NBYTE is loaded into DE, and MEMST is loaded into HL. The barber-pole pattern is tested in the same fashion it was written, except for a comparison and calling of subroutine ERROR if the contents of the memory location and the pattern-table element are not the same. The output of ERROR consists of the messages shown in listings 1a and 1b.

When DE is decremented to zero, the program jumps to the next section, which shifts the barber-pole pattern left by 1 bit and sets PATLN to the appropriate length. The byte NCYCL is decremented by 1 and, if it is not zero, the shifted barber-pole pattern is loaded into memory and verified as discussed above. If NCYCL is zero, the program prints the message "SUCCESSFUL TEST" or "UNSUCCESSFUL TEST", depending upon the value in the data-storage byte, ERFLG (error flag).

Number of bytes	Time
4K (hexadecimal 1000)	3.8 seconds
8K (hexadecimal 2000)	7.5 seconds

Table 2a: *The time required for execution of the barber-pole test of nine-cycle patterns using an Intel 8080A-2 running at a clock frequency of 2.15 MHz.*

Number of bytes	Time
4K (hexadecimal 1000)	6.9 seconds
8K (hexadecimal 2000)	13.5 seconds

Table 2b: *The time required to run the barber-pole test of 17-cycle patterns on the 2.15-MHz 8080A-2. The crystal frequency of 19.354 MHz is divided by 9.*

Speed of Execution

The speed of this program in performing the memory test is excellent. Using an Intel 8080A-2 processor running at a clock rate of 2.15 MHz, the times to do 4K and 8K bytes are shown in tables 2a and 2b. The projected time for a successful test of 64K bytes using the pattern in table 1a (9-elements/9-cycle pattern) is approximately 60 seconds; the time for using the pattern in table 1b (17-elements/17-cycle pattern) is approximately 110 seconds.

Summary

The barber-pole memory-test program meets the initial design goals of being rapid, providing sufficient information to indicate which memory component is causing the error, distinguishing between hard and soft memory errors, and aiding in flagging the memory-decoding errors.

A minor problem is that the program requires 9 bytes for data storage and 12 bytes for the stack. Thus, the computer must have part of its memory error-free.■

Acknowledgments

I would like to thank Leroy A. Noble of the Dickey-John Corporation for an initial discussion of the development of the barber pole algorithm in PL/M. The assistance of Bob Polack in the coding of the PL/M model is gratefully acknowledged.

The utility routines CI, CNVBN, CO, CROUT, ECHO, FRET, GETCH, GETHX, NMOUT, PRVAL, SRET, and VALDG are reprinted by permission of Intel Corporation, copyright 1977.

Reference

1. Nordin, Floyd L. "Memory Test Program/Keyboard Entry of Start and End Values." *INSITE Users Library*, reference number AA11, page 4-271.

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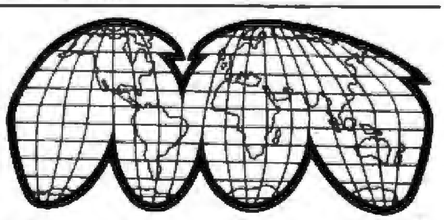

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A Little Apple SOS with Your Pascal

Timothy C. O'Konski
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The Apple III is a powerful, versatile personal computer offering the user the Sophisticated Operating System (SOS; pronounced "sauce") and a new expanded version of Pascal. SOS has a flexible and generalized command set to access devices supported by the Apple III, and Pascal offers the advantage of a language designed to teach proper programming practices. The two, therefore, go hand in hand to make applications programming productive and enjoyable. This article presents a particular set of routines to allow direct access to SOS file calls from a Pascal program. (See listing 1, page 450, and listing 2, page 460.)

By making direct system calls to SOS, you can dramatically expand the limited nature of standard Pascal input and output (I/O) constructs, which are a carry-over from the original sequential cassette-tape model. The interpretive Pascal environment on the Apple III allows you to link external (assembly-language) routines to a program or to a separately compilable unit. Thus, you can use the features of SOS for any application program that runs under it.

Although Apple III Pascal allows you to read UCSD Pascal-formatted disks as well as edit, compile, and link source text that was created on the Apple II UCSD Pascal system, the routines described in this article are executable only on the Apple III using SOS-formatted disks.

About the Author

Timothy O'Konski is a senior member of the technical staff at Apple Computer in the Personal Computer Systems Division. He has a bachelor's degree in computer science from the University of California, Berkeley and has been working in the computer industry on systems and applications software for six years.

The Console

The Apple's standard monochrome monitor is supported by the SOS console driver. The greatest advantage of using the console driver rather than Pascal read and write routines is the ability to mix commands and text. With a single call to SOS, you can turn off the cursor, clear the screen, position the cursor at any X,Y position, write a line of data, set a viewport, scroll newly written text up one line, and turn on the cursor. Because the contents of any viewport (an arbitrary rectangular area that you define) can be saved and then restored, error messages can temporarily overlay the current information, which can then be restored in a single control request to the console driver.

The SOS_IO routines that communicate with the console are:

- SOS_Open—opens the console for use by your application
- SOS_Read—reads from the keyboard
- SOS_Write—writes data and issues commands to the display
- SOS_Close—relinquishes use of the console to other programs

Writing to a Printer

With Apple III Pascal, data is passed to the printer on a character-by-character basis. This means that each buffer passed to a printing device via a Pascal write or unitwrite statement is broken down into n SOS calls, where n is the number of bytes given in the write request. This takes $n-1$ times more SOS overhead when compared to a direct request to a SOS printer driver. The performance improvement you get by using a SOS_Open and then

Text continued on page 480

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Listing 1: *The SOS file-handling routines are represented as an Apple III Pascal intrinsic unit. After compiling this unit and linking it along with the assembled routines, the linked intrinsic unit may be installed in the SYSTEM.LIBRARY file or in a program library file.*

```
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Unit SOS_ID;

Intrinsic CODE 23;

Interface

 Procedure SOS_Create ( Var Pathname; FileID, AuxID, Storage, EOFBlk : Integer;
                        Var RetCode );

 {  Creates a file on a block device with the specified pathname. }

 {  Input Values :

     Pathname   : A Pascal string that is a valid SOS pathname.
     FileID     : The SOS file identification code to associate with the
                  created file.
     AuxID      : The SOS auxiliary identification code.
     Storage    : The storage type to create. One is a standard file, thirteen
                  is a subdirectory file.
     EOFBlk     : The number of blocks to preallocate for the file on a block
                  device.  The range is Ø to 32767 blocks.
   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
 }

 Procedure SOS_Destroy ( Var Pathname, RetCode );

 {  Deletes the file specified by the passed pathname. }

 {  Input Values :

     Pathname   : The pathname of the file to destroy.

   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
 }

 Procedure SOS_Rename ( Var OldPath, NewPath, RetCode );

 {  Renames the OldPath to the NewPath-name. }

 {  Input Values :

     OldPath    : A Pascal string pathname to change FROM.
     NewPath    : A Pascal string pathname to change TO.

   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
 }

Procedure SOS_Set_Info ( Var Pathname, FileList; ListLeng : Integer;
                         Var Retcode);

{  Sets the file information specified by the passed pathname and ListLeng. }

{  Input Values :

    PathName    : The pathname to set the file information.
    File List   : The up to 15 byte list (the length SOS uses is determined by
                  ListLeng:
      Byte Ø    - The file attribute bits.  Bit 7 set is destroy OK; bit
                  6 set is rename OK; bit 1 set is write OK; bit Ø is read OK.
      Byte 1    - The file identification code.
      Bytes 2&3- The auxiliary identification code.
      Bytes 11 to
            14 - The packed values for the date and time stamp: Year (Ø..99),
                  Month (1..12), Day (1..31), Hour (1..24), Minute (1..6Ø);
                  stored in four bytes in the following fashion.

                          (high byte)          (low byte)
                   7  6  5  4  3  2  1  Ø | 7  6  5  4  3  2  1  Ø
                  +-----------------------------------------------+
            Date  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
                  +-----------------------------------------------+
                  |    Year            |  Month     |     Day     |

                          (high byte)          (low byte)
                   7  6  5  4  3  2  1  Ø | 7  6  5  4  3  2  1  Ø
                  +-----------------------------------------------+
            Time  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
                  +-----------------------------------------------+
                  |       Hour            |         Minute        |

                  (Use packed array [Ø..14] of char or Ø..255)

    ListLeng    : The file attributes to change.  One is only FileAttr, three
                  is through FileID, fourteen is through AuxID, and fifteen
                  is everything.

  Output Values :

    RetCode     : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Get_Info ( Var Pathname, FileList; ListLeng : Integer;
                         Var RetCode );

{  Gets the file information specified by the passed pathname. }

{  Input Values :

    PathName    : The pathname of the file to get the information from.

    ListLeng    : The length of the file information list to be returned
                  by SOS (as per the FileList definition).

  Output Values :
```
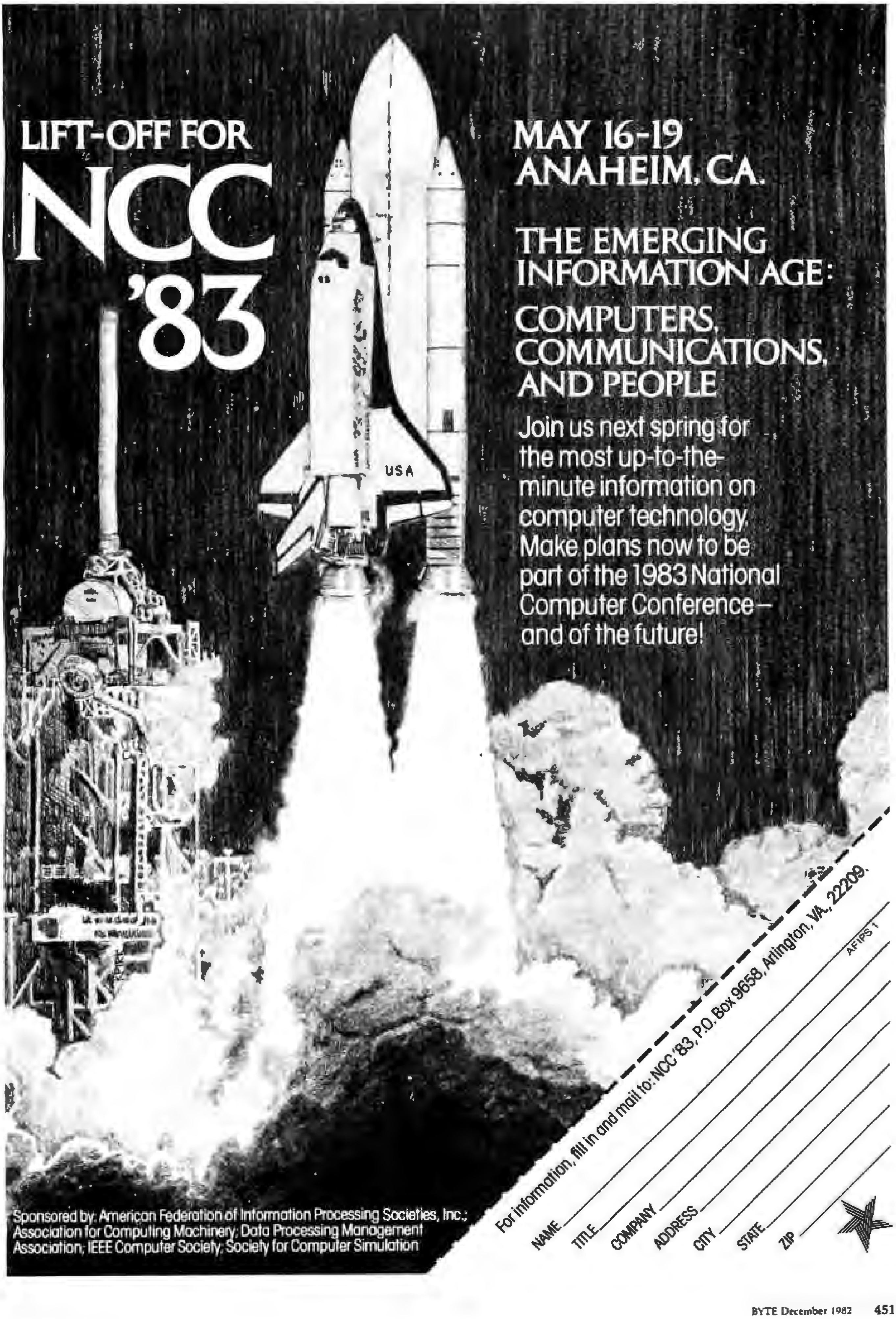

Listing 1 continued on page 452



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Listing 1 continued:

```
     FileList   : The file information returned on the file with the pathname
                  passed:

                  Byte Ø        : File attribute
                  Byte 1        : File identification
                  Byte 2 & 3    : (Low,High) Auxiliary identification
                  Byte 4        : Storage type
                  Bytes 5..8    : (Low,High) EOF in bytes
                  Bytes 9 & 1Ø  : Blocks currently used
                  Bytes 11..14  : (Low,High) Modification date and time

                  (Use packed array [Ø..14] of char or Ø..255)

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Volume ( Var DevName, VolName, TotalBlks, FreeBlks, RetCode );

{  Gets volume information on the device specified by the passed DevName. }

{  Input Values :

     DevName    : A Pascal string containing the device name; maximum of
                  15 characters in length.

   Output Values :

     VolName    : The SOS volume name returned in a Pascal string 15 bytes
                  long.
     TotalBlks  : The total number of blocks on the volume, returned
                  as an UNSIGNED integer value (Ø to 65535).
     FreeBlks   : The number of available blocks on the volume, returned
                  as an UNSIGNED integer value (Ø to 65535).
     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Set_Prefix ( Var Prefix, RetCode );

{  Sets the system prefix (NOT the Pascal prefix!) to the passed prefix
   string. }

{  Input Values :

     Prefix     : A Pascal string up to 255 characters long containing
                  the system prefix value.  Note that a "/" is automatically
                  added to the end of the system prefix.

   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Get_Prefix ( Var Prefix; Length : Integer; Var RetCode );

{  Gets the current system prefix (NOT the Pascal prefix!). }

{  Input Values :

     Prefix     : A Pascal string[n] to receive the current system prefix.
     Length     : The maximum length of the string, i.e. "n."

   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Open ( Var Path; ReqType, Pages : Integer; Var SysBuf, RefNumb,
                     RetCode );

{  Opens a file with the specified pathname. }

{  Input Values :

     Path       : A Pascal string containing the pathname of the file to
                  be opened.
     ReqType    : The manner in which to open the file, e.g. Ø = file's
                  attribute, 1 = read only, 2 = write only, 3 = read/write.
     Pages      : The number of user supplied pages pointed to by the SysBuf
                  parameter.  Note that passing a Ø means that SOS finds its
                  own buffer.  The maximum value is 4; each page is 256 bytes
                  long.  If a Ø is passed, then SOS ignores the SysBuf
                  parameter, and finds its own buffer.
     SysBuf     : This must be a 1Ø24 byte buffer for SOS to use for the
                  duration of the open. CAUTION : You cannot use OR deallocate
                  this buffer while the file is open.  Use a packed array
                  [Ø..1Ø23] of char.  If the file being opened is not on
                  a blocked device (e.g. a printer, the console), the SysBuf
                  pointer is ignored by SOS.

   Output Values :

     RefNumb    : This is the SOS file reference number returned as an integer
                  value, to be used in SOS_Read's and SOS_Write's to the file.
     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_New_Line ( RefNumb, Flag : Integer; NewCh : Char; Var RetCode );

{  Enables/disables the "newline" read mode (i.e. stops a read on the specified
   NewCh when enabled). }

{  Input Values :

     RefNumb     : The reference number of the file.

     Flag        : Ø..127 is disable; 128..256 is enable the newline mode.

     NewCh       : the character to be used as a newline character (terminates
                   the read).

   Output Values :

     RetCode     : An integer to contain the SOS return code (a zero means no
                   errors).
}

Procedure SOS_Read ( RefNumb : Integer; Var InputBuf; BytesReq : Integer;
                     Var BytesRead, RetCode );
```

Listing 1 continued on page 454

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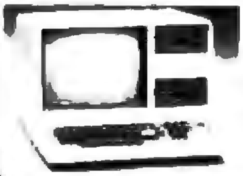

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Listing 1 continued.

```
{  Reads from the file specified by reference number. }

{  Input Values :

     RefNumb     : The reference number returned from the successful SOS_Open
                   request.
     BytesReq    : The number of bytes to read as an UNSIGNED integer value
                   (0..65535).

   Output Values :

     InputBuf    : A pointer to the buffer to read into. Use a packed array
                   [0..??] of char.
     BytesRead   : The actual number of bytes read into InputBuf.
     RetCode     : An integer to contain the SOS return code (a zero means no
                   errors).
}

Procedure SOS_S_Read ( RefNumb : Integer; Var InputBuf; OffSet,
                       BytesReq :Integer; Var BytesRead, RetCode );

{  The Same as SOS_Read, except that the buffer read into is indexed by OffSet
   bytes (e.g. for a read into a string).
}

Procedure SOS_Write ( RefNumb : Integer; Var BufPtr; NumbBytes : Integer;
                      Var RetCode );

{  Writes to the file specified by reference number. }

{  Input Values :

     RefNumb     : The SOS reference number returned from the successful
                   SOS_Open request.
     BufPtr      : The Pascal buffer to write to the file, a packed array should
                   be used.
     NumbBytes   : The number of bytes to write from BufPtr.

   Output Values :

     RetCode     : An integer to contain the SOS return code (a zero means no
                   errors).
}

Procedure SOS_S_Write ( RefNumb : Integer; Var BufPtr; OffSet,
                        NumbBytes : Integer; Var RetCode );

{  The same as SOS_Write, except that the write buffer pointed to by BufPtr is
   indexed by OffSet bytes.}

Procedure SOS_Close ( RefNumb : Integer; Var RetCode );

{  Closes the file specified by reference number. }

{  Input Values :

     RefNumb     : The reference number returned from the SOS_Open request.

   Output Values :

     RetCode     : An integer to contain the SOS return code (a zero means no
                   errors).
}

Procedure SOS_Flush ( RefNumb : Integer; Var RetCode );

{  The SOS output buffer associated with the file specified by the passed
   reference number is immediately written to the file. }

{  Input Values :

     RefNumb     : The reference number returned from the SOS_Open request.

   Output Values :

     RetCode     : An integer to contain the SOS return code (a zero means no
                   errors).
}

Procedure SOS_Get_B_Mark ( RefNumb : Integer; Var BlockNumb, RetCode );

{  Gets the current mark, or position of the file specified by the passed
   reference number, rounded up to the nearest 512 byte block. }

{  Input Values :

     RefNumb     : The SOS file reference number returned by the SOS_Open
                   request.

   Output Values :

     BlockNumb   : The mark rounded up to the nearest 512 byte block number.
                   Use an integer for the 0..32767 value range.
     RetCode     : An integer to contain the SOS return code (a zero means no
                   errors).
}

Procedure SOS_Get_B_EOF ( RefNumb : Integer; Var BlockNumb, RetCode );

{  Gets the current EOF of the file specified by the passed reference number,
   rounded up to the nearest 512 byte block. }

{  Input Values :

     RefNumb     : The SOS file reference number returned by the SOS_Open
                   request.

   Output Values :

     BlockNumb   : The EOF rounded up to the nearest 512 byte block number.
                   Use an integer for the 0..32767 value range.
     RetCode     : An integer to contain the SOS return code (a zero means no
                   errors).
}

Procedure SOS_Set_B_Mark ( RefNumb, Base, BlockNumb : Integer; Var RetCode );

{  Sets the current mark of the specified file to the 512 byte block number
   specified. }

{  Input Values :
```

Listing 1 continued on page 458

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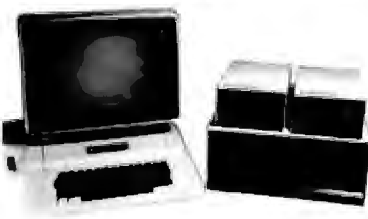

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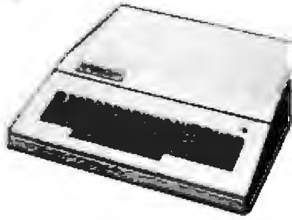

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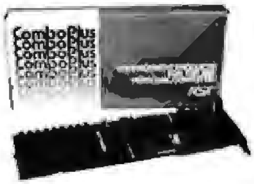

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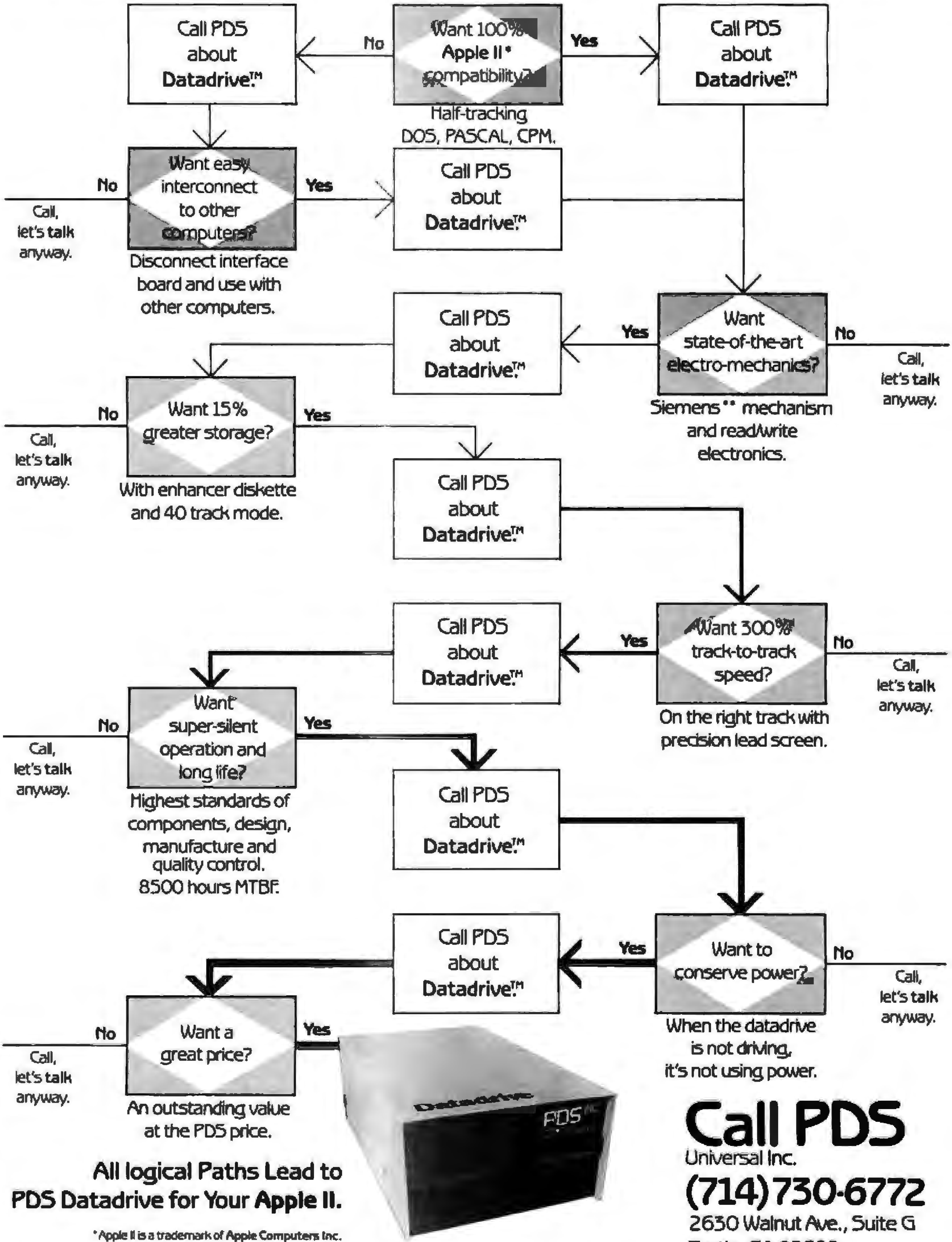
Listing 1 continued:

```
     RefNumb    : The SOS file reference number returned by the SOS_Open
                  request.
     Base       : Where to set the mark relative to : Ø = beginning of the
                  file; 1 = end of the file; 2 = positive from the current
                  position; 3 = negative from the current position.
     BlockNumb  : A integer block number from Ø to 32767 to set the mark to.

   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Set_B_EOF ( RefNumb, Base, BlockNumb : Integer; Var RetCode );

{  Sets the current EOF of the specified file to the 512 byte block number
   specified. }

{  Input Values :

     RefNumb    : The SOS file reference number returned by the SOS_Open
                  request.
     Base       : Where to set the mark relative to : Ø = beginning of the
                  file; 1 = end of the file; 2 = positive from the current
                  position; 3 = negative from the current position.
     BlockNumb  : A integer block number from Ø to 32767 to set the EOF to.

   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Get_Mark ( RefNumb : Integer; Var Low, Hi, RetCode );

{  Gets the mark of the specified file as the byte quantity passed as two
   UNSIGNED 16 bit integers. }

{  Input Values :

     RefNumb    : The file reference number returned from the SOS_Open request.

   Output Values :

     Low,Hi     : The mark returned as a 24 bit UNSIGNED quantity.
     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Get_EOF ( RefNumb : Integer; Var Low, Hi, RetCode );

{  Gets the EOF of the specified file as the byte quantity passed as two
   UNSIGNED 16 bit integers. }

{  Input Values :

     RefNumb    : The file reference number returned from the SOS_Open request.

   Output Values :

     Low,Hi     : The EOF returned as a 24 bit UNSIGNED quantity.
     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Set_Mark ( RefNumb, Base, Low, Hi : Integer; Var RetCode );

{  Sets the mark of the specified file to the byte quantity passed as two
   UNSIGNED 16 bit integers. }

{  Input Values :

     RefNumb    : The file reference number returned from the SOS_Open request.
     Base       : Where to set the mark relative to : Ø = beginning of the
                  file; 1 = end of the file; 2 = positive from the current
                  position; 3 = negative from the current position.
     Low,Hi     : The mark as a 24 bit UNSIGNED quantity.  The high byte
                  of "Hi" MUST BE Ø (i.e. Hi = Ø..255).

   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Procedure SOS_Set_EOF ( RefNumb, Base, Low, Hi : Integer; Var RetCode );

{  Sets the EOF of the specified file to the byte quantity passed as two
   UNSIGNED 16 bit integers. }

{  Input Values :

     RefNumb    : The file reference number returned from the SOS_Open request.
     Base       : Where to set the mark relative to : Ø = beginning of the
                  file; 1 = end of the file; 2 = positive from the current
                  position; 3 = negative from the current position.
     Low,Hi     : The EOF as a 24 bit UNSIGNED quantity.  The high byte
                  of "Hi" MUST BE Ø (i.e. Hi = Ø..255).

   Output Values :

     RetCode    : An integer to contain the SOS return code (a zero means no
                  errors).
}

Implementation

Procedure SOS_Create; External;
Procedure SOS_Destroy; External;
Procedure SOS_Rename; External;
Procedure SOS_Set_Info; External;
Procedure SOS_Get_Info; External;
Procedure SOS_Volume; External;
Procedure SOS_Set_Prefix; External;
Procedure SOS_Get_Prefix; External;
Procedure SOS_Open; External;
Procedure SOS_New_Line; External;
Procedure SOS_Read; External;
Procedure SOS_S_Read; External;
Procedure SOS_Write; External;
```

Listing 1 continued on page 460

A Disc Drive Decision Algorithim



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Listing 1 continued:

```
Procedure SOS_S_Write; External;
Procedure SOS_Close; External;
Procedure SOS_Flush; External;
Procedure SOS_Get_B_Mark; External;
Procedure SOS_Get_B_EOF; External;
Procedure SOS_Set_B_Mark; External;
Procedure SOS_Set_B_EOF; External;
Procedure SOS_Get_Mark; External;
Procedure SOS_Get_EOF; External;
Procedure SOS_Set_Mark; External;
Procedure SOS_Set_EOF; External;
Procedure SOS_Data; External;

End.
```

Listing 2: *The assembly-language implementation of the SOS calls must first be assembled. Then they may be linked to either a compiled main program or an intrinsic unit. All necessary equates and macro instructions are at the front of the listing. Apple III extended addressing is used to pass pointers to the Pascal stack/heap space as SOS call parameters.*

```
;       Permanent Zero Page registers
;
ZREGØ           .EQU            ØEØ
ZREG1           .EQU            ØE2
ZREG2           .EQU            ØE4
ZREG3           .EQU            ØE6
ZREG4           .EQU            ØE8
ZREG5           .EQU            ØEA
ZREG6           .EQU            ØEC
ZREG7           .EQU            ØEE
;
;       Return Address Zero page location
;
RETURNØ         .EQU            Ø28
;
;       Zero page Pascal Enhanced Indirect Addressing Registers
;
ZREGØØ          .EQU            ZREGØ
ZREGØ1          .EQU            ZREG1
ZREGØ2          .EQU            ZREG2
;
;       SOS Call Codes
;
CREATE          .EQU            ØCØ
DESTROY         .EQU            ØC1
RENAME          .EQU            ØC2
SETINFO         .EQU            ØC3
GETINFO         .EQU            ØC4
VOLUME          .EQU            ØC5
SETPRE          .EQU            ØC6
GETPRE          .EQU            ØC7
OPEN            .EQU            ØC8
NEWLINE         .EQU            ØC9
READ            .EQU            ØCA
WRITE           .EQU            ØCB
CLOSE           .EQU            ØCC
FLUSH           .EQU            ØCD
SETMARK         .EQU            ØCE
GETMARK         .EQU            ØCF
SETEOF          .EQU            ØDØ
GETEOF          .EQU            ØD1
;
;       Call the specified SOS service using "SOSBLK"
;
                .MACRO          SOS
                BRK
                .BYTE           %1
                .WORD           SOSBLK
                .ENDM
;
;       Saves a two byte quantity in the location specified
;
                .MACRO          POP
                PLA
                STA             %1
                PLA
                STA             %1+1
                .ENDM
;

;       Pushes a two byte quantity onto the stack
;
                .MACRO          PUSH
                LDA             %1+1            ;High byte first
                PHA
                LDA             %1
                PHA
                .ENDM
;
;       Moves Location1 -> Location2
;
                .MACRO          MOVE
                LDA             %1
                STA             %2
                LDA             %1+1
                STA             %2+1
                .ENDM
                .PROC           SOSCREATE,6
;*****************************************************************************
;
;       Name: SOSCREATE
;
;       Stack Usage:
;
;               Return code ptr., EOF blocks, Storage type, Auxiliary id,
;               File id, Pathname ptr.
;
;       Global Registers Used:
;
;               ZREGØØ, ZREGØ1
;
;       Files Used:
;
;               Creates a file upon successful completion.
;
;*****************************************************************************
;
```

Listing 2 continued on page 462

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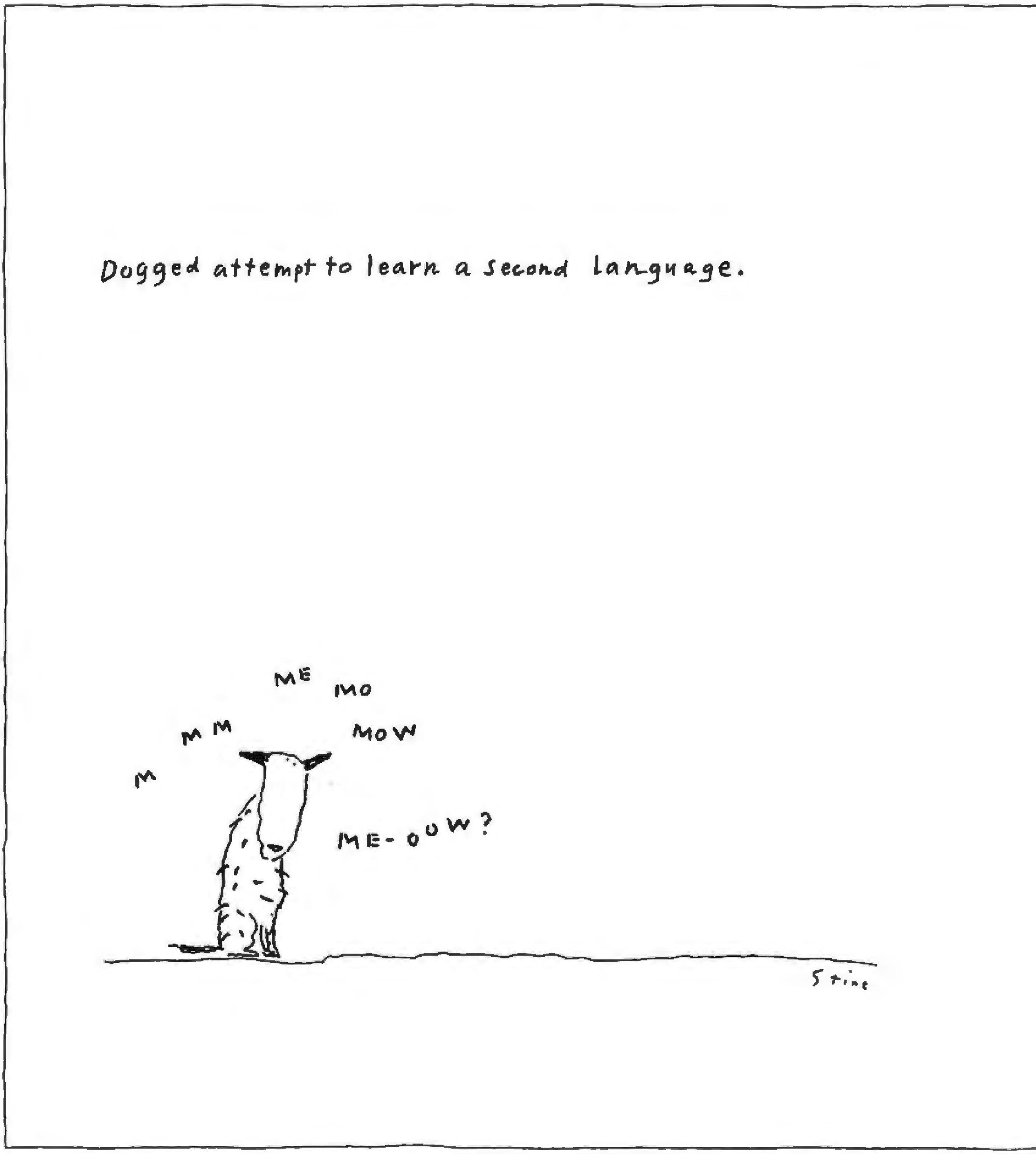
Listing 2 continued:

```
        .REF        PARAM0,PARAM1,PARAM2,PARAM3,PARAM5
        .REF        PARAM6,PARAM7,PARAM9,PARAM10,PARAM11,PARAM12
        .REF        PARAM13,PTRPRM6,SOSBLK
;
        POP         RETURN0
        POP         ZREG01          ;SOS return code ptr.
        PLA
        ASL         A
        STA         PARAM11         ;Second byte
        PLA
        ROL         A
        STA         PARAM12         ;Third byte
        LDY         #0.
        STY         PARAM10
        STY         PARAM13         ;First and fourth bytes
        STY         PARAM2          ;ZREG MSB
        PLA
        STA         PARAM9          ;Storage type
        PLA
        POP         PARAM7          ;Aux. ID
        PLA
        STA         PARAM6          ;File ID
        PLA
        LDA         #8.
        STA         PARAM5          ;Length
        MOVE        PTRPRM6,PARAM3  ;Create list pointer
        POP         ZREG00          ;Pathname ptr.
        LDA         #ZREG00
        STA         PARAM1          ;ZREG ptr. LSB
        LDA         #3.
        STA         PARAM0          ;Parameter count
        SOS         CREATE          ;Issue SOS call (assume Y =0)
        STA         (ZREG01),Y      ;Return code LSB
        TYA
        INY
        STA         (ZREG01),Y      ;MSB
        PUSH        RETURN0
        RTS
        .PROC       SOSDESTROY,2
;****************************************************************************
;
;       Name: SOSDESTROY
;
;       Stack Usage:
;
;               Return code ptr., Pathname ptr
;
;       Global Registers Used:
;
;               ZREG00, ZREG01
;
;       Files Used:
;
;               Attempts to destroy the file with the passed pathname.
;
;****************************************************************************
;
        .REF        PARAM0,PARAM1,PARAM2,SOSBLK
;
        POP         RETURN0
        POP         ZREG01          ;Return code ptr.
        POP         ZREG00          ;Pathname ptr.
        LDY         #0.
        STY         PARAM2
        LDA         #ZREG00
        STA         PARAM1          ;Pathname ZREG number
        LDA         #1.
        STA         PARAM0          ;Param. count
        SOS         DESTROY         ;Issue SOS call (assume Y = 0)
        STA         (ZREG01),Y
        TYA
        INY
        STA         (ZREG01),Y      ;Post return code
        PUSH        RETURN0
        RTS
        .PROC       SOSRENAME,3
;****************************************************************************
;
;       Name: SOSRENAME
;
;       Stack Usage:
;
;               Return code ptr., New pathname ptr., Old pathname ptr.
;
;       Global Registers Used:
;
;               ZREG00, ZREG01, ZREG02.
;
;       Files Used:
;
;               File pointed to by passed pathname.
;
;****************************************************************************
;
        .REF        PARAM0,PARAM1,PARAM2,PARAM3,PARAM4
        .REF        SOSBLK
;
        POP         RETURN0
        POP         ZREG02          ;Return code ptr.
        POP         ZREG01          ;New path ptr.
        POP         ZREG00          ;Old path ptr.
        LDY         #0.
        STY         PARAM4
        STY         PARAM2
        LDA         #ZREG01
        STA         PARAM3          ;New path ZREG
        LDA         #ZREG00
        STA         PARAM1          ;Old path ZREG
        LDA         #2.
        STA         PARAM0          ;Param. count
        SOS         RENAME          ;Issue SOS call (assume Y = 0)
        STA         (ZREG02),Y
        TYA
        INY
        STA         (ZREG02),Y      ;Post return code
        PUSH        RETURN0
        RTS
        .PROC       SOSSETINFO,4
;****************************************************************************
;
;       Name: SOSSETINFO
;
;       Stack Usage:
```

Listing 2 continued:

```
;
;               Return code ptr., List length, File list ptr.,
;               Pathname ptr.  The COINFO coroutine in SOSGETINFO is used to
;               execute the call.
;
;       Global Registers Used:
;
;               ZREG00, ZREG01.
;
;       Files Used:
;
;               The passed pathname is used in the SOS call.
;
;*****************************************************************************
;
                .REF            COINFO,SSGINFO
;
                LDA             #SETINFO
                STA             SSGINFO         ;Set the SOS call to SETINFO
                JMP             COINFO          ;Go to the coroutine
                .PROC           SOSGETINFO,4
;*****************************************************************************
;
;       Name: SOSGETINFO
;
;       Stack Usage:
;
;               Return code ptr., List length, File list ptr., Pathname ptr.
;
;       Global Registers Used:
;
;               ZREG00, ZREG01, ZREG02.
;
;       Files Used:
;
;               The passed pathname is used in the SOS call.
;
;*****************************************************************************
;
                .REF            PARAM0,PARAM1,PARAM2,PARAM3,PARAM4
                .REF            PARAM5,SOSBLK
                .DEF            COINFO,SSGINFO
;
                LDA             #GETINFO
                STA             SSGINFO         ;Set the SOS GETINFO call
COINFO          POP             RETURN0
                POP             ZREG02          ;Return code ptr.
                PLA
                STA             PARAM5          ;List return length
                PLA
                POP             ZREG01          ;File list ptr.
                POP             ZREG00          ;Pathname ptr.
                LDY             #0.
                STY             PARAM4
                STY             PARAM2
                LDA             #ZREG01
                STA             PARAM3          ;File list ZREG
                LDA             #ZREG00
                STA             PARAM1          ;Pathname ZREG
                LDA             #3.
                STA             PARAM0          ;Param. count
                BRK
SSGINFO         .BYTE           0.
                .WORD           SOSBLK
                STA             (ZREG02),Y
                TYA
                INY
                STA             (ZREG02),Y      ;Post return code
                PUSH            RETURN0
                RTS
                .PROC           SOSVOLUME,5
;*****************************************************************************
;
;       Name: SOSVOLUME
;
;       Stack Usage:
;
;               Return code ptr., Free blocks ptr., Total blocks ptr.,
;               Volume name ptr., Device name ptr.
;
;       Global Registers Used:
;
;               ZREG0, ZREG1, ZREG2, ZREG3, ZREG4.
;
;*****************************************************************************
;
                .REF            PARAM0,PARAM1,PARAM2,PARAM3,PARAM4
                .REF            PARAM5,PARAM6,PARAM7,PARAM8,SOSBLK
;
                POP             RETURN0
                POP             ZREG4           ;Return code ptr.
                POP             ZREG3           ;Free blocks ptr.
                POP             ZREG2           ;Total blocks ptr.
                POP             ZREG1           ;Volume name ptr.
                POP             ZREG0           ;Device name ptr.
                LDY             #0.
                STY             PARAM4
                STY             PARAM2
                LDA             #ZREG1
                STA             PARAM3          ;Volume name ZREG
                LDA             #ZREG0
                STA             PARAM1          ;Device name ZREG
                LDA             #6.
                STA             PARAM0          ;Param. count
                SOS             VOLUME          ;Issue SOS call (assume Y = 0)
                STA             (ZREG4),Y       ;Post LSB return code
                LDA             PARAM7
                STA             (ZREG3),Y       ;LSB # free blocks
                LDA             PARAM5
                STA             (ZREG2),Y       ;LSB # total blocks
                TYA
                INY
                STA             (ZREG4),Y       ;MSB return code
                LDA             PARAM8
                STA             (ZREG3),Y       ;MSB # free blocks
                LDA             PARAM6
                STA             (ZREG2),Y       ;MSB # total blocks
                PUSH            RETURN0
                RTS
                .PROC           SOSSETPREFIX,2
;*****************************************************************************
;
;
;       Name: SOSSETPREFIX
;
```

Listing 2 continued on page 466


Dogged attempt to learn a second language.
M
MM M
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Circle 535 on inquiry card.

Listing 2 continued:

```
;       Stack Usage:
;
;               Return code ptr., Prefix pathname ptr.
;
;       Global Registers Used:
;
;               ZREGØØ, ZREGØ1.
;
;***************************************************************************
;
                .REF            PARAMØ,PARAM1,PARAM2,SOSBLK
;
                POP             RETURNØ
                POP             ZREGØ1          ;Return code ptr.
                POP             ZREGØØ          ;Prefix path ptr.
                LDY             #Ø.
                STY             PARAM2
                LDA             #ZREGØØ
                STA             PARAM1          ;Prefix path ZREG
                LDA             #1.
                STA             PARAMØ
                SOS             SETPRE          ;Issue SOS call (assume Y = Ø)
                STA             (ZREGØ1),Y
                TYA
                INY
                STA             (ZREGØ1),Y      ;Post return code
                PUSH            RETURNØ
                RTS
                .PROC           SOSGETPREFIX,3
;***************************************************************************
;
;       Name: SOSGETPREFIX
;
;       Stack Usage:
;
;               Return code ptr., Maximum prefix length, Prefix pathname ptr.
;
;       Global Registers Used:
;
;               ZREGØØ, ZREGØ1.
;
;***************************************************************************
;
                .REF            PARAMØ,PARAM1,PARAM2,PARAM3,SOSBLK
;
                POP             RETURNØ
                POP             ZREGØ1          ;Return code ptr.
                PLA
                STA             PARAM3          ;Maximum pathname length
                PLA
                POP             ZREGØØ          ;Prefix path ptr.
                LDY             #Ø.
                STY             PARAM2
                LDA             #ZREGØØ
                STA             PARAM1          ;Prefix path ZREG
                LDA             #2.
                STA             PARAMØ
                SOS             GETPRE          ;Issue SOS call (assume Y = Ø)
                STA             (ZREGØ1),Y
                TYA
                INY
                STA             (ZREGØ1),Y      ;Post return code
                PUSH            RETURNØ
                RTS
                .PROC           SOSOPEN,6
;***************************************************************************
;
;       Name: SOSOPEN
;
;       Stack Usage:
;
;               Return code ptr., Reference number ptr., System buffer ptr.,
;               # of pages value, Request access type, Pathname ptr.
;
;       Global Registers Used:
;
;               ZREGØ, ZREG1, ZREG2, ZREG3.
;
;       Files Used:
;
;               Opens a file under the passed pathname.
;
;***************************************************************************
;
                .REF            PARAMØ,PARAM1,PARAM2,PARAM3,PARAM4
                .REF            PARAM6,PARAM7,PARAM8,PARAM9,PARAM1Ø,PTRPRM7
                .REF            SOSBLK
;
                POP             RETURNØ
                POP             ZREG3           ;SOS return code ptr.
                POP             ZREG2           ;Reference number ptr.
                POP             ZREG1           ;Sytem buffer ptr.
                LDY             #Ø.
                STY             PARAM1Ø
                STY             PARAM2
                LDA             #ZREG1
                STA             PARAM9          ;System buffer ZREG
                PLA
                STA             PARAM8          ;# pages
                PLA
                LDA             #4.
                STA             PARAM6          ;Length of Open list
                STA             PARAMØ          ;Parameter count
                MOVE            PTRPRM7,PARAM4  ;Open list ptr.
                PLA
                STA             PARAM7          ;Request access type
                PLA
                POP             ZREGØ           ;Pathname ptr.
                LDA             #ZREGØ
                STA             PARAM1          ;Pathname ZREG
                SOS             OPEN            ;Call SOS (assume Y = Ø)
                STA             (ZREG3),Y
                LDA             PARAM3
                STA             (ZREG2),Y
                TYA
                INY
                STA             (ZREG3),Y       ;Post the return code
                STA             (ZREG2),Y       ;Reference number
                PUSH            RETURNØ
                RTS
                .PROC           SOSNEWLINE,4
;***************************************************************************
;
;       Name: SOSNEWLINE
```

Listing 2 continued on page 470

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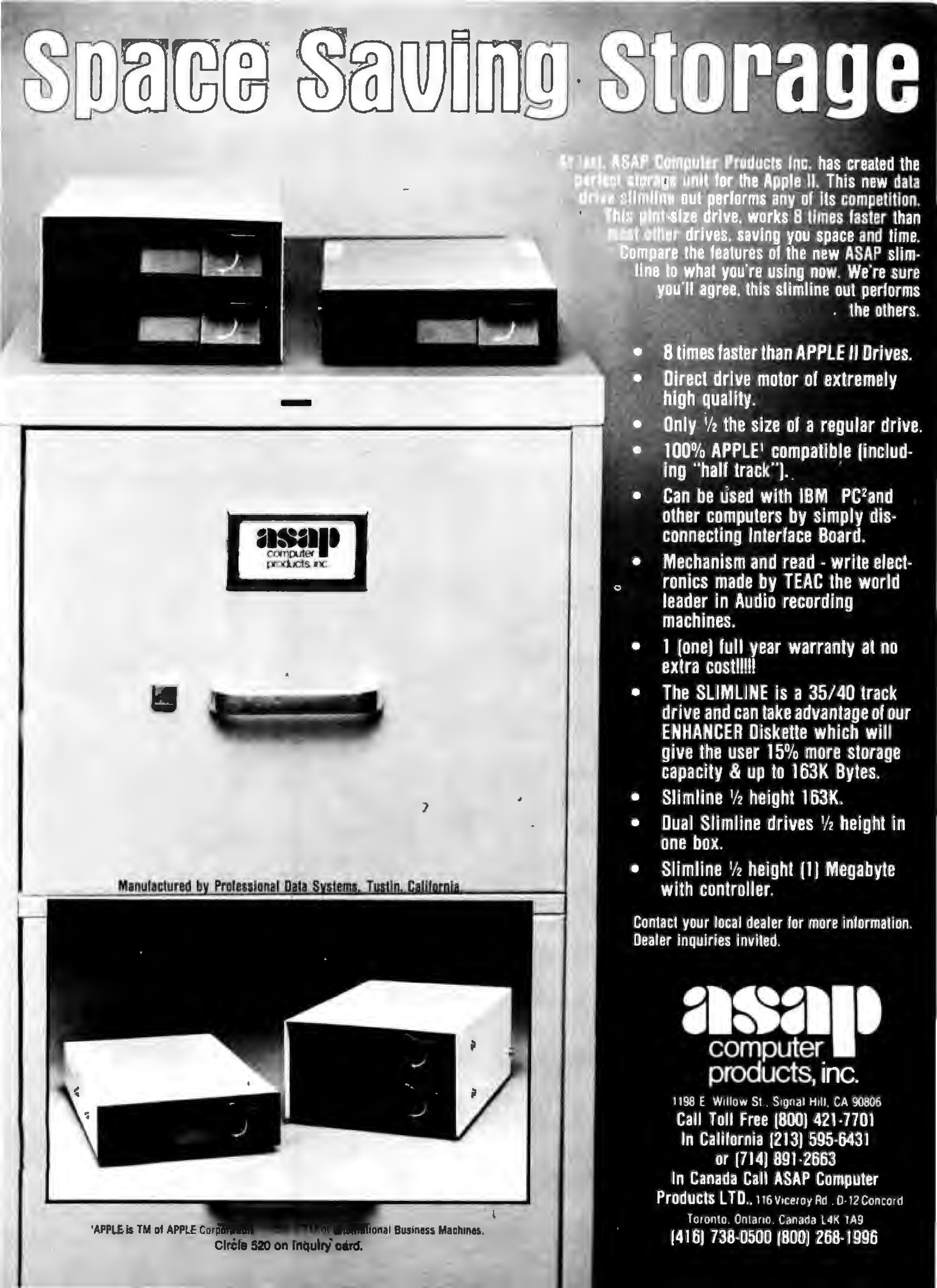
Circle 366 on inquiry card.

Listing 2 continued:

```
;
;       Stack Usage:
;
;               Return code ptr., Newline character, Newline on/off,
;               Reference number
;
;       Global Registers Used:
;
;               ZREGØØ
;
;       Files Used:
;
;               Sets the newline mode of the file with the passed reference
;               number.
;
;******************************************************************************
;
                .REF            PARAMØ,PARAM1,PARAM2,PARAM3
                .REF            SOSBLK
;
                POP             RETURNØ
                POP             ZREGØØ          ;Return code ptr.
                PLA
                STA             PARAM3          ;New line character
                PLA
                PLA
                STA             PARAM2          ;New line on/off
                PLA
                PLA
                STA             PARAM1          ;Reference number
                PLA
                LDA             #3.
                STA             PARAMØ          ;Param. count
                SOS             NEWLINE
                LDY             #Ø.
                STA             (ZREGØØ),Y      ;LSB return code
                TYA
                INY
                STA             (ZREGØØ),Y      ;MSB return code
                PUSH            RETURNØ
                RTS
                .PROC           SOSREAD,5
;******************************************************************************
;
;       Name: SOSREAD
;
;       Stack Usage:
;
;               Return code ptr., Bytes actually read ptr., Bytes requested,
;               Input buffer ptr., Reference number
;
;       Global Registers Used:
;
;               ZREGØØ, ZREGØ1, ZREGØ2.
;
;       Files Used:
;
;               Reads from the file with the passed reference number.
;
;******************************************************************************
;
                .REF            PARAMØ,PARAM1,PARAM2,PARAM3,PARAM4
                .REF            PARAM6,PARAM7,SOSBLK
                .DEF            CSREAD
;
                POP             RETURNØ
                POP             ZREGØ2          ;Return code ptr.
                POP             ZREGØ1          ;Bytes read ptr.
                POP             PARAM4          ;# bytes requested
                POP             ZREGØØ          ;Input buffer ptr.
CSREAD          LDY             #Ø.
                STY             PARAM3
                LDA             #ZREGØØ
                STA             PARAM2          ;Input buffer ZREG
                PLA
                STA             PARAM1          ;Reference #
                PLA
                LDA             #4.
                STA             PARAMØ          ;Parameter count
                SOS             READ            ;Call SOS (assume Y = Ø)
                STA             (ZREGØ2),Y
                LDA             PARAM6
                STA             (ZREGØ1),Y
                TYA
                INY
                STA             (ZREGØ2),Y      ;Return code
                LDA             PARAM7
                STA             (ZREGØ1),Y      ;# bytes actually read
                PUSH            RETURNØ
                RTS
                .PROC           SOSSREAD,6
;******************************************************************************
;
;       Name: SOSSREAD
;
;       Stack Usage:
;
;               Return code ptr., Bytes actually read ptr., Bytes requested,
;               OffSet, Input buffer ptr., Reference number
;
;       Global Registers Used:
;
;               ZREGØØ, ZREGØ1, ZREGØ2.
;       Files Used:
;
;               Reads from the file with the passed reference number.
;
;******************************************************************************
;
                .REF            PARAMØ,PARAM1,PARAM2,PARAM3,PARAM4
                .REF            PARAM6,PARAM7,SOSBLK,CSREAD
;
                POP             RETURNØ
                POP             ZREGØ2          ;Return code ptr.
                POP             ZREGØ1          ;Bytes read ptr.
                POP             PARAM4          ;# bytes requested
                POP             ZREGØØ          ;Offset
                PLA
                CLC
                ADC             ZREGØØ          ;IBufPtr + OffSet (LSB)
                STA             ZREGØØ
                PLA
                ADC             ZREGØØ+1        ;IBufPtr + OffSet (MSB)
                STA             ZREGØØ+1
                JMP             CSREAD          ;Go to SOSREAD coroutine
                .PROC           SOSWRITE,4
```

Listing 2 continued on page 472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Circle 520 on inquiry card.

Listing 2 continued:

```
;*******************************************************************************
;
;       Name: SOSWRITE
;
;       Stack Usage:
;
;               Return code ptr., Number of bytes, Buffer ptr., Reference number
;
;       Global Registers Used:
;
;               ZREG00, ZREG01.
;
;       Files Used:
;
;               Writes to the file with the passed reference number.
;
;*******************************************************************************
;
                .DEF            COWRITE
                .REF            PARAM0,PARAM1,PARAM2,PARAM3,PARAM4
                .REF            SOSBLK
;
                POP             RETURN0
                POP             ZREG01          ;Return code ptr.
                POP             PARAM4          ;# bytes
                POP             ZREG00          ;Buffer ptr.
COWRITE         PLA
                STA             PARAM1          ;Reference number
                PLA
                LDY             #0.
                STY             PARAM3          ;0 -> MSB ZREG
                LDA             #ZREG00
                STA             PARAM2          ;LSB ZREG
                LDA             #3.
                STA             PARAM0          ;Parameter count
                SOS             WRITE           ;Issue call to SOS (Y = 0)
                STA             (ZREG01),Y
                TYA
                INY
                STA             (ZREG01),Y      ;MSB return code
                PUSH            RETURN0
                RTS
                .PROC           SOSSWRITE,5
;*******************************************************************************
;
;       Name: SOSSWRITE
;
;       Purpose:
;               Issues a SOS write request to the file with the passed reference
;               number, AFTER adding in the offset to the buffer pointer.
;
;       Stack Usage:
;
;               Return code ptr., Number of bytes, OffSet, Buffer ptr.,
;               Reference number
;
;       Global Registers Used:
;
;               ZREG00, ZREG01.
;
;       Files Used:
;
;               Writes to the file with the passed reference number.
;
;*******************************************************************************
;
                .REF            COWRITE
                .REF            PARAM4
;
                POP             RETURN0
                POP             ZREG01          ;Return code ptr.
                POP             PARAM4          ;# bytes
                POP             ZREG00          ;Offset
                PLA
                CLC
                ADC             ZREG00          ;BufPtr + OffSet (LSB)
                STA             ZREG00
                PLA
                ADC             ZREG00+1        ;BufPtr + OffSet (MSB)
                STA             ZREG00+1
                JMP             COWRITE         ;Go to SOSWRITE coroutine
                .PROC           SOSCLOSE,2
;*******************************************************************************
;
;       Name: SOSCLOSE
;
;       Stack Usage:
;
;               Return code ptr., Reference number.
;
;       Global Registers Used:
;
;               ZREG00
;
;       Files Used:
;
;               Closes the file with the passed reference number.
;
;*******************************************************************************
;
                .REF            PARAM0,PARAM1,SOSBLK
;
                POP             RETURN0
                POP             ZREG00          ;Return code ptr.
                PLA
                STA             PARAM1          ;Reference #
                PLA
                LDA             #1.
                STA             PARAM0
                SOS             CLOSE           ;Issue SOS call
                LDY             #0.
                STA             (ZREG00),Y
                TYA
                INY
                STA             (ZREG00),Y      ;Post the return code
                PUSH            RETURN0
                RTS
                .PROC           SOSFLUSH,2
;*******************************************************************************
;
;       Name: SOSFLUSH
;
;       Stack Usage:
;
;               Return code ptr., Reference number.
;
;       Global Registers Used:
```

Listing 2 continued on page 474

Circle 75 on inquiry card.

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Listing 2 continued:

```
;               ZREG00
;
;       Files Used:
;
;               Flushes the file with the passed reference number.
;
;*******************************************************************************
;
                .REF            PARAM0,PARAM1,SOSBLK
;
                POP             RETURN0
                POP             ZREG00          ;Return code ptr.
                PLA
                STA             PARAM1          ;Reference #
                PLA
                LDA             #1.
                STA             PARAM0
                SOS             FLUSH           ;Write out SOS buffer
                LDY             #0.
                STA             (ZREG00),Y
                TYA
                INY
                STA             (ZREG00),Y      ;Post the return code
                PUSH            RETURN0
                RTS
                .PROC           SOSGETBMARK,3
;*******************************************************************************
;
;       Name: SOSGETBMARK
;
;       Stack Usage:
;
;               Return code ptr., # of blocks ptr., Reference number
;
;       Global Registers Used:
;
;               ZREG00, ZREG01.
;
;       Files Used:
;
;               Gets the mark of the file with the ref. number passed.
;*******************************************************************************
;
                .DEF            COBMRKEOF,SBMRKEOF
                .REF            PARAM0,PARAM1,PARAM2,PARAM3,PARAM4
                .REF            PARAM5,SOSBLK
;
                POP             RETURN0
                LDA             #GETMARK
                STA             SBMRKEOF
COBMRKEOF       POP             ZREG00          ;Return code ptr.
                POP             ZREG01          ;# of blocks ptr.
                PLA
                STA             PARAM1          ;Reference number
                PLA
                LDA             #2.
                STA             PARAM0          ;Parameter count
                BRK                             ;Call SOS
SBMRKEOF        .BYTE           0
                .WORD           SOSBLK
                LDY             #0.
                STA             (ZREG00),Y      ;Post return code
                CLC
                LDA             #0FF            ;((mark + 511) div 512 )
                                                ;                  mod 32768
                ADC             PARAM2
                LDA             #1.
                ADC             PARAM3
                STA             PARAM3
                TYA
                ADC             PARAM4          ;High byte -> A
                ROR             A
                TAX                             ;Save MSB block count -> X
                LDA             PARAM3          ;Low byte -> A
                ROR             A
                STA             (ZREG01),Y      ;LSB block count
                TYA
                INY
                STA             (ZREG00),Y
                TXA
                STA             (ZREG01),Y      ;MSB block count
                PUSH            RETURN0
                RTS
                .PROC           SOSGETBEOF,3
;*******************************************************************************
;
;       Name: SOSGETBEOF
;
;       Stack Usage:
;
;               Return code ptr., # of blocks ptr., Reference number
;
;       Global Registers Used:
;
;               ZREG00, ZREG01.
;
;       Files Used:
;
;               Gets the EOF of the file with the ref. number passed.
;
;*******************************************************************************
;
                .REF            COBMRKEOF,SBMRKEOF
;
                POP             RETURN0
                LDA             #GETEOF
                STA             SBMRKEOF
                JMP             COBMRKEOF       ;Go to the coroutine
                .PROC           SOSSETBMARK,4
;*******************************************************************************
;
;       Name: SOSSETBMARK
;
;       Stack Usage:
;
;               Return code ptr., # of blocks, Base type, Reference number
;
;       Global Registers Used:
;
;               ZREG00
;
;       Files Used:
;
;               Sets the mark of the file with the ref. number passed.
;*******************************************************************************
```

Listing 2 continued on page 476

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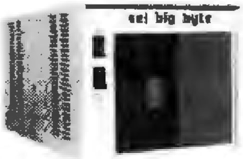

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Listing 2 continued:

```
                .DEF            COBSMEOF,SSBMEOF
                .REF            PARAM0,PARAM1,PARAM2,PARAM3,PARAM4
                .REF            PARAM5,PARAM6,SOSBLK
;
                POP             RETURN0
                LDA             #SETMARK
                STA             SSBMEOF
COBSMEOF        POP             ZREG00          ;Return code ptr.
                PLA
                ASL             A               ;Block # -> # of bytes
                STA             PARAM4
                PLA
                ROL             A
                STA             PARAM5
                LDA             #0.
                STA             PARAM3
                STA             PARAM6
                PLA
                STA             PARAM2          ;Base type
                PLA
                PLA
                STA             PARAM1          ;Reference number
                PLA
                LDA             #3.
                STA             PARAM0          ;Parameter count
                BRK                             ;Call SOS
SSBMEOF         .BYTE           0.
                .WORD           SOSBLK
                LDY             #0.
                STA             (ZREG00),Y
                TYA
                INY
                STA             (ZREG00),Y
                PUSH            RETURN0
                RTS
                .PROC           SOSSETBEOF,4
;*****************************************************************************
;
;       Name: SOSSETBEOF
;
;       Stack Usage:
;
;               Return code ptr., # of blocks, Base type, Reference number
;
;       Global Registers Used:
;
;               ZREG00
;
;       Files Used:
;
;               Sets the EOF of the file with the ref. number passed.
;
;*****************************************************************************
;
                .REF            COBSMEOF,SSBMEOF
;
                POP             RETURN0
                LDA             #SETEOF
                STA             SSBMEOF
                JMP             COBSMEOF        ;Jump to coroutine
                .PROC           SOSGETMARK,4
;*****************************************************************************
;
;       Name: SOSGETMARK
;
;       Stack Usage:
;
;               Return code ptr., High byte count ptr., Low byte count ptr.,
;               Reference number
;
;       Global Registers Used:
;
;               ZREG00, ZREG01, ZREG02
;
;       Files Used:
;
;               Gets the byte mark of the file with the passed reference numb.
;
;*****************************************************************************
;
                .DEF            COGMRKEF,GMARKEOF
                .REF            PARAM0,PARAM1,PARAM2,PARAM3,PARAM4,PARAM5
                .REF            SOSBLK
;
                POP             RETURN0
                LDA             #GETMARK
                STA             GMARKEOF
COGMRKEF        POP             ZREG00          ;Return code ptr.
                POP             ZREG01          ;High byte count ptr.
                POP             ZREG02          ;Low byte count ptr.
                PLA
                STA             PARAM1          ;Reference #
                PLA
                LDA             #2.
                STA             PARAM0          ;Parameter count
                LDY             #0.
                STY             PARAM5          ;Zero out the 4th byte
                BRK                             ;Call SOS
GMARKEOF        .BYTE           0
                .WORD           SOSBLK
                STA             (ZREG00),Y      ;Assume Y = 0
                LDA             PARAM2
                STA             (ZREG02),Y      ;Low LSB
                LDA             PARAM4
                STA             (ZREG01),Y      ;Hi LSB
                TYA
                INY
                STA             (ZREG00),Y      ;Post return code MSB
                LDA             PARAM3
                STA             (ZREG02),Y      ;Low MSB
                LDA             PARAM5
                STA             (ZREG01),Y      ;Hi MSB
                PUSH            RETURN0
                RTS
                .PROC           SOSGETEOF,4
;*****************************************************************************
;
;       Name: SOSGETEOF
;
;       Stack Usage:
;
;               Return code ptr., High byte count ptr., Low byte count ptr.,
;               Reference number
;
;       Global Registers Used:
;
;               ZREG00, ZREG01, ZREG02
;
;       Files Used:
```

Listing 2 continued on page 478

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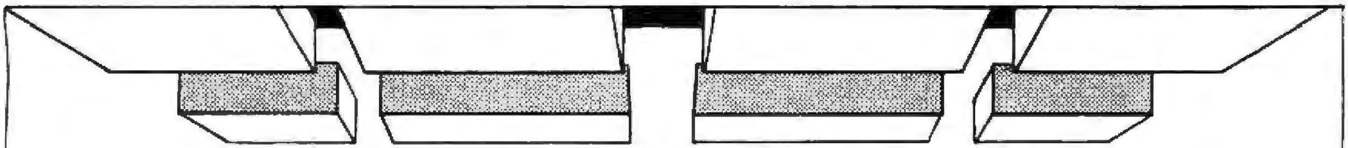

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Listing 2 continued:

```
;
;            Gets the EOF of the file with the passed reference number.
;
;*****************************************************************************
;
             .REF          COGMRKEF,GMARKEOF
;
             POP           RETURN0
             LDA           #GETEOF
             STA           GMARKEOF
             JMP           COGMRKEF       ;Jump to the coroutine
             .PROC         SOSSETMARK,5
;*****************************************************************************
;
;       Name: SOSSETMARK
;
;       Stack Usage:
;
;            Return code ptr., High byte count, Low byte count, File Base,
;            Reference number
;
;       Global Registers Used:
;
;            ZREG00
;
;       Files Used:
;
;            Sets the byte mark of the file with the passed reference numb.
;
;*****************************************************************************
;
             .DEF          COMRKEOF,SMARKEOF
             .REF          PARAM0,PARAM1,PARAM2,PARAM3,PARAM5
             .REF          SOSBLK
;
             POP           RETURN0
             LDA           #SETMARK
             STA           SMARKEOF
COMRKEOF     POP           ZREG00         ;Return code ptr.
             POP           PARAM5         ;High byte count
             POP           PARAM3         ;Low byte count
             PLA
             STA           PARAM2         ;From specified base
             PLA
             PLA
             STA           PARAM1         ;Reference #
             PLA
             LDA           #3.
             STA           PARAM0         ;Parameter count
             BRK                          ;Call SOS
SMARKEOF     .BYTE         0
             .WORD         SOSBLK
             LDY           #0.
             STA           (ZREG00),Y
             TYA
             INY
             STA           (ZREG00),Y     ;Post return code
             PUSH          RETURN0
             RTS
             .PROC         SOSSETEOF,5
;*****************************************************************************
;
;       Name: SOSSETEOF
;
;       Stack Usage:
;
;            Return code ptr., High byte count, Low byte count, File Base,
;            Reference number
;
;       Global Registers Used:
;
;            ZREG00
;
;       Files Used:
;
;            Sets the byte EOF of the file with the passed reference number.
;
;*****************************************************************************
;
             .REF          COMRKEOF,SMARKEOF
;
             POP           RETURN0
             LDA           #SETEOF
             STA           SMARKEOF
             JMP           COMRKEOF       ;Jump to the coroutine
             .PROC         SOSDATA
;*****************************************************************************
;
;       Name: SOSDATA
;
;       Purpose: The SOS parameter block area.
;
;*****************************************************************************
;
             .DEF          SOSBLK,PARAM0,PARAM1,PARAM2,PARAM3
             .DEF          PARAM4,PARAM5,PARAM6,PARAM7,PARAM8,PARAM9
             .DEF          PARAM10,PARAM11,PARAM12,PARAM13,PARAM17
             .DEF          PARAM19,PTRPRM5,PTRPRM6,PTRPRM7,PTRPRM10
;
SOSBLK       .EQU          *              ;SOS parameter area
PARAM0       .BYTE
PARAM1       .BYTE
PARAM2       .BYTE
PARAM3       .BYTE
PARAM4       .BYTE
PARAM5       .BYTE
PARAM6       .BYTE
PARAM7       .BYTE
PARAM8       .BYTE
PARAM9       .BYTE
PARAM10      .BYTE
PARAM11      .BYTE
PARAM12      .BYTE
PARAM13      .BYTE
PARAM14      .BYTE
PARAM15      .BYTE
PARAM16      .BYTE
PARAM17      .BYTE
PARAM18      .BYTE
PARAM19      .BYTE
PARAM20      .BYTE
PTRPRM5      .WORD         PARAM5
PTRPRM6      .WORD         PARAM6
PTRPRM7      .WORD         PARAM7
PTRPRM10     .WORD         PARAM10
             .END
```

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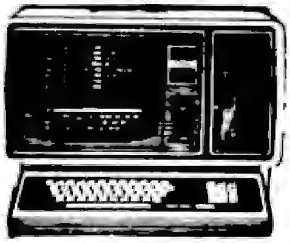

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SOS_Destroy	Removes a file from a blocked device, if possible.
SOS_Rename	Changes the name of a file.
SOS_Set_Info	Defines the directory information to be associated with a specified file
SOS_Get_Info	Returns the directory information associated with a specified file
SOS_Volume	Returns the volume name, total blocks in use, and total number of free blocks for any block device.
SOS_Set_Prefix	Sets the system prefix path name. This is *not* the Pascal prefix.
SOS_Get_Prefix	Returns the current system prefix path name.
SOS_Open	Opens any SOS file configured into the system, including the console or any printer.
SOS_New_Line	Disables or enables and sets the "read until" character for the specified SOS file.
SOS_Read	Reads from a specified file
SOS_S_Read	Reads from a specified file into an indexed buffer. Useful for reading in a Pascal-string variable after turning off range checking (i.e., {$R– }).
SOS_Write	Writes to a specified file.
SOS_S_Write	Writes to a specified file from an indexed buffer. Useful for writing string variables.
SOS_Close	Closes the specified file. If the passed reference number is 0, all user files are closed.
SOS_Flush	Writes out any information currently buffered by SOS to the specified file. Works in a similar fashion to SOS_Close with a 0 reference number passed to it. This gives the applications programmer the ability on demand to write out to disk all SOS file buffers.
SOS_Get_B_Mark	Gets the current file mark rounded up to the closest block number.
SOS_Set_B_Mark	Sets the current file position to the passed block number.
SOS_Get_B_EOF	Gets the current EOF rounded up to the closest block number.
SOS_Set_B_EOF	Sets the EOF to the passed block number. SOS 1.1 does not deallocate blocks if the EOF is reduced.
SOS_Get_Mark	Gets the current file mark and returns the low 16 bits in "Low" and the high-order 8 bits (of the 24-bit mark) in "Hi."
SOS_Set_Mark	Sets the mark to the 24-bit quantity passed.
SOS_Get_EOF	Gets the current EOF and returns the 24-bit quantity in "Low" and "Hi."
SOS_Set_EOF	Sets the EOF to the 24-bit quantity passed.

Table 1: *SOS file-management calls. When you use SOS file calls for reading or writing to your floppy disk, your applications programs do not have to take into account each drive's attributes.*

Text continued from page 448:

SOS_Write calls to write to a printer is readily discernible. For applications programs that print more than one page of data, the SOS interface is the method of choice.

SOS File Management

By using SOS file calls for reading and writing to block devices (i.e., floppy and hard disks), your applications program does not have to take into account the specific attributes of each hardware device. This allows you to write general-purpose programs that communicate to all block devices supported by SOS, including any devices to be supported in the future. Because only the SOS file structure is required to store and retrieve information, it's not necessary to write specialized software into an applications program to handle a floppy disk and another set of routines to control larger-capacity devices. This is managed by SOS at a level that is transparent to your Pascal program. The file-management calls available are described in table 1 and file-system error codes are listed in table 2 (page 482).

Helpful Hints

Because Apple III Pascal allows assembly-language reference parameters to bypass type-checking, you can use this feature to allow greater flexibility in defining output-parameter data types. For example, any Pascal data type can be passed as the argument to any reference parameter in these assembly-language routines. This lets the assembly-language routine overwrite whatever variable has been passed as a call by a reference parameter. A possible outcome is that you can easily pass the wrong variable to any reference parameter and have the assembly-language routine post the returned value in whatever data type you've just passed it.

In the Apple III Pascal system, a segment that contains external (i.e., assembly-language) routines is not allowed to cross any 32K-byte bank boundary. Therefore, the Pascal system may leave unusable holes in memory when loading units that contain assembly-language routines. The way to avoid this problem is to use the intrinsic unit SOS_IO in listing 1.

When compiling your main program, use the "{$NOLOAD+}" compile-time option as the first statement. Then, add a "{$R SOS_IO}" compile-time command after the main line's Begin statement. The Pascal interpreter will load the SOS_IO unit first, which allows your P-code-only Pascal program to cross any bank boundary that is encountered further along in the loading process.

Apple III Pascal consumes 1100 bytes of buffer space in the data space for each file that is opened, including any character device such as a printer or console. SOS, however, does not use the buffer passed on an open request (i.e., the SysBuf parameter in listing 1), unless the device is a block device. This means you can save considerable stack and heap space by using SOS to output to a printer or a console. Any variable (the integer I, for example) can be used as the SysBuf parameter when using the SOS_Open routine for a printer or the console. Note

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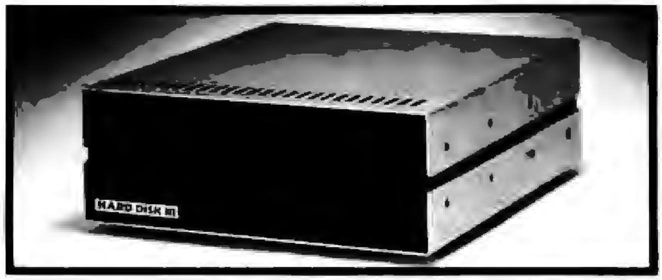

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Error Number	Error Message
32	Invalid request code
34	Invalid control parameter list
35	Character device not open
36	Device not available
37	Resource not available
44	Invalid byte count
45	Invalid block number
64	Invalid path-name syntax
65	Too many character files open
66	Too many block files open
67	Invalid file reference number
68	Cannot find the specified path name
69	Volume not found
70	File not found
71	Duplicate file name
72	Overrun error due to lack of disk space
73	Directory full
74	Incompatible file format
75	Unsupported storage type
76	Attempted read past end-of-file
77	File position out of range
78	Illegal access attempted
79	User's buffer too small
80	File busy
82	Not a SOS volume
83	Invalid value in list parameter
84	Out of memory for SOS system buffer
85	Buffer table full
86	Invalid system buffer parameter
87	Duplicate volume error
88	Not a block device. Only Open, Newline, Read, Write, and Close calls can reference a character file.
89	File level error
90	Invalid bit-map address found on volume

Table 2: *SOS file system errors.*

that a blocked-device SysBuf must be untouched and always available to SOS while the file is open. Because of that requirement, the usual scope rules for a Pascal file must be rigorously followed to keep Pascal from deallocating a SOS SysBuf before closing the file.

Although the file-handler routines in listing 1 are represented as an Apple III Pascal intrinsic unit, the declarations can alternatively be used piecemeal by suffixing an "External;" after each procedure declaration and compiling them along with any Pascal main program. However, a SOS_Data must always be included because all of the routines use it as the SOS parameter block-data area. Additionally, the following routines must be used in pairs, as they share code:

SOS_Set_Info and SOS_Get_Info
SOS_Read and SOS_S_Read
SOS_Write and SOS_S_Write
SOS_Get_B_Mark and SOS_Get_B_EOF
SOS_Set_B_Mark and SOS_Set_B_EOF
SOS_Get_Mark and SOS_Get_EOF
SOS_Set_Mark and SOS_Set_EOF

Linking the Pascal program with the assembled external routines would allow it to be run without having a SYSTEM.LIBRARY or program library on-line.

Conclusion

By using SOS_IO for file operations in your Apple III Pascal programs, you gain flexibility and power in addition to a considerable performance improvement. With a Pascal file, you always run the risk of crashing the program with "IO err: Volume not found" whenever an invalid device is specified in a Reset or Rewrite call. A SOS_Open request will not crash the program, but will instead return the appropriate error code if the path name cannot be located. The file type, modification date and time, as well as other attributes can be modified for every SOS file by means of a SOS_Set_Info call. Since the SOS_IO call communicates directly with SOS, no additional Pascal preprocessing takes place. Because of this, control characters are not expanded or translated into other characters. This feature not only reduces the amount of preprocessing, but reduces any potential anomalous effects generated whenever nondata characters are written out.

General-purpose applications programs are possible by using Pascal and SOS in combination.

The use of SOS_IO can also result in significant memory savings. The complete set of SOS_IO file-processing routines is slightly larger than 1K bytes of code. For each Pascal file opened by calling Reset or Rewrite, a mandatory 1K-byte buffer is reserved. Therefore, the entire SOS_IO package fits into the space saved using the SOS_IO to write to just one nonblocked device. Any Pascal application that deals with the Apple III only should consider using SOS_IO as a means to enhance performance and potentially realize some memory savings.■

References

1. *Apple III Owners Guide*. Cupertino, CA. Apple Computer Inc., 1981.
2. *Apple III Pascal: Introduction, Filer, and Editor*. Cupertino, CA: Apple Computer Inc., 1981.
3. *Apple III Pascal Program Preparation Tools*. Cupertino, CA: Apple Computer Inc., 1981.
4. *Apple III Pascal Programmer's Manual*, volumes 1 and 2. Cupertino, CA: Apple Computer Inc., 1981.
5. *Apple III Standard Device Drivers*. Cupertino, CA: Apple Computer Inc., 1981.
6. Scanlon, Leo J. *6502 Software Design*. Indianapolis, IN: Howard W. Sams & Co. Inc., 1980.
7. Zaks, Rodnay. *Programming the 6502*. Berkeley, CA: Sybex, 1978.

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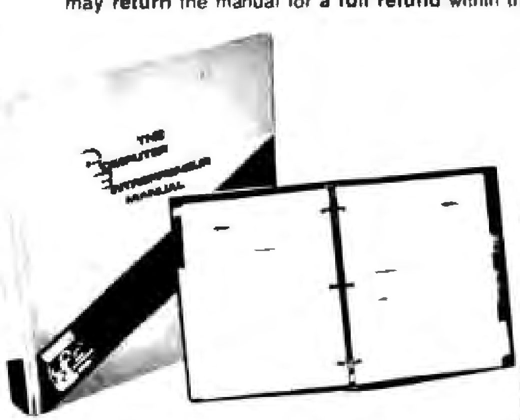

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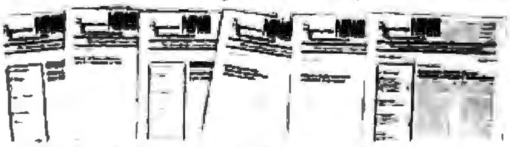

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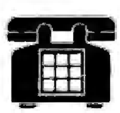

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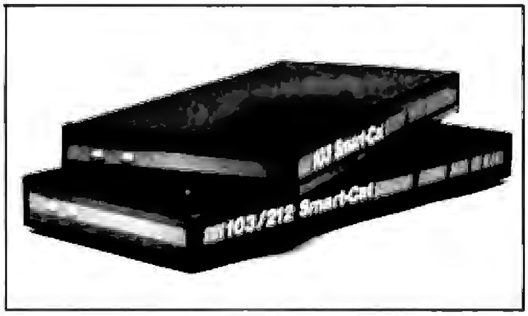

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Many single-board computers and microprocessor-evaluation kits are available that can serve as controller modules, but these are too large, overly powerful, and far too expensive for low-end controller applications. Also available now are a number of single-IC microcomputers (e.g., Intel 8048, Zilog Z8, Motorola 6805), but most of these are impractical for small-quantity designs because they incorporate on-chip mask-programmed ROM (read-only memory), thus the minimum order is several thousand units.

The few single-IC microcomputers with either on-chip EPROM (erasable programmable read-only memory) (e.g., Intel 8748, Motorola 68705) or with a "piggyback" socket (e.g., Zilog Z8-03) for a standard EPROM would be ideal as controllers for small-quantity applications because they contain a processor, RAM (random-access read/write memory), EPROM, I/O (input/output) lines, and a timer, all of which are essential for a general-purpose controller. Unfortunately these are still very difficult to obtain and not inexpensive enough to produce one-off controllers.

The aim of the design described in this article was to produce a very small, low-cost microcomputer module that would be suitable for a large number of controller applications, using only the most readily available components. The total cost of the module presented here is approximately $30.

The module consists of a 100- by 60-millimeter (mm) single-sided printed-circuit board with a 24-pin edge connector. The board accommodates a Motorola 6802 microprocessor, a 2716-type (+5-volt-only) EPROM, a 6820 (or 6821) PIA (peripheral interface adapter), a crystal-controlled clock circuit with a 60-Hz interrupt generator, and a +5-volt (V) power-supply regulator. Thus, the user has available 128 bytes of programmable memory, 2048 bytes of EPROM, 19 programmable I/O lines, and a source of real-time interrupts. All communication with external circuitry is through the 19 I/O lines. You can produce a powerful controller with this configuration. The complete circuit schematic of the module is shown in figure 1.

Circuit Description

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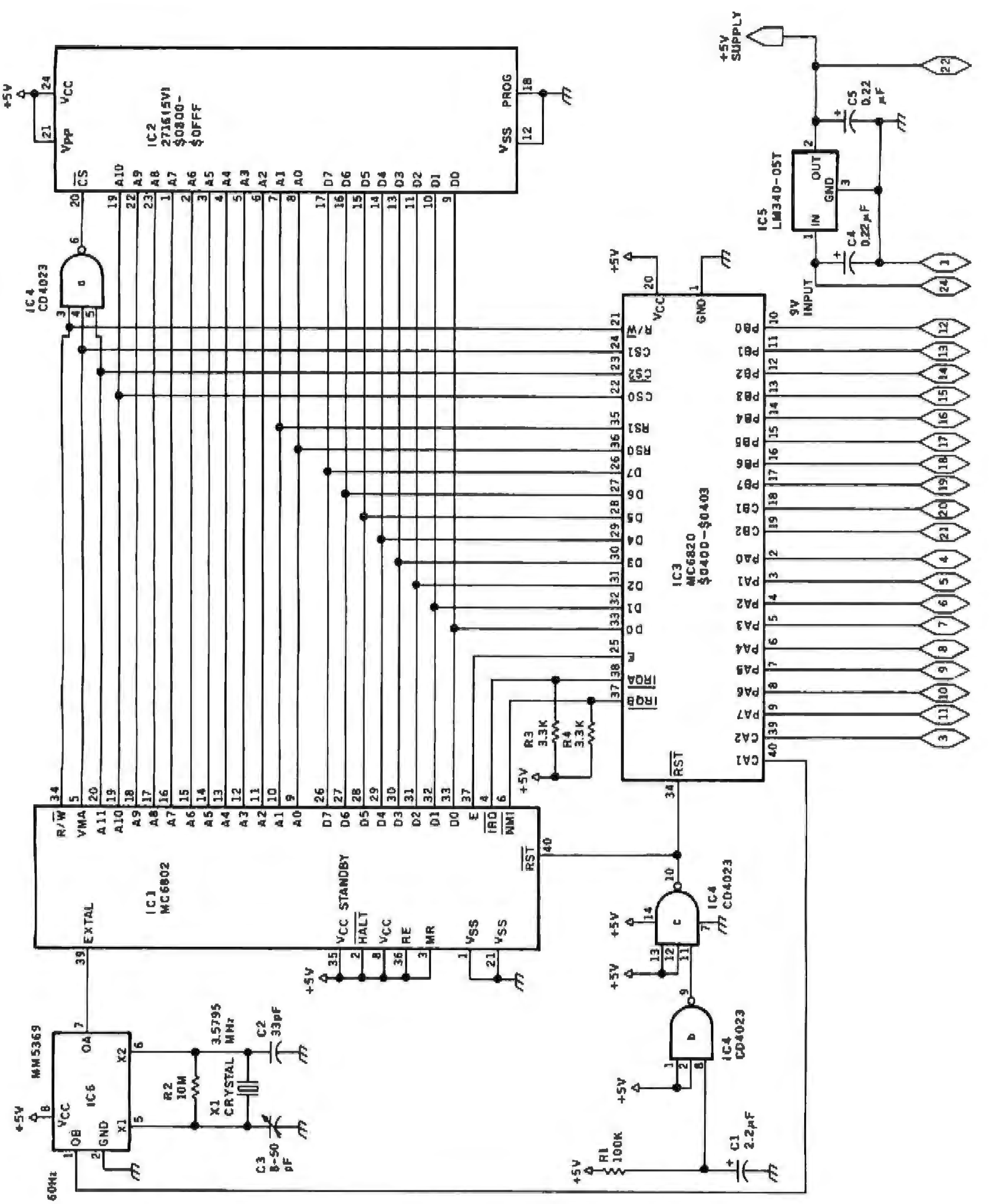

Figure 1: *Circuit diagram of the complete microcomputer module. The printed-circuit board is single-sided, and the main integrated circuits provide programmable memory, EPROM, I/O, and a counter. Other circuitry provides the system clock, a 60-Hz interrupt, and +5-V power regulation.*

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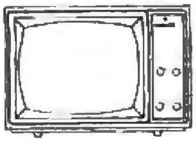

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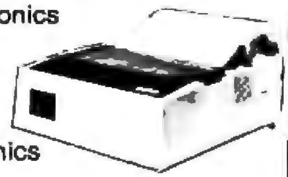

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required for "scratch pad" (memory for storage of temporary values).

For the controller to do useful work it must follow instructions stored in its memory. For program memory, the controller uses a 2716-type EPROM that can store 2048 bytes. The 2716 was chosen because it is readily available, currently costs approximately $6 in single quantities, and is easy to program and erase. The capacity of the 2716 allows storage of quite a lengthy machine-language program.

The module is designed to operate from an unregulated 9-V-DC power supply—easily obtained from a calculator-type AC adapter. Regulated +5 V DC for use by the module is obtained from IC5, a 7805 (or LM 340-T-5) three-terminal regulator. The +5-V supply is made available at the module's edge connector for use with associated interface circuitry. The module's current drain is approximately 250 milliamperes (mA), with the regulator being capable of supplying approximately 400 mA safely without a heat sink. (Care must be taken not to overload the regulator with too much extra circuitry.)

Although the MC6802 microprocessor itself has a built-in oscillator circuit requiring only an external crystal for operation, an external oscillator circuit is used. IC6 is a crystal oscillator with buffered output at the crystal frequency and incorporating a 17-stage frequency divider. With the 3.579545-MHz crystal used, which is an NTSC (National Television System Committee) television color subcarrier crystal, the frequency divider output is 60 Hz. This is connected to the CA1 input of the MC6820 PIA to provide a source of interrupts. This is very useful in controller applications to allow timing of operations without tying up the processor in software timing loops. The MC6802 divides the clock frequency by 4 internally, and so runs at 894,886 Hz—10 percent below the microprocessor's 1-MHz maximum allowable clock frequency.

The only reset facility provided for the module is a power-on reset. The combination of R1 and C1 buffered through two gates (b and c) of IC4

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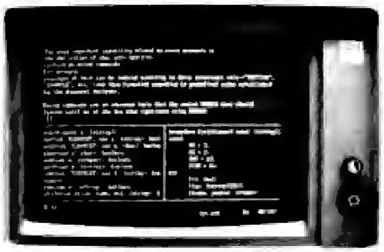

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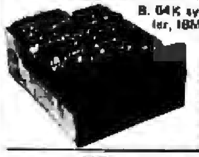

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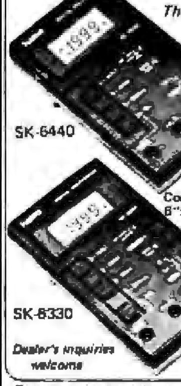

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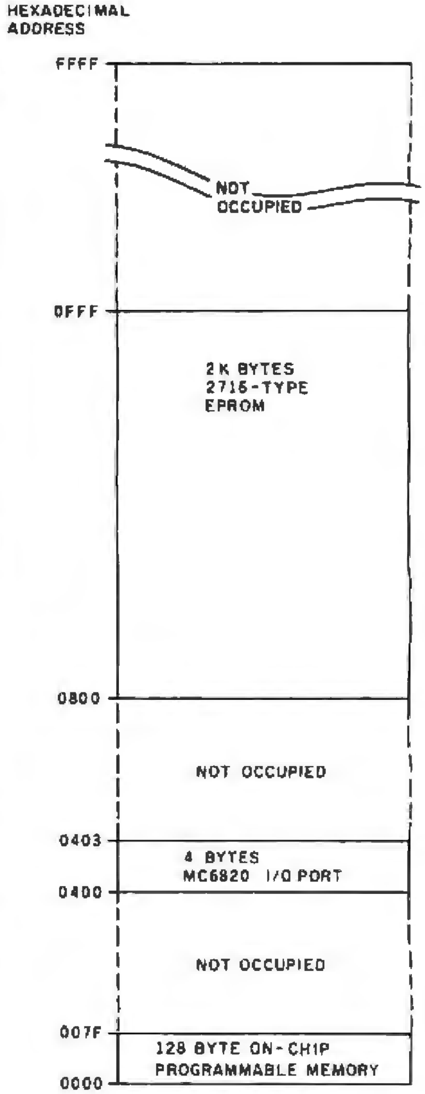

Figure 2: *Memory map of the module's address space. Unoccupied gaps are due to the simple decoding method that uses some address lines to directly enable the peripheral integrated circuits.*

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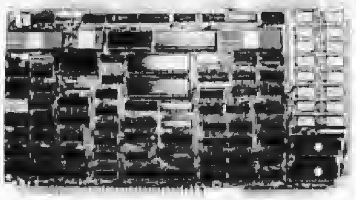

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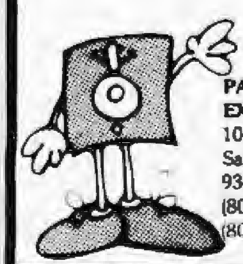

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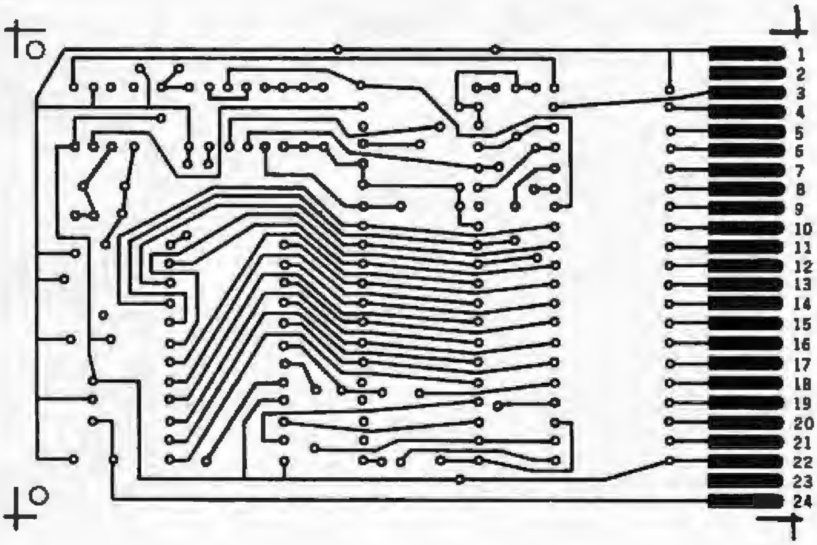

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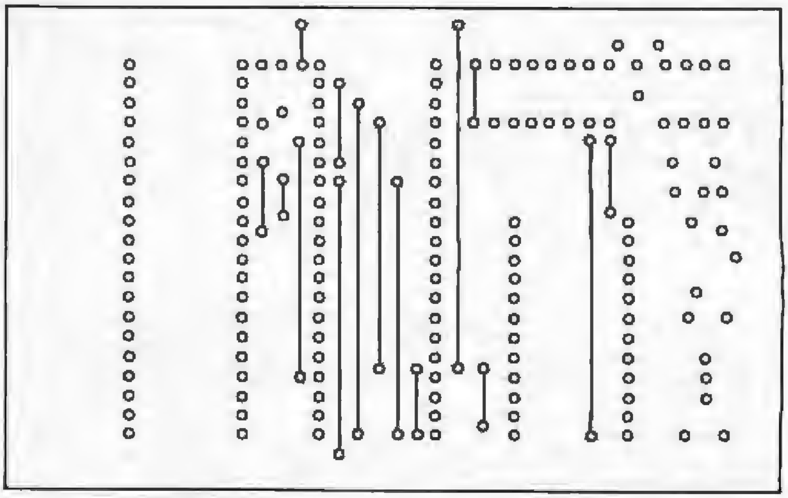

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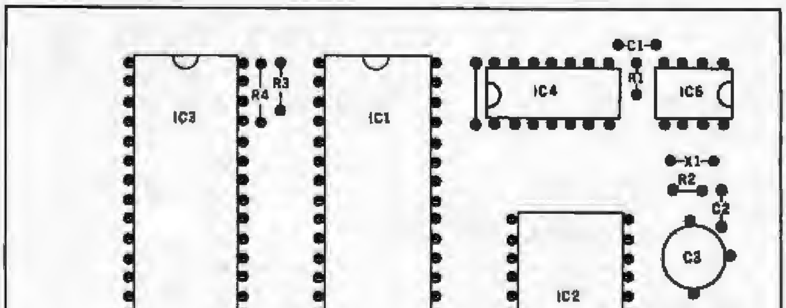

Figure 3: *Artwork for creating the printed-circuit board. Figure 3a shows the full-sized etching pattern for the single-sided board; figure 3b shows where to install wire jumpers on the component side of the board. Component placement is shown in figure 3c.*

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rate the RAM, EPROM, and I/O ports in the address space. There are a number of "don't care" address bits. (See figure 2 for a simple map of the address space.) The address-bus lines are not buffered and are not available for connection off the module.

The MC6820 PIA provides 16 I/O lines that are independently programmable as inputs or outputs. In addition, the MC6820 has 4 programmable control lines. One of these control lines, CA1, is used as the 60-Hz interrupt input. The other 3 control lines and the 16 I/O lines are available at the module's edge connector for interfacing the controller to external circuitry. All communication between the controller module and external circuitry is through these 19 I/O lines.

The Printed-Circuit Board

The printed-circuit board for the controller module measures 100 by 60 mm with a 24-pin edge connection (2.54-mm spacing). The board is single-sided to reduce costs. This necessitates a number of wire links on the component side of the board. The printed-circuit board, wiring link positions, and component overlay diagrams are shown in figure 3.

Prototype matrix boards of the same size, also with a 24-pin edge connection, are available from a number of suppliers. These matching boards are ideal for building interface modules for use with the controller module.

Software and Interface Hardware

The MC6802 processor uses an instruction set identical to the MC6800 processor. Any of the Motorola MC6800 development systems or evaluation kits are suitable for software generation. A Motorola D2 kit with 4K bytes of memory is very suitable because its address space covers the RAM and EPROM address space of the controller module. The user PIA of the D2 kit can be used to simulate the PIA on the controller module. The interface circuitry simply plugs into the user PIA, and all hardware and software debugging can be performed using the D2 kit.

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When the system is operating satisfactorily, the program can be transferred to EPROM and the controller module can replace the D2 kit.

Program alterations to allow software developed on a D2 kit to run on the controller module are minimal. The main program change required is to change the PIA address from hexadecimal 8004 through 8007 (for the D2 kit) to hexadecimal 0400 through 0403 for the controller module. This requires the change of only two bytes if all program references to the PIA use indexed addressing with the index register being loaded from a double-byte constant in memory each time it is used.

One other possible program change would be to use software loops to perform timing functions. The controller runs at an internal clock frequency of 894.886 kHz, compared with a D2 kit, for example, which runs at a clock frequency of 614.4 kHz. Adjustment of timing-loop execution times is simple if the loop counter is loaded from a constant in memory each time it is used. Then only a single memory constant need be altered, irrespective of the number of times it is used.

A number of standard interface modules can also be produced to cope with the most common interface requirements. From an $8 calculator I have designed and built an interface module for use with a 24-key keypad and an 8-digit, 7-segment LED (light-emitting diode) display. I have also built a module (costing approximately $4) that can be configured as a 7-bit A/D (analog-to-digital) or D/A (digital-to-analog) converter. As a D/A converter, the module uses only two PIA lines, and as an A/D converter, only three PIA lines. Relay drivers, lamp drivers, and switch inputs are easily implemented.

Standard software routines can be used to drive the standard interface modules and provide other commonly used software functions, e.g., a real-time clock driven by the 60-Hz interrupt source. This allows a wide range of different controllers to be produced with relatively little effort by mixing and matching standard hardware and software modules.■

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News and Speculation about Personal Computing

Conducted by Sol Libes

Random Rumors: Casio Computer is *rumored* readying a personal computer that costs $63. It will be introduced in Japan. . . . Expect a price cut on the Sinclair ZX81 if sales begin to falter as they did in England when the new Sinclair color Spectrum computer was introduced. . . . Look for Panasonic to introduce a $300 personal computer in February. . . . IBM may soon begin production of the PC outside the U. S. with a goal of producing over 1 million units next year. . . . Apple is expected to introduce an Ethernet interface for the Apple III. It has reached an agreement with 3Com Corporation to purchase $3.6 million worth of network interfaces. . . . Both Televideo and Applied Digital Data Systems will come out with low-cost color display terminals shortly. . . . Honeywell is presumed to be ready to market a personal computer using the Victor 9000 machine. . .

Predictions for 1983: In past years, it has been my practice to make some predictions for the coming year in my December column. In looking back at my predictions made last year and in prior years, I am surprised at how many have come true . . . typically over 85 percent. So, let me stick my neck out once again and make some predictions for 1983.

First, I predict that 1983 will be the year of the true portable computer. Osborne having shown the way, you can expect Radio Shack, Apple, and IBM to introduce portable personal computer systems. I assume that they will fit into a briefcase, have flat-panel displays, microfloppy drives, and built-in direct-connect modems. They will also use CMOS (complementary metal-oxide semiconductor) circuits operable from small, low-cost batteries; hence, they will be true portable systems. Expect them to have CMOS RAM (random-access read/write memory) with battery backup rather than bubble memory. Watch for the Japanese to attack this market next year.

Second, I predict that the personal computer market will divide into several separate and distinct markets with three or four suppliers dominant in each. Thus, we will see diverse markets ranging from consumer computers selling for $60 to $70, to home word-processing computers going for $1000–$2000, to small-business computers in the $3000–$5000 price range, workstations in local networks selling for $5000–$8000, and multiuser systems ranging from $7000 to $10,000. No one supplier will dominate more than one market, so we can plan on several dozen successful manufacturers and probably well over a hundred different personal computer system makers.

Third, following from that prediction, is the prospect that the number of new personal computer systems coming to market will probably be at the staggering rate of almost one per working day. Look for one-third of them to come from Japan.

Fourth, systems with separate, cableless, radio-linked keyboards will flourish—no more connecting cables getting in the way. And, I hope, manufacturers will make a concerted effort to standardize keyboard layouts. Also, I predict that several manufacturers will add voice input/output that acts as an aid to, rather than a replacement for, keyboards. Voice output should be the next big feature added to low-cost personal computers.

Fifth, don't be surprised to see IC modem chips capable of operating at 9600 bps (bits per second) and possibly as high as 19,200 bps.

Sixth, I await the introduction of erasable optical memory systems for microcomputers capable of storing up to 100 megabytes on a single disk.

Seventh, the microfloppy and micro Winchester drives will start replacing minifloppy and mini Winchester drives in personal computers. Within two or three years, microfloppies and micro Winchesters should be the dominant storage systems on personal computers.

Eight, expect arcade video games where the player actually gets into the game. For example, a flight simulator that actually gives the player a feeling of movement, acceleration, and of really flying a spaceship, with voice recognition that will respond to such commands as "Fire one!" and "Blast off!"

Apple Doings: Looks as if Apple has decided to introduce the Apple II-E this January. Unless, of course, the company decides to make changes again. Rumor has it that Apple planned to introduce the new Apple II replacement in September and initiated a special sale price to clear out inventory. But sales increased to the point where Apple decided to continue producing the Apple II for another few months and do some further design work on the II-E. Over the summer, several software houses received prototypes of the II-E so that they could get a head start on applications software development. It is rumored that the II-E will not be completely software-compatible with its predecessor.

Apple's 68000-based workstation, called Lisa, is reportedly out on beta test with several potential corporate customers. Rumor has it that units are being used in a local-network configuration.

Apple disclosed that it has won injunctions against four more Hong Kong-based makers of alleged imitation Apple II computers. Also, the U. S. Customs Service has reportedly begun confiscating and destroying imitation Apples arriving at ports in the U. S. It has been estimated that as many as 20 companies are making about 5000 Apples a month with retail prices as low as $200. Compare that to the U. S. price of $1200 to $1400.

Continuing to tighten up its sales/distribution organization, Apple has cancelled central purchasing agreements with two more independent retail chains, Compushop in Richardson, Texas, and The Computer Store (TCS) in Sudbury, Massachusetts. Compushop and TCS outlets will now have to buy equipment directly from Apple at standard dealer prices. The reason given was the same as in the previous cases of Computerland and Xerox: the sales organizations refused to let

Apple dictate where new stores could be opened.

Former Mail-Order Dealer Sues HP: Computer Place Inc., Carmel, California, has filed an antitrust suit against HP (Hewlett-Packard) alleging that the company is stopping mail-order distribution of personal computer and calculator products. Computerland was named as a codefendant. Computer Place alleges that HP stopped supporting dealer national advertising and refused to make available its new HP-86 personal computer to dealers who would not support local customers. It also claims that this action forced it out of business. It is interesting to note that a similar action filed against Apple Computer by three of its former mail-order dealers was dismissed.

Price War Develops: Atari and Commodore have accelerated the low-end personal computer price war with discounts on software, peripherals, and even basic units. This is in response to Texas Instruments' $100 rebate program. Atari is offering coupons good toward the purchase of software, while Commodore has reduced the base price of its VIC-20. The result is that both the VIC-20 and TI-99/4A can now be purchased for well under $200. I have seen both units being offered by stores in my area for under $180. It is likely that Tandy will soon reduce the price of its Color Computer.

At these prices, personal computers are close to the selling prices of computer games and are beginning to affect game sales. (Speculation is that this is why Atari is offering games coupons instead of a price reduction.) The dealer cost for a computer is now down around $150; however, dealers rely on sales of software and peripherals to make a profit. Commodore is boasting that it is now producing 70,000 VIC-20s a month and, even with the $150 dealer price, is still making a healthy profit on each unit shipped. The question is how this will affect sales of Commodore's soon to be released Max game machine, which will carry a $179 price tag.

In the meantime, the Timex/Sinclair 1000 (aka the Sinclair ZX81 with 2K-byte RAM), selling at just under $100 and already being discounted, is taking sales away from Texas Instruments, Atari, and Commodore in nationwide chains such as K-Mart.

This price war is upsetting to several Japanese companies who were planning to offer low-end computers. NEC, which planned to introduce its PC-6000 with a $450 price, is now going through a redesign to eliminate features and reduce the price. Also, NEC is rumored to be designing a very low cost machine to compete with the VIC-20. Matsushita's Panasonic subsidiary, which had already disclosed that it planned to retail two computers, the JR-100 and JR-200, in early 1983 with prices in the $300 range, has postponed introduction until summer as these products go through redesign. Sanyo, however, expects to begin selling a machine next August that will compete with the Timex/Sinclair.

The price war is undeniably making it difficult for new companies to enter the low-end marketplace. And those that do plan to enter are being thrown off balance as to pricing and timing of their entries.

Software Marketing Changing: Did you know that more than 150 new programs are marketed each month? It's getting like the record and book publishing industries. Word-processing programs, for example, already number more than one hundred, and the competition is becoming intense.

Software suppliers trying to establish brand names are providing slick packages for their products. The plain plastic sandwich bags will soon be a thing of the past, as software packages look more and more like record packages. In addition, suppliers are upping ad budgets and increasing promotional efforts, all of which serves to jack up the retail price.

But purchasers often have had trouble getting programs to work properly. Suppliers are finally beginning to face the problem by offering service with the product. For example, Peachtree Software now provides 30 days of free consultation with its software.

Currently, about half of all software is purchased via mail order. However, some experts are betting that this will shift to stores that will sell software much as record shops sell records: customers can walk in and see a demonstrations of the software packages before they buy.

Unix On 8-Bit Systems: We see an awful lot of promotion for Unix-like systems on 16-bit computers, particularly 68000-based machines. However, it is worth noting that Unix-like systems are also available on 8-bit machines. For example, several suppliers of 6809-based systems are furnishing the Uniflex operating system from Technical Systems Consultants (Chapel Hill, North Carolina). Also, Morrow Designs, located in Richmond, California, offers its Micronix operating system for the Z80-based Decision I.

Both of these systems offer multiuser, multitasking capability with file management nearly identical to that of Unix. They use a shell that includes I/O redirection, pipes, and many other Unix-like features.

Motorola Announces 68000 Enhancements: Motorola has announced that next year it plans to make available several new versions of its 16-bit 68000 microprocessor. Prototypes of some of these new parts are already being tested by potential customers.

First, Motorola will market a reduced-bus version called the 68008. It will have an external 8-bit data bus and reduced address space (1 megabyte), come in a 48-pin package, and operate with 6800 peripheral chips.

Next will be the 68010, a virtual-machine version of the 68000. It will be able to recover control of the machine after memory faults, so it can be used in a demand-paged environment. Virtual-memory support improves the 68000's ability to handle multiuser systems.

Last will be the 68020, a full 32-bit version of the 68000. It will have a 32-bit-wide data bus and an instruction cache memory. Consequently, it will run programs two to four times faster than the 68000.

IBM Aims To Fit A 370 Into A 68000: According to a technical paper that appeared in a recent issue of IBM's *Journal of Research and Development*, researchers at IBM's Endicott, New York, facility are attempting to recode Motorola 68000 microprocessors to implement the functions of an IBM System/370. The 16-bit 68000 microprocessor was selected because it is microcoded and has seventeen 32-bit general-purpose registers. The full 370 would require about four times the microcode capability of the current 68000; however, the hope is that within a few years a 370 will be encoded into one 68000. In the meantime, the research group intends to partition the 370 architecture among a number of 68000s, which will communicate over a local bus and share common local storage.

Japanese Adopt U.S. Software: More and more Japanese personal computer systems are being introduced in the U. S., but the surprising thing is that they are using American software rather than Japanese-made software. For example, Hitachi, NEC, and Panasonic will soon introduce systems using Microsoft's MS-DOS operating system, while Sony, Mitsubishi, Sanyo, and Hitachi are using the CP/M operating system from Digital Research. Hitachi will use both the MS-DOS and CP/M disk operating systems.

Not only are Japanese companies contracting with U. S. firms to supply operating systems, they are also looking to them for languages and applications programs. Structured Systems Group, for example, has signed contracts to provide its accounting software for several Japanese computers.

Atari And Lucasfilms Enter Joint Venture: Atari has announced the formation of a new company with Lucasfilms (creator of *Star Wars, The Empire Strikes Back*, and *Raiders of the Lost Ark*). Each firm has an equal share of the new venture. The first product will be a video game based on *Raiders of the Lost Ark*.

Getting Robots To Walk: Currently, mobile robots get around on wheels or tank-like tracks. But research is under way at Carnegie-Mellon and Ohio State universities to develop walking robots. Although humans take walking for granted, it is a highly complex task fraught with such problems as balance and coordination of many sequences of joint and leg movements.

It is hoped that computers can be taught to cope with this problem. The walking robot being developed at Carnegie-Mellon will have six legs. This work is being funded by the Defense Department. Work on walking robots is also being done in Japan and the Soviet Union.

Artificial Intelligence News: The introduction of the Motorola 68010 upgraded 16-bit microprocessor and the recent use of the LISP language for writing applications programs may lead to the use of AI (artificial intelligence) techniques in applications programming. LISP has long been the language of the AI community. Although there have been a few implementations of LISP on 8-bit machines, they have had very limited performance, and anyone doing serious AI work was forced to use large minicomputers. This, however, appears to be changing.

For example, the University of Pittsburgh has developed "Internist 1," which, in a test at Massachusetts General Hospital in Boston, proved almost as capable at diagnosing some diseases as physicians. Although currently running on a very large computer, this program is now being transported to run on several 68000-based microcomputers. Also, Cognitive Systems Inc., an offshoot of the Yale artificial-intelligence lab, has developed programs for stockbrokers, paralegals, accountants, and tax advisors that are already running on the 68000-based Apollo computer (Apollo Computer Inc., North Billerica, Massachusetts).

Current 68000-based systems that are large enough to support these LISP programs, such as the Apollo, cost in the $40,000 range. However, the introduction of the Motorola 68010 and the National Semiconductor 16032 is expected to soon reduce these costs to the $20,000 to $30,000 range. Xerox has already announced a LISP machine, called Dandelion, which it expects will sell for under $30,000.

Japanese Attack Disk-Drive Market: Apple Computer recently switched from Shugart to Alps Electric Ltd. drives, and DEC (Digital Equipment Corporation) and Tandy have awarded Teac the contract for supplying 5¼-inch drives for their new personal computers. These signs indicate that the Japanese have become much more aggressive in pursuit of OEM (original equipment manufacturer) floppy-disk drive contracts.

The greatest Japanese penetration of the floppy-disk market is anticipated in the half-height and microfloppy arenas. NEC and Mitsubishi have already entered the half-height market, which is currently dominated by Tandon. OEM prices of half-height double-sided 8-inch drives are already down in the $370 area. The greatest competition should be in the half-height 5¼-inch drive area, where Alps, Qume, and Teac are expected to start shipping drives to compete against Tandon and Shugart. Competition in the microfloppy arena should develop in late 1983 when more companies start shipping these drives. Presently, Sony appears to be the leader in the microfloppy area. For example, Sony has already signed a contract to supply Hewlett-Packard with 3½-inch microfloppy drives that can store 437.5K bytes. Sony is rumored to be ready to announce a double-sided version of its drive.

The Japanese are also expected to make major inroads into the Winchester-drive marketplace. Currently, some 75 percent of this market is in the hands of Seagate and Tandon with Shugart, Control Data, Quantum, Priam, and Mircopolis sharing the remainder.

Computer Store Franchises: I have a friend who owns two computer stores, plans to soon open a third, and employs more than two dozen people. Six years ago when he started his little retail operation in his basement, it was open only nights and weekends. Those days are gone.

Today, opening a computer store usually means buying a franchise. Generally, this requires an initial fee ranging from $15,000 to $45,000, depending on location, and that's followed by a monthly royalty fee that may be 5 to 6 percent of gross sales. In addition, you may be hit with a cooperative advertising fee, which is typically 1 to 3 percent of gross sales. Nonpayment of these fees, failure to to comply with the franchisor's rules and regulations for running the store, or unauthorized transfer of the franchise to another person can result in loss of the franchise.

The franchisor usually provides plans and specifications for store construction as well as training, supervision, and education of the franchisee's employees. The franchisor will provide advertising and purchasing of products and supplies at advantageous prices.

Franchising experts today estimate that opening a franchised computer store requires a minimum of $200,000 capital to be successful.

IEEE For Software Engineering Standards: The Institute of Electrical and Electronics Engineers (IEEE) has organized a Software Engineering Standards Committee with several working groups. The purpose is to create standards, guides, and recommended practices for software engineering. The working groups are concerned with areas ranging from software quality assurance to a recommended practice for the Ada programming language. For more information on these groups, contact Fletcher J. Buckley, RCA, Moorestown, NJ 08057, (609) 778-3606.

Graphics Standards Emerging: Digital Equipment Corporation, Intel Corporation, and Tektronix have announced that they will adopt and support the North American Presentation Level Protocol Syntax (NAPLPS) and Virtual Device Interface (VDI) standards for creating and transmitting computer-graphics images. NAPLPS and VDI are currently being evaluated by the American National Standards Institute X3L2 and X3H3 committees, respectively.

IBM To Conduct Education Test: IBM is lending 300 personal computers with voice output, color graphics, and a programmed series of exercises designed to teach reading and writing to selected schools as part of a test. For example, to teach writing, the computer will show a child a picture of a cat and then will ask the child to spell "cat" while helping him find the right letters by lighting areas in both phonic and regular alphabets.

Taxi Dispatching Going Digital: The dispatching of taxis via voice radio may soon be a thing of the past. Several Canadian taxi companies have switched from voice-radio dispatching to computerized radio dispatching. The taxis are equipped with a video display and keyboard.

Here's how it works: a driver enters information as to which zone he is in or headed for, whether the cab is empty, etc. The central computer then sends a message as to where to pick up the next ride. No other driver gets the call, so no one can try to beat the cabbie to the fare, which sometimes happens with voice dispatching. With computerized dispatching, companies are claiming that they can now handle as many as 500 cabs per channel whereas before the limit was about 150. Who knows, maybe they will let the passengers play Pac-Man on the system between pick-up and destination.

Computers Being Sold Door-to-Door: Two companies are already selling personal computers door-to-door, via phone, or through small Tupperware-party-like gatherings. Tronics Marketing Corporation, Houston, Texas, claims to have nearly 10,000 door-to-door salesmen in 50 states selling Texas Instruments personal computers. The Dallas-based Dynasty Computer Corporation claims that it has 2300 "distributors" selling a private-label system. Both companies have set up pyramid-type sales organizations in which distributors enlist sales agents to do the actual selling.

On The Business Side: Tandy reported that for the fiscal year that ended June 30, 1982 revenues were up 21% to more than $2 billion. Earnings increased over 32% to more than $224 million. Most of this gain was due to a 72% increase at Tandy's computer operations. Tandy estimates that its computer business now accounts for about 31% of its total revenues, or approximately $640 million. This makes Tandy far and away the largest manufacturer of personal-computer systems.

Vector Graphic posted a $252,000 loss for the last quarter of the year on a 10% decline in sales. Sales for the year, however, were up almost 45% to over $36 million compared with 1981 sales of $25 million. The decrease in the fourth quarter was blamed on dealers holding off ordering in anticipation of the introduction of a new computer system and an inventory theft of $600,000 worth of merchandise.

Random News Bits: Intel has reduced the price of its 8087 mathematics processor integrated circuit from $320 (1000-unit quantity) to $150, and prices are expected to drop further next year. Intel has been shipping the 8087 since December 1981. . . . Scopex Instruments Ltd. (Pixmore Ave., Letchworth, Hertfordshire, England) has introduced an oscilloscope with a flat liquid-crystal display screen. . . . Siemens A.G. (Munich, West Germany) has announced an experimental 14-inch, flat, high-resolution color screen CRT (cathode-ray tube) that can display 28 lines of 80 characters. . . . Human Computing Resources Corporation in Toronto, Canada, has begun work on transporting Unix System III to National Semiconductor's 16032 microprocessor. . . . Phosphor Products Ltd., Poole, Dorset, England, is reportedly developing a compact flat-panel videotex terminal. . . .

Quotation Of The Month: "Because of the nonproprietary software and limited distribution [of the PC], IBM has not only invited in Japanese competition, but has handed over a large portion of the market to the Japanese on a silver platter." John Roach, President, Radio Shack, *Computer Update Magazine*, July/August 1982

MAIL: I receive a large number of letters each month as a result of this column. If you write to me and wish a response, please include a self-addressed, stamped envelope.

Sol Libes
POB 1192
Mountainside, NJ 07092

Clubs and Newsletters

Attention: Doctors

The *Medical Computer Journal* has reviews of medical hardware and software, news of the latest developments in the medical field, and features on the uses of computers in laboratories and offices. It is published six times a year. The annual cost is $25 for individuals and $35 for libraries, institutions, and overseas mailings. For further information, write to the Medical Computer Journal, 42 East High St., East Hampton, CT 06424, or call (203) 267-2934.

Count on ABACUS

The Atari Bay Area Computer Users Society (ABACUS) welcomes anyone in the San Francisco area who wishes to attend monthly meetings and subscribe to its newsletter. The newsletter is accepting informative articles and short programs. ABACUS is also willing to trade newsletter subscriptions with other user groups. Contact ABACUS through Dave Mentley, POB 325, El Cerrito, CA 94530.

Listen to This

Voicenews is published 10 times a year to report the latest news concerning speech-synthesis and speech-recognition technology. The annual subscription rate is $95 in the U. S. and $120 overseas. Write the editor at POB 1891, Rockville, MD 20850, or call (301) 424-0114.

Attention: Lawyers

The Lawyer's Microcomputer is a monthly newsletter written specifically about practical applications of the TRS-80 in the law office. Research on printer quality, choosing software, and how to finance a computer are all included in the first issue. Yearly subscriptions are $28 (U. S.), $37 (Canada), and $43 (foreign). For more information, write Rose T. Wilkins, R. P. W. Publishing Corp., POB 1046, Lexington, SC 29072, or call (803) 359-2077.

Last Call for Clubs and Newsletters Directory

To be included in the fifth edition of the BYTE Clubs and Newsletters Directory, your club or publication must supply the following information.

1. *name of organization or publication*
2. *mailing address*
3. *contact person and telephone number*
4. *name of newsletter or publication*
5. *special interests*

Send your information to Clubs and Newsletters Directory, BYTE/McGraw-Hill, POB 372, Hancock, NH 03449.

Sorcim's Newsletter

Sorcim Corporation's newsletter *Supernews* is designed to provide user-friendly information for new users of Sorcim products. Published quarterly, *Supernews* includes articles on template-building and computer shows. New products, update policies, and customer support columns are featured. Suggestions for articles are welcome. For further information, contact Supernews, Sorcim Corp., 405 Aldo Ave., Santa Clara, CA 95050, or call (408) 727-7634.

Atari Group in the Berkshires

The Berkshire Users Group (Atari) of Berkshire County, Massachusetts, is a support group for owners of Atari 400 and 800 personal computers. BUG(A) meets on the second Saturday of each month. Members would like to exchange newsletters and information with other user groups. For more information write BUG(A), POB 593, Great Barrington, MA 01230, or call (413) 528-1438 or 528-0744.

Active Club in Finland

The 1800 Users Club of Finland meets monthly in Helsinki. Members engage in hardware and software competitions and produce a newsletter. Group members also receive a free subscription to a Finnish electronics magazine. We seek contact with other clubs. Send a self-addressed envelope to Richard Eller, 1800 Users Club, POB 559, 00101 Helsinki 10, Finland.

Newsletter Swapping

The Central Florida Computer Society (CFCS) publishes a newsletter, *Bussline*, containing information on various users groups, hardware and software reviews, and buy-sell-swap ads. CFCS members would like to swap monthly newsletters with other like-minded clubs. Send your newsletter to CFCS Inc., 2821 Sunset Dr., Apopka, FL 32703.

TRS-80 Users Meet in LA

The TRS-80 Model I Users Group of West Los Angeles meets on the last Tuesday of each month. All users are invited to attend and exchange ideas and public-domain software. For more information, write Mike Miller, 10210 Woodbine St. -1, Los Angeles, CA 90034, or call (213) 836-4103.

Welcome in Wichita

In Wichita, Kansas, a Commodore VIC-20 Users Club meets monthly to exchange the latest news and public-domain programs. Anyone is welcome. For the current meeting time and a copy of the newsletter write to Walter Lounsbery, 739 Litchfield, Wichita, KS 67203, or call (316) 262-4861.

Stay Up to Date with Eagle News

Eagle Computer, manufacturer of desktop computers for small businesses, produces *Eagle News*, a monthly newsletter. *Eagle News* contains the latest information about Eagle computers, trade shows, software news, and new products. For your copy, contact Eagle Computer Inc., Building C, 983 University Ave., Los Gatos, CA 95030, (408) 395-5005. ■

Ask BYTE

Conducted by Steve Ciarcia

Magnetic-Tape Standard

Dear Steve,

I built an FSK (frequency-shift keyed) cassette interface for my homebrewed 8080-based microcomputer. Do you know of a standard or frequently used format for recording data on magnetic tape? I want my system to be compatible with commercial software.

Michael D. Zahorik
New Berlin, WI

One of the problems with the personal computer industry is its lack of standards. A format known as the Kansas City Standard is used on many 8080-type systems. This standard, named after the location of the conference that established it, uses 1200 Hz to indicate a 0 and 2400 Hz to indicate a 1. These frequencies were chosen to be compatible with the bandwidth and frequency response of typical cassette recorders. With the homebrew FSK system for your computer and this information, you should have no trouble with compatibility. . . . **Steve**

Increasing Line Counts

Dear Steve,

In the March 1982 BYTE, you responded to a letter about high-speed printers (see "High-Speed Printers," page 442). You stated that the IBM laser printer is capable of 1800 lpm (lines per minute); however, IBM claims 1000 pages in 6 minutes, or approximately 11,000 lpm (almost 6 times as fast as 1800 lpm).

Charles Gawthrop
Wilmington, DE

Thank you very much for your letter. I have received many responses to the decimal point error that crept into that Ask BYTE answer. The correct number should have been 18,000 lines per minute, and even that is not its maximum speed.

From IBM's literature, the following calculations can be made: "allows printing at either 6, 8, or 12 lines per inch. . ." . . . "can process, for example, 1000 11-inch-long pages in approximately 6 minutes of continuous printing, regardless of the number of lines per page."

Now, 11 inches/page × 12 lines/inch = 132 lines/page
1000 pages/6 minutes = 166.67 pages/minute
166.67 pages/minute × 132 lines/page = 22,000 lines/minute

In reality, with 6 or 8 lines per inch and 66 lines per page, the effective number of lines per minute will be less. . . . **Steve**

No Joy in Stickville

Dear Steve,

I own an Atari 800, and I have been disappointed in the performance of Atari's joysticks. They are not accurate and don't always make a good electrical connection.

I have been trying to build my own using momentary switches to make the five connections needed for motion and firing. Do you know where I can buy the appropriate female plug needed for the Atari? Also, do you have any suggestions for building a joystick, or do you know any companies making better-quality Atari-compatible joysticks?

Thanks for your help. Your articles are great.

Louis Yelgin
Malden, MA

The connector used on the rear of the Atari for the joysticks is a 9-pin Type D subminiature. It's available from many of the mail-order houses that advertise in BYTE; look for Priority One Electronics and California Digital ads in any issue.

Wico, a company that manufacturers parts for arcade games, makes a deluxe version of the Atari joystick. It is large, solidly built, and has a trigger button on top of the stick, as well as one in the normal position. Order the Command Controller Joystick (part number: 15-9714) from Wico, 6400 West Grosse Point Rd., Niles, IL 60648, (312) 647-7500. . . . **Steve**

Shielding TV from Interference

Dear Steve,

I recently purchased the disk drive for the TRS-80 Color Computer. Since adding this device, I have experienced an annoying amount of interference on my television set. The drive's manual came with a flier warning that this problem might be present in some of the earlier machines and, if that was the case, you should return the computer to a service center for additional shielding.

I would prefer to make the modifications that might be necessary myself. Could you please give me an idea of what could correct this problem.

Thanks for whatever help you can give.

Richard D. Fothergill
Pittsfield, MA

The interference that you are experiencing with the TRS-80 Color Computer disk drive is probably caused by radiation from the cable that connects the drive to the computer. The cable is acting as an antenna, and to eliminate the radiation, it must be shielded. My article in the January 1981 BYTE, "Electromagnetic Interference" (page 48), describes the sources of electromagnetic interference and how to cure them.

Wrapping the disk-drive cable in several layers of aluminum foil and grounding the foil to the computer should be beneficial. But frankly, if Radio Shack has a free fix, I would let the service center do it. It will be neater and may help the resale value of the computer at some later date. . . . **Steve**

Chess Program for Home Brewers

Dear Steve,

I'd like to buy a chess-playing program for my computer. My problem is that I don't have a standard personal computer but two home-built systems. One is 6809-based, with keyboard and video display. The other is Z80-based, with 32K bytes of memory and plenty of space for 2716-type EPROMs (erasable programmable read-only memories).

I'd like to know how to change an existing chess program so that it could be run on my Z80-based computer and so that the input and output can be done through the 6809 computer, allowing it to process all communication with a human opponent.

I'm planning to use dot graphics to display the chessboard and a light pen to make moves. This means I must know the hexadecimal locations of the chess program's I/O routines and how the parameters are passed. Further, I need to know the cassette format used for storing the program. I think any cassette format can be read by a little hardware and software. A Z80 PIO (parallel input/output integrated circuit) is provided in the Z80 system.

Matti Kassi
Vantaa, Finland

The easiest way to get a chess program on your Z80 computer is to get a copy of the book Sargon—A Computer Chess Program, *by Dan and Kathe Spracklen, and start typing. It is published by Hayden Publishing Company and is available from TSE Hardside (6 South St., Milford, NH 03055) for $15.95 plus shipping. It contains complete documentation for all of Sargon's algorithms and a program listing in Z80 assembly language. With the information provided, you can tailor the program to fit any Z80 machine with 8K bytes of memory. Block diagrams and an index to subroutines are also included. All you need is the patience to type it in.* . . . **Steve**

Sorting Out Computer Languages

Dear Steve,

I've learned a great deal from reading your answers in Ask BYTE. Now, I would like to have an answer to a question that deals with a comparison of programming languages.

Obviously, no one language is best. I assume they vary in a number of ways, such as ease or difficulty in learning, ease in debugging, efficiency in run time and in memory space, etc. And, of considerable importance, some languages lend themselves better for certain types of applications. I would very much like to find something—a book perhaps—that sets forth a comparison of all the major languages—giving their characteristics and especially the facility with which they lend themselves to various uses. Can you tell me where I can find such a comparison?

Donald W. Kearney
Martinsburg, WV

An informative and timely article on the comparison of computer languages appeared in the December 1981 Popular Electronics *magazine, beginning on page 40. "Computer Language Confusion. . .Sorting It Out," by Stanley S. Veit, discusses computer languages so as to provide an understanding of what is available and to help you choose the most appropriate one for a particular application.* . . . **Steve**

Full ASCII Codes Transmittable

Dear Steve,

I own an Apple II Plus system and a Hayes Microcomputer Products Micromodem II. For some time now, I have been searching for software or hardware that will permit me to transmit both uppercase and lowercase ASCII (American Standard Code for Information Interchange) codes to another computer system (namely, a PDP VAX-11/70 with a Unix operating system). I have been unable to find anything of moderate price (say, $100 to $200) that will allow me to do this. If you can give me any advice, I sure would appreciate it.

Thanks.

Michael T. Conley
Albuquerque, NM

The best program for you to use is Visicorp's Visiterm. With Visiterm, your Apple II Plus becomes an on-line terminal with the ability to define keyboard macro instructions, define your own character set, and transfer Applesoft or Integer BASIC listings or text or binary files over a standard phone line. It is designed to work with the Micromodem and it automatically displays uppercase and lowercase on the screen.

Visiterm has a suggested retail price of $100 and is available from local dealers and Visicorp, 2895 Zanker Rd., San Jose, CA 95134, (408) 942-6000. My answer sure sounds like a commercial, but I've seen this program and can highly recommend it. . . . **Steve**■

In "Ask BYTE," Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to:

Ask BYTE
c/o Steve Ciarcia
POB 582
Glastonbury CT 06033

If you are a subscriber to The Source, chat with Steve (TCE317) directly. Due to the high volume of inquiries, personal replies cannot be given. Be sure to include "Ask BYTE" in the address.

Software Received

Apple

Advanced System Editor, a screen-oriented text editor for the UCSD Pascal system. The editor provides all common word-processing features, including copy, delete, find, search, and replace. For the Apple II; floppy disk, $175. Volition Systems, POB 1236, Del Mar, CA 92014.

The Big Math Attack, a tutorial game covering basic mathematics problems. The object is to solve a simple equation before it reaches the bottom of the screen. The more equations you solve, the faster they drop. For the Apple II; floppy disk and cassette, $25 and $20, respectively. Thesis, POB 147, Garden City, MI 48135.

Bipolar Psychological Inventory, a multidimensional personality test. This program administers, scores, and interprets test results and prints a report with norm, profile, and significant items. For the Apple II; floppy disk, $250. Diagnostic Specialists Inc., 1170 North 660 W, Orem, UT 84057.

Corral I.0.1, a cost-return analysis program for beef producers and related industries. Provides a complete breakdown and report of all costs and expenses. For the Apple II; floppy disk, $150. Applied Micro Systems, RR 3, Box 309-B, Leavenworth, KS 66048.

Crazy Mazey, an arcade-type game. Within the intricate maze are secret hordes of cash. Find the cash and run for your life. Killer cars will try to stop you in the 19 levels of the maze. For the Apple II; floppy disk, $29.95. Datamost, 9748 Cozycroft Ave., Chatsworth, CA 91311.

Crush, Crumble, and Chomp, a simulation game that lets you become the monster you always longed to be. This game allows you to design your own monster and let it loose on a city where it feeds on human tidbits. For the Apple II; floppy disk, $29.95. Epyx/Automated Simulations, POB 4247, Mountain View, CA 94040.

The Curse of Crowley Manor, an adventure-type game. What starts out as a simple homicide investigation changes into a descent into the world of the occult. Solve the mystery or face the gates of Hades. For the Apple II; floppy disk, $29.95. Adventure International, POB 3435, Longwood, FL 32750.

Death Race 82, an arcade-type game. You must escape from the killer robots in the Death Squad Cars by piloting your turbocar through the 10 levels of the maze. Destroy robots and increase your score. For the Apple II; floppy disk, $29.95. Avant-Garde Creations, POB 30160, Eugene, OR 97403.

Diskovery, a disk-utility package. Examine, edit, and store information on any track or sector of a disk. Recover, alphabetize, and purge any files on a disk. Other utilities included. For the Apple II; floppy disk, $59.95. Micro Mantic Computer, 541 Northeast McWilliams Rd., Bremerton, WA 98310.

Double Check, a checkbook balancer and money-management program. Establish up to 100 expense categories, and this program will sort all expenses and provide you with a total for tax deductions. For the Apple II; floppy disk, $49.95. Computer Tax Service, POB 7915, Incline Village, NV 89450.

Eliminator, an arcade-type game. You must protect your energizers on the planet surface from the 15 waves of attacking alien spacecraft. Destroy the aliens to increase your score. For the Apple II; floppy disk, $29.95. Adventure International (see address above).

Federation, an arcade-type game. You must wipe out the merciless invading Drorn Drones. Develop the correct strategy to skillfully deploy your Federation spacecraft. For the Apple II; floppy disk, $29.95. Avant-Garde Creations (see address above).

Graphic Writer, a program that lets you print your own character sets. Features provided include underline, boldface, large and small letters, and the ability to use inverse print with most word-processing programs and printers. For the Apple II; floppy disk, $54.95. Computer Station Software, 11610 Page Service Dr., St. Louis, MO 63141.

Laf Pak, four arcade-type games: Creepy Corridors, Apple Zap, Space Race, and Mine Sweep. Each game requires a different tactic to win. For the Apple II or II Plus; floppy disk, $34.95. Sierra On-line Inc., 36575 Mudge Ranch Rd., Coarsegold, CA 93614.

Lazermaze, an arcade-type game. To resolve interstellar conflicts, a single combat game has been developed. Accurately fire your laser at the alien and your planet could win the war. For the Apple II Plus; floppy disk, $29.95. Avant-Garde Creations (see address above).

Marauder, a two-level arcade-type game. You must descend to the alien planet's surface through a rain of laser fire and torpedoes. Once on the ground, you must destroy the central computer, which is guarded by robots. For the Apple II or II Plus; floppy disk, $34.95. Sierra On-line Inc. (see address above).

Mars Cars, an arcade-type game. There are tales of a great treasure on Mars, but it's guarded by an ancient defense system. If you can destroy the dreaded Mars Cars, the treasure is yours. For the Apple II; floppy disk, $29.95. Datamost (see address above).

The Mask of the Sun, an adventure-type game. You are an archaeologist and treasure-hunter seeking the fabulous Mask of the Sun, a gold artifact. But there's this curse. For the Apple II; floppy disk, $39.95. Ultrasoft Inc., 24001 Southeast 103rd St., Issaquah, WA 98027.

Mission Impossible, a graphics adventure game. You must save the world from nuclear disaster by deactivating the world's first automated nuclear reactor. The game has full-color graphics. For the Apple II; floppy disk, $29.95. Adventure International (see address above).

Oil Rig, a simulation where you try to become a tycoon by buying, selling, and drilling for oil. Manipulate the price of oil with purchases and trades, while ruthlessly acquiring wealth. For the Apple II; floppy disk, $29.95. Computer Programs Unlimited, 9710 24th Ave. SE, Everett, WA 98204.

The Printographer, a high-resolution printing utility that allows you to dump a picture from the disk to any dot-matrix or daisy-wheel printer. The utility comes configured for most printers. For the Apple II; floppy disk, $49.95. Southwestern Data Systems, 10761-E Woodside Ave., Santee, CA 92071.

Serpentine, an arcade-type game. You control one serpent in your quest to destroy all the evil serpents. You must outwit, outmaneuver, and eat the evil serpents to win the game. For the Apple II; floppy disk, $34.95. Broderbund Software, 1938 Fourth St., San Rafael, CA 94901.

Succession, a maze-type

game. Your creature, the Masher, must get all the creatures with numbers on their bodies into the correct order within the specified time limit. Four levels of difficulty. For the Apple II or II Plus; floppy disk, $29.95. Piccadilly Software Inc., 89 Summit Ave., Summit, NJ 07901.

Test Writer, a program that produces multiple-choice tests of any length from a pool of questions developed by the user. Its automated index card system is useful for almost any subject. For the Apple II Plus; floppy disk, $35. Persimmon Software, 502 C. Savannah St., Greensboro, NC 27406.

Tic Tac Show, a multiplayer question-and-answer game program. You can enter your own questions and answers to develop a computer-assisted instruction game. Several different subjects can be stored on disk. For the Apple II; floppy disk, $19.95. Computer Advanced Ideas, Suite 341M, 1442 A Walnut St., Berkeley, CA 94709.

The Tool, a business-applications program generator. This package handles all screen editing, field formatting, and entry validation. Includes a database manager and a report generator. Configured for use with BASIC. For the Apple II; floppy disk, $395. High Technology Software, 2201 Northeast 63rd St., POB 14665, Oklahoma City, OK 73113.

Tunnel Terror, an arcade-type game. You are given three ships, and you must shoot down the center of the tunnel to prevent the enemy from destroying you. This game has 61 levels for up to four players. For the Apple II; floppy disk, $29.95. Adventure International (see address above.)

The Wreck of the B. S. M. Pandora, a simulation game. You assume the role of a crewman trying to save your shipmates, a cargo of dangerous alien creatures, and your ship from a fatal accident. For the Apple II; floppy disk, $50. Apple Computer Inc., 10260 Bandley Dr., Cupertino, CA 95014.

Atari

Airstrike, an arcade-type game. Fight your way through the alien cavern as you shoot or dodge missiles and bombs. Destroy the alien fighters as you traverse through the levels of the fortress. For the Atari 400 and 800; cassette, $39.95. English Software Co., POB 3185, Redondo Beach, CA 90277.

Legionnaire, a real-time simulation game. Control the forces of the Roman Legions as you battle the Gaulish barbarians. The game features high-resolution graphics and sound. For the Atari 400 and 800; cassette, $35. Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214.

Pirate Adventure, a high-resolution adventure-type game. In this game, you attempt to go from your London flat to Treasure Island as you search for the long-lost treasure of Long John Silver. For the Atari 400 and 800; floppy disk, $39.95. Adventure International, POB 3435, Longwood, FL 32750.

Preppie, an arcade-type game. You must retrieve golf balls from the world's toughest golf course, the Nasty Nine, or cease to be a preppie. For the Atari 400 and 800; floppy disk, $29.95. Adventure International (see address above).

Sentinel, an arcade-type game. Your mission is to destroy the enemy's missile silos while protecting your cities from the incoming missiles. You must also destroy the strategic bombers and alien intruders. For the Atari 400 and 800; floppy disk, $29.95. Med Systems Software, POB 3558, Chapel Hill, NC 27514.

Soccer, an arcade-type game. This game uses high-resolution graphics to produce a real-time simulation of the game of soccer. Two, three, or four players can control opposing teams. For the Atari 400 and 800; floppy disk, $29.95. Gamma Software, POB 25625, Los Angeles, CA 90025.

Text Editor, a line-oriented text editor. This simplified editor can be used as a word processor or as an editor for BASIC programs. Character line length is limited to 128 characters. For the Atari 400 and 800; floppy disk, $25. Softcenter Industries, 26 Country Ridge Rd., Pomona, CA 91766.

Atari VCS

Barnstorming, an arcade-type game. Pilot your biplane through barns, over windmills, and around flocks of geese. The object is to get the quickest time for flying over the course. For the Atari VCS (video computer system); cartridge, $31.95. Activision, Drawer 7286, Mountain View, CA 94042.

Berzerk, an arcade-type game. You are trapped in a series of electric mazes. If you touch the walls, you will be destroyed. To get out, you must dodge or shoot the robot guards. For one player. For the Atari VCS; cartridge, $31.95. Atari Inc., 1196 Borregas Ave., POB 427, Sunnyvale, CA 94086.

Chopper Command, an arcade-type game. You control a chopper that's guarding a convoy of trucks delivering medical supplies. You must destroy the attacking enemy aircraft with your missiles. For the Atari VCS; cartridge, $31.95. Activision (see address above).

Defender, an arcade-type game. You must defend the Earth from attack by alien ships. Destroy the bombers, swarmers, landers, and mutants. For the Atari VCS; cartridge, $37.95. Atari Inc. (see address above).

Dragster, an arcade-type game. Race your dragster against another car and the clock. Your joystick becomes the clutch, gearshift, and gas pedal. For the Atari VCS; cartridge, $22.95. Activision (see above address).

Frogger, an arcade-type game. The object is to get your frog across the road, over the river, and home. For the Atari VCS; floppy disk, $30. Parker Brothers, POB 1012, Beverly, MA 01915.

Grand Prix, an arcade-type game. Control a Grand Prix race car and maneuver your vehicle around the course. The game features high-resolution graphics and sound. For one player. For the Atari VCS; cartridge, $31.95. Activision (see address above).

Ice Hockey, an arcade-type game. You control your forward player to shoot the puck into the opposition's goal or defend your own goal. Game has automatic scorekeeping and timing. For one or two players. For the Atari VCS; cartridge, $31.95. Activision (see address above).

Kaboom, an arcade-type game. The mad bomber is dropping bombs from a high wall. You must catch the bombs in buckets of water. For one player. For the Atari VCS; cartridge, $22.95. Activision (see address above).

Laser Blast, an arcade-type game. You must destroy the invading aliens by blasting them with your laser. The longer you play, the more difficult the game becomes. For one player. For the Atari VCS; cartridge, $22.95. Activision (see address above).

Megamania, an arcade-type game. You must shoot down the alien objects, which include celestial dice, spinning bow ties, flying widgets, and hostile hamburgers. For one player. For the Atari VCS; cartridge, $31.95. Activision (see address above).

Pitfall, an arcade-type game. Hidden in the jungle are several treasures. You must swing through trees, jump over bottomless pits, and journey through underground passages. For one player. For the Atari VCS; cartridge, $31.95. Activision (see address above).

Skiing, an arcade-type game. Step onto the slopes for a skiing experience that ranges all the way from the beginner's slope to an Olympic downhill run. Beat your best time. For one player. For the Atari VCS; cartridge, $22.95. Activision (see address above).

Starmaster, an arcade-type game. You are in the cockpit of a starfighter. Your mission is to defend your starbase from attacks and to search out and destroy the enemy's fighters. For one player. For the Atari VCS; cartridge, $31.95. Activision (see address above).

Star Wars: The Empire Strikes Back, an arcade-type game. Based on the popular film, this game pits the Rebel Snowspeeders, controlled by the player, against the Imperial Walkers on the ice planet Hoth. For one or two players. For the Atari VCS and the Sears Video Arcade; cartridge, $30. Parker Brothers (see address above).

Tennis, a graphics simulation game. You can rush the net, play the baseline, or roam the court in this version of tennis. The game provides automatic scorekeeping. For one or two players. For the Atari VCS; cartridge, $22.95. Activision (see address above).

Volleyball, an arcade-type game. This simulation of volleyball follows standard rules. The game uses setups and spiking. For one or two players. For the Atari VCS; cartridge, $26.95. Atari Inc. (see address above).

CP/M

CP+, a user-friendly program that replaces CP/M commands with English-language "menus," messages, and directions. It provides you with a software print spooler, help option, and other functions. For CP/M-based systems; floppy disk, $150. Taurus Software, Suite 815, 870 Market St., San Francisco, CA 94102.

Compare for CP/M-80, a utility program that locates and documents the differences between two text files. The files may be text or source-code files for programs in assembler, BASIC, PL/I, or other languages. For CP/M-based systems; floppy disk, $105. Solution Technology Inc., Suite 218, 1499 West Palmetto Park Rd., Boca Raton, FL 33432.

MAG/base3, a database applications-development system. You can design a database to your own specifications for any application. This system includes password protection and entry and edit functions. For CP/M-based systems; floppy disk, $795. Micro Applications Group, Suite 205, 20201 Sherman Way, Canoga Park, CA 91306.

Micro-WYL, a line-oriented text editor. This program performs all the standard text-editing functions, including moving and copy text within a document, global search and replace, and copying external files. For CP/M-based systems; floppy disk, $25. Realworld Software Inc., Suite 103, 913 South Fourth St., DeKalb, IL 60115.

PROMUtil, a utility for programming, reading, verifying, and editing EPROMs (erasable programmable read-only memories). Designed for use with the SD Systems' PROM 100 S-100 programmer board, the program can work with 2708, 2716 and 2732 EPROMs. For CP/M-based systems; floppy disk, $70. Concise Datacom Systems Inc., 1503 Pear Tree Lane, Bensalem, PA 19020.

UAPLink, a telecomputing file-transfer program. Designed specifically for Digital Equipment Corporation's VT18X computer, this program features data compression, file protection, and global transfer commands. For VT18X computers running CP/M; floppy disk, $250. Unique Automation Products, Suite L, 17922 Sky Park Circle, Irvine, CA 92714.

Heath

Exterminator, an arcade-type game. As the Exterminator, your job is to wipe out the anthropod eggs before they hatch into deadly carnivorous creatures. For one player. For the H89, Z-90, and H8/H19; floppy disk, $19.50. Evryware, POB 60802, Sunnyvale, CA 94088.

Key-Wiz, a multikeyword database-management program. This program operates as a file of "index cards" and will search a file for a particular keyword. Save up to 300 entries of 60 lines each. For the H89; floppy disk, $19.95. Interactive Micro Systems, POB 21007, Columbus, OH 43221.

IBM Personal Computer

Friendlyware PC Introductory Set, a set of programs for novices. Includes games, utilities, and business applications. The user's manual explains the workings of the computer. For the IBM Personal Computer; floppy disk, $49.95. Friendlysoft Inc., 213 Pebblebrook, Arlington, TX 76014.

Highcalc, a highway design and construction utility package. It calculates the cut and fill amounts required for highway construction. For use by contractors and engineers. For the IBM Personal Computer; floppy disk, $195. Softov Consultants, Suite R102, 360 Bloor St. E, Toronto, Ontario, M4W 3M3, Canada.

Pairstat, a statistics program used to evaluate and present paired data. Statistical results can include R square, standard deviation, beta, plot of residuals, and mean. For the IBM Personal Computer; floppy disk, $150. Davell Custom Software, POB 4162, Cleveland, TN 37311.

Supercref, a BASIC language cross-referencing program. This program will display a list of all variables or commands used in a program and the line-number references. It can output information to printer or disk. For the IBM Personal Computer; floppy disk, $25. The Write Ring, 5050 Garford #160, Long Beach, CA 90815.

Intellivision

Las Vegas Poker & Blackjack, a set of graphics simulation games. You can play four different card games: five or seven card stud, draw poker, or blackjack. The program keeps track of all bets and winnings. For one player. For the Intellivision Master Component; cartridge, $29.97. Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250.

Space Spartans, an arcade-type game featuring voice output. The game pits you against an invading alien fleet. You must protect your starbases from attack. The game requires the Intellivoice voice-synthesis module. For the Intellivision Master Component; cartridge, $45. Mattel Electronics (see address above).

Star Strike, an arcade-type game. You must defend the Earth from attack by an alien space station. Shoot the alien fighters and bomb the targets to win the game. For one player. For the Intellivision Master Component; cartridge, $34.97. Mattel Electronics (see address above).

TRS-80

Crush, Crumble, and Chomp, a simulation-type game (see description under Apple). For the TRS-80 Models I and III; floppy disk, $29.95. Epyx/Automated Simulations, POB 4247, Mountain View, CA 94040.

Dunzin, an adventure, fantasy role-playing game. You start the game as a novice warrior. Your quest is to enter the dungeon and obtain various treasures. For one player. For the TRS-80 Models I and III; floppy disk, $29.95. Med Systems Software, POB 3558, Chapel Hill, NC 27514.

Halls of Time, an arcade-type game. Your ship is trapped in a giant maze. There is only one exit, and you must find it before you run out of energy. The game features three-dimensional graphics. For the TRS-80 Model III; floppy disk and cassette, $27.95 and $23.95, respectively. Mops Computer Systems Inc., POB 26416, Austin, TX 78755.

The Institute, an adventure-type game. The game scenario has you trapped in a mysterious asylum. You are apparently sane, but your fellow inmates are not. You must try to escape by solving various problems. For the TRS-80 Models I and III; floppy disk, $19.95. Med Systems Software (see address above).

Laser Defense, an arcade-type game. You are in control of the United States' strategic laser defense satellites. You must intercept the incoming missiles with the laser beams. For one player. For the TRS-80 Models I and III; floppy disk, $18.95. Med Systems Software (see address above).

Sea Dragon, an arcade-type game. You are the commander of a nuclear submarine. Your mission is to destroy an undersea nuclear reactor. But watch out for the depth charges, mines, and other dangers. For the TRS-80 Models I and III; floppy disk, $24.95. Adventure International, POB 3435, Longwood, FL 32750.

Star Trap, an arcade-type game. The object of this game is to destroy all the bouncing stars in the time allotted. Stars are captured by opening the grid beneath them. For one or two players. For the TRS-80 Models I and III; floppy disk, $17.95. Med Systems Software (see address above).

Subterranean Encounter, a graphics adventure-type game. You must solve both strategic and word puzzles. There are alligators in the moat, a sorcerer, and a knight. For one player. For the TRS-80 Models I and III; floppy disk, $29.95. Toucan Software, 4024 Canonero Court, Fair Oaks, CA 95628.

ZX81

Artist, a graphics development program. You can create your own graphics using the 30 commands in this program. Draw, erase, move, copy, and save your graphics. You can also define commands. For the Timex Sinclair 1000 and ZX81 (16K RAM); cassette, $10. Ksoft, 845 Wellner Rd., Naperville, IL 60540.

Krakit, an adventure and treasure hunt game. The game gives you 12 clues. If you discover the answer to all the clues, you'll learn how to claim the $20,000 in prize money from the publishers. For the Timex Sinclair 1000 and ZX81; cassette, $19.95. International Publishing & Software, POB 1654, Buffalo, NY 14216.

Meteorites, an arcade-type game. Your ships must shoot the meteorites or be destroyed. You have the full mobility of your ship and can fire in any direction. For one player. For the Timex Sinclair 1000 and ZX81; cassette, $14.95. Softsync Inc., POB 480, Murray Hill Station, New York, NY 10156.

Red Alert, an arcade-type game. You must attack the alien fuel dumps that are located in a mountainous region and protected by enemy fighters. For one player. For the Timex Sinclair 1000 and ZX81; cassette, $14.95. Softsync Inc. (see address above). ■

This is a list of software packages that have been received by BYTE Publications during the past month. The list is correct to the best of our knowledge, but it is not meant to be a full description of the product or the forms in which the product is available. In particular, some packages may be sold for several machines or in both cassette and floppy-disk format; the product listed here is the version received by BYTE Publications.

This is an all-inclusive list that makes no comment on the quality or usefulness of the software listed. We regret that we cannot review every software package we receive. Instead, this list is meant to be a monthly acknowledgment of these packages and the companies that sent them. All software received is considered to be on loan to BYTE and is returned to the manufacturer after a set period of time. Companies sending software packages should be sure to include the list price of the packages and (where appropriate) the alternate forms in which they are available.

Books Received

Apple Pascal: A Programming Guide, Allen B. Tucker, Jr. New York: Holt, Rinehart & Winston, 1982; 247 pages, 18.5 by 23.2 cm, softcover, ISBN 0-03-059547-9, $17.95.

Apple Pascal Games, Douglas Hergert and Joseph T. Kalash. Berkeley, CA: Sybex, 1981; 371 pages, 17.2 by 22.3 cm, softcover, ISBN 0-89588-074-1, $14.95.

Applying Computers in Social Service and Mental Health Agencies, Simon Slavin, ed. New York: The Haworth Press, 1982; 195 pages, 16.4 by 23.4 cm, hardcover, ISBN 0-86656-102-1, $30.

BASIC for Business, Douglas Hergert. Berkeley, CA: Sybex, 1982; 223 pages, 17.5 by 22.6 cm, softcover, ISBN 0-89588-080-6, $12.95.

BASIC for Business, For the TRS-80 Model II & III, Alan J. Parker. Reston, VA: Reston Publishing, 1982; 277 pages, 17.4 by 23.3 cm, softcover, ISBN 0-8359-0352-4, $14.95.

COBOL, George Jackson. Blue Ridge Summit, PA: Tab Books, 1982; 290 pages, 12.6 by 20.7 cm, softcover, ISBN 0-8306-1398-6, $9.95.

Comparative Studies in Software Acquisition, Steven Glaseman. Lexington, MA: Lexington Books, 1982; 131 pages, 16.4 by 23.3 cm, hardcover, ISBN 0-669-05422-4, $18.95.

Computer Architecture and Organization, Theodore H. Meyer. Beaverton, OR: Dilithium Press, 1982; 333 pages, 13.8 by 21.8 cm, softcover, ISBN 0-918389-55-X, $16.95.

Computers and Man, 3rd edition, Richard C. Doft. San Francisco, CA: Boyd & Fraser Publishing, 1982; 500 pages, 16.4 by 23.4 cm, softcover, ISBN 0-87835-121-3, $16.95.

Data Communications for Microcomputers, Elizabeth A. Nichols, Joseph C. Nichols, and Keith R. Musson. New York: McGraw-Hill, 1982; 264 pages, 15 by 22.5 cm, softcover, ISBN 0-07-04680-4, $16.95.

80 Practical Time-Saving Programs for the TRS-80, Charles J. Carroll. Blue Ridge Summit, PA: Tab Books, 1982; 252 pages, 12.6 by 20.7 cm, softcover, ISBN 0-8306-1293-9, $9.95.

FORTRAN Programs for Scientists and Engineers, Alan R. Miller. Berkeley, CA: Sybex, 1982; 320 pages, 17.4 by 23.2 cm, softcover, ISBN 0-89588-082-2, $15.95.

Fundamentals of Interactive Computer Graphics, J. D. Foley and A. Van Dam. Reading, MA: Addison-Wesley, 1982; 664 pages, 16.5 by 24 cm, hardcover, ISBN 0-201-14468-9, $34.95.

The Guide to DP Training Courses: Descriptions of Over 300 Programs and Workshops, Roger Sullivan, ed. Amherst, MA: Human Resource Development Press (22 Amherst Rd.), 1982; 358 pages, 29 by 26 cm, spiral binder, ISBN 0-914234-61-7, $95.

The HP-IL System: An Introductory Guide to the Hewlett-Packard Interface Loop, Gerry Kane, Steve Harper, and David Ushijima. Berkeley, CA: Osborne/McGraw-Hill, 1982; 106 pages, 18.5 by 23.3 cm, softcover, ISBN 0-931988-77-2, $16.99.

Illustrated Computer Science Dictionary for Young People, Donald D. Spencer. Ormand Beach, FL: Camelot Publishing, 1982; 128 pages, 15.2 by 22.7 cm, softcover, ISBN 0-89218-053-6, $8.95.

Implementing BASICs, How BASICs Work, William Payne and Patricia Payne. Reston, VA: Reston Publishing, 1982; 210 pages, 16.4 by 23.4 cm, hardcover, ISBN 0-8359-3045-9, $21.

An Introduction to Process Control and Digital Minicomputers, Peter L. Ginn. Houston, TX: Gulf Publishing Co., 1982; 291 pages, 16.4 by 23.4 cm, hardcover, ISBN 0-87201-180-1, $26.95.

Literary Machines, Ted Nelson. Swarthmore, PA: Theodore Holm Nelson Publisher, 1982; 125 pages, 21.6 by 22.8 cm, softocver, ISBN-none, $15.

Microprocessor Operating Systems, volume 1, John Zarrella, ed. Suisun City, CA: Microcomputer Applications (POB E), 1981; 155 pages, 14.9 by 22.7 cm, softcover, ISBN 0-935230-03-3, $12.95

Microcomputer Systems, Ivan Flores and Christopher Terry. New York: Van Nostrand Reinhold, 1982; 288 pages, 15.6 by 23.5 cm, hardcover, ISBN 0-442-26141-1, $22.50.

A Micro-PROLOG Primer, 2nd edition, K. L. Clark, J. R. Ennals, and F. G. McCabe. London, England: Logic Programming Associates Ltd., (36 Gorst Rd.) 1982; 130 pages, 14.7 by 20.8 cm, softcover, ISBN-none, $17.

Modeling and Simulation on Microcomputers, Lance A. Leventhal, ed. La Jolla, CA: Simulation Councils Inc. (POB 2228), 1982; 120 pages, 21.6 by 27.9 cm, softcover, ISBN-none, $20.

101 Microprocessor Software and Hardware Projects, Frank P. Tedeschi and Gary Kueck. Blue Ridge Summit, PA: Tab Books, 1982; 294 pages, 12.6 by 20.7 cm, softcover, ISBN 0-8306-1333-1, $8.95.

119 Practical Programs for the TRS-80 Pocket Computer, John Clark Craig. Blue Ridge Summit, PA: Tab Books, 1982; 298 pages, 12.6 by 20.7 cm, softcover, ISBN 0-8306-1350-1, $9.95.

Pascal Implementation, Compiler and Assembler/Interpreter, S. Pemberton and M. C. Daniels. New York:

Halsted Press, 1982; 82 pages, 16.4 by 23.4 cm, hardcover, ISBN 0-470-27325-9, $64.95

Pascal Implementation, The P4 Compiler, S. Pemberton and M. C. Daniels. New York: Halsted Press, 1982; 172 pages, 16.4 by 23.4 cm, hardcover, ISBN 0-470-27325-9, $64.95.

Pascal Programming Structures for Motorola Microprocessors, George W. Cherry. Reston, VA: Reston Publishing, 1982; 359 pages, 17.4 by 23.2 cm, softcover, ISBN 0-8359-5471-4, $15.95.

PL/I Programming Problems and Applications, David T. Barnard and Robert G. Crawford. Reston, VA: Reston Publishing, 1982; 216 pages, 17.4 by 23.2 cm, softcover, ISBN 0-8359-5554-0, $10.95.

A Practical Guide to Word Processing and Office Management Systems. Merrimack, NH: Digital Equipment Corp., 1982; 117 pages, 13.6 by 21.4 cm, softcover, ISBN-none, $5.

Problem Solving and Comprehension, 3rd edition, Arthur Whimbey and Jack Lockhead. Philadelphia, PA: The Franklin Institute Press, 1982; 343 pages, 15.2 by 22.6 cm, softcover, ISBN 0-89168-048-9, $10.95.

Problem Solving and Structured Programming in WATFIV, Frank L. Friedman and Elliot B. Koffman. Reading, MA: Addison-Wesley, 1982; 527 pages, 16.4 by 23.4 cm, softcover, ISBN 0-201-10482-2, $16.95.

Software Reflected, Robert L. Baber. New York: Elsevier Science Publishing Co., 1982; 210 pages, 16.4 by 23.4 cm, hardcover, ISBN 0-444-86372-9, $29.95.

Teletext and Videotex in the United States, J. Tydeman, H. Lipinski, R. Adler, M. Nyhan, and L. Zwimpfer. New York: McGraw-Hill, 1982; 314 pages, 19.5 by 24.1 cm, softcover, ISBN 0-07-000427-7, $30.

The Third Book of Ohio Scientific, S. Roberts. Pomona, CA: Elcomp Publishing (POB 1194), 1982; 127 pages, 13.6 by 20.8 cm, softcover, ISBN 3-921682-77-0, $7.95.

TRS-80 Data Communications Systems, Frank J. Derfler Jr. Englewood Cliffs, NJ: Prentice-Hall, 1982; 159 pages, 17.4 by 23.2 cm, softcover, ISBN 0-13-931220-X, $12.95.

UCSD Pascal: A Beginner's Guide to Programming Microcomputers, J. N. P. Hume and R. C. Holt. Reston, VA: Reston Publishing, 1982; 346 pages, 17.4 by 23.2 cm, softcover, ISBN 0-8359-7913-X, $12.95.

User-Designed Computing, Louis Schlueter Jr. Lexington, MA: Lexington Books, 1982; 145 pages, 16.4 by 23.3 cm, hardcover, ISBN 0-669-05377-5, $17.95.

Your Atari Computer: A Guide to Atari 400/800 Personal Computers, Lon Poole, Martin McNiff, and Steven Cook. Berkeley, CA: Osborne/McGraw-Hill, 1982; 458 pages, 16.4 by 23.4 cm, softcover, ISBN 0-931988-65-9, $16.95. ■

This is a list of books received at BYTE Publications during this past month. Although the list is not meant to be exhaustive, its purpose is to acquaint BYTE readers with recently published titles in computer science and related fields. We regret that we cannot review or comment on all the books we receive; instead, this list is meant to be a monthly acknowledgment of these books and the publishers who sent them.

Event Queue

December 1982

December
Information Management and Technology Seminars, various sites throughout the U.S. Among the wide variety of seminars offered by Datamation Institute are "Financial Management's Use of Computer Graphics" and "Database Management Systems." Registration fees range from $595 to $795, depending upon duration and the topic covered. For details, contact Ms. Joan Merrick, Datamation Institute Seminar Coordination Office, Suite 415, 850 Boylston St., Chestnut Hill, MA 02167, (617) 738-5020. For information on in-house presentations, contact Art Gutmann, Datamation Institute for Information Management and Technology, Seminar Coordination Office, Suite 803, 331 Madison Ave., New York, NY 10017, (212) 697-2361.

December-January 1983
Intensive Seminars for Professional Development, Worcester Polytechnic Institute campus and various sites in the New York City and Boston metropolitan areas. Some of the topics to be presented are "Project Management," "Leadership Skills and Management Tools for High-Technology Professionals," and "Management Skills for First-Line Supervisors." Fees range from $495 to $990. Complete details are available from Ms. Ginny Bazarian, Office of Continuing Education, Higgins House, Worcester Polytechnic Institute, Worcester, MA 01609, (617) 793-5517. For information on in-house seminars, call Robert J. Hall at (617) 793-5574.

December-January 1983
Courses from Q.E.D. Information Sciences, various sites throughout the U.S. Among the courses offered are "Screen Design," "Designing Systems Controls," and "Teleprocessing Network Design." Complete course outlines are available from Priscilla Goudreault, Q.E.D. Information Sciences Inc., Q.E.D. Plaza, POB 181, Wellesley, MA 02181, (800) 343-4848; in Massachusetts, (617) 237-5656.

December-February 1983
Seminars of Interest to Women Professionals, various sites around Boston, MA. This series of one- and two-day seminars is presented by Boston University Metropolitan College. Among the topics on the agenda are "Managing Word Processing to Increase Productivity and Profitability," "Advanced Management for Women: Beyond the Basics," and "Data Processing Fundamentals for Accounting and Financial Managers." The seminar fees are $325 and $495, depending on duration. For registration information, contact Ms. Joan Merrick, University Seminar Center, Suite 415, 850 Boylston St., Chestnut Hill, MA 02167, (617) 738-5020.

December-March 1983
Courses for Developers and Users of Computer Systems, various sites throughout the U. S. Among the courses offered by the AMA (American Management Associations) are "Fundamentals of Data Processing for the Nondata Processing Executive," "BASIC: A Computer Language for Managers," and "Database Concepts and Designs." For complete registration and course information, contact the AMA, 135 West 50th St., New York, NY 10020, (212) 586-8100.

December 9-11
The 1982 California Educational Exposition, Anaheim Convention Center, Anaheim, CA. This exposition's theme is "Public Education: Our Purpose—Our Future." Exhibits and an all-day computer-literacy workshop highlight this event. Address inquiries to Alice Lytle, California School Boards Association, 916 23rd St., Sacramento, CA 95816, (916) 443-4691.

December 9-12
Southeast Computer Show and Office Equipment Exposition, Civic Center, Atlanta, GA. For details, contact Computer Expositions Inc., POB 3315, Annapolis, MD 21403, (800) 368-2066; in Maryland, (301) 263-8044.

December 10
The 1982 Computer Networking Symposium, Gaithersburg, MD. "Planning for the Near Term: The Next Three Years" is the theme for this symposium, which is sponsored by the IEEE Computer Society Technical Committee on Computer Communication and the Institute for Computer Sciences and Technology of the National Bureau of Standards. Papers related to the design, selection, and implementation of network systems within the next three years will be delivered. Areas of particular interest include long-haul networks, local-area networks, and satellite systems. Full details are available from Computer Networking Symposium, IEEE Computer Society, POB 639, Silver Spring, MD 20901, (301) 589-3386.

December 12-17
Small Computers in Biomedical Research, Woods Hole, MA. This course is sponsored by the Marine Biological Laboratory. It emphasizes hands-on exercises using several fully equipped microprocessor systems. The concentration is on basic machine operation and assembly language. Other topics include number systems, machine logic and architecture, operating systems, and flowcharting and interrupts. Contact the Marine Biological Laboratory, Woods Hole, MA 02543, (617) 548-3705.

December 13-15
Microcomputers in Education, Boulder, CO. This workshop is designed for educators at all levels. Topics to be covered include BASIC and Graphics, Logo, administrative uses of microcomputers, and microcomputers as laboratory instruments. Hands-on experience with a variety of computers will be provided. Information is available from Ms. Sharon Woodruff, Technical Education Research Centers, 8 Eliot St., Cambridge, MA 02138, (617) 547-3890.

December 13-15
Office Automation for Management Productivity, Shoreham Hotel, Washington, DC. Conference sections will focus on better methods to evaluate productivity, to select equipment or procedures, to integrate equipment or procedures into an organization, and to get people to work effectively in a changing environment. For further details, contact the Information Exchange, Suite 334, 4500 South Four Mile Run Dr., Arlington, VA 22204, (703) 820-5720.

December 13-16
Database: A Builder's Guide, San Francisco, CA. This seminar, led by Robert Holland, focuses on identifying subject databases and defining data architecture. For complete information, contact the Technology Transfer Institute, 741 10th St., Santa Monica, CA 90402, (213) 394-8305.

December 13-16
F8 & F3870 Microcomputer Systems, Santa Clara, CA. This is one of several courses offered by the Microprocessor Division of Fairchild Camera and Instrument Corporation. For more information, contact Fairchild Camera and Instrument Corp., Education Center, 3420 Central Expressway, Santa Clara, CA 95051, (408) 773-2161.

December 13-17
C Programming Workshop, Boston, MA. This workshop is designed for programmers or engineers able to program in another language. Areas to be explored include C operands and operators, C preprocessors, pointers and arrays, and structures and unions. The fee is $1000. A full course outline is available from Joan Hall, Plum Hall Inc., RD 2 Box 235P, Pleasantville, NJ 08232, (609) 927-3770.

December 13-17
Digital Continuous-System Simulation, University of Maryland University College, College Park, MD. The fee for this course is $975. For details, contact Marc Rosenberg, UCLA Extension, Continuing Education in Engineering and Mathematics, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1047.

December 14-15
Plenary Technology, Palo Alto, CA. Details are available from the Yankee Group, POB 43, Harvard Square, Cambridge, MA 02138, (617) 542-0100.

December 14-15
World Update '83, New York, NY. This industry briefing is designed for key management personnel. The focus is on what happened in the communications industry this year and what will happen in the future. Contact the DMW Group Inc., Publishing & Seminar Division, 2020 Hogback Rd., Ann Arbor, MI 48104, (800) 521-7802; in Michigan, (313) 971-5234.

December 14-16
A Business Approach to Systems Controls, Chicago, IL. The fee for this seminar is $600. Contact the Registrar, Arthur Andersen & Co., Center for Professional Education, 1405 North Fifth Ave., St. Charles, IL 60174, (800) 323-0815; in Illinois, (800) 942-0851.

December 14-17
Systems Project Management, Chicago, IL. The fee for this seminar is $900. For full details, contact the Registrar, Arthur Andersen & Co., Center for Professional Education, 1405 North Fifth Ave., St. Charles, IL 60174, (800) 323-0815; in Illinois, (800) 942-0851.

December 15-16
Local Area Networks: Architecture, Technology, and Products, Marriott Inn North, Dallas, TX. Topics to be covered at this workshop include network concepts and architectures, local-network characterization, internetworking, and standards. The registration fee is $570. Contact Technology Concepts Inc., 730 Boston Post Rd., Sudbury, MA 01776, (617) 443-4637.

December 20-21
Using Microcomputers in the Business Environment, Chicago, IL. This course is designed for managers and executives with little or no experience in microcomputing, but who want to understand its potential in the business environment. The course offers hands-on experience by providing one microcomputer for every two participants. The tuition is $500. Contact the Registrar, Arthur Andersen & Co., Center for Professional Education, 1405 North Fifth Ave., St. Charles, IL 60174, (800) 323-0815; in Illinois, (800) 942-0851.

December 28-29
Using Microcomputers in the Business Environment, Washington, DC. For details, see December 20-21.

January 1983

January 5-7
The Sixteenth Hawaii International Conference on System Sciences, Honolulu, HI. This conference will focus on recent developments in the theory and practice of computer software, hardware, and advanced computer systems applications as related to information and systems science. Special emphasis will be placed on medical information processing, decision support systems, and office systems and technology. Further information is available from Emily M. Yano Jorgensen, Office of Management Programs, College of Business Administration, University of Hawaii, 2404 Maile Way C-202, Honolulu, HI 96822, (808) 948-7396.

January 11-12
Local Area Networks: Architecture, Technology, and Products, Sheraton-Tara Hotel, Framingham, MA. See December 15-16 for details.

January 13
Network Optimization and Tariff Impact Strategies, San Francisco, CA. This seminar will provide a concise overview of maximizing network potential and how to plan corporate strategies to minimize the impact of tariff increases. Contact the DMW Group Inc., Publishing and Seminar Division, 2020 Hogback Rd., Ann Arbor, MI 48104, (800) 521-7802; in Michigan, (313) 971-5234.

January 18-19
Local Area Networks: Architecture, Technology, and Products, Berkeley Marina Marriott Inn, Berkeley, CA. See December 15-16 for details.

January 18-20
Microcomputers in Education, Tallahassee, FL. For details, see December 13-15.

January 18-20
Southcon/83, High-Technology Electronics Exhibition and Convention, Georgia World Congress Center, Atlanta, GA. Contact Electronic Conventions Inc., 999 North Sepulveda Blvd., El Segundo, CA 90245, (800) 421-6816; in California, (213) 772-2965.

January 18-21
Defining Software Requirements, Specifications, and Tests, San Diego, CA.

Participants in this short course will learn how to analyze and document end-user requirements, generate software requirements that include test plans, and plan the sequencing of test and integration procedures. The fee is $845. Further details are available from Ruth Dordick, Integrated Computer Systems, 3304 Pico Blvd., POB 5339, Santa Monica, CA 90405, (213) 450-2060.

January 20-21
The Twelfth Annual National Measurement Science Conference and Exhibition, Hyatt Rickeys Hotel, Palo Alto, CA. This conference is intended for managers, scientists, engineers, and operating personnel. Its theme is "Accuracy and Automation." Seminar sessions will stress practical applications of new equipment and techniques to solve measurement problems. By format and objective, this conference will promote professional and state-of-the-art approaches and emerging technologies in the fields of measurement science. For registration information, contact Bob Weber, Lockheed Missile & Space Corp., Sunnyvale, CA 94046, (408) 742-2957.

January 21-23
CP/M '83, Moscone Center, San Francisco, CA. This international exposition and conference is designed for CP/M manufacturers, software developers, distributors, and users. The exposition will be the largest presentation of CP/M-based hardware and software ever assembled. Seminars and conferences will explore CP/M applications, technical information, development aids, venture-capital programs, and software distribution. Separate end-user conferences will be held. Adam Osborne, Chris Morgan, Tony Gold, Sol Libes, and Gary Kildall have assisted in organizing this show for Digital Research Inc. Contact National Computer Shows, 824 Boylston St., Chestnut Hill, MA 02167, (800) 343-2222; in Massachusetts, (617) 739-2000.

January 24-25
Computers in Agriculture Conference and Trade Fair, Red Lion Inn, Sacramento, CA. This conference and exposition is designed to address the needs of farmers and ranchers. More than 20 speakers and 60 hardware and software exhibitors will attend. The conference seeks to answer basic questions confronting farmers and ranchers considering the purchase of a computer. For details, write to Kim Schnoor, Western Agricultural Chemicals Association, Suite 209, 6650 Belleau Wood Lane, Sacramento, CA 95831.

January 25-27
The First Annual Automated Office Expo, Moscone Center, San Francisco, CA. This show will feature computer and telecommunications systems, graphics, peripherals, and word-processing systems. This show is sponsored by *Infosystems* magazine. Contact Automated Office Expo, Suite 400, 222 West Adams St., Chicago, IL 60606, (800) 621-2134; in Illinois, (312) 263-3131.

January 25-28
Designing Real-Time Hardware for Digital Signal and Image Processing, Los Angeles, CA. Participants in this short course will learn how to implement digital filters, fast Fourier transforms, correlation, modulation, and other real-time processes by designing with general-purpose 16-bit microprocessors. Case histories and lectures will be featured. The fee is $845. Contact Ruth Dordick, Integrated Computer Systems, 3304 Pico Blvd., POB 5339, Santa Monica, CA 90405, (213) 450-2060.

January 31-February 2
Communication Networks '83, the Rivergate, New Orleans, LA. This fifth annual conference and exposition will encompass the voice, data, and telecommunications industry with sessions and demonstrations. The theme is "Communications Cost Control Via High Technology." Topics on the agenda include electronic mail and office communications, local-area networks and internetting, and modems and multiplexers. Optional in-depth skill seminars will be held. These seminars, led by industry leaders, include lectures, class activities, and a workbook. General registration fees are $395; skill seminars cost $295. Contact Louise Myerow, Conference Management Group, CW Communications Inc., POB 880, Framingham, MA 01701, (800) 225-4698; in Massachusetts, (617) 879-0700 collect.

February 1983

February 1-4
Advanced Microprocessor Programming and Applications Techniques, Los Angeles, CA. This short course is designed to teach participants how to use real-time operating systems, design customized modules to implement real-time functions, apply 16-bit microprocessor families, and how to structure multiprocessor and multicomputer architectures. The fee is $845. Contact Ruth Dordick, Integrated Computer Systems, 3304 Pico Blvd., POB 5339, Santa Monica, CA 90405, (213) 450-2060.

February 1-4
Defining Software Requirements, Specifications, and Tests, Washington, DC. For details, see January 18-21.

February 7-9
Microcomputers in Education, Washington, DC. For details, see December 13-15.

February 8-9
Local Area Networks: Architecture, Technology, and Products, Hyatt Regency Hotel, Atlanta, GA. For details, see December 15-16.

February 15-18
Peripheral Array Processors for Signal Processing and Simulation, University of California, Los Angeles. The fee for this course is $845. Contact Marc Rosenberg at the UCLA Extension, Continuing Education in Engineering and Mathematics, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1047.

February 15-18
Designing Real-Time Hardware for Digital Signal and Image Processing, Washington, DC. For details, see January 25-28.

February 16-18
Talmis, Ambassador West, Chicago, IL. Information is available from Talmis Inc., 115 North Oak Park Ave., Oak Park, IL 60301, (312) 848-4000.

February 16-19
Data and Telecommunications/Japan Exposition '83,

Tokyo Ryutsu Centre, Tokyo, Japan. Contact Cahners Exposition Group, Cahners Plaza, 1350 East Touhy Ave., POB 5060, Des Plaines, IL 60018, (312) 299-9311. In Japan, contact Cahners Exposition Group S.A., Hino Building 3F, 3-4-11 Uchikanda, Chiyoda-ku, Tokyo 101, Japan; tel: 03-254-6041.

February 17-19
Microcomputers in Education, New York, NY. For details, see December 13-15.

February 21-23
Office Automation Conference, Civic Center, Philadelphia, PA. More than 200 exhibitors are expected to participate in this conference. Fifty technical sessions will explore such topics as advanced office technology, current office technology and systems, and human factors and social issues. Details are available from the American Federation of Information Processing Societies Inc., 1815 North Lynn St., Arlington, VA 22209, (703) 558-3624.

February 22-26
The Eighteenth Annual Bias-Microelettronica '83, Milan, Italy. This international exposition is expected to attract more than 80,000 visitors. Areas of interest include active and passive components, instrumentation and equipment for component manufacturing, laboratory instrumentation, microcomputers, peripherals, and telecommunications systems. For information, contact Ente Italiano Organizzazione Mostre, Bias-Microelettronica '83, Viale Premuda 2, 20129 Milan, Italy; tel: 796.096; Telex: CONSEL 334022.

February 25-27
The Second Annual Computer Expo '83, Tupperware Convention Center, Orlando, FL. This exposition features mini- and microcomputers. The focus is on hardware, software, word processing, graphics, peripherals, supplies, services, and computer furnishings. Seminars will be held. Contact Tom Blayney, POB 1185, Longwood, FL 32750, (305) 339-1731.■

In order to gain optimal coverage of your organization's computer conferences, seminars, workshops, courses, etc, notice should reach our office at least three months in advance of the date of the event. Entries should be sent to: Event Queue, BYTE Publications, POB 372, Hancock NH 03449. Each month we publish the current contents of the queue for the month of the cover date and the two following calendar months. Thus a given event may appear as many as three times in this section if it is sent to us far enough in advance.

BYTE INDEX UPDATE
January 1982 — December 1982

"When did you run that review of the six personal computers from Japan? I think it was in the spring, but I'm not sure of the exact issue."

"In what issue of BYTE did Steve Ciarcia write about interactive-videodisc controllers?"

"When was it that Gregg Williams reviewed the IBM Personal Computer?"

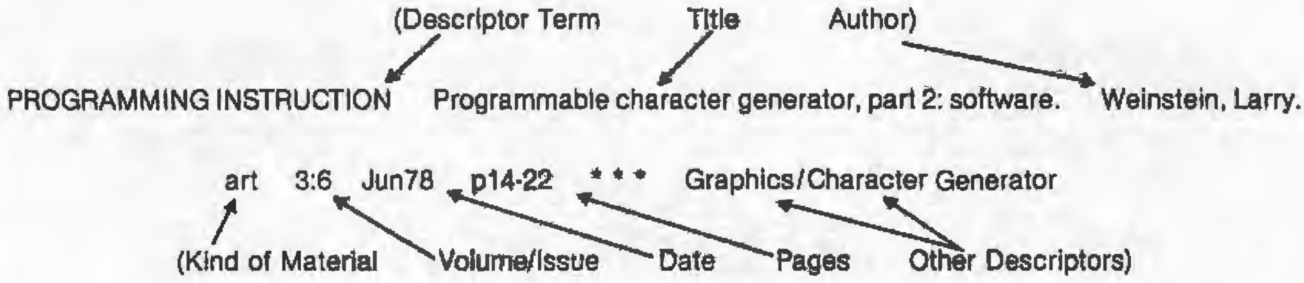
Ours is the age of information. Name any topic and there'll be an article on it *somewhere*. But *somewhere* doesn't help much if you're the one looking for specific information. The real question in the end is "How can I find what I want quickly and easily?"

In this issue of BYTE we present the first annual BYTE Index Update. In December 1981, as a service to our readers, we included a comprehensive, cumulative index covering every issue of the magazine between September 1975 and December 1981, inclusive. Among the information represented is every article and product review that has appeared in the pages of BYTE.

All entries in the index are arranged by subject descriptors, and an article may be listed under several descriptors. Any article for which a correction was published has an asterisk after its title. The correction can be found under the heading "BYTE Corrections." The figure below shows a typical index entry and describes what the different parts mean.

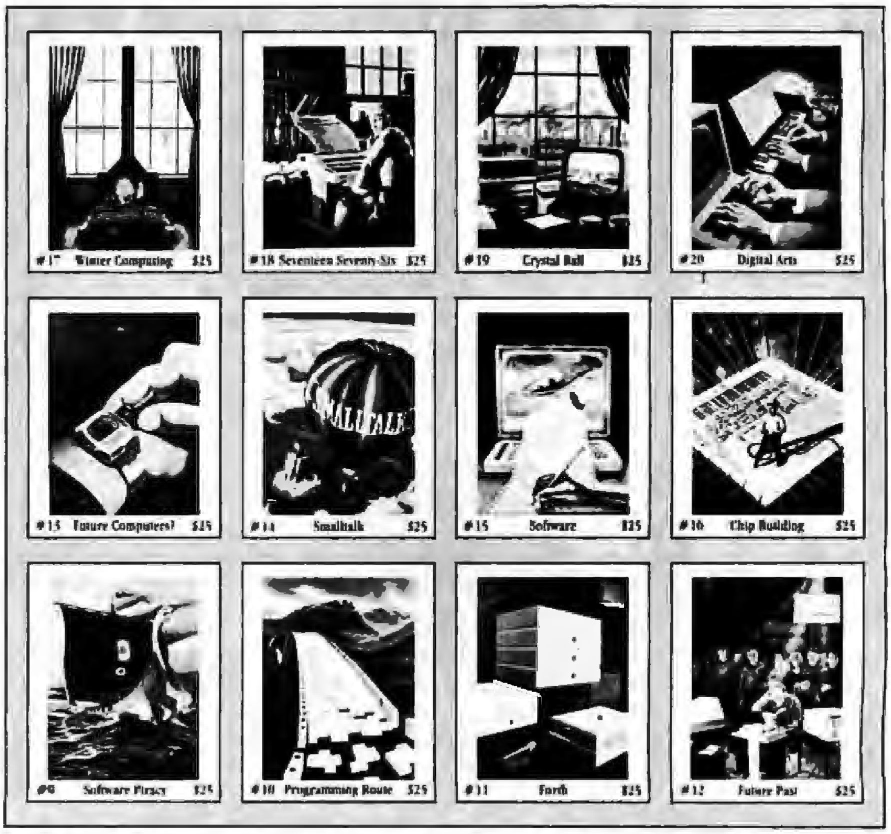
For those who require information beyond what is presented here, Microcomputer Information Services (which prepared the BYTE Index and the 1982 Update) publishes *Microcomputer Index*, which covers 20 microcomputer-oriented magazines and includes abstracts for each entry. For more information on *Microcomputer Index*, you can reach MIS by calling (408) 984-1097.

Index Entry:



Key to Abbreviations

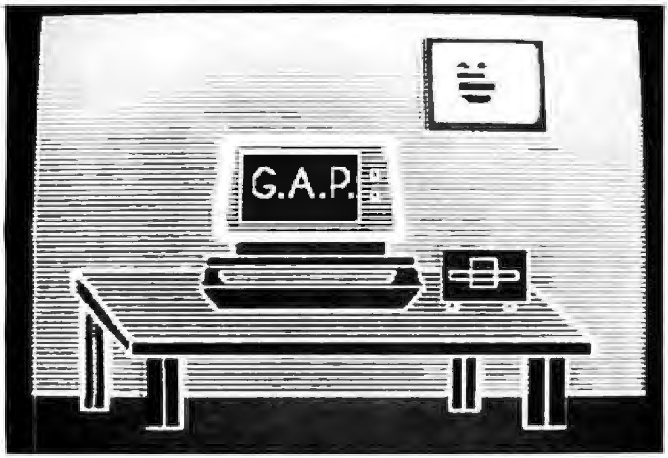
art	article	L1	program listing in BASIC
br	book review	L2	program listing in machine language
col	column	L3	program listing in assembly language
hr	hardware review	L4	program listing in FORTRAN
let	letter	L5	program listing in COBOL
sr	software review	L6	program listing in Pascal
*	see BYTE Corrections	L7	program listing in FORTH
***	marker symbol for other descriptors	L8	program listing in C programming language
		L9	other programming language



#17 Winter Computing $25
#18 Seventeen Seventy-Six $25
#19 Crystal Ball $25
#20 Digital Arts $25
#13 Future Computers? $25
#14 Smalltalk $25
#15 Software $25
#16 Chip Building $25
#9 Software Piracy $25
#10 Programming Route $25
#11 Forth $25
#12 Future Past $25

What's New?

Games



Game Animation Package

The Game Animation Package from Synergistic Software lets Applesoft programmers design full-color, high-resolution graphics. For arcade-type games, the package provides bit-mapped graphics, and its vector-graphics capabilities make full-screen pictures available for use in logos, maps, and gameboards for adventure games. Other features include two-dimensional images with lines, circles, and ellipses.

The Game Animation Package runs on 48K-byte Apple IIs with DOS 3.3 and Applesoft BASIC. It costs $49.95. Complete details are available from Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055, (800) 426-6505; in Washington, (206) 226-3216.
Circle 600 on inquiry card.

Stick Stand Has Easy-Grip Control Knob

K-Byte's Stick Stand joystick has a ball-shaped easy-grip control knob. The Stick Stand is designed to reduce hand and wrist fatigue, and it frees one hand for operating a fire button. Assembly is simple: you snap the control knob onto the joystick and then place the joystick into the Stick Stand.

The Stick Stand fits the Atari VCS and Sears Video Arcade and Atari 400/800 joysticks. It costs $6.99 and is available from K-Byte, 1705 Austin, POB 456, Troy, MI 48099, (313) 524-9878.
Circle 601 on inquiry card.

Stock-Market Simulation

Fifteen different stocks are yours to manipulate with Blue Chip Software's stock-market simulation game, Millionaire. You can buy and sell stocks, put options, buy on margin, and borrow against your net worth. Players can summon corporate histories and week-by-week industry trends and graphs.

Millionaire runs on the Apple II Plus and Apple III computers. It costs $79.95. Versions are available for the IBM Personal Computer, Osborne 1, and CP/M-based systems for $99.95. Contact Blue Chip Software, Suite 215, 18653 Ventura Blvd., Tarzana, CA 91356, (213) 881-8288.
Circle 602 on inquiry card.

Invaders Runs on Osborne

Invaders is a full-color, high-resolution arcade-type game from The Software Toolworks. In Invaders, waves of attacking aliens attempt to land, and you, sheltered behind ever-shrinking barricades, must beat them back with your space cannon. Game parameters can be modified to increase the challenge, and you can redesign the graphics display.

Designed for the Osborne 1, Invaders costs $19.95. It's available at Computerland stores, Osborne dealers, or factory-direct from The Software Toolworks, 14478 Glorieta Dr., Sherman Oaks, CA 91423, (213) 986-4885. When ordering from the manufacturer, enclose $2 for postage and handling.
Circle 603 on inquiry card.

Professional Blackjack Strategies

Intelligent Statements has released Ken Uston's Professional Blackjack—The Ultimate Game, The Winningest System. This program teaches computer-developed Blackjack strategies and simulates the playing environments of 50 different casinos.

Ken Uston's Professional Blackjack requires 48K bytes of RAM (random-access read/write memory), a disk drive, and a color or monochrome display. It costs $89.95, plus $2 shipping and handling. Versions for the Apple II, Atari, IBM Personal Computer, TRS-80, and CP/M-based systems are available. Contact Intelligent Statements Inc., POB 600, Holmes, PA 19043, (800) 345-8112; in Pennsylvania, (800) 662-2444
Circle 604 on inquiry card.

Foreign Products

Report Generator

The Mistress Report Writer from Rhodnius Inc. is a report generator designed to be used in conjunction with the Mistress database-management system. This system allows formatting and pagination of complex reports with values from Mistress databases and Unix commands. Retrieved values can be printed in a variety of formats, and arithmetic operations can be performed on them. Other features include grouping of data at any number of levels and such functions as sorting and subtotaling at any level. The suggested retail price is $2000. Complete details are available from Rhodnius Inc., POB 1, Station D, Scarborough, Ontario, M1R 4Y7, Canada, (416) 922-1743.

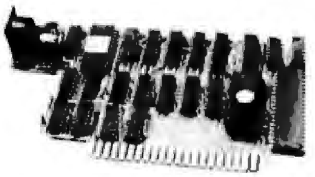
Circle 605 on inquiry card.

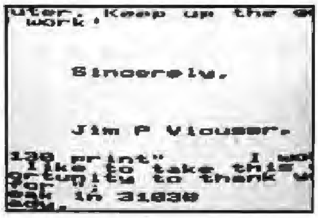
M68000 Disassembler

Norsoft Consultants is marketing an M68000 disassembler program that can interpret all 68000 instructions and produce readable source files. The disassembler's input file is a Motorola S-format ASCII (American Standard Code for Information Interchange) file, and the output file contains standard Motorola 68000 instruction mnemonics and addressing syntax. The disassembler can produce a cross-reference list to all absolute addresses found in the input file.

Written in Pascal, this disassembler will run on a variety of 68000-based systems under different operating systems. The price is $200. Full details are available from Norsoft Consultants, Veungsdalsveien 1, 3600 Kongsberg, Norway; tel: (03) 73 49 60.

Circle 606 on inquiry card.





Display-Mode Expansion for VIC

Computer World's video cartridge for the Commodore VIC-20 gives you selectable 25-line by 40- or 80-character display formats, which let you use programs written for the 2000, 3000, 4000, and 8000 CBM computers. Standard features include true uppercase and lowercase descenders, full cursor control, and VIC and PET/CBM graphics capabilities. The cartridge expands the VIC's RAM (random-access read/write memory) to 32K bytes. It does not require an external power supply.

The cartridge requires an Arfon or Commodore expansion box equipped with 3K-, 8K-, or 16K-byte RAM cartridges. It costs $249. Contact Computer World, Hilvertsweg 99, 1214 JB Hilversum, Holland; tel: 035-12633; Telex: 43776 INCO NL.

Circle 607 on inquiry card.

Robot Programming Language

Biomatik will soon introduce a programming language for microcomputer-controlled robots and manipulators called PASRO (PAScal for RObots). PASRO features elements that control robots and claws, elements for addressing process periphery and sensors, predefined special data types for robot-control programming, and arithmetic operators for flexible manipulation of new data types.

PASRO requires an ISO (International Standards Organization) Pascal compiler and will run on machines such as the Osborne 1. The price is 1,800 DM (approximately $750). Contact Biomatik Gmbh, Carl-Mez-Str. 81-83, D-7800 Freiburg I. Br., West Germany; tel: 0761-43045; Telex: 7721508 bios.

Circle 608 on inquiry card.

PERIPHERALS

PET/CBM Serial Printer Adapter

The ADA1450 printer adapter from Connecticut Microcomputer allows Commodore PET and CBM computers to use standard serial printers. The adapter features switch-selectable uppercase and lowercase, uppercase and lowercase reverse, and uppercase only. It works with Commodore disks and with Wordpro, BASIC, and other software.

The ADA1450 comes completely assembled and tested with a case, cable, and power supply for $149. Phone or write to Connecticut Microcomputer, 36 Del Mar Dr., Brookfield, CT 06804, (203) 775-4595.

Circle 609 on inquiry card.

Removable-Cartridge Winchester-Disk Drive

The SQ306 is a 3⁹⁄₁₀-inch (100 mm) removable-cartridge Winchester disk drive from Syquest Technology. Fully compatible with Seagate Technology's 5¼-inch fixed-disk Winchester drive (the model ST506/406), the SQ306 can store 6.38 megabytes of data and use controller interfaces designed for the ST506, such as the DTC 510A, Xebec SA1410, and Western Digital's WD 1000. The drive is said to be fully operational within 15 seconds of cartridge insertion.

The SQ306 uses disk packs marketed under the name of Q-Pak. They feature thin metallic-alloy platters that are impervious to dust, smoke, and humidity. The cartridges cost $35 each. The SQ306 has a suggested retail price of approximately $800. Contact Syquest Technology, 44160 Warm Springs Blvd., Fremont, CA 94538, (415) 490-7511.

Circle 610 on inquiry card.

10-Megabyte Winchester Back-up System

The Companion series of digital tape-cassette backup units for 5¼-inch Winchester disk-drive systems are marketed by MFE Corporation. According to the manufacturer, this backup system is capable of storing up to 10 megabytes of data on a single tape cassette in 4 minutes. Companion's cassette tapes, known as Back-Paks, resemble ANSI (American National Standards Institute) and ECMA (European Computer Manufacturers Association) standard 0.150-inch high-density digital cassettes.

The series comes in two versions: the Model 505, which holds 5 megabytes of data, and the Model 510 for twice that amount. The evaluation price of the Companion 505 is $995. The Model 510 is $1175. Full details are available from MFE Corp., Keewaydin Dr., Salem, NH 03079, (603) 893-1921.

Circle 611 on inquiry card.

Visual 50 Terminal

The Visual 50 can emulate Hazeltine Esprit, ADDS Viewpoint, Lear Siegler ADM-3A, and DEC VT-52 terminals. Produced by Visual Technology, the Visual 50 features menu-driven set-up modes in nonvolatile memory that permit easy selection of terminal parameters. A detached keyboard, smooth scroll, 7 by 9 dot-matrix characters, an 80-character by 24-line display, and a nonglare screen are standard. Other features include tilt and swivel abilities, n-key rollover, status line, a line-drawing character set, and line insertion and deletion.

The Visual 50 costs $695 and can be purchased through Visual Technology dealers. Service is available in major cities through Sorbus Service, a division of Management Associates Inc. Full specifications can be obtained from Visual Technology Inc., 540 Main St., Tewksbury, MA 01876, (617) 851-5000.

Circle 612 on inquiry card.

Two Terminals from Hazeltine

Hazeltine Corporation has added two more members to its line of computer terminals: the Executive 10 and the Esprit II. The Executive 10 has eight programmable-function keys, a programmable twenty-fifth status line, a full set of editing features, a 7 by 10 dot-matrix display, a split-screen display, and a business graphics-character set. Standard features include a detached keyboard and a tilt-and-swivel, nonglare green display. The Executive 10 costs $1195.

A nonglare display, green characters, and the ability to project the complete 128-character ASCII (American Standard Code for Information Interchange) set are among the Esprit II's standard features. Its editing capabilities include character insert and delete, line insert and delete, and local print. The detachable Esprit II keyboard has two-key rollover and a 14-key numeric pad. Compatible with the Hazeltine 1500, the Esprit also emulates Applied Digital Data Systems' Regent 25 or Lear Siegler's ADM-3. The suggested price is $645. For purchasing information, contact Hazeltine Corp., Computer Terminal Equipment, Greenlawn, NY 11740, (800) 645-5300; in New York, (516) 549-4532.

Circle 613 on inquiry card.

Solid-State Disk Emulators for the Apple

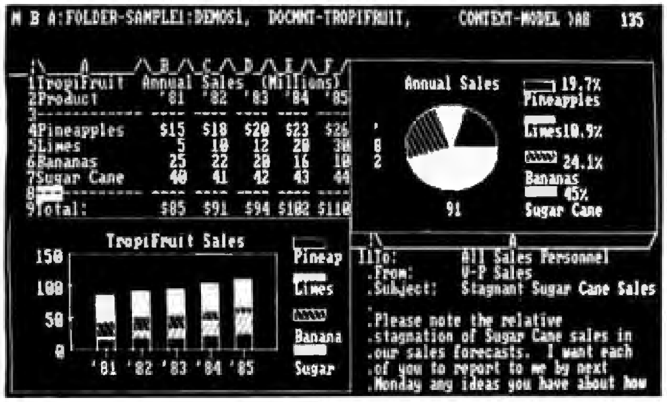
Synetix Micro Products Inc. has announced the availability of single-board SSDs (solid-state disk emulators) for the Apple II or Apple II Plus. Software compatible with Apple DOS 3.3, Apple Pascal, and the CP/M operating system, the SSD cards plug directly into any Apple I/O slot except 0 and do not require external power. Up to seven SSD cards can be installed in the Apple.

The cards are offered in a 147K-byte single-disk version and in a 294K-byte dual-disk version. The suggested prices are $450 and $850, respectively. Dealer prices are available. A kit that upgrades the 147K-byte SSD to 256K bytes costs $350. Contact Synetix Micro Products Inc., 15120 Northeast 95th St., Redmond, WA 98052, (800) 426-7412; in Washington, (206) 881-8440.

Circle 614 on inquiry card.

What's New?

SOFTWARE



Five Business Functions in One Program

The Context MBA incorporates electronic spreadsheet, telecommunications, word processing, graphics, and database functions in a single program. Developed by Context Management Systems, MBA's electronic spreadsheet gives business managers "what if" financial models that can be shown as one of nine different graphs. Information from the spreadsheet can be used in reports generated with MBA's word-processing function. The relational-like database has near instant recall, and it searches and retrieves or sorts only the information requested.

MBA requires a 256K-byte IBM Personal Computer outfitted with dual-disk drives and the IBM color graphics card. The suggested retail price is $695. Contact Context Management Systems, Suite 100, 23864 Hawthorne Blvd., Torrance, CA 91604.

Circle 615 on inquiry card.

CP+ for Friendlier Microcomputers

CP+ replaces CP/M commands with English-language menus and directions. According to Taurus Software Corporation, operating a microcomputer with CP+ is a simple matter of following the steps outlined on the screen. In addition to menus and directions, CP+ offers operator messages and Help commnds.

CP+ is compatible with any CP/M-based system, including those with optional add-on circuit boards for CP/M. CP+ installs on top of CP/M versions 1.4 and 2.2. It costs $150 per copy, complete with documentation. For details, contact Taurus Software Corp., Suite 817, 870 Market St., San Francisco, CA 94102, (415) 788-0888.

Circle 616 on inquiry card.

Cross-Assembler for Z8

System-Z8 is a CP/M-compatible cross-assembler for Zilog's Z8 microprocessor. It features a macro assembler, an interactive editor and assembler, a text editor, and a cross-reference generator. Its macro assembler has full macro and conditional assembly features and the ability to chain a series of source files together during a single assembly.

System-Z8 is available on soft-sectored 8-inch CP/M disks (3740 format) and 5¼-inch North Star and Micropolis Mod II (Lifeboat adaptation) formatted disks. It costs $150, including documentation and full user support by telephone or mail. Current System-Z8 owners are eligible for a free update procedure. Contact Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107, (213) 793-5748.

Circle 617 on inquiry card.

Database Sorts 5000 Records in 12 Seconds

The ISAM Database from Ensign Software is said to be able to sort 5000 records in 12 seconds. ISAM (indexed sequential-access method) provides keyed access to data files for reading, writing, updating, and deleting records within the file. It interfaces directly to BASIC programs through a few variables, and it's accessed by executing a call to a BASIC subroutine. Standard features include dynamic disk-space management, record buffering, searching by full key or partial key, forward and backward sequential retrieval, and the ability to access up to seven ISAM files simultaneously. Among the commands provided are open and close a file; add, delete, and update records; get next and previous record; get first and last record; and show file statistics.

The ISAM Database runs on 48K-byte IBM Personal Computers with one disk drive, PC-DOS, and disk BASIC. It's available for $69.95 from Ensign Software, Suite E, 2312 North Cole Rd., Boise, ID 83704, (208) 378-8086.

Circle 618 on inquiry card.

Interact with Your Apple

Savvy Marketing International's Savvy Personal Language System allows personal-language interaction between your Apple II and you. Using its Adaptive Recognition Processing system, which "trains" an internal Robot Programmer that actually writes your programs in machine language, Savvy lets you work with your own words, phrases, and expressions. The ability to redefine system commands is provided, so all programs can be modified at any time. Standard features include decimal arithmetic, a virtual-resource manager, and

ISAM (indexed sequential-access method) file structures.

Savvy comes with general ledger, accounts receivable, accounts payable, payroll, mailing list, document writer, and inventory control applications programs. Complete with Z80 processor card, firmware, instruction manual, and the applications packages, the Savvy Personal Language System for the Apple II costs $950. It's available from Savvy Marketing International, 9th Floor, 100 South Ellsworth St., San Mateo, CA 94401, (415) 340-0335.
Circle 619 on inquiry card.

C Compiler for 6809 Systems

Introl Corporation's Introl-C/6809 version 2.0 C language compiler system is designed for 6809-based computers running under Flex-09, Uniflex, OS-9, or CP/M DOSes. Introl-C generates position-independent and reentrant 6809 assembly-language code that's easily assembled with a supplied assembler. All standard C language functions are supported, except bit-fields, initializers, and the #line and #if preprocessor directives. Written entirely in the C language, this package includes a C compiler, a 6809 assembler, linking loader, and library manager. Source code for the runtime library is provided.

The price for Introl-C/6809 ranges between $375 and $425, depending upon operating system. Your purchase includes unlimited rights to distribute the object code produced with the compiler. It comes in both 5¼- and 8-inch floppy-disk formats. Source code for the 6809 assembler, written in C, is available as an option. For further details, contact Introl Corp., 647 West Virginia St., Milwaukee, WI 53204, (414) 276-2937.
Circle 620 on inquiry card.

Subscription-Management Progam

Publiphile is a software and hardware subscription-management system for the small publisher. Designed by WPL Associates, this system can handle from several hundred to approximately 20,000 subscribers, and it can generate mailing labels in a variety of formats. Some of the subscriber information provided by Publiphile includes separate billing addresses, purchase and credit-card orders, bad credit names, special offers, and advanced and multiple renewals. On-screen verification of individual subscriber data is permitted, and Publiphile provides hard copy for circulation summaries, expiration counts, renewal analysis, cash receipts, bank deposits, accounts receivable, earned income, and subscriber liability reports.

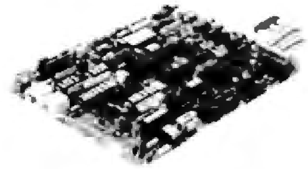
Publiphile operates on the Apple II, NEC APC, IBM Personal Computer, Radio Shack TRS-80 Model II, Victor 9000, and many CP/M-based systems. A Publiphile system ranges in price from $5000 to $20,000, which includes hardware and software for full-function word processing and connection to electronic publishing services such as Newsnet. Publiphile software can be purchased separately. For further information, contact WPL Associates Inc., Department 01, 1105-F Spring St., Silver Spring, MD 20910, (301) 589-8588.
Circle 621 on inquiry card.

PUBLICATIONS

Directory Lists People with Similar Interests

The Personal Computer Owners Directory can help you locate people with the same interests or computer as you and who are willing to trade information. Interests covered range from adventure-type games to word processing.

For a free, permanent listing in the Personal Computer Owners Directory send your name, address, computer type, interests, and trade information (optional) to Personal Computer Owners, Department 1B, POB 426, Feeding Hills, MA 01030. To receive the current issue of the directory and the next issue containing your listing, enclose $9.95.



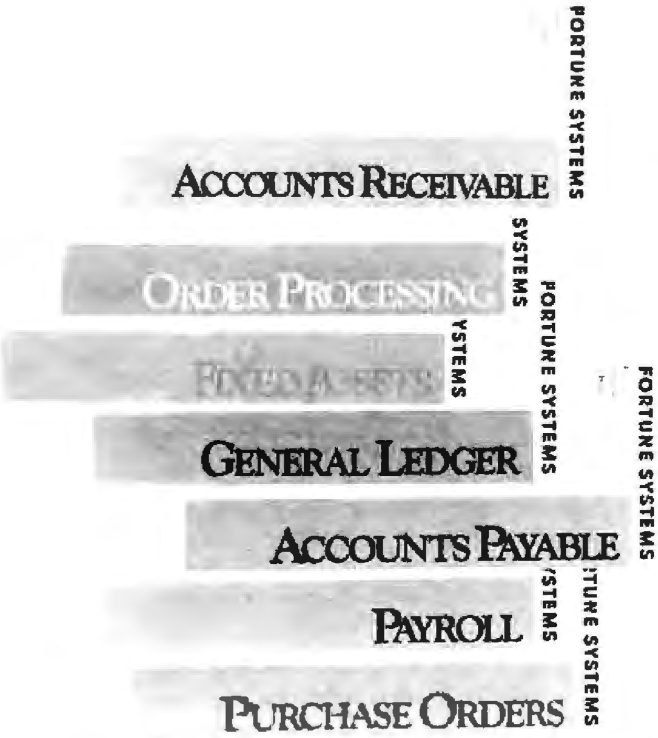
Bell 201-Compatible Modems Described

An 8-page brochure describing Racal-Vadic's line of Bell 201-compatible modems for remote terminals and computer sites is available free of charge from the company. Included are technical aspects, applications, ordering information, and complete product specifications for the firm's family of 2400-bps (bit-per-second) half-duplex modems. Future brochures from Racal-Vadic will detail its 300-, 1200-, and 2400-bps full-duplex modems, as well as its 1200- and 4800-bps half-duplex modems. For your copy, contact Racal-Vadic, Sales Department, 222 Caspian Dr., Sunnyvale, CA 94086, (408) 744-0810.
Circle 622 on inquiry card.

CIME Focuses on Computers in Design

CIME (Computers in Mechanical Engineering) is a quarterly publication of the American Society of Mechanical Engineers (ASME), a nonprofit organization. CIME probes how computers are used and how computers can be used in the design, manufacture, measure-

ment, and control of machines and industrial processes. It features case histories, work-measurement guidelines, summaries of available software, computer-aided design and modeling programs, robotics design and applications, and cost analysis. Annual subscriptions cost $20. Contact CIME, American Society of Mechanical Engineers, 345 East 47th St., New York, NY 10017, (212) 705-7750.
Circle 623 on inquiry card.



Fortune Business Software Explained

Fortune Systems Corporation has produced a series of brochures describing the Business Accounting System, a comprehensive software package designed for the Fortune 32:16 microcomputer. The Business Accounting System comprises order processing, accounts receivable, purchase orders, accounts payable, payroll, fixed assets, and general-ledger programs. The brochures detail individual features of these menu-driven programs, which can function as stand-alone packages or interface with other Fortune software.

The Business Accounting System is part of Fortune Systems' single- and multiuser business systems, which include word processing, financial modeling, and business graphics programs. Contact Fortune Systems Corp., 1501 Industrial Rd., San Carlos, CA 94070, (415) 595-5014.
Circle 624 on inquiry card.

SYSTEMS

CIE Systems Markets Line of Business Computers

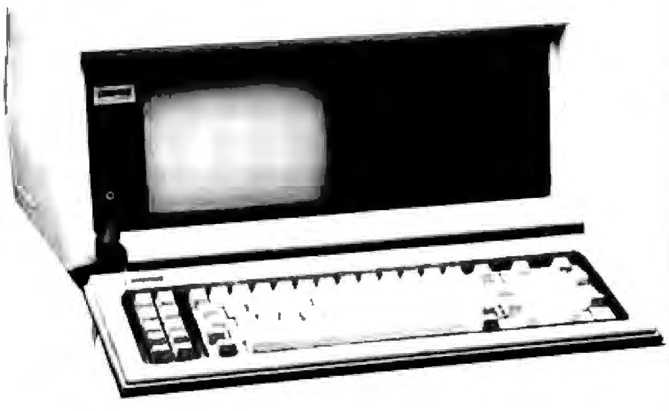
CIE Systems' 680 family of single- and multiuser business computers is based on Motorola's M68000 microprocessor and Intel's Multibus. The basic 680, the Model 680/10, is a single-user integrated workstation that comes with a built-in display, comprehensive video electronics, a detachable keyboard, and Data Technical Analysts PRO-IV applications processor. The operating speed is 8 MHz, and the 680/10 carries 128K bytes of high-speed RAM (random-access read/write memory), three RS-232C serial ports, a parallel printer port, a 10-megabyte hard disk for mass storage, and a 500K-byte 5¼-inch floppy-disk drive for backup. For expansion, an extra slot in the Multibus chassis is provided. Software supported includes the Unix III and Regulus operating systems. Standard features on multiuser 680s include 256K bytes of expandable RAM and the ability to support from 3 to 16 workstations.

In OEM (original equipment manufacturer) quantities, the 680/10 costs $5200. Multiuser 680s range in price from $6000 to about $12,000. Full product specifications can be obtained from CIE Systems, 2515 McCabe Way, POB 16579, Irvine, CA 92713, (714) 957-1112.
Circle 625 on inquiry card.

Husky Outdoor Computer

Husky is a hand-held portable computer designed for outdoor use. Produced by Sarasota Automation, Husky features 144K bytes of memory and an LCD (liquid-crystal display) that can display 128 characters in 4 lines. It includes a BASIC interpreter, the Z80 instruc-

tion set, and an RS-232C/V4 port. The CP/M-compatible Husky is battery-powered and housed in a sealed aluminum case with a membrane-protected keyboard. Its dimensions are 9½ by 8 by 1¾ inches. Husky weighs 4½ pounds and has been successfully operated in 15 feet of water. For further information, contact Sarasota Automation Inc., 1500 North Washington Blvd., Sarasota, FL 33577, (813) 366-8770.
Circle 626 on inquiry card.

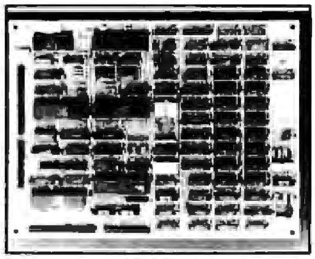


IBM-Compatible Portable from Compaq

Compaq Computer Corporation's Compaq portable computer is IBM PC-compatible. According to the manufacturer, it is able to run all the major business and applications programs written for the PC. The unit is housed in a 20- by 8½- by 15$\frac{9}{16}$-inch plastic enclosure and weighs in at 28 pounds. Its 9-inch (diagonal) high-resolution screen displays 25 lines by 80 characters. Characters are formed by a 7 by 9 dot matrix in a 9 by 14 cell. The monitor is also capable of displaying IBM PC-compatible high-resolution graphics, and provision is made for driving an external red/green/blue monitor for full-color graphics. The display also has adjustable viewing angles. Compaq's keyboard is detachable from the main unit and is connected by a 6-foot retractable coiled cable. The keyboard layout is identical to that of the IBM PC, with a 10-key numeric pad and 10 function keys, as well as cursor-control keys and an adjustable typing angle.

Compaq uses the Intel 8088 microprocessor, and a socket is provided for the addition of an 8087 mathematics coprocessor in the future. Microsoft MS-DOS version 1.1 and GWBASIC are included. The system comes with 128K bytes of 9-bit parity RAM (random-access read/write memory), expandable to 256K bytes on the main-system board, and 16K bytes of video-display RAM. The main-system board also contains three IBM PC-compatible expansion slots, a parallel printer port, and outputs for a color monitor, composite video, and connection to a standard television set through an RF (radio frequency) modulator.

The basic Compaq system includes one 320K-byte double-sided double-density 5¼-inch floppy-disk drive, 128K bytes of RAM, and a parallel printer interface. The suggested price is $2995. Available options include a second floppy-disk drive, an asynchronous-communications interface, and a serial printer interface. Compaq will be available at computer-specialty retail stores in January. For further information, contact Compaq Computer Corp., 12337 Jones Rd., Houston, TX 77070, (713) 890-7390.
Circle 627 on inquiry card.



Versatile Single-Board Computer

The 128-I single-board computer from Insight Enterprises features 128K bytes of RAM (random-access read/write memory) and a Zilog Z80A processor. Both 5¼- and 8-inch double-sided double-density floppy disks are supported, and the CP/M-based 128-I is supplied with CTC (counter/timer circuit), DMA (direct memory access), PIO (parallel input/output), and other support chips. Standard equipment includes two software-programmable RS-232C serial ports, a Centronics-type parallel printer interface, an expansion bus, and a smart Winchester disk controller interface that can handle Western Digital, IMI, and Corvus intelligent disk controllers.

The 128-I costs $600 and can be ordered from Insight Enterprises Corp., Suite 12, 373 North Western, Los Angeles, CA 90004, (213) 461-3262.
Circle 628 on inquiry card.

STD Bus-based Systems

Xitex Corporation's XM850S STD bus-based microcomputers have dual 8-inch slimline drives and two RS-232C ports. Optional capabilities include 5¼-inch Winchester- and floppy-disk drives.

A typical XM850S system features 2.4 megabytes of 8-inch floppy-disk storage, 64K bytes of dynamic RAM (random-access read/write memory), a 4-MHz Z80 processor, and the CP/M 2.2 operating system. In single units, this system costs $4799. A version with 2.4 megabytes of floppy-disk storage and 12.7 megabytes of 5¼-inch Winchester-disk storage is available for $8049.

For full details, contact Xitex Corp., 9861 Chartwell Dr., Dallas, TX 75243, (214) 349-2491.
Circle 629 on inquiry card.

Middi-Cadet

Integrated Business Computers has introduced a smaller version of its Super-Cadet microcomputer, called Middi-Cadet. Middi-Cadet measures 12 inches wide by 6 inches tall by 17 inches, so it can fit comfortably on most desktops. Standard features include 256K bytes of RAM (random-access read/write memory), a 20-megabyte 5¼-inch hard disk, a 1-megabyte floppy-disk drive, 10 serial ports, and one Centronics port. Middi-Cadet's memory can be bank-switched within any 4K-byte block, and its bank sizes are switch-selectable. Middi-Cadet also features switch-selectable MP/M-to-Oasis-to-Famos operating systems.

Optional equipment for Middi-Cadet includes a cache memory, a cartridge-tape controller, and a bisynchronous port for communications capabilities. Middi-Cadet has a suggested retail price of $7500. For full details, contact Integrated Business Computers, 21592 Marilla St., Chatsworth, CA 91311, (213) 882-9007.
Circle 630 on inquiry card.

MISCELLANEOUS

Logic Comparator

The Bugtrap Logic Comparator from Bugtrap Instrumentation is a troubleshooting tool that compares TTL (transistor-transistor logic) devices in circuit. It compares the output activity of the circuit being tested to that of a known good circuit. The circuits share a system input, but their outputs are separated and continuously compared. Any miscomparisons cause an error signal to be generated and a corresponding LED (light-emitting diode) to light.

The Bugtrap Logic Comparator comes with a reference manual that documents more than 100 of the most commonly used and testable TTL chips. It costs $265 and comes with a 14-day money-back trial period. For further details, contact Bugtrap Instrumentation, 1173 Tasman Dr., Sunnyvale, CA 94086, (408) 734-1118.
Circle 631 on inquiry card.

RS-232C Line Tester

B & B Electronics is offering an RS-232C tester that monitors and displays the status of seven RS-232C lines. The tester has LEDs (light-emitting diodes) that display the status of the following lines: transmit data, receive data, request-to-send, clear-to-send, data set ready, carrier detect, and data terminal ready. The unit has one 25-pin male and one female connector for insertion into any RS-232C interface.

The tester does not require power and is designed to remain in-line permanently. It does not affect data-transfer ability. It costs $39.95, postage paid, and is available from B & B Electronics, POB 475, Mendota, IL 61342, (815) 539-5827.
Circle 632 on inquiry card.

Winchester Controller with DMA

Compupro is marketing a high-performance Winchester disk controller that can directly access a 16-megabyte address space. The Disk 2 controller board has high-speed DMA (direct memory access) protocols that allow processor-independent data transfer between system memory and Winchester-type 8- and 14-inch drives. It can handle four drives, with up to 16 heads per drive. The Disk 2 is compatible with IEEE 696/S-100 bus standards and with MP/M, Oasis, CP/M-80, and CP/M-86 operating systems.

Disk 2 will work with the Shugart SA4000 series, Fujitsu 2300 series, and Memorex 101 series drives. The suggested retail price is $795; OEM (original equipment manufacturer) prices on request. Contact Compupro Systems, Oakland Airport, Oakland, CA 94614, (415) 562-0638.
Circle 633 on inquiry card.

Apple II Data-Protection System

Datalok from Atlantis Computers makes the DES (Data Encryption Standard) Algorithm for data protection available to Apple II or CP/M users. By storing data in encrypted form, Datalok prevents unauthorized individuals from tampering with your information. It uses a WD2001 DES chip on a board configured for the Apple bus and is supplied with in-

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Q.T. MICRO-FRAME™—Series 600

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- 6 to 22 slot Motherboard
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6 slot MB	List $599	Bison $479
8 slot MB	List $649	Bison $519
12 slot MB	List $699	Bison $559
18 slot MB	List $799	Bison $639
22 slot MB	List $899	Bison $719

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Desk Top—Dual Mini Drives

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- Full Cutout Array
- 6, 8, or 12 slot MB.
- Fused EMI/RFI Filter
- Hard Disk Power Supply (+8V@16A, ±16V@3A, ±12V@5A, +5V@5A)

6 slot MB	List $799	Bison $639
8 slot MB	List $849	Bison $679
12 slot MB	List $899	Bison $719

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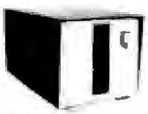
8 slot MB	List $949	Bison $759
12 slot MB	List $999	Bison $799

Q.T. DISK DRIVE CABINETS AND SUBSYSTEMS



Front—Tandon Panel

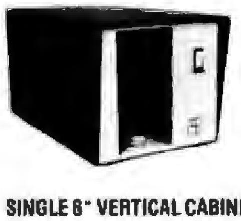
Rear view

Q.T.'s All in One™

• Universal Disk Drive Cabinet
• Expandable • Accepts all 8" drives

QT's unique new disk drive cabinet has been designed to accept virtually any 8" drive on the market today from Tandon Thinlines to 40 megabyte Quantums. Features include interchangeable face plates (Qume, Shugart, Tandon, etc.) and "electronics in a drawer" construction to simplify installation and maintenance. Heavy duty power supply will carry any combination of up to four Thinline, two standard, or one hard disk drive with floppy backup. +5V@5A, −5V@1A, +24V@5A.

DDC8 8V-XX w/one faceplate	List $399	Bison $319.00
Replacement Faceplates (Specify type)		$25.00



SINGLE 8" VERTICAL CABINET

Size: 11"H 11"W 18"D

Perfect add-on disk drive for any system. Accepts most brands.

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DUAL 8" HORIZONTAL DRIVE CABINET

Dimensions: 5"H 17"W 20"D

Designed to provide basic disk storage capacity for S-100 and other computers. Low profile permits table top stacking.

OTC-DDC+88H List $349 , Bison $279

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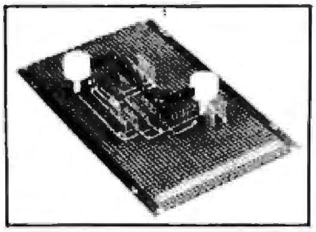
teractive software that lets you encrypt and encode data by responding to a few questions. No programming is required.

Two software utilities are supplied with Datalok. The first is the ability to encrypt and decrypt any file created under Apple DOS, such as text, integer, binary, or Applesoft. The second lets you lock and unlock an entire disk, thereby rendering it inaccessible and unbootable to unwelcome users.

Datalok requires 48K bytes of RAM (random-access read/write memory), one disk drive, DOS 3.2 or 3.3, and Applesoft BASIC. The price is $349. The CP/M software costs $69. Order Model ACS-1A from Atlantis Computers, 31-14 Broadway, Astoria, NY 11106, (212) 728-6700.

Circle 634 on inquiry card.



Tool for Wire-Wrapping

OK Industries' WA-1 Wrap-Aid wire-measuring tape ruler is designed for wire-wrapping applications. This tool eliminates wasted wire, helps prevent errors by identifying both posts to be wrapped, and can help you determine the best wire path. Special post extensions are provided for wire routing. Here's how it works: one end of Wrap-Aid is placed over the first post to be wrapped. The other end is then pulled through the wiring path and placed over the second post. The length of wire required is then read directly from the tape.

The WA-1 Wrap-Aid costs $4.95. It's available from many electronics distributors or from OK Industries Inc., 3455 Conner St., Bronx, NY 10475, (212) 994-6600.

Circle 635 on inquiry card.

Impact Detector

Shockwatch is a small glass capsule that attaches to hard-disk units and detects and flags mechanical shocks that may indicate possible damage to the unit. Manufactured by Media Recovery, Shockwatch is designed to be an integral part of any of six configurations of hard-disk packs. It uses a combination of liquid surface tension and capillary action to detect trouble. Indicators that turn from white to red alert you to an impact of a degree that could cause misalignment of the disk, which can result in a head crash. Contact Media Recovery Inc., 1435 Round Table Dr., Dallas, TX 75247, (800) 527-9497; in Texas, (214) 630-9625.

Circle 636 on inquiry card.

Ethernet for IBM

A series of products that link IBM Personal Computers together in an Ethernet local-network environment has been introduced by 3Com Corporation. All the Etherseries products are plug- and software-compatible with the PC and provide users with peripheral and information sharing and personal communications capabilities. Among the items in the series is Etherlink, which includes a plug-in controller/transceiver board, software, and manual. It costs $950.

Also available is Ethershare, a 16-bit microcomputer-based file server with a 10-megabyte Winchester-disk drive. It supports as many as 20 workstations (dependent only on disk capacity) and allows each user access to the Winchester drive as if it were a part of his system. The disk-sharing software makes storage appear as "virtual floppy disks." Most disks have a file backup system whereby files are periodically copied so as to protect against system failures. A hard-disk backup system on floppy disk or an optional tape-cartridge system is available. Passwords can be assigned so that access to data can be limited. Ethershare costs $11,500.

When equipped with a printer and Etherprint software, Ethershare can support spooled printer sharing. Another product, Ethermail, provides Ethershare with electronic-mail collection and distribution capabilities. Ethermail permits messages to be automatically amended with attachments from any PC DOS file.

The Etherseries will be expanded to allow other personal computers to communicate with each other. In addition, more software is being developed. Complete details are available from 3Com Corp., 1390 Shorebird Way, Mountain View, CA 94043, (415) 961-9602.

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6522 VIA	6.45	10/ 6.10	50/ 5 75	100/ 5.45
6532	7 90	10/ 7.40	50/ 7 00	100/ 6 60
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6116 2KX8 CMOS RAM		8 90	5/ 8 45	10/ 7 90
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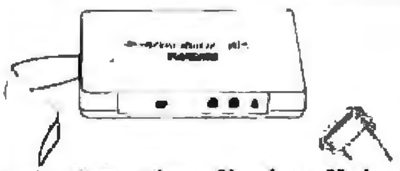

Ancher Automation Signalman Modems

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All Signalman Modems are Direct Connect, and include cables to connect to your computer and to the telephone. Signalman Modems provide the best price-performance values, and start at less than $100 **Dealer and OEM inquiries invited**

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Mark II for Atari 850
Mark IV for CBM/PET with software
Mark V for Osborne (software available)
Mark VI for IBM Personal Computer
Mark VII Auto Dial/Auto Answer
Mark VIII Bell 212 Auto Dial/Answer

DC HAYES Smartmodem	**229**
RS232 MODEM — Accoustic	**119**
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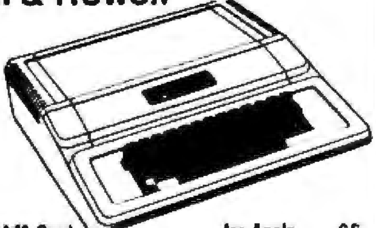
We carry Apple II+ from Bell & Howell



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Intelligent Terminal Package includes ACIA hardware based interface; DB25 Cable and STCP Software with remote telemetry, transfer to/from disk, printer output, XON-XOFF control, user program control, and status line

VE-2 IEEE to Parallel Interface 119

Includes case, power supply, full 8-bit transmission, and switch selectable character conversion to ASCII

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VIC 8K RAM	53	VIC Radar Ratrace	24
VIC 16K RAM	99	Amok (UMI)	20
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VIC Omega Race	32	Programmers Reference	15
Spiders of Mars (UMI)	39	Renaissance (UMI)	39
VIC Draw Poker	24	VIC Superslot	23

VICTORY Software for VIC

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Options include an embedded printer with 5 by 10 dot-matrix uppercase and lowercase characters, two RS-232C ports, a Zilog Z80 to run CP/M version 2.2, and a built-in 300- or 300/1200-bit-per-second modem. User applications software includes an electronic spreadsheet, a word processor, a time and project scheduler, business graphics, and accounting software. Prices for the Dot ranges from $2995 to $3997, depending upon options. For complete details, contact Computer Devices Inc., 25 North Ave., Burlington, MA 01803, (800) 343-5104; in Massachusetts, (617) 273-1550. In Canada, call Datamex Ltd. at (416) 781-9135.
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Where Do New Products Items Come From?

The information printed in the new products pages of BYTE is obtained from "new product" or "press release" copy sent by the promoters of new products. If in our judgment the information might be of interest to the personal computing experimenters and homebrewers who read BYTE, we print it in some form. We openly solicit releases and photos from manufacturers and suppliers to this marketplace. The information is printed more or less as a first-in first-out queue, subject to occasional priority modifications. While we would not knowingly print untrue or inaccurate data, or data from unreliable companies, our capacity to evaluate the products and companies appearing in the "What's New?" feature is necessarily limited. We therefore cannot be responsible for product quality or company performance.

Relational Database Management System

ABW Corporation's RL-1 Relational Database Management system is designed for the IBM Personal Computer and CP/M-based systems. This database is fully relational and comes with such operators as selection, projection, and join. Standard features include a query language, relational editor, and program interface.

A variety of applications packages are available for use with the RL-1 system, including a report generator, a graphics processor, inventory and production control, and general ledger and other accounting packages. The suggested retail price for the RL-1 Database Management system is $495. For full details, contact ABW Corp., POB M1047, Ann Arbor, MI 48106, (313) 971-9364.
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Cube Aids Program Instruction

Metacomet Software's Programmable Cube can help teach programming because it corresponds to the popular cube game. This program simulates all six sides of the cube in six colors (or special shades for black-and-white displays) as well as each move's motion. A solver provides a step-by-step guide through the solution of any scrambled cube. The Programmable Cube is supplied with a programming language designed especially for cubes, pattern-matching and control constructs, and an editor and debugger.

The Programmable Cube runs on Apple II computers and is available in both 48K- and 64K-byte versions. It costs $34.95. Contact Metacomet Software, POB 31337, Hartford, CT 06103.
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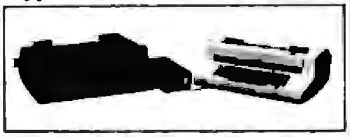

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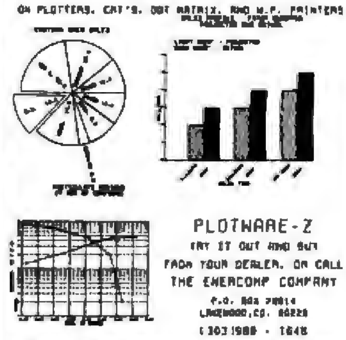

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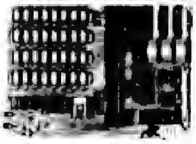

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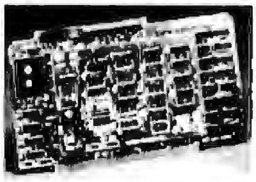

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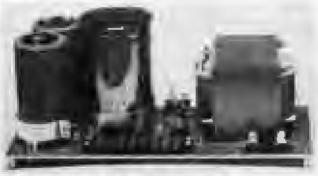

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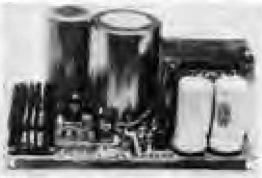

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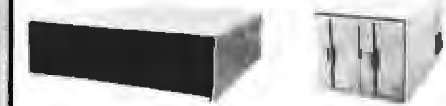

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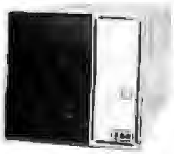

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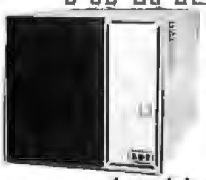

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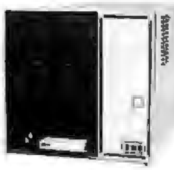

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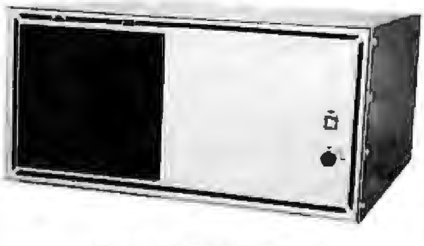

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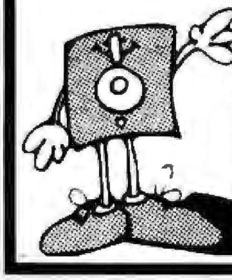

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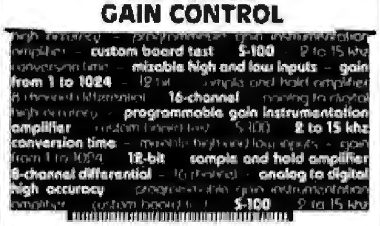

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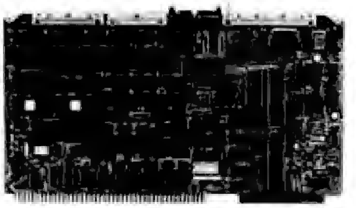

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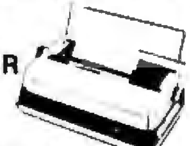

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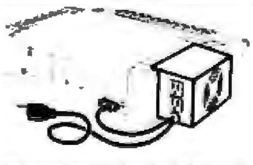

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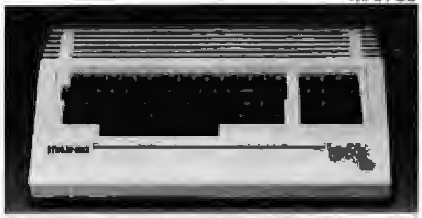

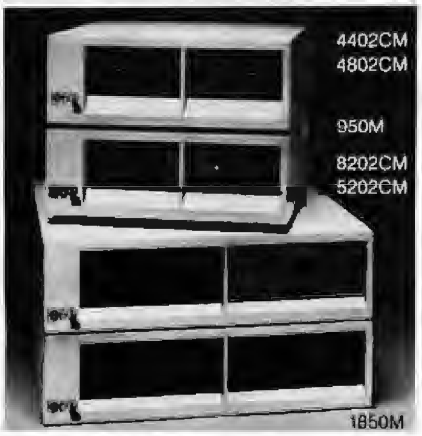

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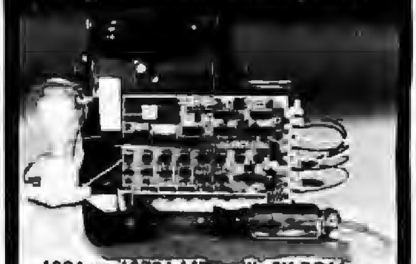

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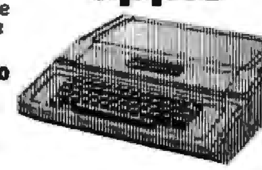

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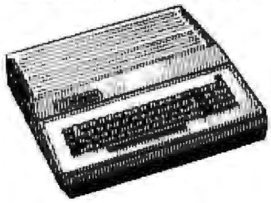

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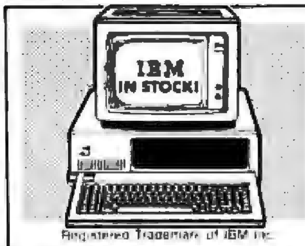

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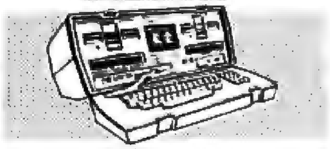

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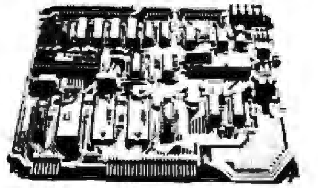

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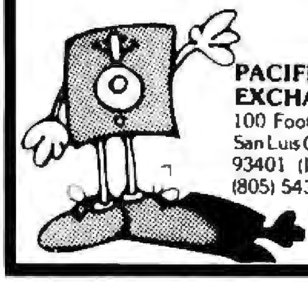

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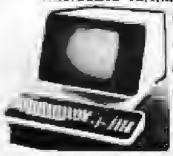

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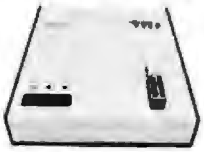

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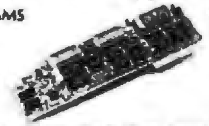

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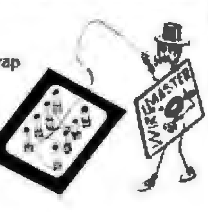

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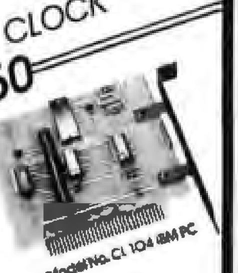

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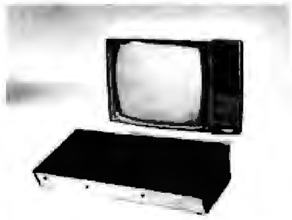

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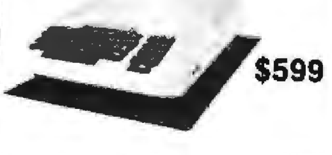

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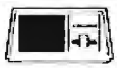

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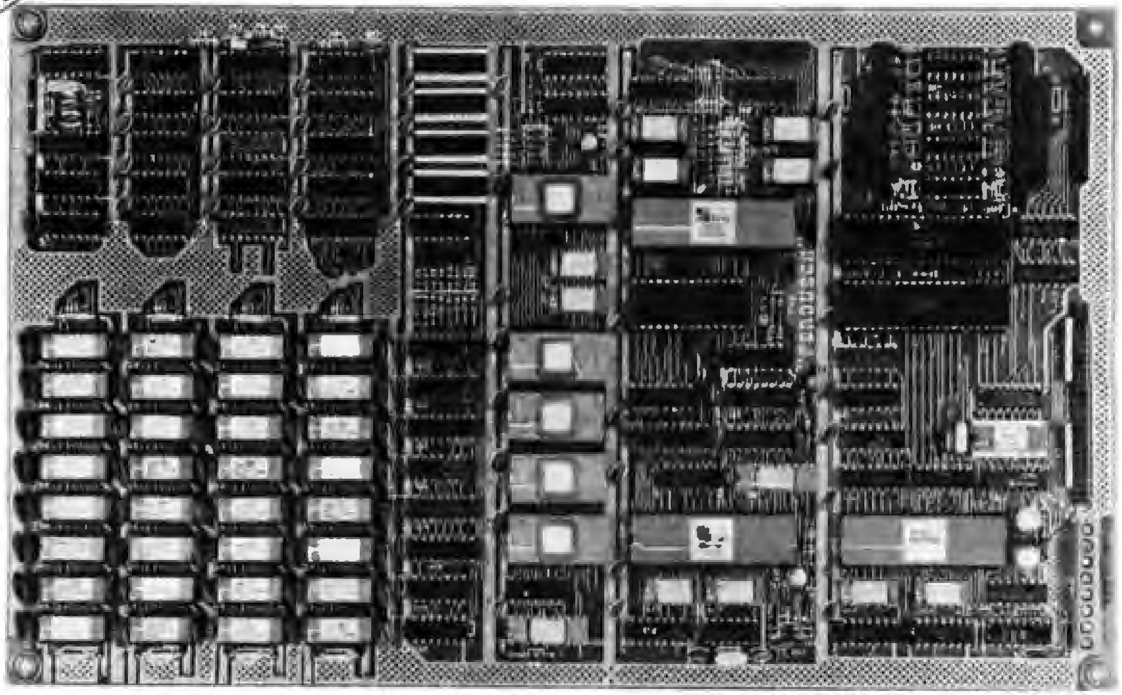

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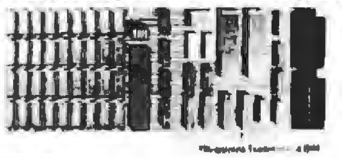

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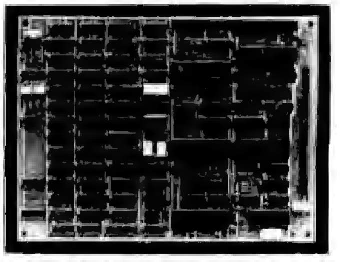

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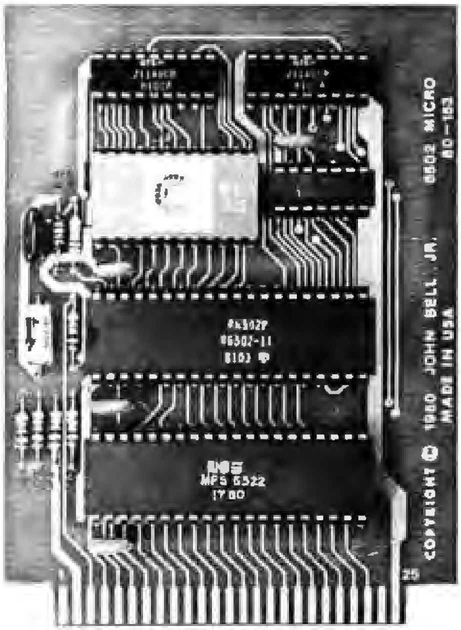

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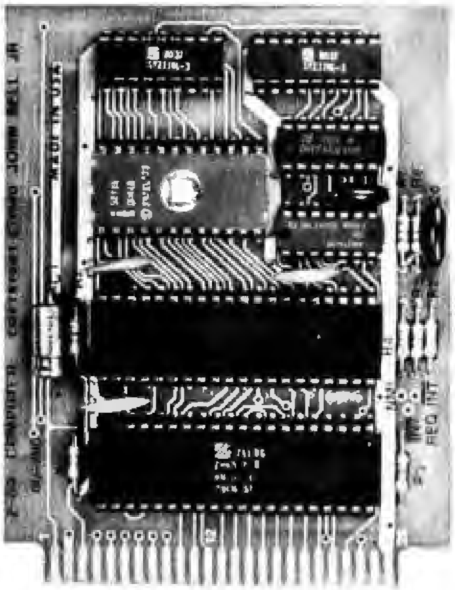

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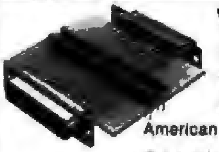

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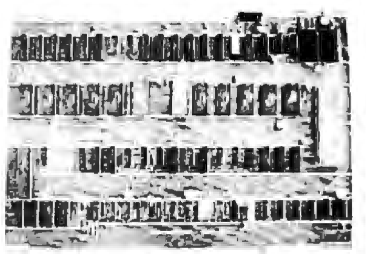

FEATURES:
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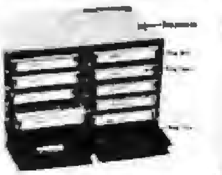

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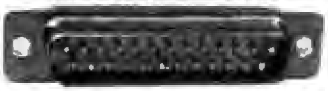
CONNECTORS



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DE9S	9 Pin Socket	2.49
DA15P	15 Pin Plug	2.49
DA15S	15 Pin Socket	3.29
DB25P	25 Pin Plug (Meets RS232)	3.79
DB25S	25 Pin Socket (Meets RS232)	4.49
DC37P	37 Pin Plug	5.49
DC37S	37 Pin Socket	6.49
DD50P	50 Pin Plug	6.49
DD50S	50 Pin Socket	7.49

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Part No.	Description	Price
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DE-15H	Hood for DA-15 Series Connectors	1.49
DB25H	Hood for DB25 Series Connectors	1.79
DB37H	Hood for DC37 Series Connectors	1.59
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JE224 KIT .... $79.95 each

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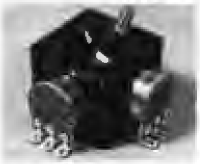

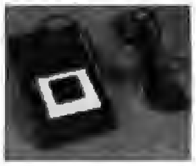

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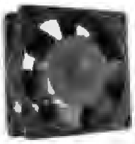

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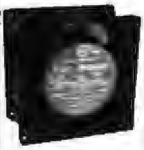

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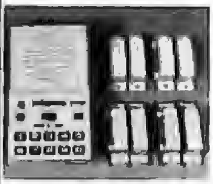
ES-07 Door Alarm **$29.95**

Home Alarm System



• Self-installation • Presettable w/individual 3-digit code — no key nec. • Instant or 10-sec delayed warning system • Alarm system incl. window & door contacts • One 9V battery required (not incl.) Low power consumption (0.01mA) • Loud audible alarm (90db) • Delayed exit feature • System complete w/one control station with built-in siren and test button; 4 magnetic contact sets & connecting wires for entire system

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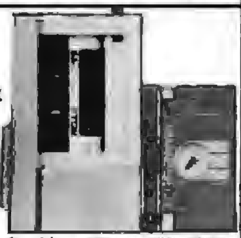
with FM Stereo Tuner Pack



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4.7/25V	.18	.15	.13	1.0/25V	.16	.14	.13
10/25V	.18	.15	.13	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	4.7/16V	.15	.13	.12
22/25V	.19	.16	.12	4.7/25V	.16	.14	.13
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.15	.13	.12
47/50V	.29	.25	.23	10/25V	.16	.14	.13
100/25V	.29	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/50V	.25	.21	.19
220/25V	.39	.34	.33	100/16V	.21	.17	.14
220/50V	.49	.45	.41	100/25V	.25	.22	.22
470/25V	.54	.49	.45	100/50V	.37	.34	.31
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JE664 EPROM PROGRAMMER

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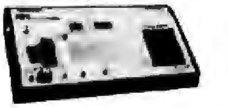

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Assembled & Tested

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JM16B	TMS2716	Motorola, TI (+5, -5, +12)	$14.95
JM32A	TMS2532	Motorola, TI	$14.95
JM32B	2732	AMD, Fujitsu, NEC, Hitachi, Intel	$14.95
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SECURITY ALARM SYSTEMS

Home Alarm System

• Self installation • Presettable wiring/visual 3-digit code — no key nec. • Instant or 10-sec. delayed warning system • Alarm system incl. window & door contacts • One 9V battery required (not incl.) • Low power consumption • Loud audible alarm (90dB) • Delayed and features • System complete w/one control station with built-in siren and test switch, 4 magnetic contact sets & connecting wires for entire system

ST-05 Home Alarm System **$59.95**

Door Security System

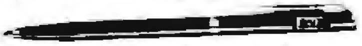
• Coded door alarm • Install in 5 second delay system • Alarm activated as door is opened • Can be de-activated by pressing personal code • Power: One 9V battery (not incl.) • System includes one personal coded keyboard and one magnetic sensor

ES-07 Door Alarm **$29.95**

Anti-Theft Auto Alarm System

• Automatic horn is activated when door or trunk is opened • Alarm sounds for 3 min. — unless turned off by secret 3-digit code • Wire cutting will not deactivate alarm • Code set by owner • Uses only 0.01mA power • System complete w/one black-box control unit, one personal coded keyboard, 1 pair of sensors, one auxiliary horn & wiring (incl. one 12A fuse)

CA-06 Auto Alarm **$59.95**



DIGITAL QUARTZ TIME PEN

• 5-Function: Hours, Minutes, Seconds, Month, Day • Liquid Crystal Display • 1/8" digits • Battery included • Uses standard Parker ink refills • Ultra-slim design (5¼" x ⅜")

771LK	Black/Gold Trim	$9.95 each
771SG	Stainless Steel/Gold Trim	$9.95 each
771LR	Red/Gold Trim	$9.95 each

STICK-ON CLOCK

5-Function LCD Quartz Digital

• Hours • Minutes • Seconds • Month • Day • Flashing Colon • Ideal for car, kitchen, bathroom, office, etc. • 1/4" digits • Runs 2 years on 1 battery (incl.) • Size 1-3/8" Round. Specify color: Red/ST-001R, White/ST-001W, Black/ST-001B

#ST-001___ (Specify letter) ..... **$4.95 each or 2/$8.95**

Stereo Cassette Player

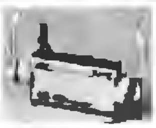
with FM Stereo Tuner Pack

- Lightweight Headphones
- Cr02/Metal/Normal Tape Selector
- Anti-Rolling Mechanism

FEATURES: • Blue carrying case, shoulder strap, belt strap, lightweight headphones, FM stereo tuner pack & instruction manual • Talkline • Tone selector • Cr02/Metal/Normal tape selector • LED operation indicator • Built-in microphone • Stop/eject, play, rewind/review, fast forward/cue, tape/radio selection functions • Vol. control • Ext. power input jack • Headphone jack • Auto-stop mechanism (shuts off player when tape ends) • Anti-rolling mechanism (prevents sound from wavering when walking, jogging, etc.) • Weight: 13 oz. • Requires 4 AA batteries (not included) • Size: 6"L x 4"W x 1-1/8"H

Model TWF-802 ..... **$69.95**

AM3-4 AA Alkaline Batteries ..... **4/$3.95**



UTIC

Mini Stereo AM/FM Receiver

WITH HEADPHONES
For Joggers, Cyclists, Skaters & Sports Events

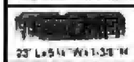
FEATURES: Lightweight headphones. Left/right balance control. Full fidelity stereo sound. Additional: Black soft carrying case and shoulder strap. Belt clip (hands free). Operates on 3 AA cell batteries (not incl. - see below). Compact size: 3-1/8"H x 4-7/8"L x 1"D. Wt. 8 oz.

Model 2830 ..... **$29.95**

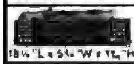
AM3-3 AA Alkaline Batteries ..... **3/$2.95**

KEYBOARDS — POWER SUPPLIES

MICRO SWITCH 69-KEY KEYBOARD
Data Entry Keyboard. Encoded Output. 8-bit Parallel EBCDIC. Switching: Hall Effect, 24-pin Edge Card Connection. Complete w/Pin Connection. Can easily be modified to ASCII code.
18½"L x 6¾"W x 1¾"H
Part No. KB69SD12-2 (Fits into DTE-20 Enclosure) ..... **$19.95 each**



MICRO SWITCH 85-KEY KEYBOARD
Word Processing keyboard, 25 Pin Edge Card Connection. Supply Voltage +5VDC. Uses keyboard in QWERTY. Additional Key Pads for Cursor and word processing functions.
23"L x 5½"W x 1-3/8"H
Part No. 85SD16-1 ..... **$29.95 each**



MICRO SWITCH 88-KEY KEYBOARD (PARALLEL)
Data Entry Keyboard used in a Diablo 1640 Terminal. Supply Voltage +5V, -12V. Switching: Hall Effect — 10-pin Edge Card Connection. Schematic included. Uses 8048 Encoder Chip.
18¼"L x 5¼"W x 1¾"H
Part No. 88SD22 (Fits into DTE-20 Enclosure) ..... **$69.95 each**

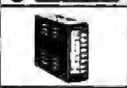
POWER SUPPLY +5VDC @ 1 AMP REGULATED — Transaction Tech.
Output: +5VDC @ 1A (also +30VDC) reg. Input 115VAC 60Hz. 2-case (black/beige) self-enclosed case, 4 ft. 3 cond. black power cord. 5¼"W x 7"D x 2¾"H. Wt. 3 lbs. Data sheet incl.
Part No. PS51194 ..... **$19.95 each**

POWER SUPPLY +5VDC @ 1 AMP REGULATED — Industries
Output: +5VDC @ 1 amp, +36-42VDC at 400mA or less, 30VAC ... Input 115VAC 60Hz. Circ. brkr. reset button, ... power cord w/rubber feet. ... On/off switch. 6¾"W x 3½"D x 3-7/8"H. Wt. 2 lbs. Data sheet included.
Part No. PS4070 ..... **$24.95 each**

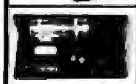
POWER SUPPLY +5VDC @ 3 AMP REGULATED — Deltron
Input: 115VAC, 47-440Hz. Output: 5VDC Adjustable @ 3 amp. 5VDC @ 2.5 amp. Adjustable current limit. Ripple & Noise: 1mV rms, 5mV p-p — 2 mounting surfaces. UL recognized. Size 4"W x 4¾"L x 2-7/16"H. Wt. 2 lbs. Data sheet included.
Part No. OPS-1 ..... **$29.95 each**

MULTI-VOLTAGE POWER SUPPLY +5, +12, −12VDC REGULATED
Input: 105-125VAC, 47-63Hz / 205-250VAC, 47-63Hz. Output: +5VDC @ 2 amps Adj. 12VDC @ 50mA Fixed, +12VDC @ 1 amp Adj., −12V @ 2 amp adj. Overvoltage protection. Size: 12¾"L x 4-7/8"W x 3⅛"D. Data sheet included.
Part No. RA0250 ..... **$39.95 each**

POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING
Input: 115/230VAC ... Output: 5VDC @ 7.5 amp, 12VDC @ 1.5 amp. ... 13⅞"D x 2¾"H. Wt. 6 lbs.
Part No. PS9470 ..... **$49.95 each**



POWER SUPPLY 4-Channel Switching Power Supply
Microprocessor, mini-computer, terminal, medical equipment and process control applications. Input: 90-130VAC, 47-440Hz. Output: +5VDC @ 5A, -5VDC @ 1A, +12VDC @ 1A, -12VDC @ 1A. Line reg. ±0.2%. Ripple 50mV p-p. Load reg. ±1%. Overcurrent protection. Adj.: 5V main output ±10%. 5-3/8"L x 1-7/8"W x 4-13/16"H. Wt. 1¾ lbs.
Part No. FCS-604A ..... **$69.95 each**



POWER SUPPLY Adjustable Switching 4-24VDC to 5 Amps
Adj. 4-24VDC: 5VDC @ 5A, 4VDC @ 4.5A ... 12VDC @ 3.5A, 18VDC @ 1.6A, 24VDC @ .5A. Overvoltage Protection. Input: 115VAC 50/60Hz. Output variations within 20mV. 8.25"L x 5.25"W x 2.25"H. Wt. 3.25 lbs.
JE224 Kit ..... **$79.95 each**
JE224A Assembled & Tested ..... **$99.95 each**

SORENSEN Regulated Power Supplies

SDC 2-6 (Pictured)

Sorensen's open construction (SOC) power supplies are series-regulated solid-state systems, designed to provide reg. DC voltages at 6 levels (2-28 vrange). These units are open-framed on sturdy black anodized aluminum for excellent mounting.

FEATURES: 115/208/230VAC input @ 50-63Hz. Low Ripple. Low noise. 3mV P-P maximum. Adjustable current limit. Voltage adjustment control. All schematics and specifications supplied with unit. Series A, B, C, E have three mounting surfaces (Series F, bottom mounting only).

Part No.	Series	Output Voltage Adjustment Range Min.	Max.	Output Current @ 40°C	@ 50°C	@ 71°C	Size (inches)	Weight	Price
SOC 2-6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOC 2-25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOC 6-10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOC 6-25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOC 12-11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOC 15-6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOC 15-8.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOC 15-17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOC 28-4.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BUG BOX™ — 30 individual compartments • Stores 60 8-pin or 30 14 or 16-pin DIPs • Heavy duty injection molded plastic • Clear plastic cover slides & locks • Cover marked w/numbers 1-30 • Compartment size: 1" x 3.75" x .5" deep • Box size: 4.8" x 3.3" x .6" • Weight: 1.75 oz.

BUG BOX™
Please specify color code: (B) Blue, (R) Red, (W) White, (Y) Yellow

Part No./Color Code		QTY	PRICE
BOX-001-(	)	1	$ 2.29
BOX-010-(	)	10	19.99
ANTI-STATIC			
BOX-001-(	)AS	1	$ 3.29
BOX-010-(	)AS	10	29.99

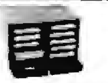
BUG CAGE™ — 12 locations store Bug Boxes, Big Bug Boxes or Bug Trays • Modular and interlocking • Heavy duty injection molded plastic • Each cage has 6 slip-on locations • 2 cages per pkg. • Cage size: 9-1/8" x 5" x 3-7/8" • 4 colors available — please specify color code (B) Blue, (R) Red, (W) White, (Y) Yellow

Part No./Color Code		Price
BOC-001-(	(2 Cages/Blue, ea.)	$11.95/pkg.

BUG TRAY™ — Stores in Bug Cage • Molded plastic • Three styles: Open (1 compartment 3.06" x 4.0" x .6"), Vertical (5 compartments .5" x 4.8" x .5"), and Horizontal (6 compartments .4" x 3.95" x .6") • Ideal for tools, hardware, components, etc. • Tray size: 3.95" x 5.01" x .6" • Black color only

PART NO.	DESCRIPTION	PRICE
BTH-001	Horizontal Bug Tray	$1.98
BTV-001	Vertical Bug Tray	1.98
BTO-001	Open Bug Tray	1.98
BTX-003	1 of each Bug Tray (3)	4.98

BUG BOX™ STORAGE SYSTEMS



BUG CAGE™ (BOC-001-___) with Bug Boxes

LSI BIG BUG BOX™ — Designed to store large IC's, Resistors, Capacitors and Diodes • Divided into three compartments measuring 1" x 4.15" x .5" deep • Three vertical and three horizontal dividers included • Heavy duty injection molded plastic • Box size: 4.9" x 3.3" x .6" • Weight: .75 oz.

LSI BIG BUG BOX™
Please specify color code: (B) Blue, (R) Red, (W) White, (Y) Yellow

PART NO./COLOR CODE		QTY	PRICE
BLX-001-(	)	1	$ 3.29
BLX-010-(	)	10	29.79
ANTI-STATIC			
BLX-001-(	)AS	1	$ 4.29
BLX-010-(	)AS	10	37.99

BACK PACK™ — Self-adhesive labels for the back of ICs • Shows exact internal logic in relation to IC pins • 532 labels in each package (including several blank labels) • Each package for 8, 14, 16, 24, 28 and 40-pin ICs • Combo package includes 1,064 labels for TTL and CMOS ICs • Microprocessor package contains 744 labels

Part No.	Description	Price
BPT-012	TTL	$7.95
BPC-012	CMOS	8.95
BPM-012	Combo	14.95
BPU-012	Microprocessor	6.95

JUMPER AND CABLE ASSEMBLIES

Custom Jumpers! Custom Cables!

STANDARD DIP JUMPERS

All jumpers use low profile dip plugs with heavy duty pins for rugged application.

Jameco Part No.	3M Cross Reference	No. Pins	Description	Cable Length	Price
DJ14-1	[illegible]	14	single end	12"	$1.79
DJ14-2	[illegible]	14	single end	24"	2.06
DJ14-3	[illegible]	14	single end	36"	2.38
DJ14-1-14	[illegible]	14	double end	12"	2.85
DJ14-2-14	[illegible]	14	double end	24"	3.10
DJ14-3-14	[illegible]	14	double end	36"	3.40
DJ16-1	[illegible]	16	single end	12"	1.88
DJ16-2	[illegible]	16	single end	24"	2.10
DJ16-3	[illegible]	16	single end	36"	2.58
DJ16-1-16	[illegible]	16	double end	12"	2.88
DJ16-2-16	[illegible]	16	double end	24"	3.29
DJ16-3-16	[illegible]	16	double end	36"	3.50
DJ24-1	[illegible]	24	single end	12"	1.89
DJ24-2	[illegible]	24	single end	24"	3.19
DJ24-3	[illegible]	24	single end	36"	3.69
DJ24-1-24	[illegible]	24	double end	12"	4.49
DJ24-2-24	[illegible]	24	double end	24"	4.85
DJ24-3-24	[illegible]	24	double end	36"	5.39

Jameco Part No.	3M Cross Reference	No. Pins	Description	Cable Length	Price
[illegible]	[illegible]	40	single end	12"	5.39
[illegible]	[illegible]	40	single end	24"	6.19
[illegible]	[illegible]	40	single end	36"	6.89
[illegible]	[illegible]	40	double end	12"	8.49
[illegible]	[illegible]	40	double end	24"	10.29
[illegible]	[illegible]	40	double end	36"	10.95

STANDARD DB25 SERIES CABLES

Now you can order DB25 P or S connectors with the cable necessary to fit your application. Choose from our standard list below in 4 foot lengths. Call today.

STANDARD CABLES

Part No.	Cable Length	Connectors	Price
DB25P-4	4 feet	1 DB25P	$7.95
DB25S-4	4 feet	1 DB25S	8.49
DB25P-4-P	4 feet	2 DB25P	13.49
DB25P-4-S	4 feet	1 DB25P/1 DB25S	13.75
DB25S-4-S	4 feet	2 DB25S	13.95

$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6½% Sales Tax
Postage — Add 5% plus $1.50 Insurance
Send S.A.S.E. for Monthly Sales Flyer!

Spec Sheets — 30¢ each
Send $1.00 Postage for your
FREE 1983 JAMECO CATALOG
Prices Subject to Change

Call for Quantity Discounts

Mail Order Electronics • Worldwide

Jameco ELECTRONICS

NEW! Telex Number Telex 176043

1355 SHOREWAY ROAD, BELMONT, CA 94002

12/82 *PHONE ORDERS WELCOME — (415) 592-8097*

5¼" Mini-Floppy Disc Drive

FOR TRS-80 MODEL I (Industry Standard)

Perfec Computer Corp.

Features single or double density. Recording mode: FM single, MFM double density. Power: +12VDC (±0.8V) 1.8 amps max., +5VDC (±0.25V) 0.6 amps max. Unit as pictured at left (does not incl. case, power supply or cables). 30-page data book included. Weighs 3½ pounds. Size: 5¾"W x 8"D x 3¼"H.

Limited Quantity!

Part No.	Price
FD200	**$179.95**
Single-sided, 40 tracks, 250K bytes capacity	
FD250	**$199.95**
Double-sided, 35 tracks, 438K bytes capacity	

EXPAND YOUR TRS-80

to 16K, 32K, or 48K

Model 1 =	From 4K to 16K Requires (1) One Kit
Model 3 =	From 4K to 48K Requires (3) Three Kits
Color =	From 4K to 16K Requires (1) One Kit

**Model 1 equipped with Expansion Board up to 48K Two Kits Required — One Kit Required for each 16K of Expansion —

TRS-80 16K Conversion Kit

Kit comes complete with 8 each MM5290 (UPD416/4116) 16K Dynamic RAM (*ns) and documentation for conversion

TRS-16K2 *150ns	$14.95
TRS-16K3 *200ns	$12.95
TRS-16K4 *250ns	$10.95

TRS-80 Color 32K or 64K Conversion Kit

Kit comes complete with 8 ea. 4164-2 (200ns) 64K Dyn. RAMs & conversion documentation. Converts TRS-80 color computers from 4K-32K Memory or 16K-64K Memory

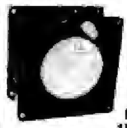
TRS-64K2 (200ns) **$54.95**

Universal Computer Keyboard Enclosure

DTE ... are designed for easy installation. High strength epoxy molded end panels in mocha brown finish. Sliding top/bottom panel for service-component access. Top/btm. panels ... finish (paint ... color) ... Vented top & bottom panels for cooling efficiency.

DTE-20 Panel width 20" **$34.95**

Sprite-style Fan

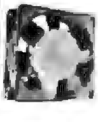


- 36cfm free air delivery
- 3.125" sq. x 1.685" depth
- 10 yrs. cont. duty at 20°C
- 115V 50/60Hz
- For Apple users

Metal Frame

PWS2107U	Cleaned & tested (used)	$ 9.95 ea.
*PWS2107F	New	$14.95 ea.

Muffin-style Fan



- 105cfm free air delivery
- 4.68" sq. x 1.50" depth.
- 10 yrs. cont. duty at 20°C
- Impedance protected, ambients to 70°C
- 115V 50/60Hz 14W Wt. 17 oz.

Metal Frame

MU2A1-U	Cleaned & tested (used)	$9.95 ea.
*MU2A-1N	New	$14.95 ea.

JOYSTICKS

JS-5K (Pictured)

JS-5K	5K Linear Taper Pots	$5.25
JS-100K	100K Linear Taper Pots	$4.95
JS-150K	150K Linear Taper Pots	$4.75
JVC-40	40K (2) Video Controller in Case	$4.95

UV-EPROM Eraser

8 Chips — 51 Minutes

1 Chip — 37 Minutes

Erases 2708, 2716, 2732, 2764, 2516, 2532, 2564. Erases up to 8 chips within 51 minutes (1 chip in 37 minutes). Maintains constant exposure distance at one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact — only 9.00" x 3.70" x 2.80". Complete with holding tray for 8 chips.

UVS-11EL Replacement Bulb **$16.95**

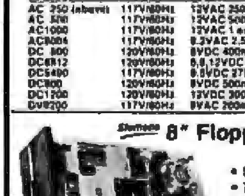
DE-4 UV-EPROM Eraser **$79.95**

AC250 (Pictured)

Wall Transformers AC and DC Types

Part No.	Input	Output	Price
AC 250 (above)	117V/60Hz	12VAC 250mA	$2.95
AC 500	117V/60Hz	12VAC 500mA	$4.95
AC1000	117V/60Hz	12VAC 1 amp	$5.95
AC9004	117V/60Hz	9.2VAC 2.5 amp	$3.95
DC 400	120V/60Hz	9VDC 400mA	$1.95
DC6812	120V/60Hz	6,9,12VDC 300mA	$6.95
DC5400	117V/60Hz	6.5VDC 275mA	$2.95
DC900	120V/60Hz	9VDC 500mA	$3.95
DC1200	120V/60Hz	12VDC 300mA	$7.95
DV9200	117V/60Hz	9VAC 200mA	$3.25

Siemens 8" Floppy Disk Drive



- Single-Sided
- 77 Tracks
- 400/800K Bytes Capacity
- Industry Standard

The FDD100-8 8" Floppy Disk Drive (Industry Standard) features single or double density. Recording mode: FM single, MFM double density. Transfer rate: 250K bits/sec. single density; 500K bits/sec double density. The FDD100-8 is designed to work with the single sided soft sectored IBM Diskette 1 or eq. disk cartridge. Hard-sectored option available. Power: 115/230VAC @ 50-60Hz, +24VDC @ 1.7 amps max., +5VDC @ 1.2 amps max. Unit as pictured above (does not include case, power supply, or cables). Size: 8.55"W x 14"L x 4.5"H. Weighs 12 lbs. Incl. 96 pg. manual.

Part No.		Price
FDD100-8	Buy 1 for	$269.95 each
FDD100-8	Buy 2 for	$259.95 each
FDD100-8	Buy 10 for	$249.95 each

Circle 255 on inquiry card.

We Have It!.. At the best prices.

Call For Super Value On S-100 System With Dbl. Dens. 8" Drives!

INTERTEC SUPERBRAIN II

Free! MicroSoft Basic 80

Self contained computer with dual disks and two RS232C ports. Complete with CP/M 2.2

64K Jr.	**$2099**
64K QD	**$2495**
64K SD	**$2949**
10 Meg. DDS Hard Disk	**$2995**

VIDEO TERMINALS

SOROC IQ 130	595
SOROC IQ 135	749
SOROC IQ 135G	799
SOROC IQ 140	1149
HAZELTINE ESPRIT	CALL
ESPRIT-II	CALL
1420	CALL
1500	CALL
1510	CALL
1520	CALL
TELEVIDEO 910C	CALL
912C	CALL
920C	CALL
925C	CALL
950C	CALL
TEXAS INST 940 BASIC	1599
940 Package	2079
745 Portable Terminal	1399
745 Portable Terminal w U L Case	1495
INTERTEC INTERTUBE III	749
ZENITH Z 19	729

PRINTERS

ANADEX DP-9000 A/01A	$1449
DP-9501A	1449
PAPER TIGER IDS 445G	*Special!* 599
PRISM PRINTER IDS-80, w/o color	Call
IDS-80, w/color	Call
IDS-132, w/color	1695
NEC 3510 RO RS232C 35 CPS	*New Low,* $1899
NEC 3530 RO, Centr Inter 35CPS	*Special,* 1859
NEC 7710 RO RS232C 55 CPS	2395
NEC 7720 KSR, RS232C 55CPS	2999
NEC 7730, RO, Centr Inter 55 CPS	2395
QUME Sprint 9/45 Lid or Full, 45 CPS, RS232C	*Only* 2049
C.ITOH Pro Writer, Parallel	549
Serial and Parallel	649
DIABLO 630 RO RS232C, 55CPS	2299
CENTRONICS 730-1, Parallel	349
737-3, RS232C	389
704-11, Parallel	1693
704-9, RS232C	1595
122G, Parallel, 120 CPS	949
EPSON	
MX80	489
MX80FT	589
MX100FT	789
RS232 Serial Interface	65
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- 7x7 dot matrix
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- 96 Character ASCII
- Microprocessor Electronics
- Expanded Print
- Right Margin Justification
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LM317T	1.19	LM380N-8	1.10	LM723H	.55	LM2900	.85
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H = TO-5 CAN   T = TO-220   K = TO-3

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75189	1.25	75493	.89
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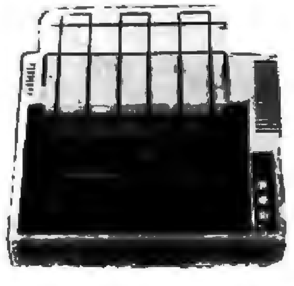

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5.0688	3.95
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6.144	3.95
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6504	6.95
6505	8.95
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6520	4.35
6522	8.75
6532	11.25
6545	22.50
6551	11.85
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74LS03	.25	74LS92	.55	74LS174	.55	74LS353	1.29
74LS04	.24	74LS93	.55	74LS175	.55	74LS363	1.35
74LS05	.25	74LS95	.75	74LS181	2.15	74LS364	1.95
74LS08	.28	74LS96	.89	74LS189	8.95	74LS365	.49
74LS09	.29	74LS107	.39	74LS190	.89	74LS366	.49
74LS10	.25	74LS109	.39	74LS191	.89	74LS367	.45
74LS11	.35	74LS112	.39	74LS192	.79	74LS368	.45
74LS12	.35	74LS113	.39	74LS193	.79	74LS373	.99
74LS13	.45	74LS114	.39	74LS194	.69	74LS374	.99
74LS14	.59	74LS122	.45	74LS195	.69	74LS377	1.39
74LS15	.35	74LS123	.79	74LS196	.79	74LS378	1.18
74LS20	.25	74LS124	2.90	74LS197	.79	74LS379	1.35
74LS21	.29	74LS125	.49	74LS221	.89	74LS385	1.90
74LS22	.25	74LS126	.49	74LS240	.95	74LS386	.45
74LS26	.29	74LS132	.59	74LS241	.99	74LS390	1.19
74LS27	.29	74LS133	.59	74LS242	.99	74LS393	1.19
74LS28	.35	74LS136	.39	74LS243	.99	74LS395	1.19
74LS30	.25	74LS137	.99	74LS244	.99	74LS399	1.49
74LS32	.29	74LS138	.55	74LS245	1.49	74LS424	2.95
74LS33	.55	74LS139	.55	74LS247	.75	74LS447	.37
74LS37	.35	74LS145	1.20	74LS248	.99	74LS490	1.95
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74LS40	.25	74LS148	1.35	74LS251	.59	74LS668	1.69
74LS42	.49	74LS151	.55	74LS253	.59	74LS669	1.89
74LS47	.75	74LS153	.55	74LS257	.59	74LS670	1.49
74LS48	.75	74LS154	1.90	74LS258	.59	74LS674	9.65
74LS49	.75	74LS155	.69	74LS259	2.75	74LS682	3.20
74LS51	.25	74LS156	.69	74LS260	.59	74LS683	3.20
74LS54	.29	74LS157	.65	74LS266	.55	74LS684	3.20
74LS55	.29	74LS158	.59	74LS273	1.49	74LS685	3.20
74LS63	1.25	74LS160	.69	74LS275	3.35	74LS688	2.40
74LS73	.39	74LS161	.65	74LS279	.49	74LS689	3.20
74LS74	.35	74LS162	.69	74LS280	1.98	74LS783	24.95
74LS75	.39	74LS163	.65	74LS283	.69	81LS95	1.49
74LS76	.39	74LS164	.69	74LS290	.89	81LS96	1.49
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74LS83	.60	74LS166	1.95	74LS295	.99	81LS98	1.49
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14 pin ST	.15	.12
16 pin ST	.17	.13
18 pin ST	.20	.18
20 pin ST	.29	.27
22 pin ST	.30	.27
24 pin ST	.30	.27
28 pin ST	.40	.32
40 pin ST	.49	.39
ST = SOLDERTAIL		
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16 pin WW	.69	.58
18 pin WW	.99	.90
20 pin WW	1.09	.98
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
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7401	.19	74136	.50
7402	.19	74141	.65
7403	.19	74142	2.95
7404	.19	74143	2.95
7405	.25	74145	.60
7406	.29	74147	1.75
7407	.29	74148	1.20
7408	.24	74150	1.35
7409	.19	74151	.55
7410	.19	74152	.65
7411	.25	74153	.55
7412	.30	74154	1.25
7413	.35	74155	.75
7414	.49	74156	.65
7416	.25	74157	.55
7417	.25	74159	1.65
7420	.19	74160	.85
7421	.35	74161	.69
7422	.35	74162	.85
7423	.29	74163	.69
7425	.29	74164	.85
7426	.29	74165	.85
7427	.29	74166	1.00
7428	.45	74167	2.95
7430	.19	74170	1.65
7432	.29	74172	5.95
7433	.45	74173	.75
7437	.29	74174	.89
7438	.29	74175	.89
7440	.19	74176	.89
7442	.49	74177	.75
7443	.65	74178	1.15
7444	.69	74179	1.75
7445	.69	74180	.75
7446	.69	74181	2.25
7447	.69	74182	.75
7448	.69	74184	2.00
7450	.19	74185	2.00
7451	.23	74186	18.50
7453	.23	74190	1.15
7454	.23	74191	1.15
7460	.23	74192	.79
7470	.35	74193	.79
7472	.29	74194	.85
7473	.34	74195	.65
7474	.33	74196	.79
7475	.45	74197	.75
7476	.35	74198	1.35
7480	.59	74199	1.35
7481	1.10	74221	1.35
7482	.95	74246	1.35
7483	.50	74247	1.25
7485	.59	74248	1.85
7486	.35	74249	1.95
7489	2.15	74251	.75
7490	.35	74259	2.25
7491	.40	74265	1.35
7492	.50	74273	1.95
7493	.35	74276	1.25
7494	.65	74279	.75
7495	.55	74283	2.00
7496	.70	74284	3.75
7497	2.75	74285	3.75
74100	1.75	74290	.95
74107	.30	74293	.75
74109	.45	74298	.85
74110	.45	74351	2.25
74111	.55	74365	.65
74116	1.55	74366	.65
74120	1.20	74367	.65
74121	.29	74368	.65
74122	.45	74376	2.20
74123	.49	74390	1.75
74125	.45	74393	1.35
74126	.45	74425	3.15
74128	.55	74428	.85
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4019	.39	74C08	.35
4020	.75	74C10	.35
4021	.79	74C14	.59
4022	.79	74C20	.35
4023	.29	74C30	.35
4024	.65	74C32	.39
4025	.29	74C42	1.29
4026	1.65	74C48	1.99
4027	.45	74C73	.65
4028	.69	74C74	.65
4029	.79	74C76	.80
4030	.39	74C83	1.95
4034	1.95	74C85	1.95
4035	.85	74C86	.39
4040	.75	74C89	4.50
4041	.75	74C90	1.19
4042	.69	74C93	1.75
4043	.85	74C95	.99
4044	.79	74C107	.89
4046	.85	74C150	5.75
4047	.95	74C151	2.25
4049	.35	74C154	3.25
4050	.35	74C157	1.75
4051	.79	74C160	1.19
4053	.79	74C161	1.19
4060	.89	74C162	1.19
4066	.39	74C163	1.19
4068	.39	74C164	1.39
4069	.29	74C165	2.00
4070	.35	74C173	.79
4071	.29	74C174	1.19
4072	.29	74C175	1.19
4073	.29	74C192	1.49
4075	.29	74C193	1.49
4076	.79	74C195	1.39
4078	.29	74C200	5.75
4081	.29	74C221	1.75
4082	.29	74C373	2.45
4085	.95	74C374	2.45
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4519	.39	74C926	7.95
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74S65	.40	74S253	.95
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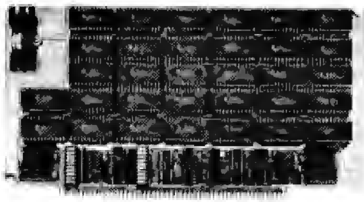

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M-Drive requires a 6MHz CPU 8085/88 dual processor, Disk 1 DMA disk controller and System Suport 1 Multifunction Board

BLGBTMD128KA	128K of A&T memory & M-Drive Software	$1198.00
BLGBTMD128KC	128K of CSC memory & M-Drive Software	$1398.00
BLGBTMD256KA	256K of A&T memory & M-Drive Software	$2395.00
BLGBTMD256KC	256K of CSC memory & M-Drive Software	$2795.00

STATIC MEMORY BOARDS

RAM 20 - 32K STATIC RAM

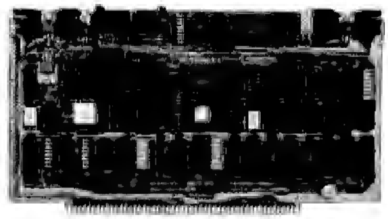
RAM 20 10 MHz, 4K byte block disable, bank select or 24 bit addressing available 8, 16, 24 or 32K

BLGBT164AA8	8K A&T	$210.00	$190.00
BLGBT164AC8	8K CSC	$280.00	$260.00
BLGBT164AA16	16K A&T	$285.00	$266.00
BLGBT164AC16	16K CSC	$355.00	$325.00
BLGBT164AA24	24K A&T	$355.00	$325.00
BLGBT164AC24	24K CSC	$425.00	$385.00
BLGBT164AA32	32K A&T	$425.00	$385.00
BLGBT164AC32	32K CSC	$495.00	$450.00

S-100 MAINFRAME

110V 60Hz CVT Mainframe uses famous 20 slot COMPUPRO Motherboard. (55 lbs.)

BLGBTENC20RM	20 Slot Rackmount	$895.00	$825.00
BLGBTENC20DK	20 Slot Desk Top	$825.00	$760.00



I/O BOARDS

SYSTEM SUPPORT 1 MULTIFUNCTION BOARD

Serial port (software prog. baud), 4K EPROM or RAM provision, 15 levels of interrupt, real time clock, optional math processor

Part No.	Description	List Price	Our Price
BLGBT162A	Assembled & Tested	$395.00	$380.00
BLGBT162C	CSC	$495.00	$480.00
BLGBT8231	Math Chip		$195.00
BLGBT8232	Math Chip		$195.00
BLGBT162AM1	A&T with 8231 Math Chip		$490.00
BLGBT162CM1	CSC w/8231 Math Chip		$655.00
BLGBT162AM2	A&T w/8232 Math Chip		$490.00
BLGBT162CM2	CSC w/8232 Math Chip		$655.00

MPX CHANNEL BOARD

I/O Multiplexer, using 8085A-2 CPU on board with 4K RAM

BLGBT196A4	Assembled & Tested	$495.00	$445.00
BLGBT196C4	CSC	$595.00	$535.00
	With 16K RAM		
BLGBT196A16	Assembled & Tested	$649.00	$585.00
BLGBT196C16	CSC	$749.00	$675.00

INTERFACER 1

Two Serial I/O

BLGBT133A	Assembled & Tested	$249.00	$219.00
BLGBT133C	CSC	$324.00	$298.00

INTERFACER 2

Three parallel, one serial I/O board

BLGBT150A	Assembled & Tested	$249.00	$219.00
BLGBT150C	CSC	$324.00	$289.00

INTERFACER 3

Eight channel multi-use serial I/O board

BLGBT1748A	Assembled & Tested	$699.00	$629.00
BLGBT1748C	CSC 200 hr. 8 Port	$849.00	$775.00
BLGBT1745A	Assembled & Tested	$599.00	$559.00
BLGBT1745C	CSC 200hr. 5 port	$699.00	$629.00

INTERFACER 4

Three Serial, 1 Parallel, 1 Centronics Parallel

BLGBT187A	Assembled & Tested	$395.00	$350.00
BLGBT187C	CSC	$495.00	$450.00

SPECTRUM COLOR GRAPHICS

Color Graphics board with Parallel I/O

BLGBT144A	Assembled & Tested	$299.00	$285.00
BLGBT144C	CSC	$395.00	$375.00

S-100 MOTHERBOARDS

Active termination, 6-12-20 Slot

BLGBT153A	A&T 6 slot, 2 lbs.	$140.00	$125.00
BLGBT153C	CSC 6 slot, 2 lbs.	$190.00	$165.00
BLGBT154A	A&T 12 slot, 3 lbs.	$175.00	$155.00
BLGBT154C	CSC 12 slot, 3 lbs.	$240.00	$220.00
BLGBT155A	A&T 20 slot, 4 lbs.	$265.00	$235.00
BLGBT155C	CSC 20 slot, 4 lbs.	$340.00	$310.00

Circle 380 on inquiry card.

PRIORITY ONE ELECTRONICS

5" DISKETTES

SOFT SECTOR
40 TRACK SINGLE SIDED DOUBLE DENSITY WITH HUB REINFORCING RINGS

PACKAGE OF 10 **$19.95**

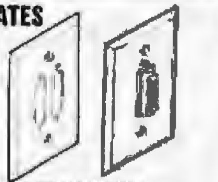
BONUS!

FREE!! KASSETTE 10 LIBRARY CASE WTIH PACKAGE OF 10 DISKETTES
A $4.25 VALUE!! BLPB15S00 *(Shipping Weight 2 lbs.)*

BLPB1580 *package of 60 less Library Case* **$120.00**

EIA/RS232 WALL PLATES

(Does not include connectors)



BLIIWPDB251 Single punched
4/$10.00
BLIIWPDB252 Dual Punched
4/$12.00

RS232 "D" SUB-MINIATURE CONNECTORS

		1-9	10-24	25-99
BLCNDDA25P	*25 Pin Male*	$3.00	$2.75	$2.25
BLCNDDA25S	*25 Pin Female*	$4.00	$3.75	$3.00
BLCNDDBS1212	1 Pc. Grey Hood	$1.60	$1.45	$1.30
BLCNDD25H	2 c. Grey Hood	$1.50	$1.25	$1.10
BLCNDDBS1228	2 Pc. Black Hood	$1.90	$1.65	$1.45

California Computer Systems

S-100 STARTER SYSTEM

We've bundled our most popular 3 board combination to form a complete S-100 System, just add mainframe, peripherals and cables! **BLPBBCCSSP1**

CCS2810 4MHz Z80 CPU
- 2/4 MHz CPU
- On board RS-232 Serial port
- On board Monitor

$695.00*
LIST RPICE: $1125.00
SAVE $430.00!!
(Shipping Weight 8 lbs.)

CCS2422 DISK CONTROLLER
- Contols 4, 8" or 5¼" drives
- IBM 3740 Standard
- Supports single or double density
- Supports single or double sided
- Plug compatible with Shugart, Mitsubishi, MPI, Qume, Tandon, and Siemens

**With the purchase of two disk drives $750.00 if purchased separately*

CCS2065 64K 4MHz RAM
- 4116 Low power dynamic RAMs
- Supports DMA
- Bank Select up to 512K
- Fail Safe refresh circuitry

ALL BOARDS ASSEMBLED & TESTED - PLUG & RUN!!

TWX YOUR LIST TO SANTA AT 1200 BAUD FOR ONLY $495.00!!

AUTO DIAL 212A MODEM

The **AUTO DIAL 212A** Modem is a direct connect 0-300 or 1200 baud modem capable of dialing and calling for you. **The AUTO DIAL 212A is compatible in function to the DC Hayes SMARTMODEM™.**

Part No.	Description	List Price	SALE Price
BLUSRADIAL212A	0-300, 1200 baud dialing modem	$599.00	$495.00

ACCOUSTIC MODEM

The **PHONE LINK** Modem is a 300 baud RS232 compatible acoustic modem capable of operating as either an answer or originate modem. It is BELL 103/113 compatible and will accept most standard phone handsets.

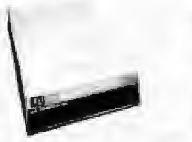
BLUSRPLNK	0-300 Baud accoustic modem	$149.00	$129.00

MICRO LINK DIRECT CONNECT MODEMS

The **MICRO LINK** Modems are available in either 0-300 or 1200 baud transmission rates and both are RS232 compatible. Operation can be answer or originate.

BLUSRMLNK300	0-300 baud direct connect	$179.00	$159.00
BLUSRMLNK1200	1200 baud direct connect	$449.00	$399.00

AUTO LINK DIRECT CONNECT AUTO ANSWER MODEMS



The **AUTO LINK** Modems are auto answer modems capable of operating at 0-300 baud or 1200 baud transmission rates. The **AUTO LINK** Modems can be operated in either answer or originate modes.

BLUSRALNK300	0-300 baud auto/direct connect	$219.00	$195.00
BLUSRALNK1200	1200 baud auto/direct connect	$499.00	$449.00
BLUSRALNK212A	0-300, 1200 baud auto/direct	$549.00	$495.00

Specs	USRADIAL212A	USRALNK212A	USRALNK1200	USRMLNK1200	USRALNK300	USRMLNK300	USRPLNK
1200 Baud	X	X	X	X			
0-300 Baud	X	X			X	X	X
Auto Dial (Hayes Smartmodem compatible)	X						
Auto Answer	X	X	X		X		
Auto Mode Select	X				X	X	
DTR Override	X	X	X	X	X	X	
RS232 plus 2&3 reversible	X	X	X	X	X	X	
LED Indicators:	X	X	X	X	X	X	X
Carrier Detect	X	X	X	X	X	X	X
Analog Loopback/ Self Test	X	X	X	X	X	X	X
Send Data	X	X	X	X	X	X	X
Receive Data	X	X	X	X	X	X	X
Terminal Ready	X	X	X		X		
Off Hook	X	X	X		X		
Answer Mode	X	X	X		X		
Ring Indicate			X		X		
High Speed	X	X					

Para Dynamics

16 SLOT S-100 MAINFRAME

CVT Power Supply, forced air cooling; security lock 120 or 220V AC@50 or 60Hz +8V@30A +16V@5A -16V@2A

Part No.	Description	List Price	Our Price
BLPDN2016D	*Desk Top (43 lbs.)*	$880.00	$790.00
BLPDN2016R	*Rack Mount (43 lbs.)*	$925.00	$835.00

8 SLOT S-100 MAINFRAME WITH CUTOUTS FOR 2 4¼" DISK DRIVES

+5@6A +8@20A, +12@5A, +16@2 -16@2

BLPDN2508D	*Desk Top (43 lbs.)*	$890.00	$800.00
BLPDN2508R	*Rack Mount (43 lbs.)*	$950.00	$855.00

DISK DRIVE FACILITY

Accommodates two 8" floppy drives of Shugart, Qume, or similar design and dimensions 110 or 220V AC at 50 or 60Hz CVT power

BLPDN2200D	*Desk Top (32 lbs.)*	$650.00	$585.00
BLPDN2200R	*Rack Mount (34 lbs.)*	$675.00	$605.00

PRONTO

Free standing cabinet. Will accept 2 8" Floppy disks and 1 8" Rigid disk. 18 slot card cage will accept the double height 10" x 10" S-100 cards (Alpha Micro and others) CVT Power Supply ±12V@3A
+24@6A, +16@5A -16@2A, +8@30A, +5@7A -5V@3A
PRONTO COMPLETE WITH POWER SUPPLY POWER-UP SEQUENCER
BLPDN20182 *PRONTO with sequencer* $1595.00 **$1435.00**
Shipped motor freight collect

DATAGARD™ SGL WABER

LINE MONITOR POWER CONDITIONERS

Before you plug in your computer, you'd better consider how you are going to insure or protect your investment from unwanted electrical pollution

DG115 SERIES
SINGLE STAGE SPIKE PROTECTION

Part No.	Description	Wt.	List	1-9	10-24
BLWBDG115P	Wall unit plug in	2 lbs	$49.95	$38.95	$34.95
BLWBDG115S	6 outlet strip w/SW&LT	3	$61.95	$48.95	$42.95

DG315
3 STAGE SPIKE FILTER AND FOUR STAGE NOISE FILTER

BLWBDG315P	Wall unit plug in	2 lbs.	$153.95	$110.95	$ 99.95
BLWBDG315S	6 outlet strip w/SW&LT	3 lb	$193.95	$140.95	$119.95
BLWBDG315R	6 outlet rack w/SW&LT	6 lb	$193.95	$140.95	$119.95

SMITH-CORONA TP-1

LETTER QUALITY - ELECTRONIC TEXT PRINTER

$599.00
BLSCMTP1210 (Serial)
BLSCMTP1P10 (Parallel)
- 12 CPS • 10 CPI • 8 LPI • SERIAL OR PARALLEL INTERFACE
- 50-19.2K Baud • Friction Feed • 88 Character

BLSCM12625	TPI	Black Mylar Ribbon	$3.50
BLSCM12658	TPI	Black Fabric Ribbon	$7.50

SEND $1.00 TODAY FOR THE NEW, FULL COLOR FALL 1982 ENGINEERING SELECTION GUIDE!

PRIORITY ONE ELECTRONICS
9161 DEERING AVE • CHATSWORTH, CA 91311
NEDA MITA
ORDER TOLL FREE (800) 423-5922 · CA, AK, HI CALL (213) 709-5464

Terms: U.S. VISA, MC, BAC, Check, Money Order, U.S. Funds Only. CA residents add 6½% Sales Tax. MINIMUM PREPAID ORDER $15.00. Include MINIMUM SHIPPING & HANDLING of $3.00 for the first 3 lbs. plus 40¢ for each additional pound. Orders over 50 lbs. sent freight collect. Just in case, please include your phone number. Prices subject to change without notice. We will do our best to maintain prices through December, 1982. Credit Card orders will be charged appropriate freight. If you haven't received your Fall '82 Engineering Selection Guide, send $1.00 for your copy today! Sale prices are for prepaid orders only.

SIEMENS FDD100-8 TRUCKLOAD PURCHASE!

WE'VE CAPTURED THE 8" FLOPPY DRIVE MARKET WITH A HUGE FACTORY DIRECT PURCHASE!!

FDD100-8
8" FLOPPY
WOW!!

See Previous Pages For More Great Deals!!

SINGLE-SIDED
DOUBLE DENSITY
90 DAY WARRANTY
SHUGART 801R COMPATIBLE

DUAL 8" SUBSYSTEM

8LCCS2422A	Controller w/CP/M 2.2	1	$395.00
8LSIEFDD1008	8" Drive	2	$550.00
IN A DUAL HORIZONTAL CABINET WITH POWER SUPPLY			$395.00
AND DATA CABLE		1	$ 35.00
			$1375.00
			8LPOBSIESUB1

SAVE $380.00

$995.00

Same as above, with CCS2810 Z80 4MHz CPU and CCS 2065 64K Dynamic RAM:

$1390.00
8LPOBSIESUB2

$275.00 — 1
$259.00 — 2-9
$225.00 — 10+
8LSIEFDD1008
OEM INQUIRIES INVITED

DON'T MISS OUT!

International Instrumentation Incorporated

- Positive Pressure Filter Cooling
- Power Supply: 4A@+5V, 3A@+24V 1A@-5V
- Each output is individually fused
- Hinged top for easy access
- Heavy non-flex .090 aluminum base
- Modular power connectors

BUY DRIVES AND CABINET TOGETHER AND SAVE!!

DUAL 8" SIEMENS FDD1008,
DUAL 8" CABINET POWER SUPPLY
AND INTERNAL POWER CABLES
IF BOUGHT SEPARATELY: $910.00

PRICED AT: **$695.00**
8LPOBIIISIE

ENVIRONMENT MONITOR PANEL

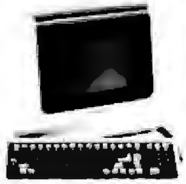
Temperature and voltage monitor with visual and audible alarm for overtemp condition. Direct Digital Readout of internal temperature in C on standard DVM

8LIIIFDE002	CABINET ONLY (Sh Wt 38 lbs.)	$285.00
8LPOBIIISIEEM	2-Drives, Cabinet, & disk environment monitor	$775.00
8LIIIFDE002EM	Cabinet only with disk environment monitor	$375.00

TeleVideo

WORLD'S BEST SELLING TERMINAL!

Extra Memory Pages FREE!



8LPOBTLV925P* $745.00
*TeleVideo 925 w/free 2nd page memory kit, a $95.00 value!

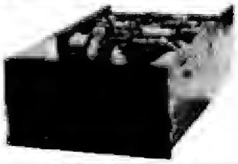
8LPOBTLV950P* $949.00
*TeleVideo 950 w/free 2nd, 3rd & 4th page memory kit $285.00 value

8LTLV910 $600.00
With emulations & foreign languages

8LTLV910BLK $600.00
Black mode version of above
(Shipping Weight 37 lbs.)

BEST BUYS!

MITSUBISHI ELECTRIC



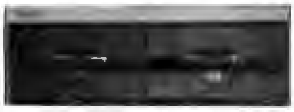
Better Than QUME! Better Than SHUGART!

8" Double-sided, double-density, interchangeable with QUME & Shugart

8LMITM289463	Shipping Weight 16 lbs	$450.00
8LMITM2894G3M	Manual	$ 10.00

2 or More $435.00 each

INTERNATIONAL INSTRUMENTATION, INC.



DUAL 8" FLOPPY DRIVE CABINET

FEATURES:
- Positive pressure forced air cooling for reliable disk drive operation
- AC input via 3 wire 7 foot international cord/socket set
- AC input EMI filtered to six amps to help prevent disk crashes due to power spikes and line noise
- 14 gauge main chassis
- Integral power supply with 5V@6A/-5V@1A/24V@6A
- Double-sided custom PC power board and supply
- Each DC supply and AC separately fused

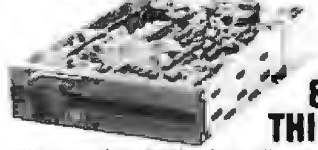
8LIIIFDE002 *Shipping Weight 38 lbs* $285.00

TWO MITSUBISHI 8" DRIVES AND CABINET TOGETHER!!

DRIVES AND CABINET SHIPPED SEPARATELY
8LPOBMITFDE

$1150.00

Tandon



8-INCH THIN LINE

Exactly one-half the height of any other model
Proprietary, high-resolution read-write heads patented by Tandon
D.C. only operation – no A.C. required
Industry standard interface
Three millisecond track-to-track access time (9 lbs.)

8LTNDTM8481	*Single Sided* $390.00	2 or more	$370.00 ea
8LTNDTM8482	*Double Sided* $495.00	2 or more	$485.00 ea

TANDON 5¼" DRIVES

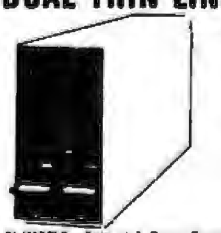
8LTNDTM1001 *Single Sided, 250KB (5 lbs.)* $220.00 ea
2 or More $200.00 ea.

8LTNDTM1002 *Double Sided, 500KB* $295.00 ea.
2 or More $270.00 ea.

8LTNDTM1003 *Single Sided, 500KB* $295.00 ea.
2 or More $270.00 ea.

8LTNDTM1004 *Double Sided, 1000KB* $395.00 ea.
2 or More $375.00 ea.

DUAL THIN LINE CABINET by JMR



- Fan Cooled
- 24V @ 4A/5A Surge
- 5V @ 2A
- Scratch Resistant Baked Enamel Finish

8LJMRTLC Cabinet & Power Supply List $200.00 $180.00
Shipping Weight 12 lbs

BUY THE CABINET AND DRIVES TOGETHER:

8LPOBJMRTND1	w/two TNDTM8481s	(30 lbs.)	$920.00
8LPOBJMRTND2	w/two TNDTM8482s	(30 lbs.)	$1150.00

Includes Power Cables

VISUAL 50

- Low profile detached keyboard features sculptured keys with matte finish
- Screen tilts and swivels
- 80 x 24 display with 25th status line
- 7 x 9 dot matrix with full decenders
- RS-232 Serial interface w/auxiliary RS-232 port
- 128 Character ASCII set and 31 character line drawing set

INTRODUCTORY OFFER!!

8LVSL50BW	Non glare Black & White	$695.00	$650.00
8LVSL50GR	P31 green display	$750.00	$685.00

(Shipping Weight 37 lbs.)

5¼" DISK CABINET FOR SINGLE OR DOUBLE DRIVES

JMR

SINGLE: 5V@1A 12V@1.5A *Shipping weight 5 lbs.*
DOUBLE: 5V@2A 12V@3A *Shipping weight 9 lbs.*

8LJMR1CS	Single 5¼" Drive Cabinet	$70.00
8LJMR2CS	Dual 5¼" Drive Cabinet	$90.00

DUAL 5¼" CABINET WITH INTERNAL DATA CABLES

8LJMR2C5C With Internal Data Cable $115.00

Circle 381 on inquiry card.

PRIORITY ONE ELECTRONICS

REPEAT OF A SELLOUT!! WOW!

B+K PRECISION

MODEL 1500
QUAD INPUT, EIGHT-TRACE DESIGN

$1495.00

LIST PRICE $2250.00

SAVE $755.00!!

This new generation scope utilizes a combination of techniques never before applied to oscilloscope design, resulting in an efficient, light weight and reliable unit.

- 100 MHz response
- Maximum sweep rate of 2 nSec/division
- 1 mV/division vertical sensitivity (CH 1 & 2)
- Eight-trace, four-channel operation provides 2 trigger views or four separate vertical inputs
- Calibrated Delayed Sweep operation
- Alternate Sweep to view main timebase and delayed timebase simultaneously
- Vertical Mode trigger selection to display four input signals in sync — even if they are unrelated in frequency
- Bright 16KV, 8 cm x 10 cm CRT display with internal graticule
- Compact overall size; only 5.4 x 11.2 x 15.75 inches and 16.5 pounds. Small enough to fit under any airline seat

The B&K Model 1500 offers all the capabilities you might demand from a lab grade oscilloscope, and at a price that will fit your budget. The cost? Remarkably reasonable especially when you compare it to the other leading 60MHz and 100MHz dual trace scopes that are currently available. This price breakthrough is made possible by **PRIORITY ONE ELECTRONICS** unequalled purchasing power. As the largest distributor of high performance oscilloscopes, we were able to place a humungous order with B&K and then pass the savings along to you!

Two x10 100MHz probes are included with each Model 1500. Optional accessories that you may wish to include on your order:

BLBKPLC100	Snap-on front cover	$26.00
BLBKPLC150	Vinyl carrying case for probes and cables	$32.00

B&K-Precision backs the 1500 with a one year warranty and has service centers located nationwide.

B+K PRECISION DMM

3½-Digit 5 Function

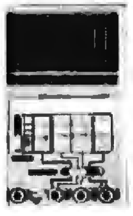
- 200 mV AC/DC voltage ranges
- 200 μA to 10A AC/DC current ranges
- Auto zeroing; auto polarity
- 10 megohm input impedance
- Completely overload protected
- Overrange indication of all ranges
- High-energy fuse for added safety
- Complete with test leads and carrying case

BLP2805 List $100.00

SALE: $88.00

B+K PRECISION DMM

3½-Digit Portable



- High-contrast liquid-crystal display
- Auto zeroing, auto polarity
- 10 megohm input impedance
- DC accuracy 1% typical
- Fully overload protected
- High-energy fuse for added safety
- Complete with test leads and carrying case

BLP2801 List $65.00

SALE: $58.00

FLUKE PORTABLE DMMs

BLFLU8060A	4½ Digits w/Freq Meter	$349.00
BLFLU8062A	4½ Digit - Tru RMS	$279.00
BLFLU8024B	3½ Digit "Investigator"	$249.00
BLFLU8020B	3½ Digit "Analyst"	$194.00
BLFLU8021B	3½ Digit "Troubleshooter"	$159.00

HITACHI DUAL TRACE OSCILLOSCOPES

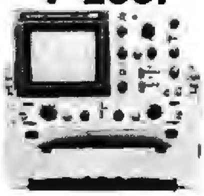
V-353F — 35 MHz DELAYED SWEEP

● Single time base delay sweep ● rectangular CRT with internal graticule ● High sensitivity 1mv/div (7MHz) ● Large dynamic range of 8 div to full bandwidth ● CH1 output ● Built-in signal delay line

BLHITV353F List $949.00

SALE: $799.00

V-203F — 20 MHz DELAYED SWEEP



● Single time base delay sweep ● High sensitivity 1mv/div (5MHz) ● Full TV triggering ● X-Y operation ● CH1 Output ● High reliability, MTBF 20,000 hours

BLHITV203F List $749.00

SALE: $625.00

V-302F — 30 MHz

● High sensitivity 1mv/div (5 MHz) ● Full TV Triggering ● X-Y operation ● CH1 Output ● Built-in signal delay line ● High reliability, MTBF 20,000 hours

BLHITV302F List $799.00

SALE: $699.00

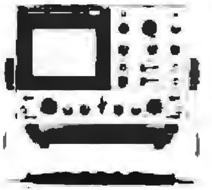
V-152F — 15 MHz

● High Sensitivity 1mv/div (5MHz) ● Full TV Triggering ● X-Y operation ● X10 sweep time magnification ● High reliability, MTBF 20,000 hours

BLHITV1524 List $595.00

SALE: $495.00

V-352F — 35 MHz DUAL TRACE



BLHITV352F
List $895.00

SALE: $749.00

Same as V353F except without delayed sweep

V202F — 20 MHz DUAL TRACE

BLHITV202F
List $695.00

SALE: $575.00

Same as V203F, except without delayed sweep

PRIORITY ONE ELECTRONICS

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NEDA MITA

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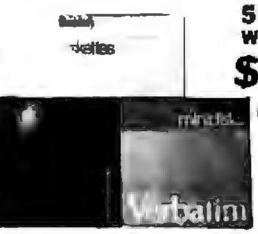
★ FREE ★

Plastic library case supplied with all diskettes purchased from California Digital

$24.95

Private labeled for California Digital by one of the most respected producers of magnetic media. Each diskette is certified double density at 40 tracks. To insure extended media life all diskette are manufactured with a reinforced hub.
Each box of diskettes is supplied with a free plastic library case.
Soft sector CAL-301, Ten sector CAL-310

Ten boxes $22.75 One hundred boxes $21.50



5¼" DISKETTES WITH LIBRARY CASE

$26.50

Your Choice
**SCOTCH
MEMOREX
VERBATIM**

Single Side Double Density

	Soft Sector	10 Sector	16 Sector	
SCOTCH	744D-0	744D-10	744D-16	26.50
MEMOREX	3481	3483	3485	26.50
VERBATIM	525-01	525-10	NA	26.50
MAXELL	MD1	MH1-10	MH1-16	29.85
DYSAN	104/1D	107/1D	NA	45.00

Double Side Double Density

SCOTCH	745-0	745-10	745-16	42.50
VERBATIM	550-01	550-10	NA	42.50
MAXELL	MD2-D	MH2-10D	MH2-160	45.00
DYSAN	104/2D	107/2D	NA	49.50
DYSAN 96	204/2D	NA	NA	59.50

EIGHT INCH DISKETTES

Single Side Single Density			Single Side Double Density		
SCOTCH	740-0	29.50	SCOTCH	741-0	39.00
MEMOREX	3060	29.50	MEMOREX	3090	35.00
DYSAN	3740/1	39.50	DYSAN	3740/D	57.50

Thirty Two Sector			Double side Double Density		
SCOTCH	740-32	29.50	SCOTCH	743-0	47.50
			MEMOREX	3114	39.50
			DYSAN	3740/2D	65.00

Scotch Head Cleaning Kit 5¼ & 8" $24.95
Plastic Library Case 5¼ & 8" 2.95
Diskette Flip Files [illegible]
Diskette Flip Files [illegible]

Microswitch ASCII KEYBOARD $79

Each keyboard contains 81 high reliability Hall Effect keys.
Outputs seven bit parallel ASCII MIC-81SD5 3 Lbs.

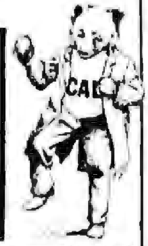
Flip & File

$18.95

Plastic storage file allows immediate access to over 50 diskettes

5¼"	DIC-521	$18.95	4 lbs
8"	DIC-850	$19.95	4 lbs.

MEMORY



2716 EPROM	64K DYNAMIC
4.50	**6.95**
450ns	4164 200ns
16K STATIC	16K DYNAMIC
7.00	**1.95**
6116 200ns	4116 200ns

2732 EPROM SALE $6.95

DYNAMIC MEMORY

	1-31	32+	100+
4116-150ns 16k	1.95	1.80	1.75
4116-200ns 16k	1.70	1.65	1.50
4164-150ns 64k Japan 128 refresh	8.00	8.75	7.90
4164-150ns 64k Texas Inst. 256 refresh	7.00		
4164-200ns 64k Japan 128 refresh	6.50	7.75	7.50
41256-200 256K dynamic memory	call for pricing		

STATIC MEMORY

21L02 200ns 1k	1.49	1.29	1.15
21L02-450ns 1k	1.29	1.15	.99
2112 450ns 2k	3.95	3.50	3.25
214-200ns 4k			
2114-450ns 4k			
4044 250ns 4k			
4044 450ns 4k			
5257 300ns 4k			
6116 P3 150ns 16k 24 pin	7.50	7.25	6.90
6116 P4 200ns 16k 24 pin	7.00	6.75	6.65
6167 / 2167 100ns 16k 20 pin	8.95	8.50	8.00

EPROMS

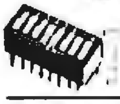
2708-450ns 8k	3.50	2.95	2.75
2716-450ns 16k	4.50	4.15	3.75
2716TMS-450ns 16k tri voltage	7.95	7.65	7.25
2516-450ns 16k	6.95	5.95	5.45
2732-200ns 32k	8.50	8.00	7.60
2732-450ns 32k	6.95	6.65	6.25
2532-450ns 32k	10.50	9.90	9.50
2764-450ns 64k	14.95	13.75	12.50
27128-450ns 128k	call for pricing		

$49.95

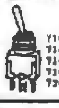
ASTEC SWITCHING POWER SUPPLY

Output: +5v. 3A; +12v .9A; −12v .075A.
Suitable for Apple look-a-like. ATC-1298

SWITCHES

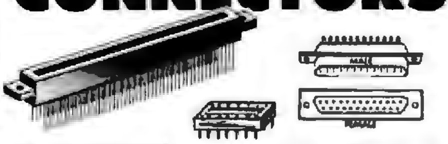


DIP SWITCHES	1	100+	1k+
[illegible]	.80	.74	[illegible]
[illegible]	.89	.84	.79
[illegible]	1.05	.91	.87
[illegible]	1.10	.99	.91



TOGGLE		1	100+
7101	[illegible]	1.39	.90
7201	[illegible]	1.10	1.10
7103	[illegible]	1.40	1.19
7108	[illegible]	1.19	1.19
7205	[illegible]	1.64	1.64

CONNECTORS



GOLD EDGE CONNECTORS

S-100 .125 centers	each	10+
Imsai solder .250" row	$3.??	$3.40
Imsai wire wrap (TI)	3.95	4.??
Soldtine Hi-Rel. .125	4.50	4.00
Soldtine Hi-Rel. W/W	5.35	4.50
Soldtine Altair 100	5.35	4.50

.156 Centers (Misc.)		
22/44 Kim Apple	2.50	2.10
36/72 Digital Group S/T	3.95	3.50
36/72 Digital Group W/W	[illegible]	[illegible]
43/86 Motorola 6800 S/T	[illegible]	[illegible]
44/88 Altos 6800 W/W	7.00	[illegible]

INTEGRATED CIRCUIT SOCKETS

	Low Profile each	Low Profile 100+	Wire Wrap each	Wire Wrap 100+
8 pin	0.10	0.09	0.40	0.44
14 pin	.10	.09	.41	.38
16 pin	.12	.11	.40	.43
18 pin	.18	.13	.44	.51
28 pin	.30	.28	.84	.87
40 pin	.43	.40	1.00	1.07

"D" Type	each	10-24	25+
DB25P male	$1.95	$1.60	$1.50
DB25S female	2.25	2.00	1.80
DB hood	1.50	1.35	1.20
DA15P male	2.15	2.10	2.00
DA15S female	2.75	2.50	2.40
DA hood W/P	1.90	1.81	1.70
DB37P male	3.30	3.10	2.15
DB37S female	4.35	3.15	3.85
DB hood W/P	1.35	1.15	1.03
DC37P male	4.30	4.00	3.70
DC37S female	6.00	6.75	5.30
DC hood W/P	2.25	2.00	1.75
DD50P male	5.50	5.10	4.75
DD50S female	6.00	6.00	6.00
DD50 hood W/P	3.00	2.40	2.10

CENTRONICS

57-10360	7.0	6.75	6.75

RIBBON CABLE CONNECTORS

17/34 6" dias	6.84	6.10	5.94
20/40 TRS-80	6.03	6.02	6.70
25/50 8" dias	6.00	6.15	6.00

Eight Inch Single Sided

	One	Two	Ten
SHUGART SA801R	$395	385	375
SIEMENS FDD100-8	259	259	225
TANDON 848-1 SLIMLINE	379	369	359

Eight Inch Double Sided

SHUGART SA851R	525	495	475
QUME DATA TRACK 8	525	495	475
MITSUBISHI M2894-63	485	475	469
OLIVETTI 802/851	369	359	349
TANDON 848-2 SLIMLINE	495	485	475
SHUGART 860 THINLINE	569	549	539

Five Inch Single Sided

SHUGART SA400	215	209	199
TANDON TM 100-1	209	199	195

Five Inch Double Sided

SHUGART SA450	349	329	315
TANDON TM 100-2	295	269	259
TANDON 96TPI TM100-4	369	355	350
OLIVETTI 502 ½ height	239	225	215

Three Inch Rigid Floppy

HITACHI-AMDEK	call for pricing

Five Inch Winchesters

SEAGATE 506 6 Megabyte	759	725	695
SEAGATE 512 12 Megabyte	995	960	960
TANDON 603SE 14 Megabyte	995	960	895
WESTERN DYNAX removable	995	960	950

Upon request, all drives are supplied with power connectors and manual

$750 *Eight Inch Subsystem*

Two Siemens FDD100-8 disk drives with power supply.
4" exhaust fan complete with all necessary power cables.

Same as above but with

Shugart 801R	MSD2801	$1195
Shugart 851R	MSD2851	1450
Olivetti 802	CAL2802	$1250
Qume DT8	MSD8DT	1450

ECLIPSE 100

$695

INDUSTRIAL S-100 MAINFRAME

Suitable for hospital and industrial applications. Constructed from 304 brushed stainless steel. Modular 500 watt toroid power supply provides - 8 volts at 30 Amps and ±16 volts at 4 Amps Supplied with standard 18 slot Faraday mother board. Auxiliary switched AC receptacles. The Eclipse 100 can be either table or rack mounted. Provisions for internally mounting a ten megabyte Winchester disk drive.
The Eclipse 100 is the perfect mainframe to fill the void left by the now defunct TEI Corporation. EPS-100 50 lbs

All merchandise sold by California Digital is premium grade.
Shipping: First five pounds $1.00. Each additional $.50.
Foreign orders: 10% shipping. Excess will be refunded.
California residents add 6% sales tax. COD's discouraged.
Open accounts extended to state supported educational institutions and companies with a "strong" Dun & Bradstreet.
Warehouse: 15608 Inglewood Blvd. Visitors by appointment.

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California Digital

Post Office Box 3097 B • Torrance, California 90503

Super Buy $259

SIEMENS FDD 100-8 8'' DISK DRIVE

10 Drives $225 • 100 Drives $209

California Digital has recently participated in the purchase of several thousand Siemens FDD 100-8 floppy disk drives. These units are electronically and physically similar to that of the Shugart 801R disk drive. Any application that will accept an 801R will work with the Siemens FDD 100-8 drive.
All units are new and shipped in factory sealed boxes. Because of the extremely low price we expect a quick sell out. Please reserve your units early. SEA-F1008 17 lbs. Manual and connectors supplied free upon request. Also available: Two drive subsystem supplied in steel enclosure with power supply and fan. $750.00 CAL-2F1008

Scotch Diskettes

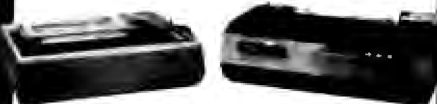
FREE FLIP & FILE

$19.95

With purchase of five boxes of Scotch diskettes.

We have recently purchased the entire excess inventory of 5¼" Scotch brand diskettes from Digital Equipment Corporation. The diskettes are all single sided double density available in soft, ten and sixteen sector. Buy one box and we supply a free plastic library storage case, buy five boxes and we supply a free flip and file storage tub. Take advantage of this one time offer and stock up for the winter.
Prime Scotch brand diskettes priced below dealer cost. Soft sector for Apple & IBM MMM-SD7440; Ten sector MMM-SD74410; Sixteen sector MMM-SD74416 2lbs.

PRINTERS



MATRIX PRINTERS

Okidata 82A serial & parallel 9.5" paper OKI-82A	459.00
Okidata 83A serial & parallel 15" paper OKI-83A	685.00
Okidata 84A parallel only 15" paper OKI-84AP	1,079.00
Okidata 84A serial & parallel 15" paper OKI-84AS	1,219.00
Epson MX80 with graphics and tractor feed EPS-MX80	[illegible]
Epson MX80FT with graphics, friction & tractor feed EPS-MX80FT	539.00
Epson MX100 with graphics 15" paper EPS-MX100	895.00
NEC 8023A parallel 9.5" paper graphics NEC 8023A	489.00
Anadex 9500A high speed dot matrix printer 15" ADX-9500A	1,279.00
Anadex 9501A 15" paper with graphics ADX-9501A	1,279.00
Texas Instruments 810 serial 15" upper & lower case TEI-810	1,299.00
Datasouth DS180 high speed 180 char/sec 15" DS1-180	1,285.00
Prowriter 8510 parallel 9.5" PRO-8510P	495.00
Prowriter 8510 serial 9.5" PRO-8510S	639.00
Prowriter II 15" paper PRO-2P	750.00
Printronix P300 high speed printer 300 lines/min PTX-P300	4,500.00
Printronix P600 high speed printer 600 lines/min PTX-P600	6,450.00
IDS prism 80 column graphics, sheet feeder IDS-P80G	1,150.00
IDS prism 132 COLOR with graphics 15" paper IDS-P132CC	1,650.00
Mannesmann Tally 1805 200 cps serial MAN-1805	1,650.00

WORD PROCESSING PRINTERS

NEC7710 55 char/sec thimble serial only NEC-7710	2,379.00
NEC7730 same as above parallel only NEC-7730	2,379.00
NEC3510 serial 15" NEC 3510	1,775.00
Diablo 620R101 25 cps serial DBL 620	1,270.00
Diablo 630 40 cps serial DBL-630	2,250.00
Smith Corona TP 1 daisy wheel parallel SCMTP1P	659.00
Smith Corona TP 1 daisy wheel serial SCM-TP1S	659.00
Brother HR11 daisy wheel printer parallel BTH-HR1P	855.00
Brother HR11 serial interface BTH-HR1S	895.00
Diablo 630 DBL 630	2,095.00
Starwriter F10 serial FRO-F10S	1,475.00
Starwriter F10 parallel FRO-F10P	1,475.00

MONITORS

Zenith Z121 green phosphor 12" 40/80 column switch ZTH-Z121	115.00
BMC 12A green phosphor 15 Mhz composite video BMC-12A	88.00
BMC 12EN green phosphor 20 Mhz high resolution BMC-12EN	139.00
NEC JB1201 green phosphor 18 Mhz composite video NEC-JB1201	169.00
NEC JB1260 green phosphor commercial grade composite NEC-1260	129.00
Motorola 23" open frame b/w/white composite video MOT-BW23	159.00
Motorola 12" open frame b/w/white requires horz sync & power MOT-BW12	69.00
Conrac 9" open frame requires horz sync & power supply CON-BW9	59.00
COLOR	
NEC JC1201 composite color NEC-JC1201	325.00
NEC RGB monitor NEC-1203DM	875.00
BMC 13" Composite video BMC-1400CL	273.00
BMC 13" RGB color monitor BMC-1401RGB	329.00
BMC interface card for Apple II for above RGB BMC-II-RGB	149.00
Comrex/Hitachi 13" RGB high res monitor COM-6600	539.00
Comrex/Hitachi 13" Composite color monitor COM-6500	395.00
Amdek color #1 composite video AMD-100	349.00
Amdek color #2 high res RGB color monitor AMD-200	739.00
Amdek color #3 commercial grade color RGB AMD-300	475.00

Direct Connect MODEMS

Hayes Micromodem 100 S-100 modem HYS-100	319.00
Hayes Smart Modem RS232 HYS-232	229.00
Hayes Micromodem II Apple direct connect HYS-MM2	279.00
Hayes Chronograph time & date HYS-CHR232	199.00
Novation Cat acoustic connect NOV-CAT	149.00
Novation D Cat direct connect via handset NOV-DCAT	169.00
Novation 212 Autocat Bell 212A NOV-212	595.00
Novation Auto Cat 103 NOV-AUTO	219.00
Universal 103LP direct connect line powered UDS-103LP	189.00
Universal 103LPJ direct connect auto answer UDS-103LPJ	209.00
Universal 202 direct connect 1200 baud half duplex UDS-202LP	189.00
Universal 212LP direct connect 1200 baud full duplex UDS-212LP	450.00
[illegible] Mark I direct connect with terminal cable SQL-MK1	89.00

TERMINALS

Ampex Dialogue 80 green screen two page function keys APX-D80C	795.00
Ampex Dialogue 80 amber screen two page function keys APX-D80A	795.00
Ampex Dialogue 80 green screen Selectric keyboard APX-D81G	805.00
Ampex Dialogue 81 amber screen Selectric keyboard APX-D81A	895.00
Ampex Touch form screen command for data entry APX-180	[illegible]
Wyse horz & vert split screen metal case detatch keybd WYS-100	825.00
Televideo 910C emulator TVI-910C	595.00
Televideo 910 Plus block mode TVI-910P	595.00
Televideo 925C detatchable keyboard 22 function keys TVI-925	795.00
Televideo 950 graphic char split screen 22 functions TVI-950	985.00
IBM 3101 10 detatchable keyboard green IBM-3101	1,195.00
Zenith Z-19 keyboard ZTH-Z19	765.00
Adds Viewpoint A1 detatchable keyboard ADD-VP1	498.00
Adds Viewpoint A2 xy cursor green screen ADD-VP2	595.00
Adds Viewpoint A3 emulator ADD-VP3	575.00

APPLE 48K Plus $1089

APPLE BRAND PRODUCTS

APL-48P	Apple Plus 48K RAM	
APL-DSK1	Apple disk with controller card	560.00
APL-DSK2	Apple disk without controller card	405.00

XITEN

XTN-G10	Xitan 10 Megabyte Galium hard disk	1,995.00
XTN-16K	16K RAM card for Apple II	69.00

RANA SYSTEMS

RAN-APL1	Apple add on disk drive with controller	525.00
RAN-APL2	Apple add on drive without controller	395.00

CALIFORNIA COMPUTER SYSTEMS

CCS-7710	Asynchronous Serial Interface	125.00
CCS-7728	Centronics Parallel Interface	95.00
CCS-7720	Apple Parallel Interface	95.00
CCS-7114	12K Rom/Prom Module	115.00
CCS-7424	Calendar/Clock Module	95.00
CCS-7440	Programmable Timer	95.00
CCS-7811R	Arithmetic Processor for Apple II plus	319.00

MOUNTAIN COMPUTERS, INC.

MTN-CPS	CPS Multifunction Card	169.00
MTN-TCLK	Clock/Calendar	
MTN-STLK	Supertalker SD200	149.00
MTN-ROMF	Rom Plus with Keyboard filter	169.00
MTN-ROMRTR	Rom Writer with Eprom socket	145.00
MTN-ADDA	A+D/D+A Converter	265.00
MTN-BSR	X-10 Control Card for BSR system	149.00

MICRO SOFT

MSF-SFTCRD	Microsoft Z-80 CPU card	249.00
MSF-16KRAM	Microsoft 16K RAM card	125.00

VISTA

VSA-A800	Vista 8" controller card	489.00
VSA-VS80	Vista Vision 80	299.00
MD-CNTRL	Micro Sci disk drive controller	99.00

FOURTH DIMENSION

FDM-SPRDRV	Super Drive-35 track Apple add on	329.00

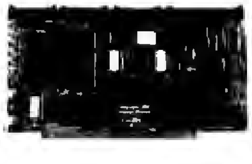
SORRENTO VALLEY ASSOC

SVA-221	Single sided single density controller	360.00
SVA-222	Double sided single density controller	360.00
SVA-223	Single or double sided double density	475.00

ADVANCED BUSINESS TECH

ABT-12KEYN	12 key pad for new Apple	95.00

S-100 BOARDS



16 BIT MICROPROCESSORS

GBT-8087	Godbout 8085/8087 Microprocessor board	495.00
GBT-8087	Godbout 8086/8088 dual 8 bit microprocessor	395.00
[illegible]	Seattle Computer 16 bit micro w/o board set	695.00
TEC-8086	Tecmar Computer 16 bit microprocessor	995.00
LDA-8086	Lomas Data Systems Lightning One	call

SINGLE BOARD COMPUTERS

MAV-BLT1	Wavemate Bullet 1 with floppy 25W for S-100	795.00
AMD-Z80	Advanced Micro Digital Floppy & SIO	750.00
TLL-FDC1	Telelek FDC1 Single board NEC765 controller	675.00

8 BIT MICROPROCESSORS

GBT-Z80	Godbout Z80 8 bit CPU 24 bit extended address	259.00
CCS-2810	California Computer Z-80 microprocessor	275.00
SDS-SBC200	SD Systems SBC 200 Z-80 microprocessor	275.00
MSM-Z80	Measurement System Z-80 board microprocessor	425.00
TAR-Z80	Tarbell Electronics Z-80 with two RS232 ports	385.00

FLOPPY DISK CONTROLLERS

GBT-DSK1	Godbout Disk One double density NEC765	385.00
MOR-DJ2	Morrow Designs Disk Jockey 2 with CPM	329.00
MOR-DJ1	Morrow Designs Disk Jockey 1 single density	225.00
CCS-2422	California Computer 2422 with CPM	329.00
TAR-DDC	Tarbell Electronics double density controller	419.00
TAR-SDC	Tarbell Electronics single density controller	279.00

CPM OPERATING SYSTEM

GBT-CPM22	Godbout CPM 2.2 for Disk One 8 bit operation	169.00
GBT-CPM86	Godbout CPM 86 for Disk One for use with 8086	269.00
GBT-CPM86	Godbout CPM 86 for operation with 8086 board	295.00

HARD DISK CONTROLLER

GBT-DSK2	Godbout Disk II hard disk controller	895.00
GBT-DSK3	Godbout Disk III hard disk controller	
MOR-HD50	Morrow Designs Winchester for Seagate 506	495.00
WDI-1000	Western Digital WD-1000 and S-100	495.00

EPROM BOARDS

ADS-PB100	Acquisition Digital Prom Blaster 100	275.00
SDS-P102	SD Systems Prom-100 programmer	350.00
SSM-PB1	SSM Prom programmer up to 2716	155.00
DCR-P32	Digital Research 32K Eprom card only board	99.00

STATIC MEMORY BOARDS

CAL-64K	California Digital Static 64 K (5 ns)	549.00
GBT-R16	Godbout Ram 16 64K memory 8/16 bit	169.00
GBT-R17	Godbout Ram 17 64K memory 8 or 16 bit	385.00
GBT-R20	Godbout Ram 20 32K static memory board	370.00
GBT-R21	Godbout Ram 21 128K 8/16 bit static memory	995.00
CCS-2116	California Computer 2116 16K static memory	135.00

DYNAMIC MEMORY BOARDS

CAL-D256	California Digital 256K dynamic memory 8 bit	495.00
SDS-E23	SD Systems Expandoram II 256K dynamic	795.00
CCS-2065	California Computer 2065 64K dynamic	399.00
MSM-DM64	Measurement Systems DM64 64K static board	549.00

INTERFACE BOARDS

[illegible]	[illegible]	[illegible]

SPECIAL FUNCTION BOARDS

HYS-MM100	S-100 Hayes Micromodem II 103 FCC approved	[illegible]
[illegible]	[illegible]	[illegible]

OCR READER

OPTICAL RECOGNITION EQUIPMENT

$295

```
DISPLAYED ASCII OUTPUT

WAND TEST DOCUMENT
4013016-001 REV. A
```

This optical recognition reader is the same unit currently used at the check out register of your local Sears, Roebuck or J.C. Penney retail outlets.
These units can be used for inputing data for inventory control, point of sale, or any application where accuracy and speed are essential. See OCR font above.
Interfaces eight bit ASCII parallel with "handshaking". Documentation and application notes included. Each reader is brand new in factory sealed boxes. Original acquisition is approximately $2,500. OCR-720 15 lbs.

All merchandise sold by California Digital is premium grade. Shipping: First five pounds $3.00. Each additional $.50. Foreign orders: 10% shipping. Excess will be refunded. California residents add 6% sales tax. COD's discouraged. Open accounts extended to state supported educational institutions and companies with a "Strong" Dun & Bradstreet. Warehouse: 15608 Inglewood Blvd. Visitors by appointment.

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ADVANCED COMPUTER PRODUCTS

SEND $2.00 for 104 PAGE CATALOG

16K Apple™ Ramcard

LIST 195
ACP
$69.95

- Full 1 year warranty
- Top quality — gold fingers
- Expand Apple II 48K to 64K
- Compatible with Z-80 Softcard™
- Allows system to run with CP/M*, PASCAL, DOS 3.3, COBAL, Visicalc, etc.
- Supplied with extra 16K RAM & has (2) LED's

32K STATIC RAM

2 or 4 MHz Expandable Uses 2114L's

16K 2 MHz Kit	$159.95
16K 4 MHz A&T	217.95
32K 4 MHz Kit	$199.95 ~~289.95~~
▲ 32K 4 MHz A&T	▲ 339.00
BARE BOARD	39.95
Bare Bd w/all parts less mem.	99.95

BARE BOARDS

S-100 Sound Board	$34.95
8080A CPU	34.95
32K Static RAM (2114)	34.95
8K EPROM (2708)	24.95
2708/2716 EPROM	34.95
ACP Proto Board	22.95
Vector 8800 Proto	22.20
Vector 8803 11 slot MB	29.85
ACP Extender with connector	18.95
13 Slot Mother Board (WMC)	32.95
9 Slot Mother Board (WMC)	29.95
6 Slot Mother Bd (Expandable)	34.95
Floppy PCB (8" SHUGART)	39.95
S100(AY5-8910) Sound Board	34.95
Apple Sound Board	24.95

64K CMOS RAM

S100 (200nS)

Uses 2716's or 6116's $349.00

Assembled & Tested $399.00

MOSTEK 4K RAMS

29¢ ea.

200,000 pieces in stock — priced to move

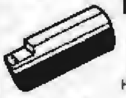
Same as MK4027 except 7mS refresh. MK4015 4Kx1 RAM

STEPPER MOTOR

Operates by applying 12VDC in one direction and then reversing polarity (or square wave). Uses 12VDC. Clock Wise Rotation. Rated 3 RPM at 4 P.P.S with a 5 degree stepping angle.

ACP PRICE $4.95 ea. 10 for $39.95

UV "EPROM" ERASER



Model UVs-11E $79.95

Holds 4 EPROM's at a time.

Model S-52T $325.00

4K STATIC RAM SELL-OFF

10/$9.90

Same as TMS4044 but designed specifically for Z-80 based systems. This is a full-spec 4Kx1 RAM, 450nS. Order P/N Zilog 6104-1 while supply lasts.

16K Memory Expansion Kits for Apple/TRS-80

8 pcs 4116 16K 200/250nS
Specify computer $12.95

CALL FOR VOLUME PRICING

Zilog Z8 CPU

with TINY BASIC Debug prog. $49.95

Plus 6132 companion quasi-static RAM 29.95

"D" SUB CONNECTORS

Unreal price. DB37 male, DB25 female. Gold PC mount with mounting holes. Mfg. AMP. Specify 25 or 37 pins

DB37 $2.50 DB25 $1.95

Stepper Motor

NEW

USED IN DATA PRODUCTS PRINTER $19.95 ea.

Astec RF Modulator

for COLOR & B/W

P/N 1082 Channel 3 or 4 $8.95

CONNECTORS

DB25P (RS232)	$3.25
DB25S Female	3.75
Hood	1.25
Set with Hood, Sale	7.50
22/44 S/T, KIM	2.95
43/86 S/T, MOT	5.55
50/100 S-100 Connector W/W	4.95
50/100 S-100 Connector S/T	3.85

1200 BAUD MODEM IC

Features:
- 1200 Baud
- 40 Pin
- 5Volts Only

SLT200 .... $129.00

PARALLEL ALPHA NUMERIC PRINTER

19 Column Printer prints 16 numerical columns plus 3 columns which have math, alpha and other notations. Each wheel has 12 positions with position 12 blank. Position 11 on numerical columns have decimal point or ∗. Utilizes 2.75" wide adding machine tape and a dual color ink ribbon. Input data parallel with four bit BCD comparator circuit (schematic provided). Print rate, 3 lines per second. Operating voltage 22-28VDC with typical cycle time of 340mS. Size 6⅝"W x 3⅛"H x 5⅝"Dp. New. $17.50 ea. 3/$45

MICROPROCESSORS

Z8001	$99.00	8228-1	$14.95	6802P	14.95
Z8002	69.00	2901	9.90	8035	14.95
Z80	8.95	2901A	14.95	8039	19.95
Z80A	11.95	2901A	49.95	8073N	24.95
F8 (3850)	19.95	6502	9.95	8748	49.95
8080	19.95	6502A	16.95	8748	49.95
1802	8.75	6800	29.95	8086	30.00
8080A	4.75	6800	11.75	8088	49.95
8085	14.95	68000	19.95	68000	129.95

RAMS

CALL FOR QTY PRICING

6116/2016	$7.95	2147	$5.99	5200	$1.99
8264-64K	8.50	411	6.99	5280	1.49
4116-2	1.99	414	4.69	6508	4.50
4116-2	8/12.95	1101	.89	6518	8.78
2101	0.99	1103	.89	6561	3.70
2102	.79	4027	4.69	6804	3.99
21L02-2	1.49	4044	3.99	6805	7.99
21L02-4	1.29	4060	4.69	9130	8.99
2111	3.49	4050	4.69	9140	8.99
2112	3.49	4096	3.99	93415	8.99
2114	1.99	4116	1.49	93425	8.99
2114L-2	3.25	4200	7.95		
2114L-4	2.29	4402	1.99		
2125	6.95	5280	4.60		

64K only $8.50

SUPPORT

8155	$9.95	8259	$6.95	68047	$22.95
8156	9.95	8275	19.95	68488	19.95
8202	29.95	8279	9.50	46505	22.95
8205	2.69	6810	4.75	6520	6.95
8212	2.75	6820	6.50	6522	8.95
8214	4.95	6821	6.50	6530-X	24.95
8216	2.75	6828	10.50	6532	17.95
8224	2.95	6834	16.95	6551	10.95
8226	2.95	6845	22.95	Z80-PIO	6.50
8228	3.95	6847	27.95	Z80A-PIO	9.50
8243	9.50	6850	5.25	Z80-CTC	6.50
8250	14.95	6852	5.25	Z80A-CTC	9.50
8251	6.50	6860	10.95	Z80-DMA	19.95
8253	11.95	6862	10.95	Z80A-DMA	27.95
8255	4.50	6875	5.95	Z80-SIO	24.95
8257	9.50	6880	2.49	Z80A-SIO	29.95

MOS PROMS

2764 (8Kx8) TS	$59.95	2708 (450nS)	$4.75
2732 (4Kx8) TS	12.95	2708 (650nS)	5.25
2716/2516, 5V (2Kx8) TS	7.95	1702A	5.75
TMS2716, 5V, 12V	17.95	MM5203AQ	14.50
3708L 5V, (450nS)	3.50	MM5204Q	9.95

HI-TECH

2513-001 (5V) Upper	$9.50	DAC08	[illegible]
2513-005 (5V) Lower	10.95	DAC100	[illegible]
2513 ADM3 (5V) Lower	14.95	2206 Function Generator	4.49
MCM66710 ASCII Shifted	13.95	MC4024 VCO	3.49
MCM66730 Math Symbol	13.95	LM566 VCO	1.95
MCM66750 Alpha Control	13.95	8038 Function Generator	3.95
1771-01 5" S Density	24.95	8116 (5V, 12V)	3.95
1791 Dual Floppy	39.95	AY5-1013 (5V, 12V)	4.95
1791-01 Dual Floppy	39.95	AY5-1014A/1015 (5-14V)	6.95
1791-02 Dual Floppy	44.95	AY5-1015A/1013 Low Pwr	5.95
[illegible]	[illegible]	[illegible]	[illegible]

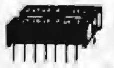
LINEAR

78H05K	$5.95	LM1414N	$1.90
78M05	1.49	LM1458CN/N	.48
78M.G.	1.49	MC1488N	.99
LM105AH	2.95	MC1489N	.99
LM300H	.99	LM1496N	.89
LM301CN	.35	LM1556N	1.60
LM304H	1.98	LM1820N	.95
LM305H	1.89	LM1850N	.99
LM308H	3.25	LM1889N	3.10
LM307CN	.39	LM2111N	1.75
LM308CN	.98	LM2900N	.99
LM309K	1.40	LM2901N	2.50
LM310CN	1.25	LM2917N	2.95
LM311D/CN	.89	CA3013T	2.19
LM312H	1.75	CA3018T	1.99
LM317T	1.70	CA3021T	3.49
LM318CN	1.49	CA3023T	2.99
LM319N/H	1.25	CA3035T	2.75
LM320K-XX*	1.35	CA3039T	1.29
LM320T-XX*	1.39	CA3046N	1.29
LM320H-XX*	1.25	CA3053N	1.49
LM323K	4.95	CA3059N	3.19
LM324N	.95	CA3060N	3.19
LM337K	5.95	CA3062N	4.95
LM338K	6.95	CA3065N	1.49
LM339N	.95	CA3080T	1.29
LM340K-XX*	1.75	CA3081N	1.69
LM340T-XX*	1.25	CA3082N	1.69
LM340H-XX*	1.25	CA3083N	1.55
LM344H	1.95	CA3086N	.80
LM348N	1.20	CA3089N	2.00
LM350K	5.60	CA3096N	3.49
LM358CN	.98	CA3097N	1.99
LM360N	1.40	CA3130T	1.30
LM372N	1.95	CA3140T	1.19
LM376N	3.75	CA3146N	2.49
LM377N	2.75	CA3160T	1.19
LM380CN/N	1.25	CA3190N	1.95
LM381N	1.79	CA3410N	.59
LM383T	1.95	MC3423N	1.49
LM386N	1.25	MC3460N	3.95
LM387N	1.40	SG3524N	3.95
LM390N	1.95	CA3600N	3.50
NE531V/T	3.75	LM3900N	.59
NE555V	.39	LM3905N	1.19
NE556N	.98	LM3909N	.98
NE561T	19.95	LM3914N	3.75
NE565N/H	1.25	LM3915N	3.95
NE566N/H	1.75	LM3916N	3.75
NE567V/H	1.50	RC4131N	2.95
NE592N	2.75	RC4136N	1.10
LM702H	.99	RC4151N	3.70
LM709N/H	.29	RC4194TK	4.95
LM710N/H	.75	RC4195TK	5.49
LM711N/H	.39	ULN2001	1.25
LM715N	1.95	ULN2003	1.50
LM723N/H	.55	SN75450N	.59
LM733N/H	.98	SN75451N	.39
LM739N	1.15	SN75452N	.49
LM741CN/H	.33	SN75453N	.49
LM741CN-14	.39	SN75454N	.49
LM747N/H	.79	SN75491N	.89
LM748N/H	.39	SN75492N	.89
LM760CN	2.95	SN75493N	.89
LM1310N	1.90	SN75494N	.89
MC1330	1.95	TL494CN	4.20
MC1350	1.95	TL496CP	1.65
MC1358	1.75		

74S00

74S00	$.39	74S124	3.69	74S244	$2.89
74S02	.49	74S133	.54	74S251	1.35
74S03	.45	74S134	.69	74S253	1.35
74S04	.62	74S135	1.15	74S257	1.20
74S05	.52	74S136	1.89	74S258	1.20
74S08	.49	74S138	1.29	74S260	.75
74S09	.49	74S139	1.29	74S280	2.79
74S10	.49	74S140	.73	74S287	2.99
74S11	.49	74S151	1.29	74S288	2.55
74S15	.42	74S153	1.29	74S373	3.10
74S20	.42	74S157	1.29	74S374	3.10
74S22	.42	74S158	1.29	74S387	2.75
74S30	.42	74S160	2.79	74S471	7.95
74S32	.49	74S174	1.49	74S472	7.95
74S38	1.15	74S175	1.49	74S473	7.95
74S40	.49	74S188	2.89	74S474	9.95
74S51	.42	74S194	1.89	74S475	9.95
74S64	.49	74S195	1.89	74S570	6.75
74S65	.45	74S196	1.89	74S571	6.75
74S74	.69	74S240	2.75	74S572	8.95
74S85	.72	74S241	2.75	74S573	8.95
74S112	.72	74S242	2.99	74S940	2.90
74S113	.72	74S243	2.99	74S941	2.90
74S114	.72				

SOCKETS



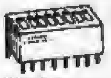
LOW PROFILE SOCKETS (TIN)

	1-24	25-49	50-100
8 pin LP	.16	.15	.14
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.29	.27	.24
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
40 pin LP	.60	.58	.56

3L WIREWRAP SOCKETS (GOLD)

	1-24	25-49	50-100
8 pin WW	.55	.54	.49
10 pin WW (Tin)	.65	.63	.58
14 pin WW	.75	.73	.67
16 pin WW	.80	.77	.70
18 pin WW	.95	.90	.81
20 pin WW	1.15	1.08	.99
22 pin WW	1.45	1.35	1.23
24 pin WW	1.35	1.28	1.14
28 pin WW	1.60	1.53	1.38
40 pin WW	2.20	2.09	1.89

DIP SWITCHES



2 Position	$.99	7 Position	$1.39
4 Position	1.19	8 Position	1.49
5 Position	1.29	9 Position	1.65
6 Position	1.35	10 Position	1.89

MUFFIN® FAN

The dependable, low cost, largest selling fan for commercial cooling applications.

- 105cfm free air delivery
- 4.68" sq. x 1.50" deep
- Weight - 17 oz.

SPECIAL PURCHASE

NEW $9.50 ea.

7400

7400	$.19	7475	$.38	74161	$.88
7401	.22	7476	.34	74162	.88
7402	.22	7479	4.60	74163	.87
7403	.22	7480	.49	74164	.87
7404	.22	7482	.95	74165	.87
7405	.25	7483	.55	74166	1.20
7406	.29	7485	.65	74167	1.95
7407	.29	7486	.35	74170	1.59
7408	.24	7489	1.75	74172	4.75
7409	.25	7490	.39	74173	.79
7410	.19	7491	.57	74174	.89
7411	.25	7492	.45	74175	.85
7412	.29	7493	.45	74176	.75
7413	.39	7494	.69	74177	.75
7414	.59	7495	.65	74178	1.34
7416	.29	7496	.69	74180	.75
7417	.29	7497	2.90	74181	1.75
7420	.22	74100	2.90	74182	.75
7421	.35	74107	.32	74184	2.25
7422	.29	74109	.37	74185	2.25
7423	.29	74116	1.05	74186	9.95
7425	.29	74121	.29	74188	3.90
7426	.29	74122	.39	74190	1.15
7427	.29	74123	.59	74191	1.15
7429	.45	74125	.39	74192	.85
7430	.22	74126	.44	74193	.85
7432	.29	74128	.59	74194	.85
7437	.25	74132	.69	74195	.85
7438	.29	74136	.75	74196	.85
7439	.29	74139	.95	74197	.85
7440	.19	74141	.79	74198	1.39
7441	.79	74142	2.95	74199	1.39
7442	.57	74143	2.95	74221	1.19
7443	.65	74144	2.95	74251	.85
7444	.69	74145	.62	74273	1.65
7445	.79	74147	1.95	74276	1.69
7446	.79	74148	1.20	74279	.75
7447	.69	74150	1.09	74283	1.40
7448	.79	74151	.67	74284	3.90
7450	.19	74152	.67	74285	3.90
7451	.19	74153	.67	74290	1.25
7453	.19	74154	1.15	74298	.85
7454	.19	74155	.76	74365	.69
7459	.25	74156	.76	74366	.69
7460	.29	74157	.69	74367	.49
7470	.29	74158	1.65	74368	.69
7472	.29	74159	2.49	74390	1.45
7473	.34	74160	.98	74393	1.90
7474	.34			74490	1.90

74LS00

74LS00	$.26	74LS113	$.43	74LS245	$2.20
74LS01	.28	74LS114	.43	74LS247	1.10
74LS02	.28	74LS122	.55	74LS248	1.10
74LS03	.28	74LS123	1.19	74LS249	1.19
74LS04	.36	74LS124	1.35	74LS251	1.40
74LS05	.28	74LS125	.90	74LS253	1.40
74LS08	.28	74LS126	.62	74LS257	.86
74LS09	.36	74LS132	.79	74LS258	.98
74LS10	.28	74LS136	.40	74LS259	2.95
74LS11	.39	74LS138	.85	74LS260	.69
74LS12	.33	74LS139	.85	74LS261	2.49
74LS13	.47	74LS145	1.25	74LS266	.69
74LS14	.96	74LS148	1.49	74LS273	1.75
74LS15	.33	74LS151	.79	74LS275	4.40
74LS20	.28	74LS153	.79	74LS279	.59
74LS21	.33	74LS154	1.70	74LS283	.99
74LS22	.33	74LS155	1.19	74LS290	.99
74LS26	.33	74LS156	.99	74LS293	.89
74LS27	.33	74LS157	.85	74LS295	1.10
74LS28	.33	74LS158	.75	74LS298	1.19
74LS30	.28	74LS160	1.05	74LS324	1.75
74LS32	.33	74LS161	1.15	74LS347	1.95
74LS33	.55	74LS162	1.05	74LS348	1.95
74LS37	.46	74LS163	1.05	74LS352	1.19
74LS38	.39	74LS164	1.19	74LS353	1.19
74LS40	.28	74LS165	.89	74LS363	1.49
74LS42	.79	74LS166	2.46	74LS365	.69
74LS47	.79	74LS168	1.15	74LS366	.69
74LS49	.95	74LS169	1.15	74LS367	.69
74LS51	.28	74LS170	1.99	74LS368	.69
74LS54	.28	74LS173	.89	74LS373	1.09
74LS55	.29	74LS174	.89	74LS374	1.89
74LS73	.46	74LS175	.89	74LS375	.69
74LS74	.42	74LS181	2.20	74LS377	1.95
74LS75	.59	74LS190	1.15	74LS385	1.95
74LS76	.45	74LS191	1.15	74LS386	.65
74LS78	.49	74LS192	.98	74LS390	1.95
74LS83A	.79	74LS193	.98	74LS393	1.95
74LS85	1.19	74LS194	1.15	74LS395	1.70
74LS86	.46	74LS195	.95	74LS399	2.35
74LS90	.57	74LS196	.89	74LS424	2.95
74LS92	.75	74LS197	.89	74LS668	1.75
74LS93	.79	74LS221	1.16	74LS670	2.29
74LS95	.88	74LS240	1.09	81LS95	1.69
74LS96	.98	74LS242	1.09	81LS96	1.69
74LS107	.48	74LS243	1.09	81LS97	1.69
74LS109	.46	74LS244	1.49	81LS98	1.69
74LS112	.43				

VOLUME PRICING CALL TOLL FREE

CMOS

4000	$.35	4037	$1.98	4089	$2.95
4001	.29	4040	1.29	4093	.99
4002	.25	4041	1.25	4094	2.95
4006	1.09	4042	.95	4096	2.39
4007	.29	4043	.85	4099	2.25
4008	1.39	4044	.85	14408	12.95
4009	.45	4046	1.75	14409	12.95
4010	.45	4047	1.39	14410	12.95
4011	.35	4048	.99	14412	12.95
4012	.25	4049	.45	14415	8.95
4013	.45	4050	.45	14419	4.95
4014	1.39	4051	1.10	4501	.39
4015	1.15	4052	1.10	4502	1.65
4016	.59	4053	1.10	4503	.69
4017	1.19	4055	3.95	4505	8.95
4018	.99	4056	2.95	4506	.75
4019	.45	4059	9.29	4507	.95
4020	1.10	4060	1.39	4508	3.75
4021	1.19	4066	.75	4510	1.19
4022	1.15	4069	.35	4511	1.19
4023	.29	4070	.49	4512	1.39
4024	.75	4071	.35	4515	2.75
4025	.29	4072	.35	4516	1.45
4027	.65	4073	.35	4518	1.39
4028	.85	4075	.35	4520	1.25
4029	1.29	4076	1.29	4555	4.95
4030	.49	4077	.35	4566	.99
4031	3.25	4078	.35	4585	2.95
4032	2.15	4081	.35	80C95	1.50
4034	3.25	4082	.35	80C97	1.25
4035	.85	4085	1.95		

SUPER IC CLOSEOUT SPECIALS

ULN2003	2/$1.99	2N0121	3/$1.00	8080A CPU	2.99	5027 CRT	$9.99
74LS668	3/1.99	SIG 2652	3.95	2102 RAM	.75	11C24	8.95
74LS377	2/1.99	74S287	1.95	4060 RAM	1.49	95H03	2.99
74LS241	2/1.99	2758 EPROM	2.99	8X300 CPU	14.95	MM5320	3.99
8259	6.95	74173/8T10	3/1.99	74S387	1.99	9131 RAM	1.99
6561 RAM	2.95	Z80A CPU	4.95	2708 EPROM	8/29.95	EMM4402	1.99
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as reviewed in May BYTE pg. 288

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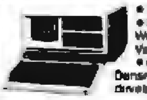

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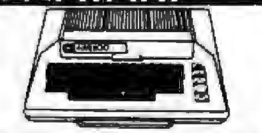

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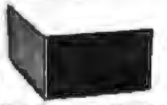

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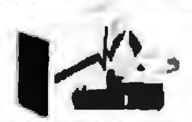

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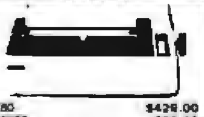

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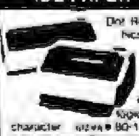

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74LS93	.59	74LS241	.95	74LS684	2.39
74LS95	.79	74LS242	1.79	74LS685	2.39
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74LS107	.39	74LS244	.95	74LS689	2.39
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4007	.25	4502	.90	74C107	1.0
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4009	.45	4508	1.90	74C151	2.2
4010	.45	4510	.90	74C154	3.2
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4012	.30	4512	.90	74C160	2.00
4013	.45	4514	1.20	74C161	2.00
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4024	.75	4532	1.90	74C200	5.7
4025	.35	4538	1.90	74C221	2.2
4026	1.60	4539	1.90	74C373	2.7
4027	.60	4543	2.70	74C374	2.7
4028	.75	4555	.90	74C901	.8
4029	.90	4556	.90	74C902	.8
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4034	2.90	4582	1.90	74C905	10.9
4035	.85	4584	.90	74C906	.9
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4060	1.39	74C08	.35	74C922	5.5
4066	.75	74C10	.35	74C923	5.9
4068	.39	74C14	1.50	74C925	6.7
4069	.30	74C20	.35	74C926	7.9
4070	.35	74C30	.35	74C927	7.9
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4072	.30	74C42	1.75	74C929	19.9
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4076	.90	74C74	.85	14409	12.9
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MEM-32180A	RAM 16 A & T	$598.95
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IEEE 696 S-100 standard, up to 6MHz 8 Bit, 12MHz 16 Bit, 24 Bit extended addressing, disable-able in 2K increments

MEM-64300A	A & T	$499.95

64K STATIC RAM - Mem Merchant

64K static S-100 RAM card 4 to 16K banks up to 8 MHz

MEM-64400A	64K A & T	$499.95

64K STATIC RAM - Jade

Uses new 2K x 8 static RAMs, fully supports IEEE 696 24 bit extended addressing, 200ns RAMs, lower 32K or entire board phantomable, 2716 EPROMs may be subbed for RAMs, any 2K segment of upper 8K may be disabled, low power typically less than 500ma

MEM-99152B	Bare board	$49.95
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64K RAM board with bank and block select switching functions for Cromemco Cromix & Alpha Micro

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Expandable RAM board from 16K to 64K using 4116 RAM chips

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Assembled & Tested		add $50.00

16K STATIC RAM - Mem Merchant

4MHz lo-power static RAM board, IEEE S-100, bank selectable addressable in 4K blocks, disable-able in 1K segments extended addressing

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S-100 I/O Boards

SYSTEM SUPPORT 1 - CompuPro

Real time clock three 16 bit interval timers, dual interrupt controllers(15 levels) up to 4K EPROM RAM, RS-232C serial channel, provision for 9511A 9512 math chip

IOX-1850A	SS1 A & T	$359.95
IOX-1850C	SS1 CSC	$459.95
IOX-1855A	with 9511 A & T	$554.95
IOX-1855C	with 9511 CSC	$654.95
IOX-1860A	with 9512 A & T	$554.95
IOX-1860C	with 9512 CSC	$654.95

INTERFACER 1 - CompuPro

2 serial I O ports 50-19 2K baud

IOI-1810A	A & T	$218.95
IOI-1810C	CSC	$288.95

INTERFACER 2 - CompuPro

3 parallel 1 serial, & interrupt timer

IOI-1820A	A & T	$218.95
IOI-1820C	CSC	$288.95

INTERFACER 3 - CompuPro

5 or 8 channel serial I/O board for interrupt driven multi-user systems up to 250K baud

IOI-1835A	5 port A & T	$558.95
IOI-1835C	5 port CSC	$628.95
IOI-1838A	8 port A & T	$628.95
IOI-1838C	8 port CSC	$749.95

INTERFACER 4 - CompuPro

3 serial 1 parallel 1 Centronics parallel

IOI-1840A	A & T	$314.95
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Multi-user I O multiplexer & interrupt controller with on-board 8085A-2 CPU & 4K or 16K of RAM

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IOI-1010A	A & T with manual	$249.95

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IOI-1060A	A & T with manual	$319.95

2719 2 SER & 2 PAR - C.C.S.

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MSF-558482		$494.95 ea	2 for $484.95 ea
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THE BUS PROBE - Jade

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FOR SALE: Seven 100-megabyte Calcomp Trident hard-disk drives; asking $10 per megabyte. Also, two 1600 BPI 125 IPS tape drives with auto load. All IBM-compatible, includes cables and manuals. Excellent for the industrious hobbyist. Call Alex at (305) 392-4128 or 940-3338

FOR SALE: IMSAI 8080 22-slot, S-100 bus system, including front panel, processor board, disk drive with controller, 32K static RAM, video board, full ASCII keyboard with interface, portable black-and-white TV as display, Mullen extender board with logic probe, BASIC, DOS, and monitor. $2150. Also, Equipment rack with 19- by 72-inch panel area, including rear door, outlet strip, and cooling fan. Make an offer. Ronald Roybal 856-105 Minnesota Ave., San Jose, CA 95125, (408) 297-7096 evenings.

WANTED: CDC Hawk 10-megabyte hard-disk drive or Shugart SA-1004 Winchester drive. Must be reasonable. Steve Waechter, POB 3597, Fullerton, CA 92634, (714) 674-3071 evenings, 871 2863 days

FOR SALE: BYTE from issue #1 through June 1980. Mint condition with shelf box holders. Best written offer within 30 days of this ad. Include name, address, and phone number. C. A. Beece 1915 White Rose, Carrollton, TX 75007

FOR SALE: Burroughs L4000 computer complete with tape punch and punched tape reader in working condition. You must provide shipping. Will fit in the back of a one-half ton pickup truck. Best offer. Russell Tiffany, R.R. 1, Box 28, Hallstead, PA 18822

FOR SALE: OSI C3-S1 computer with 48K static RAM, dual 8-inch disk drives, 6502/6800/Z80 processor, all manuals, two operating systems, BASIC, and much software. New: $4400; sell $3100. A. Babudro, POB 5758, San Diego, CA 92105, (714) 284-9646

FOR SALE: Heath H-8 complete system with 48K RAM, 4-port serial I/O, CP/M-capable with H-17 dual floppy disk. CP/M and miscellaneous software included, plus more than 40 minidisks with light use. System carefully assembled, in excellent condition, with all manuals. $2675 value in last catalog, will sell all for $1750 including shipping. Or, will sell separately. Also, old H-9 terminal, video needs work, keyboard and video display okay, make an offer. Gary Hammond, POB 54, Weirs Beach, NH 03246, (603) 497-3521 evenings

FOR SALE: First-class system. Godbout Big 16 plus drives, analog I/O, smart terminal, cables, CP/M-80, CP/M-86, Pascal-MT+, Pascal/M-86, VEDIT, and more. Excellent condition. Hard to beat at $3995. Karl Siplle, 3400 Lloyds Lane E-5, Mobile, AL 36609 (205) 343-2820 evenings

NOTICE: Inmate working with Burroughs 1800 series in FORTRAN, COBOL, and BASIC. Also, TRS-80 Model I Level II. Would like to correspond and exchange ideas, programs, and advanced concepts with computer enthusiasts. Will execute individual's programs, as long as they are contributing to educational benefits. Also, would like hard copies of TRS-80 software: games and educational. David Bensinger #R106-475, POB 56, Lebanon, OH 45036

FOR SALE: Compucolor II with 16K RAM, 32K ROM, disk, 15 MHz color display, 71-key keyboard, RS-232C port, 24-hour clock, graphics and DOS in ROM, all manuals, and documentation for hardware and software included. Also, software includes Statistics, word processing, Data Base Management, assembler, editor, chess, Star Trek and eight other game disks. Cost $2280, will sell for $1100. C. Lovejoy, 49 South St., Natick, MA 01760, (617) 655-8851 7-9 p.m.

FOR SALE: Six by Commodore back issues; almost one-half of each issue consists of practical, useful, and entertaining programs for PET, VIC-20, CBM, and Super PET computers. $2 each. Also have several exciting arcade-type games, $15 each. R. Olanson 47 Coachwood Pl. N.W., Calgary, Alberta, T3H 1E1 Canada

FOR SALE: Apple II Plus computer with 16K RAM and Leedex Video 100 black-and-white 12-inch monitor, both 1 year old. Total price $1100. Certified check. I pay shipping. Dr. Alan J. Grant 530 44th St. Brooklyn, NY 11220, (212) 436-1714

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FOR SALE: Apple II system including 48K memory, Applesoft in ROM, disk drive, Z80 Softcard, RS-232C interface card, plus a library of over 100 programs. $2200. R. S. Steele, 103 West Melbourne, Oak Ridge, TN 37830 (615) 482-5633

FOR SALE: TI 99/4A computer that has been barely used. $300 with video modulator and one command module. T. N. Gautier, 4758 South Appletree Ave., Tucson, AZ 85730, (602) 790-4533

WANTED: Apple computer programs to swap, including Mountain Computer Music System disks. Jerry Bolin, 831 Poplar St., Missoula, MT 59802

WANTED: Information on software with medical applications for a reference source on medical computing. I am interested in programs related to medical diagnosis, decision making, record keeping, office management, clinical research, or medical education. A listing of available programs and their sources will be included in the final publication. Jeffrey D. Horbar, M.D., Computer Section, Pediatrics, University of Vermont, College of Medicine, Given Building, Burlington, VT 05405

FOR SALE: Microfiche retrieval and reading system, automated, computer-controlled. Also, used Image Systems Model 201 with computer interface, holds 720 fiche. Asking $9500. R. Klein, 2929 East 6th St., Tucson, AZ 85716, (602) 327-2636 or 626-4119

FOR SALE: IBM Correcting Selectric typewriter/printer: $1000. Conversion was done by Micro Computer Devices of California. The unit includes a black box and accepts RS-232C serial interface from terminal or microcomputer. Extra features include sound reduction, dead-key disconnect (for foreign-language work), and a set of 24 typing elements. Also HP-82143A thermal printer for HP-41C programmable calculator at one-half of the list price. M. Barret, 2 Tudor City, 1-C North, New York, NY 10017 (212) 949-0009

FOR SALE: BYTE #1 through 12/79 in excellent condition. $150 or best offer. Also have Interface Age, Kilobaud Microcomputing, 80 US, TRS-80 Monthly, and Creative Computing. Gary S. Fix, 5505 Diablo Dr., Sacramento, CA 95842

FOR SALE: Processor Technology SOL-20 terminal computer has 16K memory plug-in with several program-cassettes, BASIC, Electric Pencil by Shrayer, etc. Electrohome 14-inch black-and-white TV monitor. Anderson-Jacobson (IBM) AJ841 Selectronic terminal printer that gives letter-copy printout in uppercase and lowercase. Complete setup for $1600. Also, Tektronix Model 5403 mainframe dual-trace oscilloscope with display readout. In excellent condition; $1600. Bob Goodman, POB 452, Alexandria, LA 71301 (318) 445-0262 or 640-1466 after 6 p.m.

FOR SALE: LA-36 DECwriter, including RS-232C interface, shelf, casters, cover, manual, etc. Perfect condition: $900 (plus shipping) or trade for video terminal. Also selling Tally Model 420 high-speed paper-tape punch and Model 424 reader, $50 each. Printec 100 cps printer: $100. Paper tape: $25/case (28 rolls). Peter Smart, POB 150, Silver Lake, NH 03875 (603) 367-8004

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FOR SALE: SYM-1 single-board computer and 32K memory board. Both for $250 or best offer. Charles Hembree, POB 942, El Cerrito, CA 94530, (415) 527-6677.

FOR SALE: Back issues of computer magazines. 9 titles, 124 issues, 1977 to 1982. Send SASE for list. David H. Simmons, POB 7000-140, Redondo Beach, CA 90277.

WANTED: Back issues of the following magazines: Compute, Creative Computing, Personal Computing, 80 Microcomputing, Kilobaud Microcomputing, and BYTE. If you have any of these magazines in excellent condition for sale, send magazine titles, years, volumes, numbers, and your asking price. Anthony Ayiomamitis, POB 512, Station P, Toronto, Ontario, M5S 2T1 Canada.

FOR SALE: Used Apple II Plus with 48K, modem, and integer card for $1100. In excellent working condition. David Albert, 330 East 71st St., New York, NY 10021, (212) 988-7436.

WANTED: OSI C2 OEM: advise on age, condition, and price. M. Hirsch, POB 209, Old Westbury, NY 11568, (516) 626-1265.

FOR SALE: Various back issues of Kilobaud Microcomputing, $3 includes postage. 101 BASIC Computer Games by Ahl, $4. Programs For Beginners by Blechmann, $5 includes postage. Problem Solving Principles by Lewis, $5 includes postage. Musical Applications of Microprocessors by Chamberlain, $12 includes postage. Excess postage will be refunded. Douglas Stewart, 15 Mountain View Rd., Cape Elizabeth, ME 04107, (207) 767-2351.

FOR SALE: 48 issues of BYTE from November 1977 to June 1982. Also, 12 recent issues of Creative Computing and various copies of onComputing, Computer Best of Byte, volume 1, and IEEE Microprocessors & Microcomputers, second edition. Subjects range from computer art to voice synthesis. Many articles on hardware construction. Magazines include hundreds of super games for TRS-80, Apple, PET, and IBM. All for $80. David Luneau, RFD 9 Box HBA, Concord, NH 03301, (603) 225-4743.

WANTED: Computer terminal with modem. I am just beginning to use a computer and have access to a DEC-10 system. I am looking for a quality terminal with modem in good working condition at a very reasonable price. B. Lieberman, 627 Beverly Rd., Pittsburgh, PA 15243, (412) 343-2508 or 624-3763.

WANTED: IMSAI VDP-80 64K RAM with 8-inch disk drives, in good condition. A. M. Agapos, 147 Bradley Dr., Slidell, LA 70458, (504) 286-6896 or 643-0791.

WANTED: Help for Mexican computer hackers. They need spare parts, modules, diagrams, software, etc. for a TI-960A computer. Also would experiment with other computers. If you give away any hardware, software, documentation, etc., please send to James Moran, 9873 Lily St., El Paso, TX 79927.

FOR SALE: Commodore VIC-20 in good condition. Includes radio frequency Modulator, cassette player, joystick, game paddles, several issues of VIC users magazine, and software including VIXEL #1 and #2. $400 or best offer. Brian Hibbert, Apt. 804, 1501 East Gardner Lane, Peoria Heights, IL 61614, (309) 686-3689 evenings.

BOMB

BYTE's Ongoing Monitor Box

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24	486	A Versatile Low-Cost Microprocessor Controller Module	Craig

Answers to "Board to Death" quiz on pages 94–95.

Photo 1: Panasonic Link (handheld computer)
Photo 2: Commodore VIC-20
Photo 3: Colonial Data Systems SB-80
Photo 4: California Computer Systems 2200A
Photo 5: Corvus Concept
Photo 6: Apple II Plus, revision D
Photo 7: 16K-byte TRS-80 Color Computer
Photo 8: Western Digital Pascal Microengine
Photo 9: Atari 400
Photo 10: Sinclair ZX80
Photo 11: Autocontrol AC-85
Photo 12: IBM Personal Computer

Speech Synthesizer Speaks Up for Number One

BYTE readers again have put Steve Ciarcia in the top spot. His article "Build the Microvox Text-to-Speech Synthesizer, Part 1: Hardware" has earned him first place in the September BOMB contest. He'll receive the $100 prize. Second place goes to Senior Technical Editor Gregg Williams for his product description of "The Epson QX-10 Valdocs System." As a staff member he is not eligible for the $50 second-place award. And Robin Moore earned third place for his review, "The Apple III and Its New Profile."

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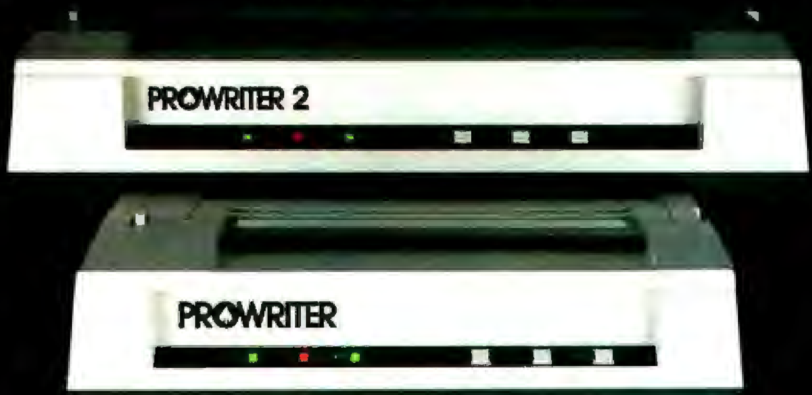

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