

749 Machine Repair Simulation

A system is composed of 1, 2, or 3 machines and a repairman responsible for maintaining these machines. Normally, the machines are running and producing a product. At random points in time, the machines fail and are fixed by the repairman. If a second or third machine fails while the repairman is busy fixing the first machine, these machines will wait on the services of the repairman in a first come, first served order. When repair on a machine is complete, the machine will begin running again and producing a product. The repairman will then repair the next machine waiting. When all machines are running, the repairman becomes idle.

Write a program that will simulate this system for a fixed period of time and calculate the fraction of time the machines are busy (utilization) and the fraction of time the repairman is busy (utilization). Machines are busy when producing parts and the repairman is busy when repairing machines.

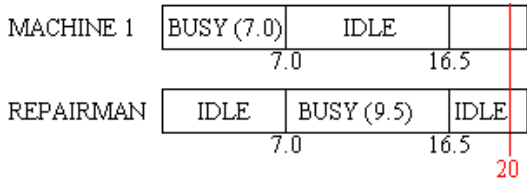
Input

The input file is composed of three parts each separated by a header record. The first part is a list of 50 random machine running times until failure. The second part is a list of 50 random machine repair times. The third part is a list of the cases to be simulated. Each case specifies the length of the simulation and the number of machines assigned to the repairman. Cases end with the specification of a 0 length and an assignment of 0 machines. Each case will use the same random machine running times and repair times, starting at the beginning.

Output

A sample with the details of the output file (print results accurately rounded to 3 decimal places) is provided below. Diagrams are also provided to illustrate the simulation process.

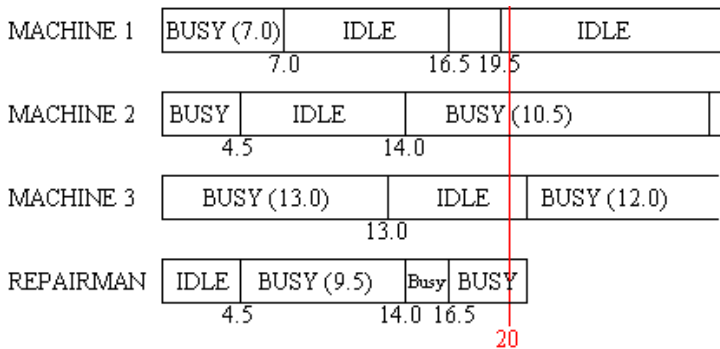
Case 1 Simulation



$$\text{Machine Utilization} = (7 + 3.5)/20 = .525$$

$$\text{Repairman Utilization} = (9.5)/20 = .475$$

Case 2 Simulation



Machine Utilization = $((7+3)+(4.5+6)+(13))/(3*20) = .558$
 Repairman Utilization = $(15.5)/20 = .775$

Sample Input

Machine running times (10 five column fields per record)
 7.0 4.5 13.0 10.5 3.0 12.0
 Machine repair times (10 five column fields per record)
 9.5 2.5 4.5 12.0 5.7 1.5
 Cases (2 five column fields per record)
 20.0 1
 20.0 3
 0.0 0

Sample Output

Case	No of Machines	Machine Utilization	Repairman Utilization
1	1	.525	.475
2	3	.558	.775