

Problem 7 – Algorithm Fun (The $3n + 1$ Problem)

Problems in Computer Science are often classified as belonging to a certain class of problems (e.g., NP, Unsolvable, Recursive, etc.). In this problem you will be analyzing a property of an algorithm whose classification is not known for all possible inputs.

Consider the following algorithm:

1. Input n
2. print n
3. if $n = 1$ then STOP
4. if n is odd then $n \leftarrow 3n + 1$
5. else $n \leftarrow n/2$
6. GOTO 2

Given the input 22, the following sequence of numbers will be printed:

22 11 34 17 52 26 13 40 20 10 5 16 8 4 2 1

It is conjectured that the algorithm above will terminate (when a 1 is printed) for any integral input value. Despite the simplicity of the algorithm, it is unknown whether this conjecture is true. It has been verified, however, for all integers n such that $0 < n < 1,000,000$ (and, in fact, for many more numbers than this.)

Given an input n , it is possible to determine how many numbers printed before and including the 1 is printed. For a given n this is called the *cycle-length* of n . In the example above, the cycle length of 22 is 16.

For any two numbers i and j you are to determine the maximum cycle length over all numbers between and including both i and j .

The Input

The input will consist of a series of pairs of integers i and j , one pair of integers per line, separated by a single space. All integers will be less than 10,000 and greater than 0.

You should process all pairs of integers and for each pair determine the maximum cycle length over all integers between and including i and j .

The Output

For each pair of input integers i and j you must output i, j , and the maximum cycle length for integers between and including i and j . These three numbers must be separated by only one space with all three numbers on one line and with one line of output for each line of input. The integers i and j must appear in the output in the same order in which they appeared in the input and must be followed by the maximum cycle length (on the same line).

Error Checking

Number of parameters per line. Error Message: "Invalid # of parameters on line: X"

Input is integers only, must be between 1 and 10,000, and first integer must be less than second integer.
Error Message: "Invalid range on line: x"

NOTE: There will be a maximum of 1 error for any given line of input. In other words, there will be either a range issue or a parameter count issue. Never both.

Sample Input

```
1 10
100 200
55
201 210
850 12000
33 32
900 1000
1500 1700
-25 700
```

Sample Output

```
1 10 20
100 200 125
Invalid # of parameters on line: 3
201 210 89
Invalid range on line: 5
Invalid range on line: 6
900 1000 174
1500 1700 180
Invalid range on line: 9
```