

## 350 Pseudo-Random Numbers

Computers normally cannot generate really random numbers, but frequently are used to generate sequences of pseudo-random numbers. These are generated by some algorithm, but appear for all practical purposes to be really random. Random numbers are used in many applications, including simulation.

A common pseudo-random number generation technique is called the linear congruential method. If the last pseudo-random number generated was  $L$ , then the next number is generated by evaluating  $(Z \times L + I) \bmod M$ , where  $Z$  is a constant multiplier,  $I$  is a constant increment, and  $M$  is a constant modulus. For example, suppose  $Z$  is 7,  $I$  is 5, and  $M$  is 12. If the first random number (usually called the *seed*) is 4, then we can determine the next few pseudo-random numbers are follows:

Last Random Number, $L$	$(Z \times L + I)$	Next Random Number, $(Z \times L + I) \bmod M$
4	33	9
9	68	8
8	61	1
1	12	0
0	5	5
5	40	4

As you can see, the sequence of pseudo-random numbers generated by this technique repeats after six numbers. It should be clear that the longest sequence that can be generated using this technique is limited by the modulus,  $M$ .

In this problem you will be given sets of values for  $Z$ ,  $I$ ,  $M$ , and the seed,  $L$ . Each of these will have no more than four digits. For each such set of values you are to determine the length of the cycle of pseudo-random numbers that will be generated. But be careful: the cycle might not begin with the seed!

### Input

Each input line will contain four integer values, in order, for  $Z$ ,  $I$ ,  $M$ , and  $L$ . The last line will contain four zeroes, and marks the end of the input data.  $L$  will be less than  $M$ .

### Output

For each input line, display the case number (they are sequentially numbered, starting with 1) and the length of the sequence of pseudo-random numbers before the sequence is repeated.

### Sample Input

```
7 5 12 4
5173 3849 3279 1511
9111 5309 6000 1234
1079 2136 9999 1237
0 0 0 0
```

### Sample Output

Case 1: 6

Case 2: 546

Case 3: 500

Case 4: 220