# Homework 4

(Time Limit: 1 second)

**Problem Description**

Given positive integers , and , we want to find the remainder of the division of by .

**Input Format**

Each test case contains three positive integers, , and . Two consecutive numbers in a test case are separated by a whitespace character. The input ends with -1, which shall not be processed.

**Technical Specifications**

There are two subtasks:

* 1. There are at most test cases. Furthermore, , and . Please take care of integer overflows.
  2. There are at most test cases. Furthermore, , and . Because of the time limit of 1 second, efficiency is now an issue. I implemented the method of “recursive doubling” for this subtask.

**Output Format**

For each test case, output the remainder of the division of by .

**Example**

|  |  |
| --- | --- |
| **Sample Input:** | **Sample Output:** |
| 1 4 2  3 4 5  11 3 121  5 2 7  2 6 3  7 3 10  -1 | 1  1  0  4  1  3 |

**Remarks**

Because I will test your program using diff, please follow the aforementioned format exactly. For example, please avoid all prompts for inputs.

Solving Subtask (i) and Subtask (ii) earns you 80 and 100 points, respectively.

**Recursive Doubling**

“Recursive doubling” is efficient for solving this homework. Let me take for illustration:

* Write in binary so that we know .
* Calculate , , , , , and in the following way:
* Having written in binary, we now calculate as

To avoid integer overflows, you may use long long integers and take your numbers modulo after every multiplication.