

# Fibonacci Sequence

The well-known *Fibonacci sequence* is:  $F_i = F_{i-1} + F_{i-2}$  for  $i \geq 2$ ,  $F_0 = 0$ ,  $F_1 = 1$ . Tom discovers that the Fibonacci number grows very quickly, for example  $F_{40} = 102334155$ . To make further discovery of the Fibonacci numbers, Tom takes the following steps:

1. Take the first  $n$  Fibonacci numbers (exclude  $F_0$ )  $S_1 = \{F_1, F_2, \dots, F_n\}$
2. Modulo each Fibonacci number by a positive integer  $Q$ , i.e.  $A_i = F_i \% Q$  and obtain a new sequence  $S_2 = \{A_1, A_2, \dots, A_n\}$
3. Sort the numbers in  $S_2$  from small to large and obtain sequence  $S_3$   
 $S_2 = \{A_1, A_2, \dots, A_n\} \rightarrow S_3 = \{c_1, c_2, \dots, c_n\}$
4. For numbers in sequence  $S_3$ , calculate the weighted sum modular  $Q$

$$\left( \sum_{k=1}^n k \cdot c_k \right) \% Q = (1 \cdot c_1 + 2 \cdot c_2 + 3 \cdot c_3 + \dots + n \cdot c_n) \% Q$$

Can you write a program to calculate the result?

## Input

The input contains multiple test cases. The first line of the input is a number  $T$  ( $1 \leq T \leq 100$ ), indicating the number of test cases. Each test case contains two integers  $n$  ( $2 \leq n \leq 5,000,000$ ) and  $Q$  ( $2 \leq Q \leq 1000,000,000$ ) in one line.

## Output

For each test case, print the weighted sum in a separate line.

Sample input	Sample output
4	46
5 100	2
5 3	11
15 13	973061125
5000000 1000000000	

**Explanation:** In the second sample: the first 5 Fibonacci numbers are  $\{1, 1, 2, 3, 5\}$ , after modular 3 it becomes  $\{1, 1, 2, 0, 2\}$  and after sorting it is  $\{0, 1, 1, 2, 2\}$ , hence the weighted sum is

$$0 \cdot 1 + 1 \cdot 2 + 1 \cdot 3 + 2 \cdot 4 + 2 \cdot 5 = 23$$

After modular 3 it is  $23 \% 3 = 2$ .

**Hints:** radix sort