

## Problem Rapid

Input file `stdin`  
Output file `stdout`

Marius has a secret permutation  $p_1, p_2, \dots, p_n$ . Although Marius does not want to reveal the values of the elements in the permutation, he is willing to answer a limited number of queries of the following type:

- `? i j` ( $1 \leq i, j \leq n, i \neq j$ ) — What is the minimum value between  $p_i$  and  $p_j$ ?

Find the positions of the numbers  $n - 1$  and  $n$  in Marius' permutation.

**Note!** If  $p_i = n - 1$  and  $p_j = n$ , then both  $(i, j)$  and  $(j, i)$  are considered correct answers.



### Input Data

Each test contains multiple test cases. The first line will contain two numbers  $t$  and  $lim$  — the number of test cases and the maximum number of queries per test case that Marius is willing to answer.

### Interaction Protocol

**The hidden permutation is fixed at the beginning of each test case (the interactor is not adaptive).**

The interaction for each test case begins with reading  $n$  — the size of the permutation  $p$ .

If  $n = -1$ , then the answer for the last test case was incorrect. To obtain a verdict of "Wrong answer" instead of another verdict, we recommend immediately terminating the program.

After this, to ask Marius what the minimum between  $p_i$  and  $p_j$  is, print a line in the following format:

- `? i j` ( $1 \leq i, j \leq n, i \neq j$ )

Marius will respond with a number  $x = \min(p_i, p_j)$ , which you can read from `stdin`.

If the query is invalid or if it is the  $lim + 1$ -th query in the test case,  $x$  will be equal to  $-1$ . In this case, to obtain a verdict of "Wrong answer" instead of another verdict, we recommend immediately terminating the program.

To display the answer for a test case, print a line in the following format:

- `! i j` ( $1 \leq i, j \leq n, i \neq j$ )

After displaying the answer, you can read the value of  $n$  for the next test case.

If  $p_i = n - 1$  and  $p_j = n$ , then any order of positions  $i$  and  $j$  is considered correct.

**After each printed line, you must output an endline and flush the `stdout`. In C++, this can be done with the instruction `cout<<endl`;**

## Scoring

Let  $q$  be the maximum number of queries used for a test case in a given test. The percentage of the total score awarded for that test will be:

- 1, if  $q \leq 10,000$ ;
- $\frac{\text{lim}+1-q}{\text{lim}+1-10,000}$ , if  $10,000 < q \leq \text{lim}$ ;
- 0, if  $q > \text{lim}$ .

## Restrictions

#	Points	Restrictions
1	4	$t = 25, 2 \leq n \leq 140, \text{lim} = 12\,000$
2	8	$t = 25, n = 3\,000, \text{lim} = 12\,000$
3	16	$t = 25, n = 5\,000, \text{lim} = 12\,000$
4	20	$t = 25, n = 7\,500, \text{lim} = 12\,000$
5	12	$t = 25, n = 9\,300, \text{lim} = 11\,000$
6	24	$t = 25, n = 9\,600, \text{lim} = 10\,200$
7	16	$t = 25, n = 9\,900, \text{lim} = 10\,000$

## Examples

Input file	Output file
1 12000 5	? 1 2
1	? 1 3
3	? 3 5
4	! 5 3

## Explanations

Marius' hidden permutation is  $[3, 1, 5, 2, 4]$ .

The interaction begins with reading the number of test cases  $t = 1$ , the maximum number of queries per test case  $\text{lim} = 12000$ , and the size  $n = 5$  of the permutation in the first test case.

After this:

- For the query "What is the minimum value between  $p_1$  and  $p_2$ ?", Marius responds with 1.
- For the query "What is the minimum value between  $p_1$  and  $p_3$ ?", Marius responds with 3.
- For the query "What is the minimum value between  $p_3$  and  $p_5$ ?", Marius responds with 4.

Accepted answers for this test case are  $(3, 5)$  and  $(5, 3)$ , since  $a_5 = n - 1$  and  $a_3 = n$ .