

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 newline 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 $a_3 = n$.