

PROBLEMS SUBMIT CODE MY SUBMISSIONS STATUS HACKS ROOM STANDINGS CUSTOM INVOCATION

C2. Guessing the Greatest (hard version)

time limit per test: 1 second
memory limit per test: 256 megabytes

The only difference between the easy and the hard version is the limit to the number of queries.

This is an interactive problem.

There is an array a of n **different** numbers. In one query you can ask the position of the second maximum element in a subsegment $a[l..r]$. Find the position of the maximum element in the array in no more than **20** queries.

A subsegment $a[l..r]$ is all the elements a_l, a_{l+1}, \dots, a_r . After asking this subsegment you will be given the position of the second maximum from this subsegment **in the whole** array.

Input

The first line contains a single integer n ($2 \leq n \leq 10^5$) — the number of elements in the array.

Interaction

You can ask queries by printing " $? \ l \ r$ " ($1 \leq l < r \leq n$). The answer is the index of the second maximum of all elements a_l, a_{l+1}, \dots, a_r . Array a is fixed beforehand and can't be changed in time of interaction.

You can output the answer by printing " $! \ p$ ", where p is the index of the maximum element in the array.

You can ask no more than **20** queries. **Printing the answer doesn't count as a query.**

After printing a query do not forget to output end of line and flush the output. Otherwise, you will get `Idleness limit exceeded`. To do this, use:

- `fflush(stdout)` or `cout.flush()` in C++;
- `System.out.flush()` in Java;
- `flush(output)` in Pascal;
- `stdout.flush()` in Python;
- see documentation for other languages

Hacks

To make a hack, use the following test format.

In the first line output a single integer n ($2 \leq n \leq 10^5$). In the second line output a permutation of n integers 1 to n . The position of n in the permutation is the position of the maximum

Example

input	Copy
5 3 4	
output	Copy
? 1 5 ? ? ! 1	

Note

In the sample suppose a is $[5, 1, 4, 2, 3]$. So after asking the $[1..5]$ subsegment 4 is second to max value, and it's position is 3. After asking the $[4..5]$ subsegment 2 is second to max value and it's position in the whole array is 4.

Note that there are other arrays a that would produce the same interaction, and the answer for them might be different. Example output is given in purpose of understanding the interaction.

Codeforces Round 703 (Div. 2)

Finished

Practice

→ Virtual participation

Virtual contest is a way to take part in past contest, as close as possible to participation on time. It is supported only ICPC mode for virtual contests. If you've seen these problems, a virtual contest is not for you - solve these problems in the archive. If you just want to solve some problem from a contest, a virtual contest is not for you - solve this problem in the archive. Never use someone else's code, read the tutorials or communicate with other person during a virtual contest.

Start virtual contest

→ Clone Contest to Mashup

You can clone this contest to a mashup.

Clone Contest

→ Submit?

Language: GNU G++20 13.2 (64 bit, win

Choose file: Choose File No file chosen

Submit

→ Last submissions

Submission	Time	Verdict
315283059	Apr/13/2025 14:52	Accepted

→ Problem tags

binary search interactive *1900

No tag edit access

→ Contest materials

Announcement

Tutorial (en)