DMOPC '23 Contest 1 P3 - Colour Scheme

Time limit: 2.0s **Memory limit:** 1G

There is a hidden array A of size N, where A_i represents the colour of the ith element. You are allowed at most M questions. In each question, you can query a range $[l, r]$ and get the number of distinct colours in that range. Find an array B such that the colour scheme of B is equivalent to the colour scheme of A. That is, for any pair $1 \leq i, j \leq N$, either $A[i] = A[j]$ and $B[i] = B[j]$, or $A[i] \neq A[j]$ and $B[i] \neq B[j]$ must hold.

For example, $A = [1, 2, 3, 4, 3, 3, 3, 2, 2, 1]$ and $B = [4, 3, 2, 1, 2, 2, 2, 3, 3, 4]$ have an equivalent colour scheme.

Constraints

$1 \leq N \leq 5\,000$

$M = 120\,000$

Interaction

This is an interactive problem, where you and the judge exchange information back-and-forth to solve the problem.

At first, you should read in a line containing the integer N.

You will then start the interaction by proceeding with your queries.

Each query should be formatted as `? l r` followed by a `\n` character, with $1 \leq l \leq r \leq N$.

In response, the judge will return an integer x on its own line, whose value is the number of distinct integers in the range $[l, r]$ of the hidden array A.

If you believe you have the solution, you may output `!` followed by a space-separated list of N integers $B_1, B_2, \ldots, B_N$, $1 \leq B_i \leq N$, an array which has an equivalent colour scheme to the hidden array A. You must terminate your program immediately after performing this operation. Note that this operation does **not** count towards the query limit of M.

If at any point you attempt an invalid question (such as an invalid output format or an invalid range), or you exceed the query limit M, the judge will respond with -1. You should terminate your program immediately after receiving this feedback to receive a `Wrong Answer` verdict, or you may receive an arbitrary verdict. If the final list you output is incorrect, you will receive a `Wrong Answer` verdict. Otherwise, you will receive a verdict of `Accepted` for the corresponding test case.

Please note that you may need to flush `stdout` after each operation, or interaction may halt. In C++, this can be done with `fflush(stdout)` or `cout << flush` (depending on whether you use `printf` or `cout`). In Java, this can be done with `System.out.flush()`. In Python, you can use `sys.stdout.flush()`.

Scoring

If you have received a verdict of `Accepted`, your score for the test case will be calculated as follows, where K is the number of queries that you used.

	Score
$60\,000 < K \leq 120\,000$	$30 + \lfloor (120\,000 - K)/2\,000 \rfloor$ points
$50\,000 < K \leq 60\,000$	$60 + 4\lfloor (60\,000 - K)/1\,000 \rfloor$ points
$K \leq 50\,000$	100 points

Your score for a batch is the minimum of the scores of all of the tests in the batch.

Sample Interaction

`>>>` denotes your output. Do not print this out.

Here, the hidden array A is $[1, 2, 3]$. One of the possible valid arrays B is $[3, 2, 1]$.

```
3
>>> ? 1 2
2
>>> ? 1 3
3
>>> ? 2 3
2
>>> ! 3 2 1
```