Problem F. Foxes

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Dwarf the Zookeeper has recently been promoted to head of the Fox Pavilion at the Wrocław Zoo. His love for the fox (or *lis*, as it is called in Polish) knows no bounds.

The dwarf takes care of a long row of foxes in enclosures arranged along the main pathway. Each fox has a *magnificence* value, and the dwarf takes pride in finding the *Longest Increasing Subsequence* (LIS) of magnificence among his foxes.

Today, the dwarf is transferring some foxes to other zoos and replacing them with foxes that the other zoos sent in return. At the beginning of the day, Dwarf the Zookeeper stands with a cart of new foxes next to the first (leftmost) enclosure. The dwarf will walk along the pathway, moving from enclosure to enclosure. Sometimes, he will stop at one of the enclosures and replace the fox there with another fox, possibly with a different magnificence. Each time this happens, he must immediately calculate the length of the longest increasing magnificence subsequence. Can you help him keep track of this number?

Input

The first line of input contains two integers N and Q, representing the number of enclosures along the pathway and the number of actions the dwarf takes.

The second line of input contains N integers $m_1, m_2, \ldots, m_N$, describing the initial magnificence of each fox.

The next Q lines describe the actions. A single action is one of the following:

1. `<` — the dwarf moves one enclosure to the left,
2. `>` — the dwarf moves one enclosure to the right,
3. `!` v — the dwarf exchanges the fox in the current enclosure for a fox with magnificence v.

Output

For each `!` action, output a single line containing the length of the longest increasing subsequence of the foxes' magnificence.

Limits

$2 \le N \le 200\,000$, $1 \le Q \le 500\,000$, $1 \le m_i \le 10^6$, $1 \le v \le 10^6$.

Example

standard input	standard output
5 8 3 4 1 7 2 > ! 2 > > > ! 10 < ! 11	2 3 2

Note

First, Dwarf the Zookeeper moves to the second enclosure and exchanges the fox for one with magnificence 2. The length of the longest increasing subsequence is 2. Then he moves to the fifth enclosure and exchanges the fox for one with magnificence 10, and the length of the LIS becomes 3. Finally, the Zookeeper moves to the fourth enclosure and changes the magnificence to 11, making the length of the LIS 2 again.