

Rounddog

Input file: **standard input**
Output file: **standard output**
Time limit: 2 seconds
Memory limit: 1024 megabytes

“There must be an end to every beginning”

For a sequence $A = (a_1, a_2, \dots, a_m)$, define:

- the length of the strict longest increasing subsequence:

$$\text{LIS}(A) = \max\{k \mid \exists 1 \leq i_1 < i_2 < \dots < i_k \leq m, a_{i_1} < a_{i_2} < \dots < a_{i_k}\}.$$

- the length of the strict longest decreasing subsequence:

$$\text{LDS}(A) = \max\{k \mid \exists 1 \leq i_1 < i_2 < \dots < i_k \leq m, a_{i_1} > a_{i_2} > \dots > a_{i_k}\}.$$

For any sequence A , define $f(A)$ as the maximum integer k satisfying the following conditions:

There exist k real numbers x_1, x_2, \dots, x_k . After appending them to the end of A in order, we obtain a new sequence $B = (a_1, a_2, \dots, a_m, x_1, x_2, \dots, x_k)$, and the following hold:

1. all elements in sequence B are pairwise distinct;
2. $\text{LIS}(B) = \text{LIS}(A)$;
3. $\text{LDS}(B) = \text{LDS}(A)$.

Now given a permutation $P = (P_1, P_2, \dots, P_n)$ of length n , for each prefix $P^{(i)} = (P_1, P_2, \dots, P_i)$, you need to compute $f(P^{(i)})$ and output all answers.

“One day I will return to your side”

Input

The first line contains an integer T ($1 \leq T \leq 10^5$), the number of test cases.

For each test case:

- The first line contains an integer n ($1 \leq n \leq 2 \cdot 10^5$);
- The second line contains n integers P_1, P_2, \dots, P_n ($1 \leq P_i \leq n$), representing a permutation of length n .

It is guaranteed that the sum of n over all test cases does not exceed $2 \cdot 10^5$.

Output

For each test case, output one line containing n integers representing the answers.

Example

standard input	standard output
5	0 0
2	0 0 0
1 2	0 0 1 0
3	0 0 1 0 0
1 3 2	0 0 1 2 1 2
4	
3 4 1 2	
5	
2 5 1 3 4	
6	
3 6 2 1 4 5	