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PROBLEMS SUBMIT CODE MY SUBMISSIONS STATUS HACKS ROOM STANDINGS CUSTOM INVOCATION

D. Local Construction

time limit per test: 2 seconds memory limit per test: 256 megabytes

An element b_i $(1 \le i \le m)$ in an array b_1, b_2, \dots, b_m is a local minimum if at least one of the following holds:

- $2 \leq i \leq m-1$ and $b_i < b_{i-1}$ and $b_i < b_{i+1}$, or
- $ullet \ i=1$ and $b_1 < b_2$, or
- i=m and $b_m < b_{m-1}$.

Similarly, an element b_i $(1 \le i \le m)$ in an array b_1, b_2, \ldots, b_m is a local maximum if at least one of the following holds:

- $2 \leq i \leq m-1$ and $b_i > b_{i-1}$ and $b_i > b_{i+1}$, or
- $ullet \ i=1$ and $b_1>b_2$, or
- i=m and $b_m>b_{m-1}$.

Note that local minima and maxima are not defined for arrays with only one element.

There is a hidden permutation* p of length n. The following two operations are applied to permutation p alternately, starting from operation 1, until there is only one element left in p:

- Operation 1 remove all elements of p which are **not** local minima.
- Operation 2 remove all elements of p which are not local maxima.

More specifically, operation 1 is applied during every odd iteration, and operation 2 is applied during every even iteration, until there is only one element left in p.

For each index i $(1 \leq i \leq n)$, let a_i be the iteration number that element p_i is removed, or -1 if it was never removed.

It can be proven that there will be only one element left in p after at most $\lceil \log_2 n \rceil$ iterations (in other words, $a_i \leq \lceil \log_2 n \rceil$).

You are given the array a_1, a_2, \ldots, a_n . Your task is to construct any permutation p of n elements that satisfies array a.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \le t \le 10^4$). The description of the test cases follows.

The first line of each test case contains a single integer n ($2 \le n \le 2 \cdot 10^5$) — the number of elements in permutation p.

The second line of each test case contains n integers a_1, a_2, \ldots, a_n ($1 \le a_i \le \lceil \log_2 n \rceil$ or $a_i = -1$) — the iteration number that element p_i is removed.

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

It is guaranteed that there exists at least one permutation p that satisfies array a.

Output

For each test case, output n integers representing the elements of the permutation satisfying array a.

If there are multiple solutions, you may output any of them.

Example

input	Сору
7	

Codeforces Round 1019 (Div. 2)

Finished

Practice



→ Virtual participation

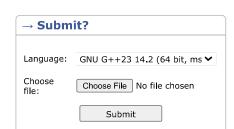
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Start virtual contest

→ Clone Contest to Mashup

You can clone this contest to a mashup.

Clone Contest



→ Last submissions		
Submission	Time	Verdict
316649295	Apr/22/2025 10:52	Accepted



→ Contest materials

• Announcement (en)

30

^{*}A permutation of length n is an array consisting of n distinct integers from 1 to n in arbitrary order. For example, [2,3,1,5,4] is a permutation, but [1,2,2] is not a permutation (2 appears twice in the array), and [1,3,4] is also not a permutation (n=3 but there is 4 in the array).

```
1 1 -1
  -1 1 2 1
8
3 1 2 1 -1 1 1 2
1 1 1 -1 1 1 1
1 1 1 1 -1
5
-1 1 1 1 1
-1 1 2 1 2
output
                                                                                     Сору
3 2 1
4 3 5 1 2
6 7 2 4 3 8 5 1
6 5 2 1 3 4 7
5 4 3 2 1
1 2 3 4 5
4 5 2 3 1
```

Note

In the first test case, operations will be applied to permutation [3,2,1] as follows:

1. The only local minimum in [3, 2, 1] is 1. Hence, elements 3 and 2 are removed. There is only one remaining element; hence the process terminates.

This satisfies array a=[1,1,-1] as both p_1 and p_2 were removed on iteration number 1, while p_3 was not removed.

In the second test case, operations will be applied to permutation p = [4, 3, 5, 1, 2] as follows:

- 1. The local minima in [4,3,5,1,2] are 3 and 1. Hence, elements 4,5, and 2 are removed.
- 2. The only local maximum in [3,1] is 3. Hence, element 1 is removed. There is only one remaining element; hence the process terminates.

This satisfies array a=[1,-1,1,2,1] as elements $p_1=4$, $p_3=5$, and $p_5=2$ were removed on iteration 1, element $p_4=1$ was removed on iteration 2, and element $p_2=3$ was not removed

In the third test case, operations will be applied on permutation [6, 7, 2, 4, 3, 8, 5, 1] as follows:

- 1. The local minima in [6,7,2,4,3,8,5,1] are 6,2,3, and 1. Hence, elements 7,4,8, and 5 are removed.
- 2. The local maxima in [6,2,3,1] are 6 and 3. Hence, elements 2 and 1 are removed.
- 3. The only local minimum in [6,3] is 3. Hence, element 6 is removed. There is only one remaining element; hence the process terminates.

In the fourth test case, one permutation satisfying the constraints is [6, 5, 2, 1, 3, 4, 7]. 1 is the only local minimum, so only it will stay after the first iteration. Note that there are other valid permutations; for example, [6, 4, 3, 1, 2, 5, 7] would also be considered correct.

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