Problem A. Very Important Persons

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Opening ceremony of the new campus of N State University will be visited by nm very important persons. The ceremony will take place in a hall that has the form of a rectangle, seats in the hall are arranged in n rows, m seats in each row. Rows are numbered from 1 to n, seats in each row are numbered from 1 to m, the j-th seat of the i-th row is denoted as (i, j).

The organizers of the ceremony have numbered the guests from 1 to nm in accordance with their importance — the greater, the more important. The most important guest, the mayor of the city, gets the number nm. The mayor is planning to take seat $(1, 1)$. Now the other guests must be assigned seats. The guests must be arranged according to their importance, there must be no situation that a guest with greater number is seating further from the mayor than a guest with smaller number. The distance between two seats (r_1, s_1) and (r_2, s_2) is measured as $|r_1 - r_2| + |s_1 - s_2|$.

Help the organizers to assign guests to seats.

Input

Input contains several test cases. The first line contains the number of test cases t $(1 \le t \le 400)$.

Each test case is specified with a line that contains two integers: n and m $(1 \le n, m \le 20)$.

Output

For each test case output the hall plan after the seats are assigned to guests.

Output n lines, each line must contain m integers, the j-th integer of the i-th line must be equal to the importance of the guest that will be assigned the seat (i, j).

If there are several valid ways to assign seats to guests, output any of them.

Example

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

Problem B Bad Order

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

Little Dima has a nice pattern at the floor of his room, it consists of n dots arranged in a row. Strange coincidence, but Dima also has n toy cubes that he likes to play, they have weights of $1, 2, \ldots, n$ grams, respectively. Dima has finished playing with his cubes and put them on a floor at the dots, one cube at each dot. Now he is going to reorder them in such way that their weight increased from left to right. However, he took a break before doing so, meanwhile bad boy Vadim entered the room.

Vadim knows that Dima will use the following way to rearrange the cubes. Each time he will look for the cube with the smallest weight that is at wrong dot yet, and swap it with the one that occupies its dot.

Vadim is very vicious, so he wants to force Dima to make the maximum number of swaps. He took some cubes out of the Dima's row and now he is planning to put them back. He wants to put them back in such way, that there still was exactly one cube at each dot, cubes that were not taken before stayed at their places, and Dima needed maximum possible number of swaps to sort the cubes using his method.

How should Vadim put the cubes back to the row?

Input

Input data contains several test cases. The first line of input contains the number of test cases t.

Each test is described in the following way.

The first line of the description contains an integer n — the number of cubes ($1 \le n \le 10^5$). The following line contains n integers a_i ($0 \le a_i \le n$)

If a_i is equal to 0, that means that the cube from the i-th dot was taken away by Vadim, this dot is now empty. In the other case a_i is the weight of the cube at the i-th dot.

It is guaranteed that all remaining cubes have different weights, Vadim must return exactly the cubes that are currently missing from the line.

The sum of n in all test cases of one input data doesn't exceed 10^5.

Output

Output two lines for each test case.

The first line must contain the maximum number of swaps that Vadim can force Dima to make.

The second line must contain n integers — weights of cubes in order they will be arranged after Vadim puts cubes he has taken away back. Note, that cubes that were not taken away must remain at their current positions.

If there are several possible arrangements that force Dima to make maximum number of swaps, output any of them.

Example

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

Problem C Red-Black Tree

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

Did you now that most standard libraries use red-black tree to implement "set" data structure? In this problem you have to find the number of ways to color the vertices of the given binary tree so that it became red-black. Print the answer modulo $10^9 + 7$.

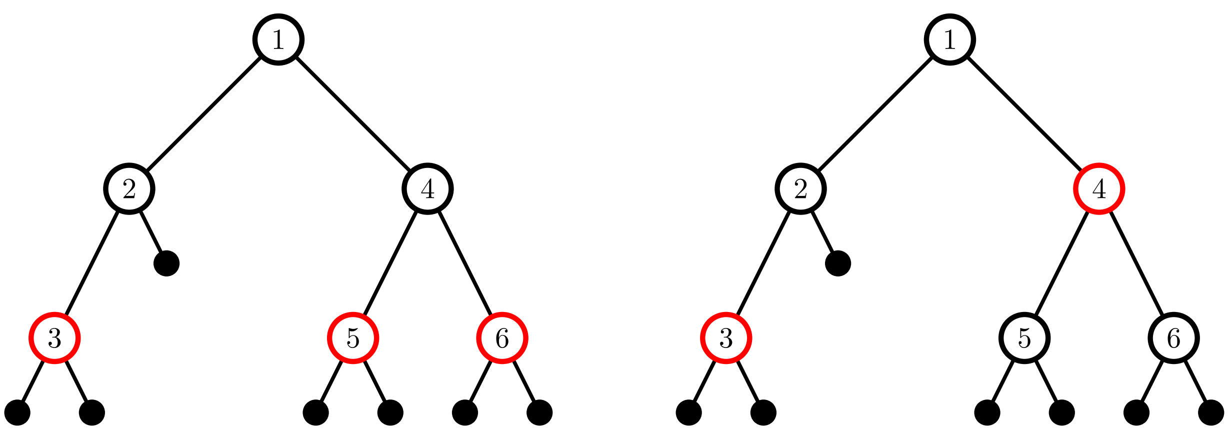
Consider a binary tree. If the vertex has less than two children, add fake vertices to the potential places of the missing children. The tree is called a red-black tree if the following constraints are satisfied:

1. Each vertex is colored one of the two colors: red or black.
2. The root of the tree and added fake vertices are colored black.
3. The parent of a red vertex is black.
4. All paths the root to fake leafs contain the same number of black vertices.

Note that the parent of a black vertex can be black itself.

Two ways to color the tree are different if there is a vertex that has different colors.

The picture shows two ways to color the tree from the second test case.



Input

The first line contains one integer n — the number of vertices in a tree ($1 \le n \le 500\,000$).

The following n lines describe a tree. The i-th of these lines contains two integers l_i and r_i — the indices of the left and the right child of the i-th vertex, or 0 if the corresponding child is missing ($l_i = 0$ or $i < l_i \le n$; $r_i = 0$ or $i < r_i \le n$). The root of the tree has number 1. Input describes the correct tree.

Output

Output one integer — the number of ways to color the given tree so that it was a correct red-black tree. The answer must be printed modulo $10^9 + 7$.

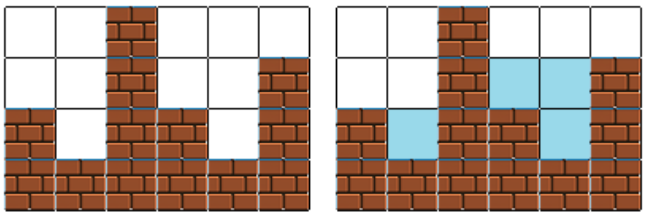
Examples

<table>
<tr><th>standard input</th><th>standard output</th></tr>
<tr><td>3
2 3
0 0
0 0</td><td>2</td></tr>
<tr><td>6
2 4
3 0
0 0
5 6
0 0
0 0</td><td>2</td></tr>
</table>

D. All's Wall That Ends Wall

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

In the magical forest, you come upon N walls that you think is a great place to store water for your animal friends. The i^{th} wall consists of a_i blocks stacked on top of each other.



Your job is to answer queries of two types:

- For queries of the first type, print the amount of water that could be stored between all the walls.

- For queries of the second type, increase the number of blocks on the x^{th} wall by v.

Input

The first line of input is T – the number of test cases.

The first line of each test case is integers N and Q $(1 \leq N, Q \leq 10^5)$.

The second line contains N space-separated integers a_i $(1 \leq a_i \leq 10^5)$.

The next Q lines contain either 'P' – denoting a query of the first type, or 'U' followed by x and v – denoting a query of the second type $(1 \leq x \leq N)$ $(1 \leq v \leq 10^4)$.

Output

For each test case and query of the first type, output on a line the amount of water that could be stored between the walls.

Example

input

```
1
6 3
2 1 4 2 1 3
P
U 1 2
P
```

output

```
4
6
```

E. Sherlock Bones

time limit per test: 1.5 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

The great dog detective Sherlock Bones is on the verge of a new discovery. But for this problem, he needs the help of his most trusted advisor -you- to help him fetch the answer to this case.

He is given a string of zeros and ones and length N.

Let $F(x, y)$ equal to the number of ones in the string between indices x and y inclusively.

Your task is to help Sherlock Bones find the number of ways to choose indices (i, j, k) such that $i < j < k$, s_j is equal to 1, and $F(i, j)$ is equal to $F(j, k)$.

Input

The first line of input is T – the number of test cases.

The first line of each test case is an integer N $(3 \leq N \leq 2 \times 10^5)$.

The second line is a string of zeros and ones of length N.

Output

For each test case, output a line containing a single integer- the number of ways to choose indices (i, j, k).

Example

input

```
3
5
01010
6
101001
7
1101011
```

output

```
2
3
7
```

Problem E. Array Study

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

Vasya likes to study arrays. Recently his parents presented him with an array a that contains elements equal to 1 and -1. Vasya immediately started to study it.

Additionally Vasya likes zeroes. So he decided to consider various subarrays $a[l_i, \ldots, r_i]$ of array a. For each subarray he tries to find the maximum length of its subarray with the sum equal to 0. If there is no such subarray, he considers the answer to be 0. Vasya has written down q subarray requests $[l_i, r_i]$, and now he wants to find the sum of answers to them.

For example, let us consider sample test.

- subarray $[1, 5]$: the maximal subarray with sum 0 — $[2, 5]$;
- subarray $[1, 3]$: the maximal subarray with sum 0 — $[2, 3]$;
- subarray $[2, 4]$: the maximal subarray with sum 0 — $[2, 3]$;
- subarray $[3, 4]$: no subarray with sum 0;
- subarray $[3, 5]$: the maximal subarray with sum 0 — $[4, 5]$.

So the sum of answers for the sample test is $4 + 2 + 2 + 0 + 2 = 10$.

Input

Input data contains several test cases. The first line contains the number of test cases t ($1 \le t \le 1000$).

Each of t test cases is described in the following way: the first line of the description contains n — the number of elements of the array ($1 \le n \le 10^5$).

The following line contains n integers a_i — elements of the array ($a_i = -1$ or $a_i = 1$).

The following line contains q — the number of subarrays that Vasya is interested in ($1 \le q \le 10^5$).

Each of the following q lines contains two integers l_i, r_i — left and right border of the i-th subarray ($1 \le l_i \le r_i \le n$)

It is guaranteed that the sum of n in all test cases of one input data doesn't exceed 10^5, the sum of q in all test cases of one input data doesn't exceed 10^5.

Output

For each test output one integer — the sum of answers for the given q subarrays.

Example

standard input	standard output
1 5 1 -1 1 1 -1 5 1 5 1 3 2 4 3 4 3 5	10