A. Beat The Odds

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Given a sequence $a_1, a_2, \ldots, a_n$, find the minimum number of elements to remove from the sequence such that after the removal, the sum of every 2 consecutive elements is even.

Input

Each test contains multiple test cases. The first line contains a single integer t ($1 \le t \le 100$) — the number of test cases. Description of the test cases follows.

The first line of each test case contains a single integer n ($3 \le n \le 10^5$).

The second line of each test case contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 10^9$) — elements of the sequence.

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

Output

For each test case, print a single integer — the minimum number of elements to remove from the sequence such that the sum of every 2 consecutive elements is even.

Example

input
2
5
2 4 3 6 8
6
3 5 9 7 1 3
output
1
0

Note

In the first test case, after removing 3, the sequence becomes $[2, 4, 6, 8]$. The pairs of consecutive elements are $\{[2, 4], [4, 6], [6, 8]\}$. Each consecutive pair has an even sum now. Hence, we only need to remove 1 element to satisfy the condition asked.

In the second test case, each consecutive pair already has an even sum so we need not remove any element.

B. Shoe Shuffling

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

A class of students got bored wearing the same pair of shoes every day, so they decided to shuffle their shoes among themselves. In this problem, a pair of shoes is inseparable and is considered as a single object.

There are n students in the class, and you are given an array s in **non-decreasing** order, where s_i is the shoe size of the i-th student. A shuffling of shoes is valid only if **no student gets their own shoes** and if every student gets shoes of size **greater than or equal to** their size.

You have to output a permutation p of $\{1, 2, \ldots, n\}$ denoting a valid shuffling of shoes, where the i-th student gets the shoes of the p_i-th student ($p_i \ne i$). And output -1 if a valid shuffling does not exist.

A permutation 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).

Input

Each test contains multiple test cases. The first line contains a single integer t ($1 \le t \le 1000$) — the number of test cases. Description of the test cases follows.

The first line of each test case contains a single integer n ($1 \le n \le 10^5$) — the number of students.

The second line of each test case contains n integers $s_1, s_2, \ldots, s_n$ ($1 \le s_i \le 10^9$, and for all $1 \le i < n$, $s_i \le s_{i+1}$) — the shoe sizes of the students.

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

Output

For each test case, print the answer in a single line using the following format.

If a valid shuffling does not exist, print the number -1 as the answer.

If a valid shuffling exists, print n space-separated integers — a permutation p of $1, 2, \ldots, n$ denoting a valid shuffling of shoes where the i-th student gets the shoes of the p_i-th student. If there are multiple answers, then print any of them.

Example

Note

In the first test case, any permutation p of $1, \ldots, n$ where $p_i \neq i$ would represent a valid shuffling since all students have equal shoe sizes, and thus anyone can wear anyone's shoes.

In the second test case, it can be shown that no valid shuffling is possible.

C. Sum of Substrings

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a binary string s of length n.

Let's define d_i as the number whose decimal representation is $s_i s_{i+1}$ (possibly, with a leading zero). We define $f(s)$ to be the sum of all the valid d_i. In other words, $f(s) = \sum_{i=1}^{n-1} d_i$.

For example, for the string $s = 1011$:

- $d_1 = 10$ (ten);
- $d_2 = 01$ (one)
- $d_3 = 11$ (eleven);
- $f(s) = 10 + 01 + 11 = 22$.

In one operation you can swap any two adjacent elements of the string. Find the minimum value of $f(s)$ that can be achieved if at most k operations are allowed.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \leq t \leq 10^5$). Description of the test cases follows.

First line of each test case contains two integers n and k ($2 \leq n \leq 10^5$, $0 \leq k \leq 10^9$) — the length of the string and the maximum number of operations allowed.

The second line of each test case contains the binary string s of length n, consisting of only zeros and ones.

It is also given that sum of n over all the test cases doesn't exceed 10^5.

Output

For each test case, print the minimum value of $f(s)$ you can obtain with at most k operations.

Example

input
3 4 0 1010 7 1 0010100 5 2 00110
output
21 22 12

Note

- For the first example, you can't do any operation so the optimal string is s itself. $f(s) = f(1010) = 10 + 01 + 10 = 21$.
- For the second example, one of the optimal strings you can obtain is "0011000". The string has an f value of 22.
- For the third example, one of the optimal strings you can obtain is "00011". The string has an f value of 12.

D. Max GEQ Sum

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

You are given an array a of n integers. You are asked to find out if the inequality

$$\max(a_i, a_{i+1}, \ldots, a_{j-1}, a_j) \geq a_i + a_{i+1} + \cdots + a_{j-1} + a_j$$

holds for all pairs of indices (i, j), where $1 \leq i \leq j \leq n$.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \leq t \leq 10^5$). Description of the test cases

follows.

The first line of each test case contains a single integer n ($1 \leq n \leq 2 \cdot 10^5$) — the size of the array.

The next line of each test case contains n integers $a_1, a_2, \ldots, a_n$ ($-10^9 \leq a_i \leq 10^9$).

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

Output
For each test case, on a new line output "YES" if the condition is satisfied for the given array, and "NO" otherwise. You can print each letter in any case (upper or lower).

Example

input
3
4
-1 1 -1 2
5
-1 2 -3 2 -1
3
2 3 -1

output
YES
YES
NO

Note
In test cases 1 and 2, the given condition is satisfied for all (i, j) pairs.

In test case 3, the condition isn't satisfied for the pair $(1, 2)$ as $\max(2, 3) < 2 + 3$.

E. Number of Groups

You are given n colored segments on the number line. Each segment is either colored red or blue. The i-th segment can be represented by a tuple (c_i, l_i, r_i). The segment contains all the points in the range $[l_i, r_i]$, inclusive, and its color denoted by c_i:

- if $c_i = 0$, it is a red segment;
- if $c_i = 1$, it is a blue segment.

We say that two segments of **different** colors are *connected*, if they share at least one common point. Two segments belong to the same group, if they are either connected directly, or through a sequence of directly connected segments. Find the number of groups of segments.
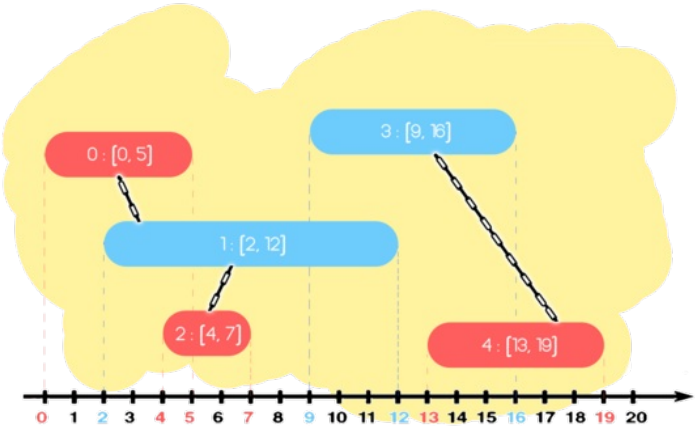
Input
Each test contains multiple test cases. The first line contains the number of test cases t ($1 \leq t \leq 10^5$). Description of the test cases follows.

The first line of each test case contains a single integer n ($1 \leq n \leq 10^5$) — the number of segments.

Each of the next n lines contains three integers c_i, l_i, r_i ($0 \leq c_i \leq 1, 0 \leq l_i \leq r_i \leq 10^9$), describing the i-th segment.

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

Output
For each test case, print a single integer k, the number of groups of segments.

Example

input
2
5
0 0 5
1 2 12
0 4 7
1 9 16
0 13 19
3
1 0 1
1 1 2

Note

In the first example there are 5 segments. The segments 1 and 2 are connected, because they are of different colors and share a point. Also, the segments 2 and 3 are connected, and so are segments 4 and 5. Thus, there are two groups: one containing segments $\{1, 2, 3\}$, and the other one containing segments $\{4, 5\}$.

F. K-Set Tree

You are given a tree G with n vertices and an integer k. The vertices of the tree are numbered from 1 to n.

For a vertex r and a subset S of vertices of G, such that $|S| = k$, we define $f(r, S)$ as the size of the smallest rooted subtree containing all vertices in S when the tree is rooted at r. A set of vertices T is called a rooted subtree, if all the vertices in T are connected, and for each vertex in T, all its descendants belong to T.

You need to calculate the sum of $f(r, S)$ over **all possible distinct combinations** of vertices r and subsets S, where $|S| = k$. Formally, compute the following:

$$\sum_{r \in V} \sum_{S \subseteq V, |S|=k} f(r, S),$$

where V is the set of vertices in G.

Output the answer modulo $10^9 + 7$.

Input

The first line contains two integers n and k ($3 \le n \le 2 \cdot 10^5$, $1 \le k \le n$).

Each of the following $n - 1$ lines contains two integers x and y ($1 \le x, y \le n$), denoting an edge between vertex x and y.

It is guaranteed that the given edges form a tree.
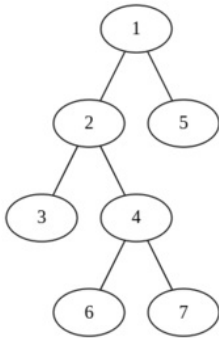
Output

Print the answer modulo $10^9 + 7$.

Examples

input

```
3 2
1 2
1 3
```

output

```
25
```

input

```
7 2
1 2
2 3
2 4
1 5
4 6
4 7
```

output

```
849
```

Note

The tree in the second example is given below:

We have 21 subsets of size 2 in the given tree. Hence,

$S \in \{\{1, 2\}, \{1, 3\}, \{1, 4\}, \{1, 5\}, \{1, 6\}, \{1, 7\}, \{2, 3\}, \{2, 4\}, \{2, 5\}, \{2, 6\}, \{2, 7\}, \{3, 4\}, \{3, 5\}, \{3, 6\}, \{3, 7\}, \{4, 5\}, \{4, 6\}, \{4, 7\}, \{5, 6\}, \{5,$

And since we have 7 vertices, $1 \le r \le 7$. We need to find the sum of $f(r, S)$ over all possible pairs of r and S.

Below we have listed the value of $f(r, S)$ for some combinations of r and S.

- $r = 1$, $S = \{3, 7\}$. The value of $f(r, S)$ is 5 and the corresponding subtree is $\{2, 3, 4, 6, 7\}$.

- $r = 1$, $S = \{5, 4\}$. The value of $f(r, S)$ is 7 and the corresponding subtree is $\{1, 2, 3, 4, 5, 6, 7\}$.
- $r = 1$, $S = \{4, 6\}$. The value of $f(r, S)$ is 3 and the corresponding subtree is $\{4, 6, 7\}$.