problem A - arrays

Statement

You are given an array of N postive integers $A[0\ ..\ N-1]$.

Let $B_{L,R}$ be a copy of array A and rearrange the numbers $A[L\ ..\ R]$ in non-decreaseing order.

For example, if $A = [3, 2, 1]$, then $B_{0,1} = [2, 3, 1]$ and $B_{0,2} = [1, 2, 3]$.

Please calculate there are how many differenct arrays in $B_{i,j}$ where $0 \le i \le j < N$.

Input Format

The first line contains one integer N, indicating the size of array A.

The second line contains N positive integers $A[0], A[1], \ldots, A[N-1]$.

Constraint

- $1 \le N \le 10^6$
- $\forall\ 0 \le i < N$, $1 \le A[i] \le 10^6$

Output Format

Output the answer in one line.

Sample Input

3
3 2 1

Sample Output

4

problem B - bipartite matching

Statement

You are playing a game about coutructing a n-digit binary number. Initially, all digits of this binary number are zero.

The purpose of this game is change some digits into one such that the number of one is as many as possible. But there are some constraints you have to obey:

- All digit ones you change into are colorful.
- All possible colors are numbered from 1 to m.
- i-th digit can only change into color $c_{i,1}$ or $c_{i,2}$.
- All colors of digit one you change into are distinct.

You may think "this game is so easy! It's just a maximum bipartite Matching problem! Isn't it?"

Yes! It's really a bipartite matching problem.

In order to avoid you just copy the code from codebook, we ask you output the resulting binary number and add some constraint about this binary number.

Please look output format for detail.

Input Format

The first line contains two integers n and m, indicating the number of digits and the number of possible colors.

In following n lines, the i-th line of these n lines consists of two integer $c_{i,1}, c_{i,2}$, indicating two colors i-th digits can change into.

Constraint

- $1 \leq n, m \leq 5 \times 10^5$
- $1 \leq c_{i,1}, c_{i,2} \leq m$
- $c_{i,1} \neq c_{i,2}$

Output Format

You should output n digits to describe your resulting binary number.

If i-th digit is still zero, the i-th digit you print should be 0. If i-th digit is one and its color is $c_{i,1}$, the i-th digit you print should be 1. If i-th digit is one and its color is $c_{i,2}$, the i-th digit you print should be 2.

If there are multiple solutions with maximum number of digit one, you should choose the solution with largest resulting binary number. (Note that the first digit is the most significant bit)

If there are still multiple solutions, please output the lexicographically smallest one.

Sample Input

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

Sample Output

```
112
```

Problem C - counting

Statement

You are given an array of N postive integers $A[0\ ..\ N-1]$.

Please count how many ordered integer pairs (x, y) meet the following two conditions:

1. $0 \le x \le y < N$
2. $\forall\ i \in [x, y]$ and $j \notin [x, y]$, $A[i] \ne A[j]$

Input Format

The first line contains one integer T, indicating the number of test cases in this input file.

Each test case consists of two lines. The first line contains one integer N. The second line contains N positive integers $A[0], A[1], \ldots, A[N-1]$.

Constraint

- $1 \le T \le 10^6$
- $1 \le N \le 10^6$
- $\forall\ 0 \le i < N$, $1 \le A[i] \le N$
- sum of N in all test cases $\le 10^6$

Output Format

For each test case, output the answer in one line.

Sample Input

3
4
1 2 1 3
1
1
4
4 4 3 4

Sample Output

4
1
2

Problem D - domino

Statement

You are given x grey and y white standard dominoes of 2×1 squares. You are also given a rectangular board. the height and width of this board is 2 and $(x + y)$, respectively. You are asked to count how many different configuration to place these $(x + y)$ dominoes on the board so as to meet the following conditions:

1. Each domino completely covers two squares.
2. No two dominoes overlap.
3. Each domino lies entirely inside the board. It is allowed to touch the edges of the board.
4. The grey dominoes cannot be place vertically. (You can see sample explanation for detail)

You are given another positive integer M. Please output the answer modulo M.

Input Format

The first line contains one integer T, indicating the number of test cases in this input file.

Each test case consists of one line. This line contains three integer x, y, M.

Constraint

- $1 \le T \le 10^3$
- $0 \le x, y$
- $1 \le x + y \le 2 \times 10^3$
- $10^8 \le M \le 10^9 + 7$
- M is a prime number

Output Format

For each test case, output the answer modulo M in one line.

Sample Input

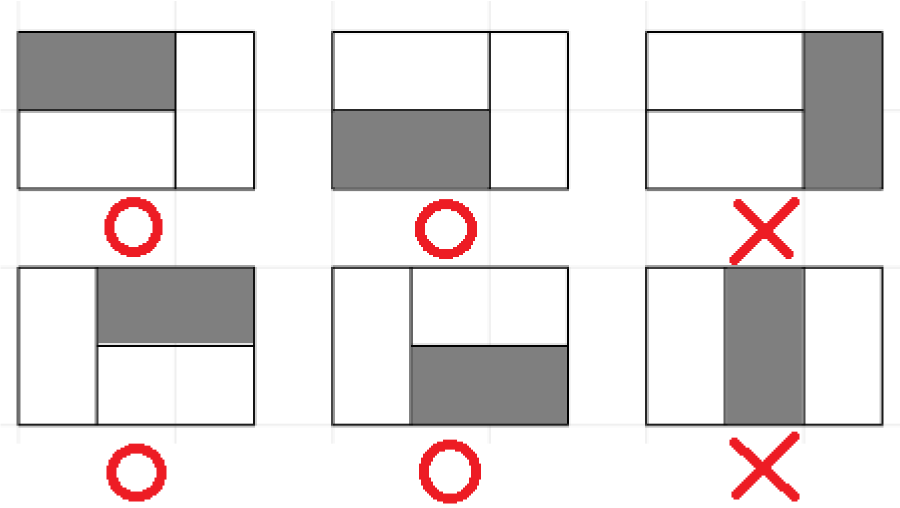
```
2
1 2 1000000007
514 514 100000007
```

Sample Output

```
4
47081134
```

Sample Explanation

Take the first test case $x = 1, y = 2$ for example.
The left four pictures are all possible valid configurations. And the right two picture are invalid because the grey domino is placed vertically.



Problem E - encode the binary tree

Statement

You are given a **binary rooted tree** with N nodes (binary rooted tree is a rooted tree and each node has at most two children). The nodes are numbered from 0 to $N-1$ and the root is numbered as 0.

We can use an integer sequence $A_1, A_2, \ldots, A_{N-1}$ to represent the tree. In this sequence, A_i denote the parent of node i.

Now we ask you to renumber all nodes **except root** such that the sequence representing the tree is the lexicographically smallest one in all possible method of renumbering.

Input Format

The first line contains one integer T, indicating the number of test cases in this input file.

Each test case consists of two lines. The first line contains one integer N, denoting the number of nodes in the binary rooted tree. The second line contains $N-1$ integer $p_1, p_2, \ldots, p_{N-1}$ where p_i is the node number of parent of node i.

Constraint

- $1 \leq T \leq 2 \times 10^4$
- $2 \leq N \leq 2 \times 10^5$
- sum of N in all test cases $\leq 2 \times 10^5$
- $0 \leq p_i < N$
- the given tree is binary rooted tree in all test cases

Output Format

For each test case, Please output one line containing an integer sequence $A_1, A_2, \ldots, A_{N-1}$. The sequence is the lexicographically smallest one representing the given rooted binary tree in all possible method of renumbering.

Sample Input

```
2
3
2 0
7
0 1 6 0 1 4
```

Sample Output

```
0 1
0 0 1 1 2 5
```

Problem F - Fat input

Statement

You are given a zero-based array A of length 10^9 containing only 1 and -1.
The number of 1 is not more than 10^7.
Please count how many pair of (x, y) satisify $\sum_{i=x}^{y} A_i > 0$ and $0 \le x \le y < 10^9$!

Input Format

The first line contains one integer n, indicating how many segments of A is 1.
In following n lines, the i-th line of these n lines consists of two integers l_i, r_i ($0 \le i < n$), indicating the A_j is 1 for $l_i \le j \le r_i$

Constraint

- $0 < n \le 10^6$
- $l_i \le r_i$
- $r_i + 1 < l_{i+1}$ for $0 \le i < n - 1$
- $0 \le l_0$
- $r_{n-1} < 10^9$
- $\sum_{i=0}^{n-1} (r_i - l_i + 1) \le 10^7$

Output Format

Output only one number in one line indicating the answer.

Sample Input

```
2
0 1
3 4
```

Sample Output

```
16
```

Problem G - go go drivers

Statement

There is a 2D game about driving a car to pass all checkpoints. You are given N integer coordinates $(x_1, y_1), (x_2, y_2), \ldots, (x_N, y_N)$ on the plane. (x_i, y_i) is the coordinate of i-th checkpoint. Initially, there is only the first checkpoint occurring on the plane. If you drive pass i-th checkpoint, the the $(i+1)$-th checkpoint will occur on the plane. When driving pass all checkpoints, you finish the game.

You can start your driving from any point on the plane with any direction. And you can describe you driving route as a polyline. The polyline is no need to be simple. This is, the polyline may intersect itself arbitrarily. We ask you to finish the game with minimum number of turn(i.e. minimize the number of segment in the polyline) . Please output the least turns you need.

Input Format

The first line contains one integer T, indicating the number of test cases in this input file.

Each test case start with one line containing an integer N, denoting the number of checkpoints. The next N lines will each contain two integers. The i-th line denoting the i-th checkpoints coordinator (x_i, y_i).

Constraint

- $T \leq 10^2$
- $1 \leq N \leq 10^3$
- $0 \leq x_i, y_i \leq 10^4$
- $\forall i \neq j$, $(x_i, y_i) \neq (x_j, y_j)$

Output Format

For each test case, output a number in a line, denoting the least turn you need.

Sample Input

```
4
4
0 0
0 1
1 1
1 0
4
0 0
1 1
2 1
3 0
4
0 0
1 0
```

2 0
3 0
4
0 0
0 3
0 1
0 2

Sample Output

2
1
0
2

Problem H - hosting a contest

Statement

Every year, National Taiwan University(NTU) host an Individual contest in order to select students for participating ICPC. Traditionally, there are 8 problems in selecting contest and every person who solve at least 5 problems will be selected. But all we know ICPC is a team contest formed by three people. So NTU hope the number of selected students will be divisible by 3. Besides, NTU also hope the number of selected students will be at least L and at most R.

This year, there are M problems in pool. And there are N participants. NTU carefully investigate the abilities of all participants so it know for each participants which problems they are able to solve.

Now, NTU want to choose 8 problems from the pool such that the number of selected students will meet all requirement (i.e. divisible by 3, at least L and at most U).

Please help NTU to count how many different problemset of 8 problems can be chosen from pool. (You can assume if a person have ability to solve a problem, he/she always can solve it in the selected contest.)

Input Format
The first line contains four integer N, M, L, U. Then follows N lines of string of length M. If i-th participant is able to solve j-th problem, the j-th character of i-th line is `1`, and it's `0` otherwise.
Constraint

- $3 \leq N \leq 500000$
- $8 \leq M \leq 20$
- $3 \leq L \leq U \leq N$

Output Format

Output only one number in one line indicating the answer.

Sample Input

```
3 12 3 3
100000001111
111111111111
111111111111
```

Sample Output

```
35
```

Problem I - intersection

Statement

You are given a permutation $p_1, p_2, \ldots, p_N$. Please count there are how many pair of sequences $a_1, a_2, \ldots, a_{num_a}$ and $b_1, b_2, \ldots, b_{num_b}$ meet following conditions:

1. $a_1 < a_2 < \ldots < a_{num_a}$ and $b_1 < b_2 < \ldots < b_{num_b}$
2. for all integer $x \in [1, N]$, x occur either in sequence $\langle a \rangle$ or in sequence $\langle b \rangle$
3. $\forall i < num_a$, $p_{a_i} < p_{a_{(i+1)}}$
4. $\forall i < num_b$, $p_{b_i} > p_{b_{(i+1)}}$

Input Format

The first line contains one integer T, indicating the number of test cases in this input file.

Each test case consists of two lines. The first line contains one integer N. The second line contains N positive integers $p_1, p_2, \ldots, p_N$.

Constraint

- $1 \leq T \leq 5 \times 10^5$
- $2 \leq N \leq 10^6$
- sum of N in all test cases $\leq 10^6$
- $p_1, p_2, \ldots, p_N$ is a permutation of $1 \sim N$

Output Format

For each test case, output the answer modulo $10^9 + 7$ in one line.

Sample Input

```
4
2
1 2
3
3 1 2
4
2 4 1 3
4
3 4 1 2
```

Sample Output

```
2
3
1
0
```

Problem J - Josephus problem

Statement

Josephus and his friends are trapped by Roman soldiers. The soldiers determine to choose only one of them as their slave and kill all others. The soldiers hope the slave is not stupid but also not too smart.

In order to choose the slave, The soldiers create a one-person card game as follow:

There are N red cards and N blue cards on the table. The i-th red card is written a number a_i and the i-th blue card is written a number b_i.

In each turn, the player must choose one red card and one blue card from the table. Suppose it's x-th red card and y-th blue card. The two cards should satisfy $a_x + b_y > 0$. After determining the two cards, player must remove them from the table and get $a_x + b_y$ points.

The game end only when player cannot choose one red card and one blue card from table such that the sum of numbers written on them are positive.

The soldiers tell to Josephus and his friends: "We will choose the one who can finish the game in exactly K turns as slave and kill all others! If there are more than one person can finish the game in exactly K turns, then we will choose the one with highest points".

Though the soldiers say that. In fact, they will keep the one who get **least points** among all people who can finish the game in **exactly K turns**. Luckily, Josephus accidentally get the information.

Josephus don't want to be kill. So He wants to finish the game in K turns with least points.

Now the problem for you is, output the least points he can get in exactly K turns. If it's impossible complete the game in exactly K turns, output `-1`.

Input Format

The first line contains one integer T, indicating the number of test cases in this input file.

Each test case consists of three lines. The first line contains two postive integer N and K. The second line contains N integers $a_1, a_2, \ldots, a_N$. The third line contains N integer $b_1, b_2, \ldots, b_N$.

Constraint

- $1 \le T \le 10^5$
- $1 \le K \le N \le 10^6$
- sum of N in all test cases $\le 10^5$
- $-10^9 \le a_i, b_i \le 10^9$

Output Format

For each test case, output the answer in one line.

Sample Input

```
3
3 1
2 3 4
-1 -2 -3
3 2
2 3 4
-1 -2 -3
3 3
2 3 4
-1 -2 -3
```

Sample Output

```
-1
3
3
```