A. Do you want a date?

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Leha decided to move to a quiet town Vičkopolis, because he was tired by living in Bankopolis. Upon arrival he immediately began to expand his network of hacked computers. During the week Leha managed to get access to n computers throughout the town. Incidentally all the computers, which were hacked by Leha, lie on the same straight line, due to the reason that there is the only one straight street in Vičkopolis.

Let's denote the coordinate system on this street. Besides let's number all the hacked computers with integers from 1 to n. So the i-th hacked computer is located at the point x_i. Moreover the coordinates of all computers are distinct.

Leha is determined to have a little rest after a hard week. Therefore he is going to invite his friend Noora to a restaurant. However the girl agrees to go on a date with the only one condition: Leha have to solve a simple task.

Leha should calculate a sum of $F(a)$ for all a, where a is a non-empty subset of the set, that consists of all hacked computers. Formally, let's denote A the set of all integers from 1 to n. Noora asks the hacker to find value of the expression $\sum_{a \subseteq A, a \neq \varnothing} F(a)$. Here $F(a)$ is calculated as the maximum among the distances between all pairs of computers from the set a. Formally, $F(a) = \max_{i, j \in a} |x_i - x_j|$. Since the required sum can be quite large Noora asks to find it modulo $10^9 + 7$.

Though, Leha is too tired. Consequently he is not able to solve this task. Help the hacker to attend a date.

Input

The first line contains one integer n $(1 \le n \le 3 \cdot 10^5)$ denoting the number of hacked computers.

The second line contains n integers $x_1, x_2, \ldots, x_n$ $(1 \le x_i \le 10^9)$ denoting the coordinates of hacked computers. It is guaranteed that all x_i are distinct.

Output

Print a single integer — the required sum modulo $10^9 + 7$.

Examples

input
```
2
4 7
```
output
```
3
```

input
```
3
4 3 1
```
output
```
9
```

Note

There are three non-empty subsets in the first sample test: $\{4\}$, $\{7\}$ and $\{4, 7\}$. The first and the second subset increase the sum by 0 and the third subset increases the sum by $7 - 4 = 3$. In total the answer is $0 + 0 + 3 = 3$.

There are seven non-empty subsets in the second sample test. Among them only the following subsets increase the answer: $\{4, 3\}$, $\{4, 1\}$, $\{3, 1\}$, $\{4, 3, 1\}$. In total the sum is $(4 - 3) + (4 - 1) + (3 - 1) + (4 - 1) = 9$.

B. Glad to see you!

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

This is an interactive problem. In the output section below you will see the information about flushing the output.

On Sunday Leha the hacker took Nura from the house where she lives and went with her to one of the most luxurious restaurants in Vičkopolis. Upon arrival, they left the car in a huge parking lot near the restaurant and hurried inside the building.

In the restaurant a polite waiter immediately brought the menu to Leha and Noora, consisting of n dishes. It is interesting that all dishes in the menu are numbered with integers from 1 to n. After a little thought, the girl ordered exactly k different dishes from available in the menu. To pass the waiting time while the chefs prepare ordered dishes, the girl invited the hacker to play a game that will help them get to know each other better.

The game itself is very simple: Noora wants Leha to guess any two dishes among all ordered. At the same time, she is ready to answer only one type of questions. Leha can say two numbers x and y $(1 \le x, y \le n)$. After that Noora chooses some dish a for the number x such that, at first, a is among the dishes Noora ordered (x can be equal to a), and, secondly, the value $|x - a|$ is the minimum possible. By the same rules the girl chooses dish b for y. After that Noora says «TAK» to Leha, if $|x - a| \le |y - b|$, and «NIE» otherwise. However, the restaurant is preparing quickly, so Leha has enough time to ask no more than 60 questions. After that he should name numbers of any two dishes Noora ordered.

Help Leha to solve this problem!

Input

There are two numbers n and k $(2 \le k \le n \le 10^5)$ in the single line of input denoting the number of dishes in the menu and the number of dishes Noora ordered.

Output

If you want to provide an answer, output a string of the form $2\ x\ y$ $(1 \le x, y \le n, x \ne y)$, if you think the dishes x and y was among dishes ordered by Noora. After that, flush the output and terminate your program.

Interaction

While helping Leha, you can ask queries to Noora no more than 60 times. Each query should be printed in it's own line and have the form $1\ x\ y$ $(1 \le x, y \le n)$. You have to both print the end-of-line character and flush the output. After flushing you should read the answer for this query from input.

After each query jury's program will print one line «TAK» or «NIE» (without quotes) in input stream depending on the girl's answer.

To flush you can use (just after printing an integer and end-of-line):

- `fflush(stdout)` in C++;
- `System.out.flush()` in Java;
- `stdout.flush()` in Python;
- `flush(output)` in Pascal;
- see the documentation for other languages.

Hacking

For hacking you should write numbers n and k $(2 \le k \le n \le 10^5)$ in the first line and, for describing dishes Noora ordered, k different integers $a_1, a_2, \ldots, a_k$ $(1 \le a_i \le n)$, *written in ascending order* in the second line. Of course, solution you want to hack won't be able to read the numbers of ordered dishes.

Example

input

```
3 2
NIE
TAK
NIE
TAK
TAK
TAK
```

output

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

Note

There are three dishes in sample. Noora ordered dished numberes 2 and 3, which Leha should guess. If Noora receive requests for the first dish $(x = 1)$, then she'll choose the second dish $(a = 2)$ as the dish with the minimum value $|x - a|$. For the second $(x = 2)$ and the third $(x = 3)$ dishes themselves will be optimal, because in that case $|x - a| = 0$.

Let Leha asks Noora about the next couple of dishes:

- $x = 1, y = 2$, then he'll recieve «`NIE`» answer, because $|1 - 2| > |2 - 2|$
- $x = 2, y = 1$, then he'll recieve «`TAK`» answer, because $|2 - 2| \le |1 - 2|$
- $x = 1, y = 3$, then he'll recieve «`NIE`» answer, because $|1 - 2| > |3 - 3|$
- $x = 3, y = 1$, then he'll recieve «`TAK`» answer, because $|3 - 3| \le |1 - 2|$
- $x = 2, y = 3$, then he'll recieve «`TAK`» answer, because $|2 - 2| \le |3 - 3|$
- $x = 3, y = 2$, then he'll recieve «`TAK`» answer, because $|3 - 3| \le |2 - 2|$

According to the available information, it is possible to say that Nura ordered dishes with numbers 2 and 3.

C. Find a car

time limit per test: 4 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

After a wonderful evening in the restaurant the time to go home came. Leha as a true gentlemen suggested Noora to give her a lift. Certainly the girl agreed with pleasure. Suddenly one problem appeared: Leha cannot find his car on a huge parking near the restaurant. So he decided to turn to the watchman for help.

Formally the parking can be represented as a matrix $10^9 \times 10^9$. There is exactly one car in every cell of the matrix. All cars have their own machine numbers represented as a positive integer. Let's index the columns of the matrix by integers from 1 to 10^9 from left to right and the rows by integers from 1 to 10^9 from top to bottom. By coincidence it turned out, that for every cell (x, y) the number of the car, which stands in this cell, is equal to the minimum positive integer, which can't be found in the cells (i, y) and (x, j), $1 \le i < x, 1 \le j < y$.

1	2	3	4	5
2	1	4	3	6
3	4	1	2	7
4	3	2	1	8
5	6	7	8	1

The upper left fragment 5×5 of the parking

Leha wants to ask the watchman q requests, which can help him to find his car. Every request is represented as five integers x_1, y_1, x_2, y_2, k. The watchman have to consider all cells (x, y) of the matrix, such that $x_1 \le x \le x_2$ and $y_1 \le y \le y_2$, and if the number of the car in cell (x, y) does not exceed k, increase the answer to the request by the number of the car in cell (x, y). For each request Leha asks the watchman to tell him the resulting sum. Due to the fact that the sum can turn out to be quite large, hacker asks to calculate it modulo $10^9 + 7$.

However the requests seem to be impracticable for the watchman. Help the watchman to answer all Leha's requests.

Input

The first line contains one integer q $(1 \le q \le 10^4)$ — the number of Leha's requests.

The next q lines contain five integers x_1, y_1, x_2, y_2, k $(1 \le x_1 \le x_2 \le 10^9, 1 \le y_1 \le y_2 \le 10^9, 1 \le k \le 2 \cdot 10^9)$ — parameters of Leha's requests.

Output

Print exactly q lines — in the first line print the answer to the first request, in the second — the answer to the second request and so on.

Example

input

```
4
1 1 1 1 1
3 2 5 4 5
1 1 5 5 10000
1 4 2 5 2
```

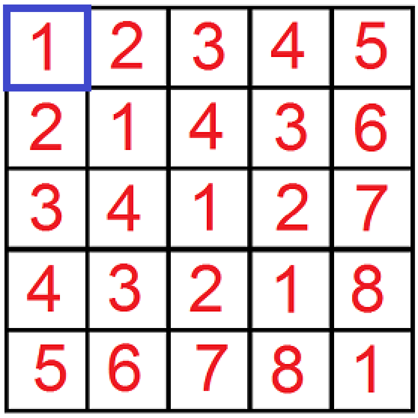
output

```
1
13
93
0
```

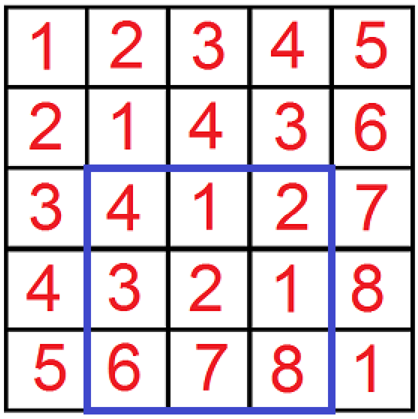
Note

Let's analyze all the requests. In each case the requested submatrix is highlighted in blue.

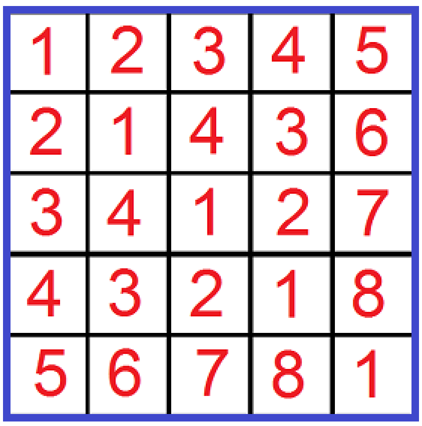
In the first request $(k = 1)$ Leha asks only about the upper left parking cell. In this cell the car's number is 1. Consequentally the answer is 1.



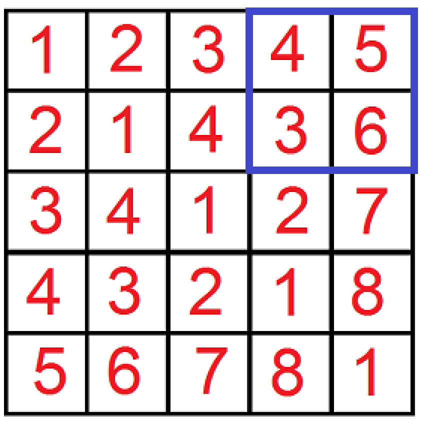
In the second request $(k = 5)$ suitable numbers are $4, 1, 2, 3, 2, 1$. Consequentally the answer is $4 + 1 + 2 + 3 + 2 + 1 = 13$.



In the third request $(k = 10000)$ Leha asks about the upper left frament 5×5 of the parking. Since k is big enough, the answer is equal to 93.



In the last request $(k = 2)$ none of the cur's numbers are suitable, so the answer is 0.



D. Hitchhiking in the Baltic States

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Leha and Noora decided to go on a trip in the Baltic States. As you know from the previous problem, Leha has lost his car on the parking of the restaurant. Unfortunately, requests to the watchman didn't helped hacker find the car, so friends decided to go hitchhiking.

In total, they intended to visit n towns. However it turned out that sights in i-th town are open for visitors only on days from l_i to r_i.

What to do? Leha proposed to choose for each town i a day, when they will visit this town, i.e any integer x_i in interval $[l_i, r_i]$. After that Noora choses some subsequence of towns $id_1, id_2, ..., id_k$, which friends are going to visit, that at first they are strictly increasing, i.e $id_i < id_{i+1}$ is for all integers i from 1 to $k - 1$, but also the dates of the friends visits are strictly increasing, i.e $x_{id_i} < x_{id_{i+1}}$ is true for all integers i from 1 to $k - 1$.

Please help Leha and Noora in choosing such x_i for each town i, and such subsequence of towns $id_1, id_2, ..., id_k$, so that friends can visit maximal number of towns.

You may assume, that Leha and Noora can start the trip any day.

Input

The first line contains a single integer n ($1 \le n \le 3 \cdot 10^5$) denoting the number of towns Leha and Noora intended to visit.

Each line i of the n subsequent lines contains two integers l_i, r_i ($1 \le l_i \le r_i \le 10^9$), denoting that sights in i-th town are open for visitors on any day $x \in [l_i, r_i]$.

Output

Print a single integer denoting the maximal number of towns, that Leha and Noora can visit.

Example

input

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

output

```
3
```

Note

Consider the first example.

Let's take this plan: let's visit the sight in the second town on the first day, in the third town on the third day and in the fifth town on the fourth. That's would be the optimal answer.

E. Surprise me!

time limit per test: 8 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Tired of boring dates, Leha and Noora decided to play a game.

Leha found a tree with n vertices numbered from 1 to n. We remind you that tree is an undirected graph without cycles. Each vertex v of a tree has a number a_v written on it. Quite by accident it turned out that all values written on vertices are distinct and are natural numbers between 1 and n.

The game goes in the following way. Noora chooses some vertex u of a tree uniformly at random and passes a move to Leha. Leha, in his turn, chooses (also uniformly at random) some vertex v from remaining vertices of a tree $(v \neq u)$. As you could guess there are $n(n - 1)$ variants of choosing vertices by players. After that players calculate the value of a function $f(u, v) = \varphi(a_u \cdot a_v) \cdot d(u, v)$ of the chosen vertices where $\varphi(x)$ is Euler's totient function and $d(x, y)$ is the shortest distance between vertices x and y in a tree.

Soon the game became boring for Noora, so Leha decided to defuse the situation and calculate expected value of function f over all variants of choosing vertices u and v, hoping of at least somehow surprise the girl.

Leha asks for your help in calculating this expected value. Let this value be representable in the form of an irreducible fraction $\frac{P}{Q}$. To further surprise Noora, he wants to name her the value $P \cdot Q^{-1} \mod 10^9 + 7$.

Help Leha!

Input

The first line of input contains one integer number n $(2 \le n \le 2 \cdot 10^5)$ — number of vertices in a tree.

The second line contains n different numbers $a_1, a_2, \ldots, a_n$ $(1 \le a_i \le n)$ separated by spaces, denoting the values written on a tree vertices.

Each of the next $n - 1$ lines contains two integer numbers x and y $(1 \le x, y \le n)$, describing the next edge of a tree. It is guaranteed that this set of edges describes a tree.

Output

In a single line print a number equal to $P \cdot Q^{-1}$ modulo $10^9 + 7$.

Examples

input

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

output

```
333333338
```

input

```
5
5 4 3 1 2
3 5
1 2
4 3
2 5
```

output

```
8
```

Note

Euler's totient function $\varphi(n)$ is the number of such i that $1 \le i \le n$,and $gcd(i, n) = 1$, where $gcd(x, y)$ is the greatest common divisor of numbers x and y.

There are 6 variants of choosing vertices by Leha and Noora in the first testcase:

- $u = 1, v = 2, f(1, 2) = \varphi(a_1 \cdot a_2) \cdot d(1, 2) = \varphi(1 \cdot 2) \cdot 1 = \varphi(2) = 1$
- $u = 2, v = 1, f(2, 1) = f(1, 2) = 1$
- $u = 1, v = 3, f(1, 3) = \varphi(a_1 \cdot a_3) \cdot d(1, 3) = \varphi(1 \cdot 3) \cdot 2 = 2\varphi(3) = 4$
- $u = 3, v = 1, f(3, 1) = f(1, 3) = 4$
- $u = 2, v = 3, f(2, 3) = \varphi(a_2 \cdot a_3) \cdot d(2, 3) = \varphi(2 \cdot 3) \cdot 1 = \varphi(6) = 2$
- $u = 3, v = 2, f(3, 2) = f(2, 3) = 2$

Expected value equals to $\frac{1}{6} \cdot (1 + 1 + 4 + 4 + 2 + 2) = \frac{14}{6} = \frac{7}{3}$. The value Leha wants to name Noora is $7 \cdot 3^{-1} = 7 \cdot 333333336 = 333333338 \mod 10^9 + 7$.

In the second testcase expected value equals to $\frac{160}{20} = \frac{8}{1}$, so Leha will have to surprise Hoora by number $8 \cdot 1^{-1} = 8 \mod 10^9 + 7$.