Central-European Olympiad in Informatics, CEOI 2020, Day 1 (IOI, Unofficial Mirror Contest, Unrated)

A. Fancy Fence

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

Everybody knows that Balázs has the fanciest fence in the whole town. It's built up from N fancy sections. The sections are rectangles standing closely next to each other on the ground. The ith section has integer height h_i and integer width w_i. We are looking for fancy rectangles on this fancy fence. A rectangle is fancy if:

- its sides are either horizontal or vertical and have integer lengths
- the distance between the rectangle and the ground is integer
- the distance between the rectangle and the left side of the first section is integer
- it's lying completely on sections

What is the number of fancy rectangles? This number can be very big, so we are interested in it modulo $10^9 + 7$.

Input

The first line contains N ($1 \le N \le 10^5$) – the number of sections. The second line contains N space-separated integers, the ith number is h_i ($1 \le h_i \le 10^9$). The third line contains N space-separated integers, the ith number is w_i ($1 \le w_i \le 10^9$).

Output

You should print a single integer, the number of fancy rectangles modulo $10^9 + 7$. So the output range is $0, 1, 2, \ldots, 10^9 + 6$.

Scoring

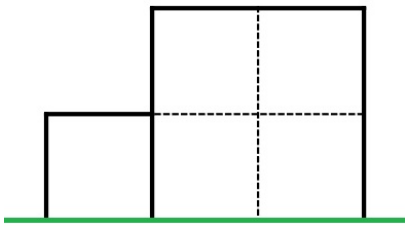
Subtask	Points	Constraints
1	0	sample
2	12	$N \le 50$ and $h_i \le 50$ and $w_i = 1$ for all i
3	13	$h_i = 1$ or $h_i = 2$ for all i
4	15	all h_i are equal
5	15	$h_i \le h_{i+1}$ for all $i \le N - 1$
6	18	$N \le 1000$
7	27	no additional constraints

Example

input
2 1 2 1 2
output
12

Note

The fence looks like this:



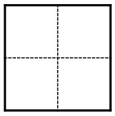
There are 5 fancy rectangles of shape:

There are 3 fancy rectangles of shape:

There is 1 fancy rectangle of shape:

There are 2 fancy rectangles of shape:

There is 1 fancy rectangle of shape:



B. Roads

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

The government of Treeland wants to build a new road network. There are $2N$ cities in Treeland. The unfinished plan of the road network already contains N road segments, each of which connects two cities with a straight line. No two road segments have a common point (including their endpoints). Your task is to determine $N - 1$ additional road segments satisfying the following conditions:

1. Every new road segment must connect two cities with a straight line.
2. If two segments (new or old) have a common point, then this point must be an endpoint of both segments.
3. The road network connects all cities: for each pair of cities there is a path consisting of segments that connects the two cities.

Input

The first line of the standard input contains N ($2 \le N \le 10^5$) – the number of existing road segments. Each of the following N lines contains four integers: x_1, y_1, x_2, y_2, where (x_1, y_1) and (x_2, y_2) are the coordinates of the endpoints of the segment ($-10^7 \le x_i, y_i \le 10^7$).

Output

The standard output must contain $N - 1$ lines, each of them containing four integers, x_1, y_1, x_2, y_2, where (x_1, y_1) and (x_2, y_2) are the coordinates of the cities that are the endpoints of a new road segment. If there are multiple solutions, your program may output any of them.

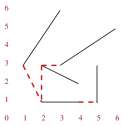
Scoring

Subtask	Points	Constraints
1	0	samples
2	15	all input segments are vertical.
3	15	each pair of input segments are parallel.
4	15	each input segment is either horizontal or vertical.
5	15	$N \le 10\,000$
6	40	no additional constraints

Example

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

Note



C. Star Trek

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

The United Federation of Planets is an alliance of N planets, they are indexed from 1 to N. Some planets are connected by space tunnels. In a space tunnel, a starship can fly both ways really fast. There are exactly $N-1$ space tunnels, and we can travel from any planet to any other planet in the Federation using these tunnels.

It's well known that there are D additional parallel universes. These are exact copies of our universe, they have the same planets and space tunnels. They are indexed from 1 to D (our universe has index 0). We denote the planet x in universe i by P_x^i. We can travel from one universe to another using dimension portals. For every i ($0 \leq i \leq D-1$), we will place exactly one portal that allows us to fly from $P_{A_i}^i$ to $P_{B_i}^{i+1}$, for some planet indices A_i and B_i (i.e. $1 \leq A_i, B_i \leq N$).

Once all the portals are placed, Starship Batthyány will embark on its maiden voyage. It is currently orbiting around P_1^0. Captain Ágnes and Lieutenant Gábor have decided to play the following game: they choose alternately a destination (a planet) to fly to. This planet can be in the same universe, if a space tunnel goes there, or it can be in another universe, if a portal goes there. Their aim is to visit places where no one has gone before. That's why, once they have visited a planet P_x^i, they never go back there (but they can visit the planet x in another universe). Captain Ágnes chooses the first destination (then Gábor, then Ágnes etc.). If somebody can't choose a planet where they have not been before in his/her turn, he/she loses.

Captain Ágnes and Lieutenant Gábor are both very clever: they know the locations of all tunnels and portals, and they both play optimally. For how many different placements of portals does Captain Ágnes win the game? Two placements are different if there is an index i ($0 \leq i \leq D-1$), where the ith portal connects different pairs of planets in the two placements (i.e A_i or B_i differs).

This number can be very big, so we are interested in it modulo 10^9+7.

Input

The first line contains two space-separated integers, N ($1 \leq N \leq 10^5$) – the number of planets and D ($1 \leq D \leq 10^{18}$) – the number of additional parallel universes. Each of the next $N-1$ lines contains two space-separated integers u and v ($1 \leq u, v \leq N$), denoting that P_u^i and P_v^i are connected by a space tunnel for all i ($0 \leq i \leq D$).

Output

You should print a single integer, the number of possible placements of portals where Captain Ágnes wins modulo 10^9+7.

Scoring

Subtask	Points	Constraints
1	0	samples
2	7	$N = 2$
3	8	$N \leq 100$ and $D = 1$
4	15	$N \leq 1000$ and $D = 1$
5	15	$D = 1$
6	20	$N \leq 1000$ and $D \leq 10^5$
7	20	$D \leq 10^5$
8	15	no additional constraints

Example

input
3 1 1 2 2 3
output
4

Note

There is only 1 portal and $3 \cdot 3 = 9$ different placements. The following 4 placements are when the Captain wins.