Problem E. Game on the board

Input file:	`input.txt` or standard input
Output file:	`output.txt` or standard output
Time limit:	1 second
Memory limit:	512 megabytes

Alice and Bob play a game. The game consists of x rounds.

Before the start of the game, three integers a, b and c are written on the board. Each player has 0 points before the start of the game.

Each round consists of four actions:

1. Alice computes the smallest non-negative integer that is **not** written on the board.
2. Bob computes the smallest non-negative integer that is written on the board.
3. The player whose number is greater, gains one point. This player is considered the winner of the round.
4. The number of points of the **losing** player in this round is written on the board.

Note, that the integers computed by Alice and Bob in each round will not be equal.

Determine Alice's and Bob's numbers of points after x rounds.

Input

The first line of the input contains an integer x ($1 \le x \le 10^9$), the number of rounds.

The second line contains an integer a ($0 \le a \le 10^9$), the first integer on the board.

The third line contains an integer b ($0 \le b \le 10^9$), the second integer on the board.

The fourth line contains an integer c ($0 \le c \le 10^9$), the third integer on the board.

Output

Print two integers — the number of Alice's and Bob's points after x rounds.

Examples

input	output
3 0 1 2	3 0
1 1 2 3	0 1
2 4 4 1	1 1

Note

In the first example, Alice wins all three rounds.

In the second example, in the first round, Alice's number will be 0 and Bob's number will be 1, so Bob will win the first round.

In the third example, Bob wins the first round and Alice wins the second.

Scoring

There are 50 non-sample tests in this problem. Each of them is scored independently and costs 2 points.

Solutions that work correctly for $x \leq 100\,000$ will get at least 40 points.

Problem F. Least Common Ancestor

Input file:	`input.txt` or standard input
Output file:	`output.txt` or standard output
Time limit:	1 second
Memory limit:	512 megabytes

You are given a tree — connected undirected graph without cycles, that has n vertices. The root of the tree is the vertex number 1.

The distance between two vertices of the tree is equal to the number of edges on the path between those vertices.

Consider a non-empty set of tree vertices $U = \{u_1, u_2, \ldots, u_k\}$. Its *least common ancestor* is the vertex that is furthest from the vertex number 1, such that it belongs to the path from 1 to u_i for all u_i in U.

For each non-empty set of vertices of the tree consider the vertex that is the least common ancestor of this set. Find the sum of indices of these vertices. This sum can be large, so you must print this sum modulo $10^9 + 7$.

Input

The first line of input contains an integer n ($1 \le n \le 300\,000$) — the number of vertices in the tree.

Each of the following $n - 1$ lines contains two integers u_i and v_i ($1 \le u_i, v_i \le n$), they describe the edge between u_i and v_i. It is guaranteed that the given graph is a tree.

Output

Output one integer — the required sum modulo $10^9 + 7$.

Example

input	output
4 1 2 2 3 2 4	25

Note

In the sample test if the set U contains the vertex 1, the least common ancestor of U is 1, since the path from 1 to this vertex only contains 1. There are eight such sets.

If U doesn't contain 1, but contains 2, the least common ancestor of U is 2, since all paths contain vertices $1, 2$, and the vertex 2 is further than the vertex 1 from the vertex 1. There are four such sets U.

If $U = \{3\}$, the least common ancestor is 3. If $U = \{4\}$ the least common ancestor is 4.

If $U = \{3, 4\}$, the least common ancestor is 2, since only 1 and 2 are on both paths, and the vertex 2 is further than the vertex 1 from the vertex 1.

Adding up all the values, we get $1 \cdot 8 + 2 \cdot 4 + 3 + 4 + 2 = 25$.

Scoring

Tests for this problem are divided into five groups. For each of the groups you earn points only if your solution passes all tests in this group and all tests in all of the **required** groups.

Group	Points	Additional constraints	Req. Groups	Comment
		n		
0	0	–	–	Sample tests.
1	20	$n \le 18$	0	
2	20	$n \le 2000$	1	
3	15	–	–	$u_i = 1, v_i = i + 1$
4	15	–	–	$u_i = i, v_i = i + 1$
5	30	–	$0 - 4$	

Problem G. Strange Function

Input file:	`input.txt` or standard input
Output file:	`output.txt` or standard output
Time limit:	1 second
Memory limit:	512 megabytes

For a permutation p of integers from 1 to m consider a function $f(p) = |p_1 - p_2| + |p_2 - p_3| + \cdots + |p_{m-1} - p_m|$. For a permutation p of size m denote as p^{-1} such permutation g of size m, that for each i from 1 to m the equality $p_{g_i} = i$ holds. A subsequence of size m of an array a is an array $a_{i_1}, a_{i_2}, \ldots a_{i_m}$ of size m, such that $1 \le i_1 < i_2 < \cdots < i_m \le n$.

You are given an array a of size n, that contains integers from 1 to m. For each of its subsequences that are permutations p of size m, find the number $f(p^{-1})$. Find the sum of these values. The answer can be large, so print it modulo $10^9 + 7$.

Input

The first line of input contains two integers n and m ($1 \le n, m \le 200\,000$).

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le m$) — the elements of a.

Output

Output one integer — the required sum modulo $10^9 + 7$.

Example

input	output
6 3 1 2 3 1 2 3	20

Note

The array in the first sample test has 8 subsequences that are permutations of size 3. For each such subsequence its elements are underlined, the inverse permutation is shown, and the required function calculation is demonstrated.

- $\underline{1}, \underline{2}, \underline{3}, 1, 2, 3,\ p^{-1} = (1, 2, 3),\ f(p^{-1}) = |1 - 2| + |2 - 3| = 2.$
- $\underline{1}, \underline{2}, 3, 1, 2, \underline{3},\ p^{-1} = (1, 2, 3),\ f(p^{-1}) = |1 - 2| + |2 - 3| = 2.$
- $\underline{1}, 2, \underline{3}, 1, \underline{2}, 3,\ p^{-1} = (1, 3, 2),\ f(p^{-1}) = |1 - 3| + |3 - 2| = 3.$
- $\underline{1}, 2, 3, 1, \underline{2}, \underline{3},\ p^{-1} = (1, 2, 3),\ f(p^{-1}) = |1 - 2| + |2 - 3| = 2.$
- $1, \underline{2}, \underline{3}, \underline{1}, 2, 3,\ p^{-1} = (3, 1, 2),\ f(p^{-1}) = |3 - 1| + |1 - 2| = 3.$
- $1, \underline{2}, 3, \underline{1}, 2, \underline{3},\ p^{-1} = (2, 1, 3),\ f(p^{-1}) = |2 - 1| + |1 - 3| = 3.$
- $1, 2, \underline{3}, \underline{1}, \underline{2}, 3,\ p^{-1} = (2, 3, 1),\ f(p^{-1}) = |2 - 3| + |3 - 1| = 3.$
- $1, 2, 3, \underline{1}, \underline{2}, \underline{3},\ p^{-1} = (1, 2, 3),\ f(p^{-1}) = |1 - 2| + |2 - 3| = 2.$

The final answer is $2 + 2 + 3 + 2 + 3 + 3 + 3 + 2 = 20$.

Scoring

Tests for this problem are divided into five groups. For each of the groups you earn points only if your solution passes all tests in this group and all tests in all of the **required** groups.

Group	Points	Additional constraints		Req. groups	Comment
		n	m		
0	0	–	–	–	Sample tests.
1	15	$n \le 20$	$m \le 20$	0	
2	15	$n \le 900$	$m \le 900$	$0 - 1$	
3	15	$n \le 10\,000$	$m \le 10\,000$	$0 - 2$	
4	15	$n \le 100\,000$	$m \le 10$	0	
5	40	–	–	$0 - 4$	

Problem H. Addition

Input file:	`input.txt` or standard input
Output file:	`output.txt` or standard output
Time limit:	3 seconds
Memory limit:	512 megabytes

You are given a two-dimensional array a of integers that contains n rows and m columns. Initially all elements of the array are equal to zero. You have to process q of the following types:

- `1` r_1 c_1 r_2 c_2 t ($1 \le r_1 \le r_2 \le n$, $1 \le c_1 \le c_2 \le m - t + 1$, $1 \le t \le m$). *Addition to a rectangle* given by its corners (x_1, y_1) and (x_2, y_2) where $x_1 \le x_2$, $y_1 \le y_2$ is performed by adding 1 to all elements of $a_{x,y}$ such that $x_1 \le x \le x_2$, $y_1 \le y \le y_2$.

  For all i such that $0 \le i < t$ you must perform adding on a rectangle given by its corners $(r_1, c_1 + i)$, $(r_2, c_2 + i)$.

- `2` r_1 c_1 r_2 c_2 ($1 \le r_1 \le r_2 \le n$, $1 \le c_1 \le c_2 \le m$). You must calculate the sum of elements $a_{x,y}$ in a rectangle given by its corners (r_1, c_1), (r_2, c_2). This sum can be quite large, so it must be printed modulo 2^{31}.

Input

The first line of input contains three integers n, m and q ($1 \le n, m \le 10^9$, $1 \le q \le 100\,000$) — the number of rows, the number of columns and the number of queries.

The following q lines contain queries in the format described above.

Output

For each query of the second type print the answer on a single line. It is guaranteed that there is at least one query of type 2.

Examples

input	output
1 4 2 1 1 1 1 2 3 2 1 1 1 4	6
4 8 6 1 1 1 2 4 3 1 2 1 3 2 2 1 3 3 4 4 1 2 3 3 4 6 2 1 2 3 5 2 1 5 4 8	5 28 6
6 6 6 1 1 1 3 5 1 1 2 1 4 4 3 2 1 1 6 5 1 2 2 6 5 1 1 2 2 5 6 1 2 2 2 3 4	48 34
13 8 8 2 2 1 8 5 1 4 2 7 8 1 2 1 2 8 4 1 3 2 13 5 2 1 4 2 8 5 3 1 2 2 9 4 1 1 4 2 9 5 2 2 3 2 7 5	0 12 130

Note

The first sample test contains a one-dimensional array of size 4. Initially the array is equal to $(0, 0, 0, 0)$. After the first query the elements at segments $[1; 2]$, $[2; 3]$ and $[3; 4]$ are increased by 1, the resulting array $(1, 2, 2, 1)$ has the sum equal to 6.

The second sample test performs the following transformations of the given array (rows are indexed bottom up):

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

$\longrightarrow$

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

$\longrightarrow$

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

$\longrightarrow$

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

Scoring

Tests for this problem are divided into nine groups. For each of the groups you earn points only if your solution passes all tests in this group and all tests in all of the **required** groups.

Group	Points	Additional constraints		Req. groups	Comment
		n, m	q		
0	0	–	–	–	Sample tests.
1	7	$n, m \leq 100$	$q \leq 100$	0	
2	8	$n, m \leq 700$	$q \leq 700$	0 – 1	
3	10	–	$q \leq 10\,000$	–	$t_i = 1$.
4	15	–	$q \leq 10\,000$	0 – 3	
5	9	–	–	–	In second type queries $(r_{i,1}, c_{i,1}) = (1, 1)$, $(r_{i,2}, c_{i,2}) = (n, m)$.
6	11	$n, m \leq 1000$	–	–	All queries of type 2 are after all queries of type 1, $t_i = 1$.
7	10	$n, m \leq 1000$	–	6	All queries of type 2 are after all queries of type 1.
8	14	–	–	3, 6	$t_i = 1$.
9	16	–	–	0 – 8	