

Problem ChalkBoard

Input file `stdin`
Output file `stdout`

Șogard is in huge trouble after his 9-day vacation. He is in urgent need of improving his mathematics skills for his upcoming math exam, so he calls his best friend Richard for some help. Richard came up with the following training routine: he has a chalkboard with the number x written on it (x is initially equal to 1), and he will give q queries of the following 3 types:

- Replace x with (x multiplied by a), where a is given.
- Replace x with (x divided by a), where a is given such that it is a divisor of x .
- You are given an interval $[l, r]$. Find how many numbers d exist such that d divides x , and the prime factors of d are in the closed interval $[l, r]$. You need to find the answer modulo $10^9 + 7$.

Richard prepared the queries in advance, but he forgot to prepare the answers for his queries, and as such, he asks you for help in finding the answers to his queries so that he can help Șogard pass his upcoming math exam.

Input data

The first line of the input will contain the number q . The following q lines will contain one of the following:

- A number t which represents the type of query given.
- If $t = 1$, then on the same line, a new number a which represents that x will be multiplied by a .
- If $t = 2$, then on the same line, a new number a which represents that x will be divided by a . It is guaranteed that number a will divide x .
- If $t = 3$, then on the same line, two new numbers l, r which represent the interval for the 3rd type of query.

Output data

Print the answer for the 3rd type of queries, in the input order. Note that we want to find each answer modulo $10^9 + 7$.

Restrictions

- $1 \leq q \leq 2 \cdot 10^5$
- $1 \leq a \leq 10^6$
- $1 \leq l \leq r \leq 10^6$

#	Points	Restrictions
1	26	$1 \leq q, a \leq 10^3$
2	33	$1 \leq a \leq 2 \cdot 10^5$
3	41	No further restrictions.

Examples

Input file	Output file
12	8
1 5	32
1 10	16
1 15	24
1 9	8
3 2 3	
3 2 5	
3 3 5	
1 49	
1 11	
3 5 16	
2 77	
3 4 16	

For the first query of type 3, the prime decomposition of x is $2 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5$, so we can choose the d in 8, 32, respectively 16 ways. Then, for the next queries of type 3, our x is multiplied by $7 \times 7 \times 11$, so we can choose d in 24 ways, respectively 8 ways.

Problem Cntcrit

Input file `stdin`
Output file `stdout`

You are given an integer N . Consider all the labeled undirected graphs with N vertices. For each such graph, count the number of critical edges in it. Find the sum of the number of critical edges for all undirected graphs with N vertices.

An edge (u, v) is critical if by removing it, the number of connected components increases.

Since this number can be very large, print it modulo M , where M is a prime number.

Input data

The first line of the input will contain the numbers N and M .

Output data

Print a single integer, the sum of the number of critical edges for all undirected graphs with N vertices.

Restrictions

- $1 \leq N \leq 5\,000$.
- $2 \leq M \leq 10^9 + 9$, M is prime.

#	Points	Restrictions
1	11	$1 \leq N \leq 6$
2	53	$1 \leq N \leq 150$
3	36	No further restrictions.

Examples

Input file	Output file
6 2017	1254
319 666013	385993

Problem Connected

Input file `stdin`
Output file `stdout`

You are given an **undirected tree** with N vertices, numbered from 1 to N (a tree is an undirected connected graph in which there are no cycles) and a permutation P of its nodes (a sequence of length N , arranged in any order and no node number appears twice in the sequence).

You are asked to compute the number of **contiguous** subsequences $[l, r]$ ($1 \leq l \leq r \leq N$) of P such that the nodes $P_l, P_{l+1}, \dots, P_r$ form a **connected undirected** graph.

Input data

The first line contains an integer N .

The next $N - 1$ lines contain 2 integers u_i, v_i , denoting an edge of the tree.

The last line of the input contains the N numbers $P_1, P_2, \dots, P_N$, representing the permutation P .

Output data

You need to write a single line with an integer: the number of **contiguous** subsequences $[l, r]$ ($1 \leq l \leq r \leq N$) of P such that the nodes $P_l, P_{l+1}, \dots, P_r$ form a **connected undirected** graph.

Restrictions

- $1 \leq N \leq 2 \cdot 10^5$.
- $1 \leq u_i, v_i \leq N$.

#	Points	Restrictions
1	10	$N \leq 200$
2	20	$N \leq 2000$.
3	30	The given tree is just a simple chain.
4	40	No further restrictions.

Examples

Input file	Output file
5 1 2 1 3 2 4 2 5 1 2 4 3 5	10

Explanations

In the **sample case**, one example of a **contiguous** subsequence of nodes which forms a connected region is the one formed by the first 4 elements of P . One example of a subrange of nodes from P which does not form a connected region is 2, 4, 3.

Problem From Constanța 2 Timișoara

Input file `stdin`
Output file `stdout`

Adi of Adi and Sorin would like to visit their country this summer. They live in a country that can be represented as a graph with N nodes and M edges, where each city is a node and each bidirectional road between two cities is a weighted edge in the same graph (where the weight of the edge represents the length of the road in kilometers).

Since they really like the cities Constanța and Timișoara, they decided to visit both of these cities in their vacation. More formally, we will note the city of Constanța as node X and the city of Timișoara as node Y . Now, if they want to start their journey in city u and end it in city v , then their path will have the following properties:

- the length of the path is as small as possible (where the length is equal to the sum of weights of the edges in the path)
- the path visits both X and Y

Let $d(u, v)$ be the length of the path that Adi of Adi and Sorin will visit if they start their journey in node u and end it in node v . Note that a node or an edge can occur multiple times in the path.

Your task is to calculate $\sum_{1 \leq u < v \leq N} d(u, v)$. Since this number can be very large, calculate it modulo $10^9 + 9$.

Input data

The first line of the input contains the numbers N, X, Y and M . The next M lines will each contain three numbers u, v and c , representing a weighted edge between u and v of weight c .

Output data

Output a single number, the sum of $d(u, v)$ for all ordered pairs of nodes modulo $10^9 + 9$.

Restrictions

- $1 \leq N, M \leq 250\,000$
- $1 \leq X, Y \leq N$
- $1 \leq u, v \leq N$
- $1 \leq c \leq 10^9$
- There will be no self-loops or multiple edges in the input.

#	Points	Restrictions
1	12	$1 \leq N \leq 100, 1 \leq M \leq 200$
2	29	$1 \leq N \leq 2\,000, 1 \leq M \leq 4\,000$
3	59	No further restrictions.

Examples

Input file	Output file
3 2 1 3 1 2 1 3 1 1 3 2 3	6

Explicații

$$d(1, 2) + d(1, 3) + d(2, 3) = 1 + 3 + 2 = 6$$

Problem Mermaid of the Waters

Input file `stdin`
Output file `stdout`

*The title of the problem has as much to do
with the statement
as Denise's lyrics have to do with Marius's
(for those who know).*

On a 0-indexed binary string S of length N , you can apply the following operation any number of times:

- Choose an index i ($0 \leq i < N - 1$) such that $S_i = S_{i+1}$ and remove S_i and S_{i+1} from S .

After this operation, we get the string $S_0 \dots S_{i-1} S_{i+2} \dots S_{N-1}$

Given a positive integer N , Conte the Swedish asks you to find the number of binary strings of length N that can become empty after applying the operation above on them any number of times. Since this number can be very large, calculate it modulo $10^9 + 9$.

Input data

The only line of the input will contain the number N .

Output data

Output a single number, the number of binary strings of length N that can become empty after applying the operation any number of times.

Restrictions

- $1 \leq N \leq 2 \cdot 10^5$.

#	Points	Restrictions
1	3	$1 \leq N \leq 6$
2	11	$1 \leq N \leq 16$
3	38	$1 \leq N \leq 1\,000$
4	48	No further restrictions.

Examples

Input file	Output file
4	6

Explanations

The 6 strings are 1111, 0000, 1100, 0011, 0110, 1001.

Problem Final Standings

Input file	stdin
Output file	stdout

After you helped kids form teams for IKPC (International Kindergarten Programming Contest), you now want to know which team won the competition!

Your teacher provided you information regarding the number of teams, N , the number of problems, P , as well as the number of actions taken by the teams, Q .

For the i^{th} action, you know the number of the team, t_i , the problem number they submitted on, p_i , as well as the verdict of the solution, 1 if the solution was accepted or 0 if the solution was rejected. If team t_i **did not submit** a correct solution before the i^{th} action to that problem p_i , the penalty of the team corresponding to problem p_i is increased by i . If a team submits multiple solutions to a problem, the total penalty is increased by the **sum of the penalties** accumulated by the time the first correct solution was submitted, **including the first correct solution**. However, if a team **never submits any correct solution** to a problem p , the penalties accumulated for p are **NOT** added towards the final penalty.

For example, if a team submits the following solutions on problem 1, they will get the total penalty increased by 24, as only the submissions sent at times 5, 9 and 10 are considered. Take note that the wrong solution at time 15 is not added to the total penalty.

- a wrong solution at time 5
- a wrong solution at time 9
- a correct solution at time 10
- a wrong solution at time 15

In order to *simplify* the competition, each action takes place at a **different** moment of time, thus the i^{th} action will take place in the i^{th} minute. The moments of time are indexed from 1.

The final standings of the competition are decided as follows:

- First, the teams are ordered in non-ascending order of the number of problems they solved. **Warning**, if the team submits more than a correct solution for the same problem, only the first correct solution is counted.
- If two or more teams are tied, they will be ordered in non-descending order of their penalties. **Warning**, in order to compute the penalty, we will consider the penalty accumulated only among the problems which were **solved**, without considering the solutions sent after the problem was solved, irrespective of the status of the solution.
- If they are still tied, they will be ordered in the non-ascending order of the number of first solves they obtained. A first solve consists of a team being the first one to solve a certain problem.
- If they are still tied, they will be ordered in increasing order of their team numbers (if two teams have the exact same stats, the team with a smaller label goes first).

For example, if a team solved 10 problems and has a penalty of 190, it will be ahead of any team who solved 9 problems or less, as well as ahead any team who solved 10 problems but with a penalty greater than 190 or if they have the same penalty too, they will be ahead if they have more first solves than the other team or the same number of first solves too but a smaller label.

Input data

The first line of the input will contain the numbers N , P and Q , as stated above.

The next Q lines will each contain three values, t_i , p_i and v_i , where t_i ($1 \leq t_i \leq N$) is the number of the team which had this action, p_i ($1 \leq p_i \leq P$) is the problem number they submitted on, v_i is the verdict they got (0 for rejected and 1 for accepted).

Output data

The output will contain a single line, with the order of the teams, from the first placed team to the last placed team, according to the restrictions specified in the statement.

Restrictions

- $1 \leq N, P \leq 100$.
- $1 \leq Q \leq 10^4$.

#	Points	Restrictions
1	30	$1 \leq N, P \leq 50$
2	70	No further restrictions.

Examples

Input file	Output file
7 11 17 5 3 0 4 11 1 2 5 1 3 9 1 2 11 1 7 7 0 6 1 1 4 2 1 6 11 1 4 9 1 5 5 0 1 4 1 2 2 1 2 6 0 6 10 1 3 8 1 3 5 1	4 2 6 3 1 5 7

Explanations

In the table below you can see the list of solved problems, penalty and first solves for each team

International Informatics Olympiad in Teams – National Round Thursday 29th February, 2024

Team	Solved problems	Penalty	First solve count
4	3	20	2
2	3	21	1
6	3	31	2
3	3	37	2
1	1	12	1
5	0	0	0
7	0	0	0

Problem XYQueries

Input file `stdin`
Output file `stdout`

You are given an array A with N integers. Let $\min(i, j)$ be the minimum value in the subarray $A_i, A_{i+1}, \dots, A_j$, and $\max(i, j)$ the maximum value in the subarray $A_i, A_{i+1}, \dots, A_j$. You are also given Q queries, for the i^{th} query you are required to count the number of pairs (l, r) , $1 \leq l \leq r \leq N$ where $\min(l, r) = X_i$ and $\max(l, r) = Y_i$.

Input data

The first line of the input contains two integers N and Q . The second line contains N integers, $A_1, A_2, \dots, A_N$. The next Q lines describe the queries, the i^{th} of them contains two integers X_i, Y_i .

Output data

The output will consist of Q lines, the i^{th} line containing the answer to the i^{th} query.

Restrictions

- $1 \leq N, Q \leq 10^5$.
- $1 \leq A_i \leq N, \forall i \in \{1, 2, \dots, N\}$.

#	Points	Restrictions
1	9	$1 \leq N, Q \leq 100$
2	23	$1 \leq Q \leq 100$
3	31	The test cases are randomly generated.
4	37	No further restrictions.

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Examples

Input file	Output file
7 5 3 5 3 4 2 1 5 2 5 3 5 1 2 2 4 2 4	2 5 1 2 2
15 10 7 9 2 13 12 13 11 13 13 13 10 5 13 7 2 5 13 7 13 11 13 5 10 7 13 2 9 7 9 2 9 11 13 11 13 1 8	25 1 15 1 1 2 1 2 15 15