NOI '20 P2 - Destiny

Time limit: 2.0s **Memory limit:** 1G

Given a tree $T = (V, E)$ (V is the set of vertices and E is the set of edges) and a set of pairs of vertices $Q \subset V \times V$ satisfying for all $(u, v) \in Q$, $u \neq v$ and u is an ancestor of v on tree T, you are supposed to compute how many functions $f : E \to \{0, 1\}$ (i.e. for each edge $e \in E$, the value of $f(e)$ would be either 0 or 1) satisfies the condition for any $(u, v) \in Q$ there exists an edge e on the path from u to v such that $f(e) = 1$. Output the answer modulo $998\,244\,353$.

Input Specification

The first line contains an input n denoting the number of vertices in tree T. The nodes are numbered from 1 to n and the root node is node 1. In the following $n - 1$ lines, each line contains two integers separated by a space x_i, y_i such that $1 \leq x_i, y_i \leq n$ denoting there exists an edge on the tree between node x_i and y_i. There are no guarantees for the direction of the edge. The following line contains an integer m denoting the size of Q. In the following m lines, each line contains two integers separated by a space u_i, v_i denoting $(u_i, v_i) \in Q$. There may be duplication, or in other words, there might exist some $i \neq j$ such that $u_i = u_j$ and $v_i = v_j$.

Output Specification

The output contains only an integer denoting the number of functions f satisfying the condition above.

Sample Input 1

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

Sample Output 1

```
10
```

Sample Input 2

```
15
2 1
3 1
4 3
5 2
6 3
7 6
8 4
9 5
10 7
11 5
12 10
13 3
14 9
15 8
6
3 12
5 11
2 5
3 13
8 15
1 13
```

Sample Output 2

```
960
```

Constraints

For all test cases, $n \le 5 \times 10^5$, $m \le 5 \times 10^5$.
The input forms a tree, where for all $1 \le i \le m$, u_i is the ancestor of v_i.

Test Case	n	m	Additional Constraints

1	≤ 10	≤ 10	None.
2			
3			
4			
5	≤ 500	≤ 15	
6	$\le 10\,000$	≤ 10	
7	$\le 100\,000$	≤ 16	
8	$\le 500\,000$		
9	$\le 100\,000$	≤ 22	
10	$\le 500\,000$		
11	≤ 600	≤ 600	
12	≤ 1000	≤ 1000	
13	≤ 2000	$\le 500\,000$	
14			
15	$\le 500\,000$	≤ 2000	
16			
17	$\le 100\,000$	$\le 100\,000$	See below.
18			
19	$\le 50\,000$		None.
20	$\le 80\,000$		
21	$\le 100\,000$	$\le 500\,000$	
22			
23	$\le 500\,000$		
24			
25			

In this problem, a perfect binary tree is a binary tree such that each non-leaf node has two children and the depths of all leaf nodes are the same; if we number the nodes in a perfect binary tree from up to down, from left to right, the tree formed by the nodes with smallest numbers form a complete binary tree. Test cases 17 and 18 are complete binary trees.