Competitive Programming SS24

Submit until end of contest

Problem: Crime (5 second timelimit)

Max commiting a crime.
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For years, Max and Timofey have been stealing goods of increasing value. They have stolen watches, cars, paintings and heavily protected secrets from all countries. Now they are planning their greatest crime.

They want to steal the ultimate secret — the solutions to our CompProg problems.

Surely, the solutions are protected by mind-blowing algorithms, trap doors and frightening tutors. However, every safeguard has its weakness, and in this case the building that houses the chair of Algorithm Engineering provides ripe opportunities for infiltration. Naturally, the building looks like a tree. Each room can be associated with a vertex of the tree, and passages between neighboring rooms are associated with the edges. The root of the tree is located in vertex 1, which coincidentally houses the office of the fearsome Prof. Dr. Friedrich himself. All leaves of the tree have exits to the outside.

In addition to the plan of the building, Max and Timofey have gathered intel on problem locations. For every problem j, they know that the statement is stored in the room x_j, while the solution is hidden in the room y_j. Due to the advanced alarm system in the building, our criminal friends have only one chance at the heist, and they need to act fast. If they decide to steal the problem j, the only way for them to act is as follows. Max steals the problem statement from room x_j, and simultaneously Timofey steals the solution from room y_j. After picking up, Max runs to an exit reachable from x_j and Timofey runs to an exit reachable from y_j. Neither of them dares to move towards the root of the tree, therefore from every vertex they can only move to an adjacent vertex in its subtree. Not all tutors are equally well-trained in secure storage systems, so it may happen that x coincides with y — in that case, both Max and Timofey still need to start the heist in the respective room, and each of them can run to any reachable exit on their own. Since it is impossible to predict which doors will function at the day of the heist, they have to think of an exit plan for each possible combination of exits.

In order to plan the heist in the optimal way, can you to help them find the number of possible combinations of exits for each problem?

Input The input consists of:

- One line with an integer n ($2 \le n \le 2 \cdot 10^5$), the number of rooms.
- $n-1$ lines, the ith of which contains two integers u_i and v_i ($1 \le u_i, v_i \le n, u_i \ne v_i$), denoting an edge in the tree.

- One line with an integer q ($1 \leq q \leq 2 \cdot 10^5$), the number of problems.
- q lines, the jth of which contains two integers x_j and y_j ($1 \leq x_j, y_j \leq n$), the rooms storing the statement and the solution of the jth problem.

Output For each problem j output the number of ordered pairs (a_j, b_j) where a_j is an exit reachable from x_j, and b_j is an exit reachable from y_j.

Sample Input 1

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

Sample Output 1

```
2
2
1
4
```

Sample Input 2

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

Sample Output 2

```
4
1
2
```