IOITC 2020 Day 2

Pairing Trees

You have a tree with N vertices labelled 1 to N, where N is an even integer. Additionally, there are $N/2$ pairs $(A[1], B[1]), (A[2], B[2]), \cdots, (A[N/2], B[N/2])$ such that each vertex appears in exactly one pair. You are allowed to perform the following operations.

- **Type 1:** Pick an i such that $1 \leq i \leq N/2$ and swap $A[i], B[i]$.
- **Type 2:** Pick i and j such that $1 \leq i < j \leq N/2$ such that the shortest path from $A[i]$ to $B[i]$ does not have any common vertices with the shortest path from $A[j]$ to $B[j]$. Swap $A[i], A[j]$.

A state is called *terminal* if no type 2 operations can be performed from that state. It can be shown that a terminal state always exists, and can be obtained from any initial state using the given operations. You want to reach a terminal state using these operations. Since you don't like the number 2, you want to use as few type 2 operations as possible.

Print the smallest number of type 2 operations required to reach a terminal state. You can perform as many type 1 operations as you like.

Input

- The first line contains N, the number of nodes in the tree.
- Each of the following $N-1$ lines contains two positive integers, the labels of the nodes connected with an edge.
- The i^{th} of the next $N/2$ lines contains the integers $A[i]$ and $B[i]$.

Output

Print the minimum number of type 2 operations required to reach a terminal state.

Test Data

It is guaranteed that each integer from 1 to N appears in exactly one pair. In all subtasks, $2 \leq N \leq 200000$.

- **Subtask 1 (19 points):** $N \leq 16$
- **Subtask 2 (24 points):** $N \leq 1000$ and it is guaranteed that the answer is ≤ 2
- **Subtask 3 (57 points):** No additional constraints.

Sample Input

```
6
1 2
1 3
2 4
3 5
1 6
1 6
2 4
3 5
```

Sample Output

```
1
```

Explanation

The pairs are $(1, 6), (2, 4), (3, 5)$. An optimal solution is as follows:

- Swap $A[2], A[3]$. This is possible because the shortest path between $A[2], B[2]$ has no common vertex with the shortest path between $A[3], B[3]$.

After this the pairs are $(1, 6), (3, 4), (2, 5)$. It is easy to see that this is a terminal state.

Limits

Time: 3 seconds

Memory: 512 MB