F - Sum of Mex

Editorial (/contests/abc438/tasks/abc438_f/editorial)

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Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 525 points

Problem Statement

You are given a tree T with N vertices. The vertices are numbered from 0 to $N-1$, and the i-th edge $(1 \leq i \leq N-1)$ bidirectionally connects vertices u_i and v_i. (Note that vertex numbers are 0-indexed and edge numbers are 1-indexed.)

For a pair of integers (i, j) where $0 \leq i, j < N$, define $f(i, j)$ as follows:

- The vertex number of the vertex with the smallest number among the vertices **not included** in the path from vertex i to vertex j in tree T.
  - Here, if the path from vertex i to vertex j includes all vertices from vertex 0 to vertex $N-1$, let $f(i, j) = N$.

Note that the path from vertex i to vertex j in tree T includes vertices i and j.

Find the value of $\displaystyle\sum_{0 \leq i \leq j < N} f(i, j)$.

Constraints

- $2 \leq N \leq 2 \times 10^5$
- $0 \leq u_i < v_i < N$
- The graph given in the input is a tree.
- All input values are integers.

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Input

The input is given from Standard Input in the following format:

$$
\begin{array}{ll}
N & \\
u_1 & v_1 \\
u_2 & v_2 \\
\vdots & \\
u_{N-1} & v_{N-1}
\end{array}
$$

Output

Output the value of $\sum_{0 \leq i \leq j < N} f(i, j)$.

Sample Input 1 Copy

```
2
0 1
```

Copy

Sample Output 1 Copy

```
3
```

Copy

We have $f(0, 0) = 1$, $f(0, 1) = 2$, $f(1, 1) = 0$. Thus, output $1 + 2 + 0 = 3$.

Sample Input 2 Copy

```
5
0 1
0 2
2 3
2 4
```

Copy

Sample Output 2 Copy

```
16
```

Copy

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Sample Input 3 Copy

```
7
1 4
2 6
0 5
0 3
2 5
1 5
```

Sample Output 3 Copy

```
16
```

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