12 Expected Inversions

12.1 Problem Description

For an integer sequence $a_1, ..., a_n$ of length n, its inversion number $\text{inv}(a)$ is defined as the number of integer pairs (i, j) such that $1 \le i < j \le n$ and $a_i > a_j$.

For a given rooted tree of n nodes (with vertices numbered from 1 to n), a **DFS procedure** on the tree is as following.

- During the process, we maintain a **current vertex**, namely u, and a **set of visited vertices**, namely M.

- Let the root of the tree be x. Initially, $u = x$ and $M = \{x\}$.

- Repeat the following process until M contains all vertices:

- - If there is at least one child vertex of u that is not in M, randomly choose one among those vertices equiprobably (namely v). Set u to v and add v to M.

- Otherwise, set u to the father of u.

For each $u = 1, ..., n$, we record the number of vertices in M when u is added to M (including u). Let this number be d_u. We call $(d_1, d_2, ..., d_n)$ a **DFS order**. As **DFS procedure** is non-deterministic, the resulting **DFS order** may vary as well. Assume that each decision in the **DFS procedure** is independent.

You are given an unrooted tree of n vertices, with vertices numbered from 1 to n. For each $i = 1, ..., n$, compute the expected inversion number of the **DFS order** when rooting the tree at i and start a **DFS procedure**. To avoid precision errors, print the answer modulo 998244353.

You are given T independent test cases. Solve each of them.

How to compute non-integers modulo 998244353: It can be proved that the answer to this problem can always be written as a fraction P/Q with P, Q being integers and $Q \not\equiv 0 \pmod{998244353}$. There is exactly one integer $R \in [0, 998244353)$ that satisfies $QR \equiv P \pmod{998244353}$. Print this R as the answer.

12.2 Input

The first line of input contains a single integer $T(1 \le T \le 10)$, indicating the number of test cases. Then T test cases follow.

The first line of each test case contains a single integer $n(1 \le n \le 10^5)$, indicating the number of vertices in the tree. Each of the next $n - 1$ lines contains two integers $u, v(1 \le u, v \le n)$, indicating an edge on the tree. It is guaranteed that the input edges form a tree.

12.3 Output

For each test case, print the answers in n lines. The i-th line should contain the expected inversion number of the **DFS order** when rooting the tree at vertex i.

12.4 Sample Input

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

12.5 Sample Output

```
499122177
1
2
```