

F. Shoo Shatters the Sunshine

time limit per test: 7 seconds

memory limit per test: 256 megabytes

You are given a tree with n vertices, where each vertex can be colored red, blue, or white. The *coolness* of a coloring is defined as the maximum distance* between a red and a blue vertex.

Formally, if we denote the color of the i -th vertex as c_i , the coolness of a coloring is $\max d(u, v)$ over all pairs of vertices $1 \leq u, v \leq n$ where c_u is red and c_v is blue. If there are no red or no blue vertices, the coolness is zero.

Your task is to calculate the sum of coolness over all 3^n possible colorings of the tree, modulo 998 244 353.

*The distance between two vertices a and b in a tree is equal to the number of edges on the unique simple path between vertex a and vertex b .

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \leq t \leq 50$). The description of the test cases follows.

The first line of each test case contains a single integer n ($2 \leq n \leq 3000$) — the number of vertices in the tree.

Each of the next $n - 1$ lines contains two integers u and v ($1 \leq u, v \leq n$) — the endpoints of the edges of the tree.

It is guaranteed that the given edges form a tree.

It is guaranteed that the sum of n over all test cases does not exceed 3000.

Output

For each test case, output the sum of coolness over all 3^n possible colorings of the tree, modulo 998 244 353.

Example

| input | Copy |
|--|------|
| <pre> 3 3 1 2 2 3 6 1 2 1 3 1 4 3 5 5 6 17 1 2 1 3 1 4 1 5 2 6 2 7 2 8 3 9 3 10 7 11 7 12 11 13 13 14 14 15 10 16 16 17 </pre> | |
| output | Copy |
| <pre> 18 1920 7855509 </pre> | |

Codeforces Round 1024 (Div. 1)

Finished

Practice



→ Virtual participation

Virtual contest is a way to take part in past contest, as close as possible to participation on time. It is supported only ICPC mode for virtual contests. If you've seen these problems, a virtual contest is not for you - solve these problems in the archive. If you just want to solve some problem from a contest, a virtual contest is not for you - solve this problem in the archive. Never use someone else's code, read the tutorials or communicate with other person during a virtual contest.

Start virtual contest

→ Clone Contest to Mashup

You can clone this contest to a mashup.

Clone Contest

→ Submit?

Language: GNU G++23 14.2 (64 bit, ms)

Choose file: Choose File No file chosen

Submit

→ Last submissions

| Submission | Time | Verdict |
|---------------------------|-------------------|------------------------|
| 321910773 | May/29/2025 13:36 | Accepted |
| 321902702 | May/29/2025 13:28 | Wrong answer on test 3 |

→ Problem tags

combinatorics dp trees *3300

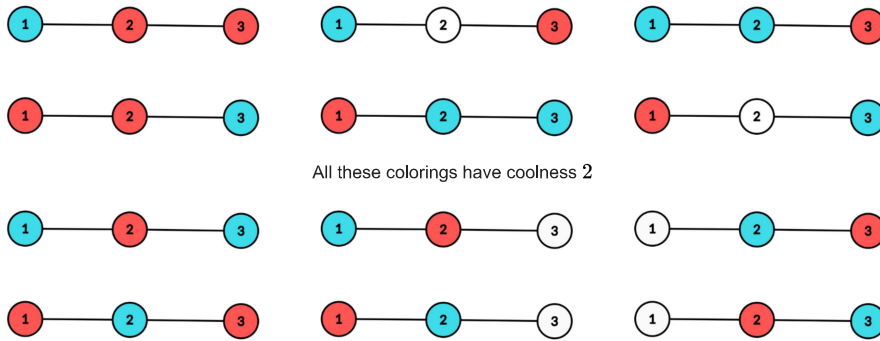
No tag edit access

→ Contest materials

- Announcement (en)
- Tutorial (en)

Note

In the first test case, there are 12 colorings that have at least one blue and one red node. The following pictures show their coloring and their coolness:



All these colorings have coolness 2

All these colorings have coolness 1

Therefore, the sum of coolness over all possible colorings is $6 \cdot 2 + 6 \cdot 1 = 18$.

In the second test case, the following are some examples of colorings with a coolness of 3:

