Problem
Social Network
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Input File: *sn.in*
Time Limit: *3 seconds.*

Raymond is a big data analyst. He builds a social network G from n persons numbered $1, 2, \ldots, n$. For two groups of people G_1 and G_2, he utilizes the following two rules for constructing the network:

Rule 1: If there are two persons $p_1 \in G_1$ and $p_2 \in G_2$ have a common interest, then G_1 and G_2 can be merged into one group by connecting every person in G_1 to all the persons in G_2. This construction is called the *join* operation, denoted by $G_1 \bigotimes G_2$. For each person $p_1 \in G_1$ and $p_2 \in G_2$, we say that p_1 and p_2 have a connecting relation after applying Rule 1.

Rule 2: If any two persons, one from G_1 and the other from G_2, have no common interest, then no connection can be made between persons in G_1 and G_2. This construction is called the *union* operation, denoted by $G_1 \bigcup G_2$.

According to the above two rules, Raymond can build a social network using the following recursive manner:

(1) A social network can contain only one person.

(2) If G_1 and G_2 are social networks, then $G = G_1 \bigotimes G_2$ is a social network;

(3) If G_1 and G_2 are social networks, then $G = G_1 \bigcup G_2$ is a social network.

For ease of input description, we use "J" to represent the join operation $\bigotimes$, and use "U" to represent the union operation $\bigcup$. A social network can be represented by a construction expression. For example, consider the following construction expression

$$((((1)\text{J}(2))\text{U}((3)\text{U}(4)))\text{J}(5))\text{J}((((6)\text{J}(7))\text{U}((8)\text{U}(9)))\text{J}(10)).$$

The corresponding social network can be constructed as follows. Step 1: build $G_1 = (1)\text{J}(2)$ and $G_2 = (3)\text{U}(4)$ (Figure 1(a) and (b)); Step 2: build

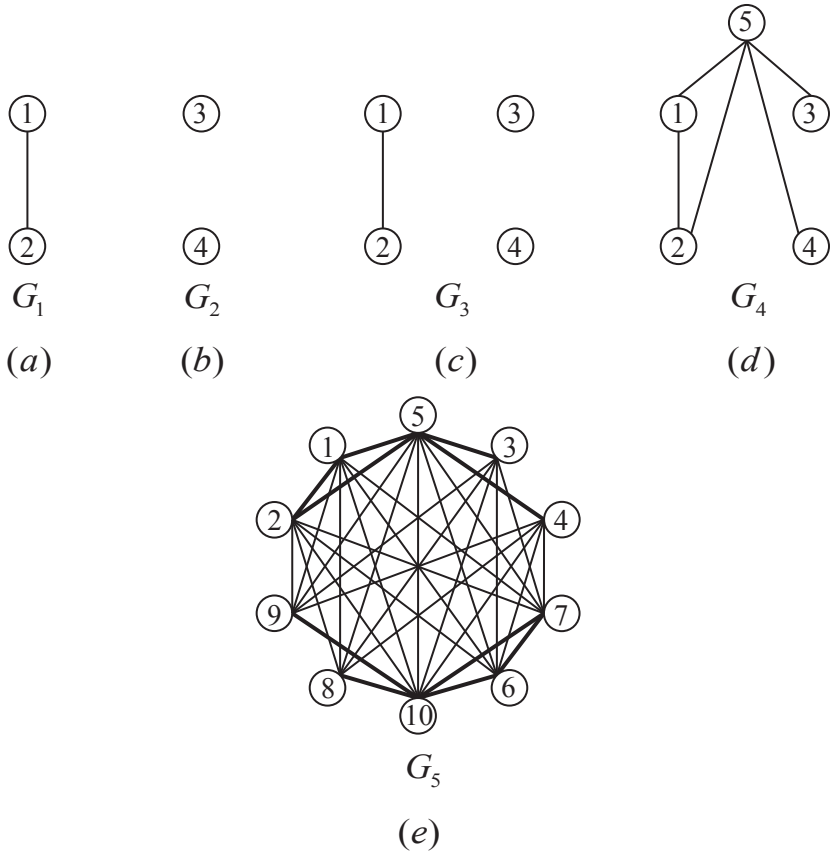

Figure 1: The construction of a social network

$G_3 = (G_1)\mathrm{U}(G_2)$ (Figure 1(c)); Step 3: build $G_4 = (G_3)\mathrm{J}(5)$ (Figure 1(d)). Step 4: build $G'_4 = (((6)\mathrm{J}(7))\mathrm{U}((8)\mathrm{U}(9)))\mathrm{J}(10)$, where G'_4 has same structure with that of G_4. Step 5: build $G_5 = (G_4)\mathrm{J}(G'_4)$ (Figure 1(e)).

After building the network, Raymond would like to assign all the persons in the network to nature numbers (this weighting is used for some special survey). For each person i, we use $r(i)$ to denote the number assigned to i. The assignment must satisfy the following property that for **every** path between two persons, i and j, having the same number (i.e., $r(i) = r(j)$) in the network, there exists at least one person k (on that path) whose number is higher than $r(i)$ $(=j)$, that is $r(k) > r(i) = r(j)$. An assignment is *optimal* if the largest used number is the smallest among all assignments. Moreover, the largest used number in an optimal assignment is called the *assignment*

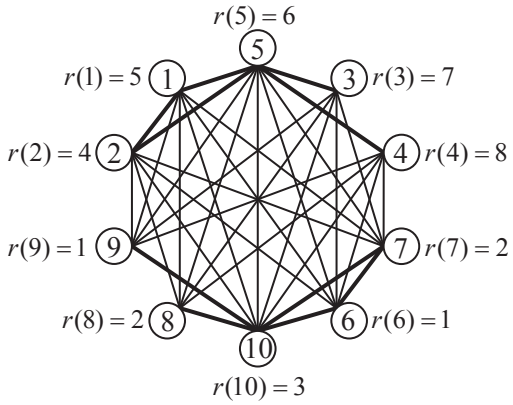

Figure 2: An optimal assignment of a social network

number. Figure 2 illustrates an optimal ranking of the social network shown in Figure 1(e). The assignment number equals 8.

Given a construction expression corresponding social network G, your task is to write a computer program to compute the assignment number of G.

Technical Specification

1. For ease of input, we use J to represent the join operation $\otimes$, and use U to represent the union operation $\bigcup$.
2. $2 \leq n \leq 10000$.
3. $0 \leq$ the number of connecting relations $\leq \frac{n(n-1)}{2}$.
4. The number of operation equals to exactly $n-1$, which builds n persons into one social network.

Input File Format

The first line of the input file contains an integer indicating the number of test cases to follow. The input consists of a number of test cases. Each test

case consists of two lines: the first line contains n and the second line contains a construction expression, where the construction expression consists of digits, alphabets J and U, and parentheses indicating the order of construction. Moreover, the expression will be in the form: *Exp*= (*Exp*)J(*Exp*) or *Exp*= (*Exp*)U(*Exp*), which implies that the most outer part of construction expression will not enclosed by redundant parentheses.

Output Format

The output contains one line for each test case. Each line contains the assignment number of the corresponding social network.

Sample Input

2
10
((((1)J(2))U((3)U(4)))J(5))J((((6)J(7))U((8)U(9)))J(10))
10
((((1)J(2))J((3)J(4)))J(5))J((((6)J(7))J((8)J(9)))J(10))

Output for the Sample Input

8
10