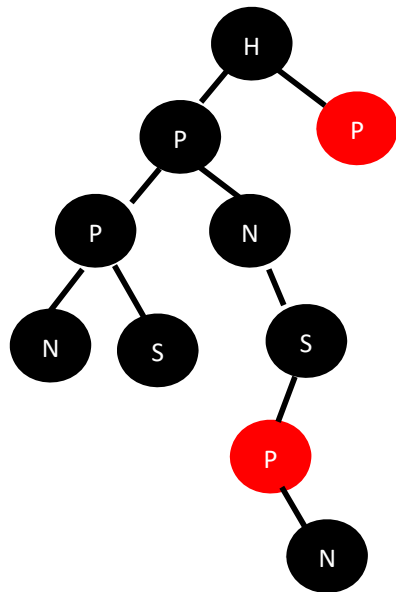


Finding People Breaking Mobility-Restriction Rules

Due to the Covid-19 pandemic, the government has declared that people can only move from home (H) to shops (S) today. Policemen are investigating your building, and have created a map of your neighborhood. This map has the form of a binary tree, in which the root is always the home (H) of investigated people. "P" represents the people in any other node. "S" represents the shops, and "N" represents nothing. The connections among tree nodes are the roads between places.

A person is breaking the law if they are in a position that is not in any path from home (H) to any shop (S).

For example, in the following binary tree:



Only the red nodes are the people that are breaking the mobility-restriction rules, since they are not in the way from home to any shop. The other people of the tree are not breaking the rules.

Implement an **efficient** program in C++ that receives input from a binary tree of characters and returns the number of people that are breaking the mobility-restriction rules.

In the presented binary tree example, this program should return 2 as there two people breaking the rules.

Indicate and discuss the **computational complexity** of your proposed solution inside a comment before the implementation of the function.

Input

The first line will indicate the number of cases. Each case will be defined with a line, which respectively includes a binary tree of characters.

Each binary tree is represented with a string recursively, in which:

- # represents an empty tree
- [c] represents a tree with just one element on the root with the "c" character

- (left n right) represents a tree with “c” characters as root element, the left subtree represented by “left” recursively and the right subtree represented by “right” recursively.

The presented binary tree example is represented as follows with this notation:

```
((([N] P [S]) P (# N ((# P [N]) S #))) H [P])
```

Output

The output of each case should be printed in one line. The output of each case will be the number of people breaking mobility-restriction rules.

Implementation Details

In the virtual campus, there is some supporting material for helping you in reading binary trees of integers from the standard input. You should adapt this supporting material for reading trees of characters.

Example of input

```
4
((([N] P [S]) P (# N ((# P [N]) S #))) H [P])
#
(((([S] P #) P #) P #) H #)
((((([P] P #) P #) S #) P #) H #)
```

Example of output

```
2
0
0
3
```