2026/2027 SOUTHERN CALIFORNIA REGIONAL INTERNATIONAL COLLEGIATE PROGRAMMING CONTEST

Problem 3
Lots of Infuriating Spurious Parentheses

You are coding in your favorite parenthetical language. The language consists of expressions, or sequences of parentheses, which are groups of "(" and ")" characters that are *balanced*. An expression B is *balanced* if it consists of zero or more balanced expressions concatenated together, or if it has the form (C), where C is a balanced expression.

You are typing a lot of these parenthetical expressions into your code editor, which comes with a fully functioning *linter*. The linter is a piece of software that aims to style and format your code neatly. For example, a very common linter will automatically indent lines of code to make it more readable. In this language, the linter knows how to remove redundant parentheses.

Redundant parentheses are the outer pair of parentheses when you have a (potentially empty) expression E that is wrapped by two pairs of consecutive parentheses: $((E))$. Redundant parentheses do not need to only be the first and last character. For example, the expression $()(())()$ has a pair of redundant parentheses.

Every pair of redundant parentheses will be removed by the linter. Some example expressions are shown after the linter has been applied.

- $(((()(())))) \rightarrow (()())$ after removing 2 pairs of parentheses
- $((((())))) \rightarrow ()$ after removing 3 pairs of parentheses
- $(()(()(()))) \rightarrow (()(()(())))$ after removing 0 pairs of parentheses

You have stumbled upon N parenthetical fragments, which are series of "(" and ")" characters that may or may not be balanced. You want to concatenate every ordered pair of fragments together (including a fragment with itself), and for every concatenation that forms a valid balanced expression, determine how many pairs of parenthesis the linter will remove.

The first line of input contains one integer N ($1 \leq N \leq 10^5$), representing the total number of fragments.

The next N lines of input contains a string s_i representing the i-th fragment. It is guaranteed that s_i only consists of "(" and ")" and the sum of characters does not exceed 10^6, that is to say $\sum_{i=1}^{N} |s_i| \leq 10^6$.

Let $r_{i,j}$ be the number of pairs of redundant parentheses that are removed when string i is concatenated to string j. Determine and print the sum of $r_{i,j}$ across all $1 \leq i, j \leq N$.

Sample Input 1

```
3
((
))
()))
```

Output for Sample Input 1

```
3
```

Problem 3
Lots of Infuriating Spurious Parentheses (continued)

Sample Input 2

```
2
(())
(())
```

Output for Sample Input 2

```
8
```