DMPG '19 S3 - Chemical Counting Capers

Time limit: 1.0s **Memory limit:** 128M

A **chemical formula** is a way of presenting information about the elements present in a molecule. Each distinct element in the formula is uniquely represented by a **symbol**, a string consisting either of one uppercase English letter or one uppercase followed by one lowercase English letter. There are three types of **components** that may be present in a chemical formula:

- `E n`, a valid symbol followed by a positive integer no greater than 10^9.
- `(`, an opening parenthesis.
- `) n`, a closing parenthesis followed by a positive integer no greater than 10^9.

A chemical formula X is valid if and only if:

- $X =$ `E n`, indicating that there are `n` atoms of the element represented by `E`.
- $X =$ `( A ) n`, where `A` is a valid chemical formula, indicating that the number of atoms of each element in `A` must be multiplied by `n`.
- $X =$ `A B`, where `A` and `B` are valid chemical formulas. The number of atoms of each element `E` in X equals the number of atoms of `E` in `A` plus the number of atoms of `E` in `B`.

Dr. Henri is observing a chemical formula made of N components and wants to know the number of atoms of each element present in it. Since these numbers may be very large, he would like to know their values mod $10^9 + 7$. Can you help him?

Constraints

Subtask 1 [50%]

$1 \leq N \leq 1\,000$

Subtask 2 [50%]

$1 \leq N \leq 1\,000\,000$

Input Specification

The first line contains one integer, N.
The second line contains a valid chemical formula consisting of N space-separated components.

Output Specification

Output K lines, where K is the number of distinct elements present in the formula. Each line should be of the form `a b`, where `a` is the symbol of the element and `b` is the number of atoms of that element mod $10^9 + 7$. Please output the symbols in **lexicographically increasing order**.

Sample Input 1

```
4
( C 1 Cl 4 ) 2
```

Sample Output 1

```
C 2
Cl 8
```

Sample Input 2

```
8
( Co 1 ( N 1 H 3 ) 6 ) 2 Cl 3
```

Sample Output 2

```
Cl 3
Co 2
H 36
N 12
```