

Problem 11 : Enumerating strings

Introduction

Let $\Sigma = \{a, b\}$. Let Σ^* be the set of all finite length strings that can be formed using a, b . A language L over the set Σ is a subset of Σ^* (i.e. $L \subset \Sigma^*$). A *regular expression* over Σ is defined inductively as follows:

- ϕ is a regular expression representing the set of the empty strings;
- ϵ is a regular expression representing the set consisting of the empty string (i.e. string of length 0) ϵ ;
- for each $a \in \Sigma$, a is a regular expression representing the set $\{a\}$;
- If α and β are regular expressions representing the sets A and B , then
 1. $\alpha + \beta$ is a regular expression representing $A \cup B$,
 2. $\alpha\beta$ is a regular expression representing the language $AB = \{xy : x \in A, y \in B\}$.
 3. α^* is a regular expression representing $A^* = \bigcup_{i=0}^{\infty} A^i$, where $A^0 = \{\epsilon\}$ and $A^{i+1} = A^i A$ for $i \geq 0$.

For example, the regular expression $(a + b)^*$ represents Σ^* , and the regular expression $ab(a + b)$ represents the language $\{aba, abb\}$.

Problem

Given a regular expression which does not have any occurrence of ϕ or ϵ in it, and a number k , you have to output the first k non-empty strings of the language represented by the regular expression. The strings in the language are assumed to be ordered first by length, and the strings of same length are ordered lexicographically (i.e. in a dictionary order). If the number of strings in the language is finite, say n , and $n \leq k$ then print all the n strings in this order.

The grammar of the regular expression is:

$$S \rightarrow a \mid b \mid (S) \mid S^* \mid SS \mid S + S$$

The precedence of the operators is assumed to be this: $*$ $+$ $()$ concatenation. There will be no whitespace in the input regular expression string.

Input

The input will consist of several test cases. Each case appears on a single line. Each line will first have a regular expression, and then a number k separated by a blank line. The input will be terminated by the string 0 on a single line. The length of the string containing the regular expression (including brackets and stars) will be at most 10.

Output

For each case, you have to print the first k strings of the language represented by the regular expression, each string appearing on a single line. There should be no blank line in the output.

Sample Input

```
(a+b)* 6  
ab(a+b) 4  
0
```

Sample Output

```
a  
b  
aa  
ab  
ba  
bb  
aba  
abb
```