

Southeastern European Regional Programming Contest
Bucharest, Romania
October 18, 2014

Problem G
Grammar

Input File: G.in
Output File: standard output
Program Source File: G.c, G.cpp, G.java

Bob is one of the best students of the Formal Languages class. Now he is learning about context free grammars in the Chomsky Normal Form (CNF). Such a grammar consists of:

- a set of nonterminal symbols N
- a set of terminal symbols T
- a special nonterminal symbol, called the start symbol S
- a set R of rules of the form $A \to BC$ or $A \to a$, where A, B, $C \in N$, $a \in T$.

If $A \in N$, we define $L(A)$, the language generated by A, as follows:

$$L(A) = \{ wz \mid w \in L(B), z \in L(C), \text{where } A \to BC \in R \} \cup \{ a \mid A \to a \in R \}.$$

The language generated by the grammar with start symbol S is defined to be $L(S)$.
Bob must solve the following problem: for a given context free grammar in CNF, on input string x, determine whether x is in the language generated by the grammar, L(S).

The program input is from a text file. It starts with the input string `x (|x|<=1000)`. Follows the grammar rules, in the form `ABC` or `Aa`, each on a separate line. We consider that the start symbol is always `S`. The program prints `1` if the string is in the language generated by the grammar, `0` otherwise.

The input data are correct and terminate with an end of file. The program prints the result to the standard output from the beginning of a line.

Input/output samples are given in the table below. There are three tests. The first two use the same grammar: `SAB`, `Sa`, `Ab` ($S \to AB$, $S \to a$, $A \to b$). For the first test the input string is `a`, and the result is `1`, while for the second test the input string is `ab` and the result is `0`.

Sample input	Sample output
a **SAB** **Sa** **Ab**	**1**
ab **SAB** **Sa** **Ab**	**0**
ab **SAB** **Sa** **Ab** **Ba**	**0**