Problem H

Basic Tautologies

Time Limit: 1 second

Let ***A*** := {=, -, a, b, c, . . . , z, A, B, C, . . . , Z}.

We assume that ***** represent the operation of concatenation between strings.

We define the set of formulas over ***A*** recursively as follows:

- If ***X*** belongs to ***A*** \ {=, -} then ***X*** is formula (variable).
- IF ***X*** is a formula, so is ***X****-.
- If ***X*** and ***Y*** are formulas, so is: ***X*******Y****=.

These formulas are understood as logical formulas with connectives - for negation, = for equivalence and ***A*** \ {=, -} as variables. That is = and - are not variables. Also, variables ***a*** and ***A*** are considered different. Similarly ***b*** is different to ***B*** and so on.

Of course our formulas are given in Reverse Polish Notation (RPN). We can evaluate a formula for a given boolean input {0, 1} and the output is either 0 or 1 as usual.

A formula is a tautology if it evaluates to 1 for every input. For example aa= is a tautology while aa=- is not. Note that aa= represents the formula a=a in the standard infix notation and aa=- represents the formula -[a=a].

Input

The first line is a natural number ***N*** less than 100. Then, there are ***N*** lines, each one is a string over ***A***. Every string is of size less than 200 characters.

Output

You must display ***N*** lines, each one with 3 possible answers: incorrect, tautology or formula. Answer number i gives the output of string number i. The output is "incorrect" if the input string is not a formula. The output is "formula" if the input string is a formula that is not a tautology. The output is "tautology" if the input string is a formula that is a tautology.

Sample Input	Sample Output
3 aa= aa=- ab	tautology formula incorrect

Note:

Perhaps some students have no idea on how to evaluate a formula in RPN form. However I assume that she/he knows how to do it in the standard form, hence I need only to describe how to convert a RPN formula into a standard infix form. We define **f**(***X***) the translation of a RPN formula ***X*** by recursion as follows:

We assume that ***X***, ***Y***, ***Z*** represent formulas.

1. If ***X*** is a variable then **f**(***X***) := ***X***.
2. If ***X*** is of the form ***Y****- then **f**(***X***) := [*-***f**(***Y***)*].
3. If ***X*** is of the form ***Y*******Z****= then **f**(***X***) := [***f**(***Y***)*=***f**(***Z***)*].

where [and] are parenthesis symbols (not needed in a RPN formula).

Just in case, I include the truth tables for = and -.

The truth table for = is:

A	B	A=B
0	0	1
0	1	0
1	0	0
1	1	1

The truth table for - is:

A	-A
0	1
1	0

Good luck!

Problemsetter: Dr. Mauricio Javier Osorio Galindo