

10847 Basic Tautologies

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

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 $A \setminus \{=, -\}$ 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 $A \setminus \{=, -\}$ 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.

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 \neg is:

A	$\neg A$
0	1
1	0

Good luck!

Sample Input

```
3
aa=
aa=-
ab
```

Sample Output

```
tautology
formula
incorrect
```