7758 Lost Logic

Gustav is reading about 2-*satisfiability*, a well known problem of assigning truth values to boolean variables in order to satisfy a list of *constraints* — simple logical formulas involving two variables each.

We are using n variables $x_1, x_2, \ldots, x_n$ that can take on values "0" (false) and "1" (true). A constraint is a formula of the form $a \rightarrow b$ where both a and b are possibly negated variables. As usual, $\rightarrow$ denotes logical implication: $a \rightarrow b$ is 0 only when a is 1 and b is 0. The negation of variable a is denoted by "!a".

Given an assignment of values to variables, we say that the constraint is *satisfied* if it evaluates to 1. Gustav has constructed a list of constraints and correctly concluded that there are *exactly three* different assignments of values to variables that satisfy all the constraints. Gustav has wrote down all three assignments but has, unfortunately, lost the list of constraints.

Given three assignments of n values to variables, find any list consisting of at most 500 constrains such that the three given assignments are the *only* assignments that satisfy all the constraints.

Input

The input file contains several test cases, each of them as described below.

The first line contains an integer n $(2 \leq n \leq 50)$ — the number of variables. Three lines follow, each describing one assignment. The k-th line contains n space-separated integers $v_1^k, v_2^k, \ldots, v_n^k$, where each v_i^k is either '0' or '1' and denotes the value of the variable x_i in the k-th assignment. All three assignments will be different.

Output

For each test case, the output must follow the description below.

If there is no solution output a single line containing the integer '-1'.

Otherwise, the first line should contain an integer m where $1 \leq m \leq 500$ — the number of constraints in your solution. The k-th of the following m lines should contain the k-th constraint. Each constraint should be a string constructed according to the following rules:

- A *variable* is a string of the form 'xi' where i is an integer between 1 and n inclusive written without leading zeros.
- A *literal* is a string consisting of a variable possibly preceded by the '!' character.
- A *constraint* is a string of the form 'a -> b' where both a and b are literals. The implication sign consists of the "minus" character and the "greater-than" character and there is a single space character both before and after the implication sign.

Sample Input

```
3
0 0 0
0 1 0
1 0 0
4
0 0 1 0
1 0 0 0
```

```
1 0 1 1
```

Sample Output

```
3
x1 -> !x2
x3 -> x1
x3 -> x2
-1
```