Problem 1 (4%) System of Linear Equations $A \cdot \vec{x} = \vec{b}$

Your task in this problem is to solve a given system of linear equations.

For example, let x, y, and z be the set of variables. The system

$$\begin{cases} x + y = 3 \\ y + z = 4 \\ x + y + z = 1 \end{cases} \quad \text{has a unique solution} \quad \begin{cases} x = -3 \\ y = 6 \\ z = -2 \end{cases},$$

the system

$$\begin{cases} x + y = 3 \\ y + z = 4 \end{cases} \quad \text{has an infinite number of solutions} \quad \begin{cases} x = z - 1 \\ y = 4 - z \\ z \in \mathbb{R} \end{cases},$$

and the system

$$\begin{cases} x + y = 3 \\ y + z = 4 \\ x - z = 2 \end{cases} \quad \text{has no feasible solution at all.}$$

Input

The first line contains an integer n, ($1 \leq n \leq 100$), the number of variables in the system.
The second line contains n strings $s_1, s_2, \ldots, s_n$, $1 \leq |s_i| \leq 10$, the set of variables.
It is guaranteed that the variables contain only lower-case letters.

The third line contains an integer m, ($1 \leq m \leq 500$), the number of equations in the system. Then m lines follow, each of which describes an equation in the system. Each of the lines begins with an integer k, the number of literals in the equation (項數), followed by k strings each of the following format:

`%d%s`

which denotes a variable (string) and its coefficient (int).
For example, the line

```
4 -2x 1y -4x 6
```

describes the equation:

```
-2x + y -4x + 6 = 0.
```

Note that a variable could appear multiple times in the description. However, it is guaranteed that the descriptions will be valid.

Output

In the first line, output the type of the linear system.
If it has a unique solution, print the string "UNIQUE". If it has infinite number of solutions, print the string "INFINITE". If it has no feasible solutions at all, print the string "INFEASIBLE".

If the system has feasible solutions, describe them in the next n lines, one line for each variable. Each of these lines should start with a string s, the variable to describe. If it can be any real value, i.e., $\mathbb{R}$, append a string "free" and end the line.
Otherwise, it should then contain an integer k, the number of literals. Then k strings follows in the same line, each of the following format:

```
%d%s
```

which is the variable and its coefficient. Note that, only free variable and constant can appear in the description, and each variable can appear at most once. Each description can contain at most one constant.
For example, the line

```
x 1 -3
```

describes that

```
x = -3.
```

The two lines

```
x free
y 2 1x -1
```

describes that

$$\begin{cases} x \in \mathbb{R} \\ y = x - 1 \end{cases}$$

The relative error of your output should not exceed 10^{-6}.

See the next page for sample inputs and outputs.

Example

Sample Input 1

```
3
x y z
3
3 1x 1y -3
3 1y 1z -4
4 1x 1y 1z -1
```

Sample Output 1

```
UNIQUE
x 1 -3
y 1 6
z 1 -2
```

Sample Input 2

```
3
x y z
2
3 1x 1y -3
3 1y 1z -4
```

Sample Output 2

```
INFINITE
x 2 1z -1
y 2 4 -1z
z free
```

Sample Input 3

```
3
x y z
3
3 1x 1y -3
3 1y 1z -4
3 1x -1z -2
```

Sample Output 3

```
INFEASIBLE
```

Note

You should use `double` floating points to ensure low relative error of the output. When using floating points, the equality operator `'=='` no longer promises correct result, and you need to use "low absolute difference principle" instead.