

Problem C

Erdős Numbers

Source: erdos.(c|cc|pas|java)

Input: erdos.in

The Hungarian Paul Erdős (1913–1996, pronounced as “Ar-dish”) was not only one of the strangest mathematicians of the 20th century, he was also among the most famous ones. He kept on publishing widely circulated papers up to a very high age, and every mathematician having the honor of being a co-author to Erdős is well respected.

Not everybody got a chance to co-author a paper with Erdős, so many people were content if they managed to publish a paper with somebody who had published a paper with Erdős. This gave rise to the so-called *Erdős numbers*. An author who has jointly published with Erdős had Erdős number 1. An author who had not published with Erdős but with somebody with Erdős number 1 obtained Erdős number 2, and so on. Today, nearly everybody wants to know what Erdős number he or she has. Your task is to write a program that computes Erdős numbers for a given set of scientists.

Input

The input file contains a sequence of scenarios, each scenario consisting of a paper database and a list of names. A scenario begins with the line “ p n ”, where p and n are natural numbers with $1 \leq p \leq 32000$, $1 \leq n \leq 3000$. Following this line are p lines containing descriptions of papers (this is the paper database). A paper is described by a line of the following form:

LastName1, FirstName1, LastName2, Firstname2, . . . : TitleOfThePaper

The names and the title may contain any ASCII characters between 32 and 126 except commas and colons. There will always be exactly one space character following each comma. The first name may be abbreviated, but the same name will always be written in the same way. In particular, Erdős’ name is always written as “Erdos, P.”. (Umlauts like ‘ö’, ‘ä’, . . . are simply written as ‘o’, ‘a’, . . .)

Example:

```
Smith, M.N., Martin, G., Erdos, P.: Newtonian forms of prime factors  
matrices.
```

After the p papers follow n lines each containing exactly one name in the same format as in the paper database.

The line ‘0 0’ terminates the input.

No name will consist of more than 40 characters. No line in the input file contains more than 250 characters. In each scenario there will be at most 10 000 different authors.

Output

For every scenario first print the number of the scenario in the format shown in the sample output. Then print for every author name in the list of names their Erdős number based on the papers in the paper database of the scenario. The authors should be output in the order given in the input file. Authors that do not have any relation to Erdős via the papers have Erdős number *infinity*. Adhere to the format shown in the sample output.

Sample Input

```
2 2
Smith, M.N., Martin, G., Erdos, P.: Newtonian forms of prime factors matrices.
Gardner, M., Martin, G.: Commuting Names
Smith, M.N.
Gardner, M.
0 0
```

Sample Output

```
Database #1
Smith, M.N.: 1
Gardner, M.: 2
```