

## PhD Pairings

You are a graduate admissions officer for a large university to which a number of prospective PhD students have applied and been accepted. As part of the PhD program, every student is strongly encouraged to participate in research through an on-campus research lab. Due to personal interest, each applicant has a ranking of which labs they would like to join. Similarly, each lab has a ranking of students that they would prefer to take, based on their prior experience in this research area. However, because of funding disparities and turnover, some labs are able to take on a large number of graduates, while others are more limited in their open spots. In addition, there is another catch. Not every student is a match for every lab. Some laboratories may not be willing to accept a student because they lack the relevant expertise needed to contribute. Likewise, some students may not be interested in joining a particular lab and prefer exploring other options.

Thus, you have been tasked with matching up each of these accepted students to a research lab. You must also ensure that no pair of applicants and labs exists where the applicant prefers the new lab over their current lab, and the lab prefers the new applicant over one of their current ones, as this would lead to arguments between lab groups. If a viable matching of candidates to labs exists, you will report the optimal matching for research labs, that is, the matching that best adheres to each lab's ranking of applicants. If no such matching of candidates to labs exists, you must report the unmatched lab slots back to your supervisor such that they can look for additional students.

## Input

The first line of input will contain the value  $1 \leq L < 10^3$ , the number of labs accepting students, and the second line will contain the value  $1 \leq S < 10^3$ , the number of accepted applicants. The following  $L$  lines will contain the name of the lab without spaces, followed by a number of students  $a > 0$  it can accept, followed by the number of  $n \geq a$  students it approves of taking, followed by its ranking of these  $n$  students' names from best to worst. The following  $S$  lines will contain the name of the student, followed by the number of labs  $m \geq 1$  they would approve of joining, followed by their ranking of these  $m$  labs' names from best to worst.

## Output

If a valid stable matching exists, output *True* followed by  $L$  lines containing the name of each lab and followed by the space-separated list of the applicants they will take. The names of the applicants should appear in order of that lab's ranking. If no valid matching exists, output *False* followed by a line for each unmatched lab with its name and number of open slots. The unmatched labs should be reported in the order which they were input in.

## Sample Input 1

```
3
5
BioCore 1 4 Emily Sara John Amy
DataWorks 2 3 Sara Michael Emily
RoboNet 2 2 John Amy
Emily 2 BioCore DataWorks
Michael 1 DataWorks
Sara 2 DataWorks RoboNet
John 2 BioCore RoboNet
Amy 3 DataWorks RoboNet BioCore
```

## Sample Output 1

True  
BioCore Emily  
DataWorks Sara Michael  
RoboNet John Amy

## Sample Input 2

3  
5  
BioCore 1 4 Emily Sara John Amy  
DataWorks 2 3 Sara Michael Emily  
RoboNet 2 2 John Sara  
Emily 2 BioCore DataWorks  
Michael 1 DataWorks  
Sara 2 DataWorks RoboNet  
John 2 BioCore RoboNet  
Amy 3 DataWorks RoboNet BioCore

## Sample Output 2

False  
RoboNet 1