

# Digest Recommendation

## Problem ID: digest

Quora's mission is to share and grow the world's knowledge. A vast amount of the knowledge that would be valuable to many people is currently only available to a few - either locked in people's heads, or only accessible to select groups. We want to connect the people who have knowledge to the people who need it, to bring together people with different perspectives so they can understand each other better, and to empower everyone to share their knowledge for the benefit of the rest of the world.

There's a lot of content on Quora and we need a way of recommending the top stories for a user. Recommender systems drive many features at Quora, but in this problem we'll focus on Digest recommendation. Quora Digests are emails which we send to users containing top recommended stories based on their interests.

Note: This is a fictitious representation of our Digest recommender system.

There are  $n$  stories ( $S_1, \dots, S_n$ ) and  $m$  users ( $U_1, \dots, U_m$ ). Each story is created by a single user. A user can follow both other users and other stories.

The Digest recommendation score for story  $S_k$  to user  $U_i$  is defined as follows:

- If  $U_i$  created or follows  $S_k$ , the score is  $-1$ .
- Otherwise, the score is

$$\sum_{j=1}^m a(U_i, U_j) \times b(U_j, S_k)$$

where

$$a(U_i, U_j) = \begin{cases} 0 & \text{if } i = j \\ \text{otherwise, } 3 & \text{if } U_i \text{ follows } U_j \\ \text{otherwise, } 2 & \text{if } U_i \text{ follows stories created by } U_j \\ \text{otherwise, } 1 & \text{if } U_i \text{ follows stories followed by } U_j \\ \text{otherwise, } 0 \end{cases}$$

$$b(U_j, S_k) = \begin{cases} 2 & \text{if } U_j \text{ created } S_k \\ \text{otherwise, } 1 & \text{if } U_j \text{ follows } S_k \\ \text{otherwise, } 0 \end{cases}$$

Given the stories, users, and their associations, find the top three recommended Digest stories for each user.

## Input

Your program will receive input from standard input.

The first line contains two space-separated positive integers  $n$  and  $m$ , representing the number of stories and the number of users.

The following  $n$  lines each contain a single integer. The  $k$ -th line contains an integer  $j$  indicating that  $U_j$  created  $S_k$ .

After that, there will be two integers  $p$  and  $q$ , representing the number of follows between users and the number of story follows.

The next  $p$  lines each contain two integers  $i$  and  $j$  representing that user  $U_i$  follows user  $U_j$ .

The final  $q$  lines each contain two integers  $i$  and  $k$  representing that user  $U_i$  follows story  $S_k$ .

## Output

Your program should write to standard output.

Print  $m$  lines. The  $i$ -th line should contain three integers representing the recommended stories for  $U_i$ . To select the stories to output, sort all the stories in non-increasing order by recommendation score, and in increasing order by story index among stories with the same score. Then, print the indexes of the first 3 stories in that order.

## Constraints

- $5 \leq n, m \leq 200$
- $0 \leq p \leq n^2 - n$
- $0 \leq q \leq nm$
- It is guaranteed that there will be at least 3 stories to recommend for each user.
- There will be no duplication on follow relations.
- When  $U_i$  created  $S_k$ , it is guaranteed that  $U_i$  does not follow  $S_k$ .

## Scoring

There are 25 test cases, each worth 4 points. Your submission score will be the sum of the points you get from each test case you pass.

### Sample Input 1

```
7 5
1
1
2
3
4
5
5
2 4
1 2
4 5
1 7
5 2
3 3
4 1
```

### Sample Output 1

```
3 6 4
1 2 4
1 2 5
7 2 6
1 3 4
```