

Extra Credit Problem

CSCI2100B Data Structures

February 19, 2013

1 Problem Description

One college of CUHK wants to set a new course for all the students in this college. In this course, students are required to be assigned into different groups. The college committee believe that increasing the diversity of each group can improve the effect of this course. Specifically, the criterion for group assignment are as follows:

1. The number of students between any two groups should be more or less the same;
2. For each group, they would like to have students from at least 2 different faculties and 3 departments;
3. The male/female ratio for each group should be more or less balance.

Now, the college committee have obtained the student list with all the information they need including student ID, name, gender, department, and faculty. A portion of this list is shown in Table 1. However, they do not know how to separate them in a proper way to increase the diversity as much as possible. Thus, they come to you for help.

ID	Name	Gender	Faculty	Department
1000000001	Teresa	F	Arts	CRS
1000000002	Peter	M	Engineering	CSE
1000000003	Tiffany	F	Social Science	GRM
1000000004	Robert	M	Medicine	CLO
1000000005	Derrick	M	Science	Physics
1000000006	Yang	F	Education	SPE

Your task is to separate all the student in the list into a pre-assigned number of groups with the diversity in each group as much as possible. **Please note that there is no unique arrangement to this problem. We will mark your algorithm according to the diversity of your result. The measurement of diversity is confidential.**

2 Input

The first line consists of three integers: N - total number of students, M - total number of faculties, T - total number of departments and P - the number of groups you should separate the students into. The following N lines describe the information of each student in each

line. The information includes student ID (string with length of 10), gender, faculty code and department code. For convenience, gender are labeled as 0 or 1 (0 denotes male and 1 denotes female), faculty code are labeled from 1 to M and department code are labeled from 1 to T .

3 Output

The output should have $4 \times P$ lines, where P is the number of groups mentioned in the input section. We use four consecutive lines to describe one group. For each group, you should output the following information in the corresponding line:

1. The total number of students (K) in this group, followed by the number of males (K_0) and females (K_1), please make sure that $K = K_0 + K_1$;
2. The total number of different faculties (N_f) in this group, followed by K faculty labels which students in this group belong to **in non-decreasing order**, please note that $N_f \leq K$;
3. The total number of different departments (N_d) in this group, followed by K department labels which students in this group belong to **in non-decreasing order**, please note that $N_d \leq K$ as well;
4. K student IDs of all the students in this group.

Please note that your output should be consistent for all groups. We will verify this.

4 Sample Input

```
20 5 10 4
1000000001 0 1 1
1000000002 0 1 1
1000000003 0 1 2
1000000004 0 1 2
1000000005 1 2 3
1000000006 1 2 3
1000000007 1 2 4
1000000008 1 2 4
1000000009 0 3 5
1000000010 0 3 5
1000000011 0 3 6
1000000012 0 3 6
1000000013 1 4 7
1000000014 1 4 7
1000000015 1 4 8
1000000016 1 4 8
1000000017 0 5 9
1000000018 0 5 9
1000000019 1 5 10
1000000020 1 5 10
```

5 Sample Output

```
5 3 2
5 1 2 3 4 5
5 1 3 5 7 9
1000000001 1000000005 1000000009 1000000013 1000000017
5 3 2
5 1 2 3 4 5
5 1 3 5 7 9
1000000002 1000000006 1000000010 1000000014 1000000018
5 2 3
5 1 2 3 4 5
5 2 4 6 8 10
1000000003 1000000007 1000000011 1000000015 1000000019
5 2 3
5 1 2 3 4 5
5 2 4 6 8 10
1000000004 1000000008 1000000012 1000000016 1000000020
```

Please note that it is just one of the solutions.

6 Hand-in

Please compress both your source code and brief algorithm specification (other related material if any) into an .rar file and send it to hyzhang@cse.cuhk.edu.hk. Your submission will be accepted until **the last day of this semester**. Of course, we encourage you to submit as early as possible and it is allowed to revise your algorithm after submission. Extra credit will only help you in borderline cases.

If you have any question about this specification, please feel free to contact hyzhang@cse.cuhk.edu.hk.