

# Introduction of Computer

## Homework 3 - Algorithms

Due 23:59, Apr 30, 2019

### Part A. Remainder (50%)

Design an efficient algorithm to find the remainder of  $k^N$  divided by  $m$  where  $N$  and  $m$  are very large integer.  $k$ ,  $N$ ,  $m$  are positive integers.

Write a program in C++, or Python3 (version  $\geq 3.5$ ) to solve the problem. We will execute your program with the command:

C++: `./a.out k N m`

Python3: `python3 remainder.py k N m`

Write in the file `remainder.(py/cpp)`. Finally, write a short report that describes your algorithm design and how to run your code.

Correct methods will get 40% credit. 10% for the merit of your algorithms.

### Part B. Admission List (50%)

A university has 10 departments with dept  $i$  to accept  $h(i)$  students. 10K students joined the exam. The exam includes scores on 3 subjects. For a score set  $g=(g_1, g_2, g_3)$ , the weighted score of dept  $i$  is  $s(i, g)$ . Every student has a preference list for depts. Design an algorithm such that each student is only admitted to a dept, and a student will be admitted to his  $j$ -th preferred dept only if those ranked before him have better weighted score for that dept than he.

Write a program in C++, or Python3 (version  $\geq 3.5$ ) to solve the problem. Given the information of students and departments, you should output the admission list. We will execute your program with the command:

C++: `./a.out student.csv dept.csv output.txt`

Python3: `python3 admit.pystudent.csv dept.csv output.txt`

where the 3 input arguments are :

`student.csv` : Each row represents a student. The first number is student ID; the following 3 integers are his/her subject scores  $g_1, g_2, g_3$ . The last 10 integers are the student's department preference order.

00001 70 80 90 9 1 2 3 4 5 6 7 8 10

00002 60 80 20 1 4 2 5 8 9 7 10 3 6

dept.csv : Each row represents a department. The first number is department ID; the following 3 numbers are the weights for 3 subject scores. The last number is the max number of students the department accept.

1 0.4 0.5 0.1 400

2 0.3 0.3 0.4 600

output.txt: In each row, the first number is student ID; the second one is the department ID which admits the student. If the student is not admitted by any dept, output -1. The number of rows in output.txt must match that in student.csv. TA provide an example\_output.txt, please follow the format.

00001 2

00002 -1

Design an algorithm for this problem. Write in the file admit.(py/cpp). Finally, write a short report that describes your algorithm design and how to run your code. Optical methods will get 40% credit. 10% for the merit of your algorithms.

### **Submission rules**

- Compress 2 code files and report.pdf into a zip file and upload to Ceiba.
- No Plagiarism.
- Accept late submission for 2 days after the deadline. Late submission penalty is 15 points per day.
- Wrong submitted format will get 10 points penalty.
- It is your responsibility to make sure the submission is completed. Showing an unsubmitted set of homework after the due date will not work.