

## Sec. B & C

### DAA Assignment 1 (Practice Only/Non-evaluative/No submissions)

An instructor of a course has given  $k$  assignments to students and each assignment has been diligently evaluated by a lazy TA, and the students are assigned marks. If a student was absent in a particular assignment, he/she is notionally given marks -1. Take the evaluation sheet of a course as an input, with details of  $n$  students, each student's details mentioning the roll number, name, and marks of  $k$  assignments for the student.

1. Sort the students as per the total average marks (total marks excluding assignments in which a student was absent / total number of assignments in which the student was present), given at each student attempts at least 1 assignment. Use quick sort. Write the complexity.
2. An instructor remembers the names of a few mischievous students and wishes to retrieve their records for reasons unsaid. Store the database as a hash-table, hashed by the student name using Hashing by Linear Probing. Print the details of the queried students. Write the complexity.
3. Now that the instructor does not get to see couples roaming this sacred campus, the instructor plays a boring game. A student  $X$  loves a student  $Y$  if the pattern of marks between  $X$  and  $Y$  are the same.

Let  $marks(X)=[x_1 x_2 x_3 \dots x_k]$  be the marks obtained by the student  $X$  in the  $k$  assignments. Let  $marks(Y)=[y_1 y_2 y_3 \dots y_k]$  be the marks obtained by the student  $Y$  in the  $k$  assignments. Let  $d(X,Y) = \sum_{i=1}^k \delta(x_i, y_i)$  be the distance function between students  $X$  and  $Y$ , where

$$\delta(x_i, y_i) = \begin{cases} 100 & \text{if } x_i = -1 \text{ or } y_i = -1 \\ x_i(x_i - y_i)^2 & \text{if } x_i \neq -1 \text{ and } y_i \neq -1 \end{cases}$$

A student  $X$  loves the student  $Y$  who has the least distance using  $d(X,Y)$  as the distance measure, out of all students in the database.

- i. Given the details of a (new) specific student  $X$ , search the database to locate the student  $Y$  whom the person  $X$  loves. Write the complexity.
- ii. Students  $X$  and  $Y$  are partners if  $X$  loves  $Y$  and simultaneously  $Y$  loves  $X$ . Find all partners in the dataset. Write the complexity.
- iii. Students  $X$ ,  $Y$  and  $Z$  are in a complex relationship, if  $X$  loves  $Y$ ,  $Y$  loves  $Z$  and  $Z$  loves  $X$ . Find all complex relationship cases in the database. Write the complexity.