

Data Structures (CL2001)

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Course Instructor(s)

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Lab Mid Exam (A)

Total Time: 120 minutes

Total Marks: 50

Total Questions: 03

Semester: Fall-2024

Campus: Karachi

Dept: Computer science

- You must comment your student ID on top of each file in the .cpp and word file.
- Name the .cpp file for each question according to Roll_No e.g. k23-xxxx_Q1.cpp, k23-xxxx_Q2.cpp etc.
- Create a ZIP folder of all your solutions and copy it in the local storage with the title K23-xxxx_B.
- Submission are on local storage that can be accessed using win+r keys and entering \\172.16.5.41
- address in the dialog box.
- Enter your username as khifast\K23xxxx and its assigned password.
- Zip folder needs to be pasted in the "Exam Submission\teacherName\CourseName."

Student Name

Roll No

Section

Student Signature

BCS-38

LLO # 1: Use & explain concepts related to basic and advanced data structures and describe their usage in terms of common algorithmic operations. Marks:[8 wtg, 16 marks]

Given a 1D array with elements ranging from [0-1000], your task is to replace the elements in the array according to their relative rank. The smallest element should be replaced by 0, the second smallest element by 1, and so on. If multiple elements have the same value, they should all be assigned the same rank. For Example: {12, 5, 8, 5, 15, 8} will be replaced by {2, 0, 1, 0, 3, 1}. The smallest element, 5, appears twice and both are replaced by 0. The next smallest element, 8, appears twice and both are replaced by 1. The next smallest element, 12, is replaced by 2. The largest element, 15, is replaced by 3.

LLO # 2: Compare different data structures in terms of their relative efficiency and design effective solutions and algorithms that make use of them. Marks:[8 wtg, 16 marks]

A deck of cards has 52 playing cards. Each card has 2 attributes: **rank & suit**. The rank can be represented by a number (2-14). 2-10 as normal and 11,12,13,14 will represent J, Q, K, A respectively. The suit can be represented by a character. 'h' for hearts, 'd' for diamonds, 'c' for clubs and 's' for spades. Create a class Card to represent this.

Assume that the **randomly** generated cards will be unique (no need to check). To generate the cards randomly, simply generate **random** values based on which **rank & suit** will be assigned.

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You will simulate a game of cards between 2 players, where each player's cards will be stored within a separate Linked List. Each node in the linked list will have a Card object.

The players will initially be start with 5 cards (randomly generated). The players take turns placing cards from their hands, starting with Player 1, followed by Player 2. After all, two players place a card, the cards are compared:

- If cards have the same suit, the player with the highest rank card will place the next card from their hand, and the process continues.
- If any of the two cards don't match, both two cards go to the player who placed the first card, and that player will play another card next.

This cycle repeats until any player have used up their cards. The first player to finish his cards is declared the winner, while the last player with cards left in hand becomes the loser.

LLO # 3: Use & explain concepts related to basic and advanced data structures and describe their usage in terms of common algorithmic operations. Marks:[9 wtg, 18 marks]

A person is trapped in a disaster area and needs to reach a safe zone. They are currently located at the top left corner of a 6x6 matrix. The matrix represents the area, with 'X' indicating danger areas and 'R' indicating red zones. The person starts with full health and will lose some health when entering a red zone. They cannot enter a danger area (marked with 'X').

find a path and calculate health for the person to reach the safe zone (D) while maximizing their health and avoiding danger areas (X)?

H	S	S	X	R	R
S	S	S	X	S	R
S	R	S	S	S	X
S	X	S	X	S	S
S	S	S	R	S	X
S	X	S	S	S	D

Note: 'H' marks the starting point, 'D' is the safe ending point, 'X' signifies danger areas, 'R' represents red zones decreasing health, and 'S' denotes safe paths.