National University of Computer and Emerging Sciences

Karachi Campus

Data Structures (CS2001)

Date: September 20th 2024

Course Instructor(s)

Dr. Jawwad A. Shamsi, Dr. Abdul Aziz, Dr. Farrukh Hasan, Ms. Mubashra Fayyaz, Ms. Ayesha Ali, Ms. Rafia Shaikh, Mr. Nouman Rajput

Sessional-I Exam

Total Time: 1 hour

Total Points: 30

Total Questions: 03

Semester: Fall-2024

Dept: CS / AI/ CYS/ SE

Student Name _____ Roll No _____ Section _____ Student Signature _____

Do not write below this line

Attempt all questions in order. Out of order answers will not be graded.

CLO #1: Use & explain concepts related to basic and advanced data structures and describe their usage in terms of common algorithmic operations

Question 1: **[10 points]**

You are the developer of a music streaming app, and you want to implement a playlist feature that allows users to add, remove, and navigate through songs. The playlist should maintain the order in which songs were added, and users should be able to move forward and backward through the playlist.

Required:

Implement a doubly linked list to store the songs (song names) in the playlist and write functions to:

i. Add a song to the end of the playlist
ii. Remove a song from the playlist
iii. Move to the next song in the playlist
iv. Move to a specific in the playlist
v. Print the current song.

CLO 1#: Use & explain concepts related to basic and advanced data structures and describe their usage in terms of common algorithmic operations

Question 2: **[10 points]**

Write a C++ class to implement a stack using a dynamic array that can automatically resize itself when new elements are added or removed. In addition, it should provide a function to reverse the stack items in linear time complexity using the same stack class implementation.

E.g.

Stack items: A,B,C,D

Reverse items: D,C,B,A

Note: You only need to provide functions for the above operations, not all stack operations

CLO 1#: Use & explain concepts related to basic and advanced data structures and describe their usage in terms of common algorithmic operations

Question 3: **[10 points]**

You are required to build a system to analyze the GPA of students at your university. The university has ID, GPA, name and age of the students recorded. This data is recorded in a class and stored in an array (array of objects), and your goal is to implement a program that performs various operations related to student GPA.

A. Sort_GPA: Implement the sort_GPA method to sort the student data with respect to GPA in descending order using any stable sorting algorithm.

B. GPA_Lookup: Implement the lookup_GPA method using binary search (assuming data has been sorted in part A) to return the IDs of students given their GPA. The function should return all students with a specific GPA.