National University of Computer and Emerging Sciences

Data Structures (CL-2001)

Date: October 16th 2024

Course Instructor(s)

Mr. Shafique Rehman

Mr. Sameer Faisal

Mr. Muhammad Khalid

Ms. Alishba Subhani

Lab Mid Exam (A)

Total Time: 1 Hour 30 Minutes

Total Points: 50

Total Weightage: 25

Total Questions: 03

Semester: Fall 2024

Campus: Karachi

Department(s): CS, SE, AI, CY

Student Name	Roll No	Section	Student Signature

General Instructions:

Carefully read the following instructions before attempting the paper.

- Except your Name, Roll No, Section and Signature, **DO NOT WRITE** anything on this paper.
- The Exam paper consists of 3 questions on 2 printed sides of 1 page.
- In case of any ambiguity, you may make assumptions, but your assumption must not contradict any statement in the question paper. Also mention your assumptions.
- **DON'T** share your program, if your code is matched to any member of your class, both will get straight F in the course without asking who shared or who magically copied.

Submission Instructions:

- Submit a .cpp file for each question.
- All your files must be named by your roll number along with question number e.g. K23-XXXX_Q1.cpp.

Question # 01 (LLO #: 1)   **[16 Points, 8 Weightage]**

Hammad, a wedding dress designer known for delivering dresses on time, has several customers visiting his boutique daily to collect their dresses. Each customer has placed an order on a specific day and month (ignore the year). Since everyone wants to be served first, Hammad needs to sort the customers based on their order dates (day and month only). If two customers ordered on the same date, the customer with the longer name should be served first. Once the customers are sorted, assign hanger numbers starting from 1 based on the order in which they will be served. Additionally, implement a function that uses binary search to find the hanger number for a specific customer's dress by name. If the customer is not found, return -1. For example, with 5 customers: Mubeen (ordered on 9th September), Ali (ordered on 1st September), Shaheer (ordered on 15th September), Sadiq (ordered on 8th September), Romaan (ordered on 20th September), the sorted output with hanger numbers would be: Ali (hanger 1), Sadiq (hanger 2), Mubeen (hanger 3), Shaheer (hanger 4), Romaan (hanger 5).

Note: You can use any sorting algorithm except bubble sort.

National University of Computer and Emerging Sciences

Question # 02 (LLO #: 1) [16 Points, 8 Weightage]

Calculators are a useful tool for computing mathematical expressions. So you are tasked to create a simple calculator but there is a catch that you are allowed to implement it using linked lists. Consider a linked list with a Node N, Data D and pointer next which points to the next node and another pointer previous which points to the previous node. Each node might have a **number, operator** (*,-,*,/) and brackets. Your job is to iterate each node collect the number and form a single number and perform the necessary operations via the operators and output an answer. Note that brackets might be double as explained in the illustration below also note that there is a math rule is to solve the inner bracket first. Create two classes Node and Linked List and perform the operations.

Example:

10 → add → (→12 → multiply → (→2 →) → minus → 2 →) → NULL

Answer: 32

Question # 03 (LLO #: 1) [18 Points, 9 Weightage]

You are tasked to find a palindrome in a nxn matrix. Note there can be multiple palindromes in a given matrix so try to idealize the scenario. You can start at any position of the matrix and using recursive calls traverse through the matrix to find a palindrome string. If there exists no palindrome, simply output there are no palindromes.

Example: 5x5 matrix

```
G R O O T
B A R R O
W R D B S
R A D A R
W E S T G
```

Output:

Here one palindromes RADAR