National University of Computer & Emerging Sciences, Karachi
Fall 2022 CS-Department
Midterm 1
26th September 2022, 8:30 AM – 9:30 AM

Course Code: CS2001/AI	**Course Name:** Data Structures
Instructor Name: Dr. Jawwad A Shamsi , Dr. Fahad Sherwani, Ms. Anam Qureshi, Mr. Zain ul Hassan, Mr. Shoaib Rauf, Mr. Shahroz, Ms. Sobia Iftikhar, Ms. Abeer Gauhar, Mr. Ali Fatmi	
Student Roll No:	**Section No:**

Instructions:

- Please return the question paper.
- Please read each question completely before answering it. There are 4 **questions and 2 pages**
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.
- Show all steps clearly.

Time: 60 minutes. **Max Marks**: 20 points

Question 1:. Arrays (CLO: 1) **5 points**

Suppose A, B, C are arrays of integers of size M, N, and M + N respectively. The numbers in array A appear in ascending order while the numbers in array B appear in descending order. Write a user defined function to produce third array C by merging arrays A and B in ascending order. Use A, B and C as arguments in the function.

Question 2: Recursion with Backtracking (CLO: 2**)** **5 points**

Given a square maze containing positive numbers, find a path from the corner cell (marked as 2 in bold) to the middle cell (marked as 0 in bold). You can move exactly 'n' steps from any cell in two directions i.e. right and down. where **n is value of the cell**. For instance, if a cell has a value 2, the number 2 indicates that movement along 2 cells are allowed. These 2 cells can be taken in any combination and in any of the allowable direction. For instance, 1 step right and 1 step down will be allowed; however, 2 cells right and 2 cells down will not be allowed as this will count to 4 steps in total. The movement should not exceed the boundary.

Your task is to write a function using recursion with backtracking to find a path from corner cell to middle cell in maze.

Sample Input: 5 x 5 maze

[**2**, 2, 4, 4, 3,]

[3, 4, 3, 2, 2,]

[1, 1, **0**, 3, 2,]

[3, 2, 2, 1, 2,]

[3, 3, 4, 3, 1,]

Where cell (0,0) with value three is the source and the destination is (2,2) with value 0.

Question 3: Linked List (CLO:3) **5 points**

Write a function to reverse the specified portion of the given linked list.

For instance:

Input:

Linked List: 1→ 2 → 3 → 4 → 5 → 6 → 7

Start position = 2

End position = 5

Output:

1→ 5 → 4 → 3 → 2 → 6 → 7

Question 4 Elementary Sorting (CLO:3) **5 points**

Write a function that takes a NxN 2D array and its dimension N as parameters and sort the given array such that after sorting the values in the array are in column-wise ascending order.

Example:

Before sorting:

2	3	2	8
9	4	54	5
1	7	4	11
6	1	9	2

After sorting:

1	2	5	9
1	3	6	9
2	4	7	11
2	4	8	54

**********Good Luck **********