

## **Faculty of Computing**

### **CS110: Fundamentals of Computer Programming**

**Class: BESE-16B**

#### **Lab 11: Recursion**

<b>CLO 2</b>	Solve given real-world problem by applying appropriate programming concepts and techniques.
<b>CLO 3</b>	Build a program and associated documentation using appropriate IDE and supplementary tools.

**Date: 25<sup>th</sup> November 2025**

**Time: 2:00 pm-5:00 pm**

**Instructor: Dr. Momina Moetesum**

**Lab Engineer: Mr. Nadeem Nawaz**



## Lab 11: Recursion

### Learning Objectives:

After completing this lab, you will be able to use recursion to develop clean codes for various problems.

### Lab Tasks

#### Task 1[CLO2]

Use recursion to write following two functions that take an array of integers from user in the main() and then return the following for display in main():

- The sum of all elements in an array.
- The count of the number of occurrences of a specific element in the array

#### Task 2: [CLO 2]

Write a C++ program to implement a recursive function to calculate the sum of digits of a given number.

#### Task 3: [CLO 3]

Write a C++ program to check if a given string is a palindrome using recursion. A palindrome reads the same forward and backward.

- Input: A string  $s$ .
- Output: True/False depending on whether  $s$  is a palindrome.

**Example:** Input:  $s = \text{"radar"}$

Output: True

#### Task 4: [CLO 3]

Write a C++ program to solve path finding in a grid. Given an  $m \times n$  grid, write a recursive function to calculate the number of unique paths from the top-left corner to the bottom-right corner. You can only move right or down.

Input: Two integers  $m$  and  $n$  (grid dimensions).

Output: Number of unique paths.

**Example:**

Input:  $m=2, n=3$

Output: 3 (Paths: Right  $\rightarrow$  Right  $\rightarrow$  Down, Right  $\rightarrow$  Down  $\rightarrow$  Right, Down  $\rightarrow$  Right  $\rightarrow$  Right)



**Deliverables:**

Compile a single Word document with codes for each question and screenshots of the outputs and submit this Word file on LMS.



## Lab Rubrics

Your Lab 11 will be graded out of 5 for each rubric according to the following rubrics. Grades for CLO3 will be shared at different intervals during the semester.

### Lab Rubrics for Lab 10 (Recursion)

Sr. No.	Assessment	Unacceptable (0 Marks)	Does Not Meet Expectations (1/2 Marks)	Meets Expectations (3/4 Marks)	Exceeds Expectations (5 Marks)
1	<b>Application of Programming Concepts</b> (CLO2, PLO3)	<p>The student did not submit any work.</p> <p>OR</p> <p>The student plagiarized the solution and/or used unfair means.</p>	<p>The student is unable to apply the appropriate programming concepts to solve the given problem thus resulting in an incomplete or ineffective solution.</p> <p>The program flow is messy and incomprehensible.</p> <p>Codes are non-modular and cannot be reused.</p>	<p>The student requires some guidance to apply the appropriate programming concepts to solve the given problem.</p> <p>The program flow requires minor improvements.</p> <p>Codes are semi-modular and semi-reusable.</p>	<p>The student demonstrates a clear ability to apply the appropriate programming concepts to solve the given problem.</p> <p>The program flow is adequate.</p> <p>Codes are modular, reusable, and easily readable.</p>
2	<b>Software Tool Usage</b> (CLO3-PLO5)		<p>The student demonstrates a lack of understanding of tool usage.</p> <p>Implementation has syntax/semantic/runtime errors, and the student is unable to debug and correct the errors.</p> <p>The code has inadequate comments and variable names and does not adhere to the coding standards.</p> <p>No Error handling has been performed.</p> <p>Documentation is poorly structured.</p>	<p>The student demonstrates some understanding of tool usage.</p> <p>The codes are correct in terms of their syntax, however, the program output is not always correct in all test cases.</p> <p>The code has limited comments and inconsistent variable names and may not adhere to the coding standards.</p> <p>Some Error handling has been performed.</p> <p>Documentation is adequately structured.</p>	<p>The student demonstrates a good understanding of tool usage.</p> <p>Furthermore, his/her coding is complete and functional, and the program output is correct in all test cases.</p> <p>The code has sufficient comments and consistent variable names and reasonably adhere to the coding standards.</p> <p>Adequate Error handling has been performed.</p> <p>Documentation is well structured.</p>