National University of computer and emerging sciences

Object Oriented Programming (CL-1004)

Semester: Fall 2025
Section: BCS-3A
Course Instructor: Mr. Abdullah Yaqoob

LAB # 02

Pointers, Dynamic Memory Allocation, and Structures using C++

Submission Guidelines:

- Complete all tasks and include:
  - The programming question,
  - A screenshot of the code.
  - A screenshot of the output.
- Convert the Word document into a PDF file.
- On the first page of the PDF, include:
  - Your name.
  - Your roll number/ID
  - Your section
  - Your instructor's name.

- For each task, include the following comment at the top of the code:

  - **Example: TASK # Number by Your Name – Your ID** [TASK #01 by Abdullah Shaikh – 1234]

- Rename the PDF file using the following format:
  CourseName_LabNumber_YourName_YourID

  - **Example:** OOP_LAB_02 - Abdullah Shaikh - 1234

- Submit the PDF file before the deadline on GCR. Late submissions will not be accepted.

Objectives:
After completing this lab, students will be able to:

- Understand pointers and their applications.
- Perform call by reference using pointers.
- Apply pointer arithmetic and explore types of pointers.
- Implement dynamic memory allocation and resolve memory leaks.
- Explore the relationship between pointers and arrays.
- Understand and work with structures in C++.

TASK # 01

Write a program in C++ that creates a function named SwapValues which takes two pointers as arguments and swaps their values without using a third variable.

TASK # 02

Write a program in C++ that creates a function named FirstAndLastIndex which takes a string, a character, and two pointer variables as arguments. It should calculate and return the first and last occurrence of the character in the string using pointers.

TASK # 03

Write a program in C++ that creates a function named sumArray which takes an array and its size as arguments (using a pointer) and calculates the sum of all the elements in the array. The function should use pointer arithmetic to access the elements.

TASK # 04

Write a program in C++ that dynamically allocates memory for a square matrix (NxN), takes input from the user, and calculates the sum of both the main diagonal and the secondary diagonal. The program should then display both sums and the matrix.

Explanation:
In this problem, you will dynamically allocate memory for a square matrix using pointers, take input for the matrix elements, and then calculate the sum of the main and secondary diagonals. The main diagonal consists of elements where row index equals column index (i.e., matrix[i][i]), while the secondary diagonal consists of elements where the sum of the row and column index equals N - 1 (i.e., matrix[i][N-i-1]).

TASK # 05

Write a program in C++ that dynamically allocates memory for two strings, takes input for both strings from the user, and concatenates them into a third string. The program should display the original strings and the concatenated result.

THE END!