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## Lab Manual 11

### Arrays-II (Multi-Dimensional Arrays)

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### Lab Tasks

#### Problem 01

In this task, you need to do the following:

- Declare a character array of size 20
- Ask user to enter a sentence and store it in this array
- Display number of upper case and lower case letters
- Print frequency of each letter in the input
- Convert uppercase letters to lowercase and vice versa
- Capitalize first letter of each word

#### Problem 02

Create an array of size 5x5 first fill the array with random values between 1 and 100, print it in straight and reverse order. Now, fill that array from the user input and print it in straight and reverse order.

#### Problem 03

Write a program to add two matrix using multi-dimensional dimensional arrays.

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} + \begin{bmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 1+9 & 2+8 & 3+7 \\ 4+6 & 5+5 & 6+4 \\ 7+3 & 8+2 & 9+1 \end{bmatrix}$$
$$= \begin{bmatrix} 10 & 10 & 10 \\ 10 & 10 & 10 \\ 10 & 10 & 10 \end{bmatrix}$$

#### Problem 04

Write a program to declare a 3x3 integer type array and store values by taking input from user. And find sum of lower triangular matrix.

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**Input array elements:** 1 0 0  
                                   4 5 0  
                                   7 8 9

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**Sum of lower triangular matrix= 19**

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1	0	0
4	5	0
7	8	9

## Problem 05

- Take an array of size 5x5 and initialize it with random numbers of range 1 to 10, now add all the elements of the 2D array and display sum.
- Modify part a in such a way that you have to find individual sum of each row of the 2D array and store corresponding result in 1D array i.e. sum of all the elements of row 0 should be stored in 1st element of 1D array, similarly sum of all elements of the second row of 2D array should be stored at the second index of 1D array. Display the final sum array (i.e. 1D array). Think about the size of 1D array yourself.

Example:

**Array:**

2 3 5 3 1  
 4 5 1 2 1  
 4 7 3 2 0  
 2 1 1 5 1  
 1 7 8 9 0

**Sum array:**

14 13 16 10 25

- Perform sum of all the elements of the arrays whose row number and column number both are odd. Display the final sum. it.

Example:

**Array:**

2 3 5 3 1  
 4 5 1 2 1  
 4 7 3 2 0  
 2 1 1 5 1  
 1 7 8 9 0

**Sum array: 13**

## Problem 06

You have to create two 2D arrays and do a matrix multiplication. E.g. If First array is of size 3x2 and 2nd one of 2X2:

**How to multiply 2 matrices?**

$$\begin{bmatrix} 1 & 2 \\ 2 & 4 \\ 3 & 5 \end{bmatrix} \times \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix} \quad 1 \times 1 + 2 \times 2 = 1 + 4 = 5$$

$$\begin{bmatrix} 1 & 2 \\ 2 & 4 \\ 3 & 5 \end{bmatrix} \times \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix} \quad 1 \times 2 + 2 \times 4 = 2 + 8 = 10$$

$$\begin{bmatrix} 1 & 2 \\ 2 & 4 \\ 3 & 5 \end{bmatrix} \times \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix} \quad 2 \times 1 + 4 \times 2 = 2 + 8 = 10$$

& so on ....

### Problem 07

Write a program to find a sub-string within different strings. If found display the starting positions. (Using 2D-array)

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**Array Elements:** { "helloworld"  
                           "hellohello",  
                           "c++world" }

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**Enter String to Search:** world  
**Substring found at position:**  
 0,5  
 2,3

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#### Submission Instructions:

1. Save all .cpp files with your roll no and task number  
 e.g. i19XXXX\_Task01.cpp
2. Now create a new folder with name *ROLLNO\_LAB11* e.g. i19XXXX\_LAB11
3. Move all of your .cpp files to this newly created directory and compress it into .zip file.
4. Now you have to submit this zipped file on Slate.

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