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CSE117 Problem Solving with C

Handout - Lab Session - 7

Two-dimensional Arrays
&
Three-dimensional Arrays

Objective:

- To be able to declare, initialize and manipulate 2D arrays in C.
- To be able to use nested loops to traverse and manipulate 2D arrays.
- To be able to write programs that perform mathematical operations on matrices.
- To be able to declare, initialize and manipulate 3D arrays in C and perform operations such as sum of elements, average and finding largest number.

Pre-Lab: Go through the concepts of 2D and multidimensional arrays. Write the algorithm and flowcharts for all the exercise problems given in this handout.

During Lab: Solve all the exercise problems. You should work on the additional set of programs only after completing this week's tasks.

Post Lab: Take the quiz.

Read 8.7 & 8.8 in the *textbook.

Lab Exercises

Design algorithm, flow chart, and program using the data requirements given for the exercise problems and try all the test cases.

Exercise 1: 2D-Array Sum

Write a program that reads a 2D array of integers from the user at the keyboard and find the sum and average of all elements.

Sample Test Cases	Input	Output
Test Case 1	Enter the size of the array: 3 4 Enter elements in the array: 1 2 3 4 5 6 7 8 9 10 11 12	Sum = 78 Average = 6.50
Test Case 2	Enter the size of the array: 2 2 Enter elements in the array: -1 -2 -3 -4	Sum = -10 Average = –2.50

Exercise 2: 2D Array Transpose

Write a program that reads in a 2D array of integers and find the transpose of the array.

Sample Test Cases	Input	Output
Test Case 1	Enter the size of the arrays : 3 4 Enter elements in the array: 1 2 3 4 5 6 7 8 9 10 11 12	1 5 9 2 6 10 3 7 11 4 8 12
Test Case 2	Enter size of the array: 2 2 Enter elements in the array: -1 -2 -3 -4	-1 -3 -2 -4

Exercise 3: **Diagonal sum**

Write a program that reads in a 2D array of integers and finds the sum of the elements of the main diagonal.

Sample Test Cases	Input	Output
Test Case 1	Enter the size of the array: 3 3 Enter elements in the array: 1 2 3 4 5 6 7 8 9	Diagonal Sum = 15
Test Case 2	Enter size of the array: 2 2 Enter elements in the array: -1 -2 -3 -4	Diagonal Sum = -5

Exercise 4: **Sum of two matrices**

Write a program that reads in two 2D arrays of integers and adds them together, element by element.

Sample Test Cases	Input	Output
Test Case 1	Enter the size of the array: 3 3 Enter elements in the first array: 1 2 3 4 5 6 7 8 9 Enter elements in the second array: 2 2 2 3 3 3 4 4 4	3 4 5 7 8 9 11 12 13
Test Case 2	Enter the size of the array: 2 2 Enter elements in the first array: -1 -2 -3 -4 Enter elements in the second array: 1 2 3 4	0 0 0 0

Exercise 5: Matrix Multiplication

Write a program that reads in two 2D arrays of integers and find their product.

Sample Test Cases	Input	Output
Test Case 1	Enter the size of the first array: 3 3 Enter the size of the second array: 3 3 Enter elements in the first array: 1 2 3 4 5 6 7 8 9 Enter elements in the second array: 1 2 3 4 5 6 7 8 9	30 36 42 66 81 96 102 126 150
Test Case 2	Enter the size of the first array: 2 3 Enter the size of the second array: 2 3	Can't multiply matrices of these sizes.

Exercise 6: Equal or not

Write a program that reads in two 2D arrays of integers and check if they are equal.

Sample Test Cases	Input	Output
Test Case 1	Enter the size of the array: 3 3 Enter elements in the first array: 1 2 3 4 5 6 7 8 9 Enter elements in the second array: 1 2 3 4 5 6 7 8 9	These arrays are equal.
Test Case 2	Enter the size of the array: 3 3 Enter elements in the first array: 1 2 3 4 5 6 7 8 9 Enter elements in the second array: 1 2 3 4 5 6 7 4 9	These arrays are not equal.

Exercise 7: Sum of two 3D arrays.

Write a program that reads in two 3D arrays of integers and compute their sum.

Sample Test Cases	Input	Output
Test Case	Enter the size of the array: 2 3 3 Enter elements in the first array: 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 Enter elements in the second array: 3 3 3 3 3 3 3 3 3 5 5 5 5 5 5 5 5 5	5 5 5 5 5 5 5 5 5 6 6 6 6 6 6 6 6 6

***Textbook :** B. A. Forouzan and R. F. Gilberg —Cengage Learning , Computer Science: A Structured Programming Approach Using Cǁ Third Edition.