INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
Programming with C and C++ (CSC-101)

Assignment 03 Autumn Semester 2023-24

1. Given an array of ten numbers provided by the user, write a C program to determine how often a specific number, also entered by the user, appears in the array. If found, your program should display its frequency; if not, indicate its absence. For example, for the array [5, 6, 7, 8, 5, 9, 10, 5, 11, 12] and a search for the number 5, the output should be "The number 5 is present 3 times in the array."

2. Given an array of ten integers inputted from the keyboard, write a C program that outputs the counts of positive, negative, even, and odd numbers in the array. Your program should display four results: the counts of positive numbers, negative numbers, even numbers, and odd numbers.

3. Write a C program to copy the contents of one array into another in the reverse order. The program should take double type values from the keyboard.

4. You are required to work with a 5×5 matrix. The matrix can be: (a) Entered manually through the keyboard, or (b) Initialized directly within the program using a predefined 2-dimensional array 'mat[5][5]'. Your task is to write a C program that will calculate and display the determinant value of this 5×5 matrix.

5. Write a C program to check if two strings are anagrams of each other. For example: "listen" and "silent"; "cinema" and "iceman"; "debit card" and "bad credit" are anagrams.

6. Write a C program that can rotate a two-dimensional square array of integers either 90 or 180 degrees clockwise. Test your function to ensure it works as intended.

7. Write a program to find the non-overlapping sub-matrices of a given matrix of a specified order.

   For Example: If the given matrix A is:

$$A = \begin{bmatrix} 1 & 3 & 7 & 8 \\ 6 & 5 & 3 & 2 \\ 9 & 7 & 8 & 1 \\ 0 & 7 & 0 & 6 \end{bmatrix}$$

   And the specified order of the sub-matrix is 2, then the extracted non-overlapping sub-matrices will be:

$$\begin{bmatrix} 1 & 3 \\ 6 & 5 \end{bmatrix}, \begin{bmatrix} 7 & 8 \\ 3 & 2 \end{bmatrix}, \begin{bmatrix} 9 & 7 \\ 0 & 7 \end{bmatrix}, \begin{bmatrix} 8 & 1 \\ 0 & 6 \end{bmatrix}$$

   Your task is to extract such non-overlapping sub-matrices (order 2) for any given even ordered matrix.

8. Given an array of integers, check whether the array contains three consecutive numbers. Write a C program that accomplishes this.

9. Write a C program to reverse the order of words in a given sentence. The sentence will have words separated by spaces, and you should preserve the original spaces between words. For example:
   Input: Hello World! This is a test
   Output: test a is This World! Hello

10. Given an array of integers (both positive and negative), find the contiguous subarray that has the largest sum. For example, given the array '[-2, 1, -3, 4, -1, 2, 1, -5, 4]', the contiguous subarray with the largest sum is '[4, -1, 2, 1]', with a sum of 6.

11. A perfect number is a positive integer that is equal to the sum of its proper divisors excluding itself. The smallest perfect number is 6, which has divisors 1, 2, and 3. The sum of these divisors is 6. Write a program that checks if a given number is perfect.

12. You're given two arrays, 'arr1[]' and 'arr2[]', each of size 'n'. Determine a pair, one element from each array, such that the absolute difference between the elements of the pair is the smallest among all possible pairs. For instance, given arrays 'arr1 = [1, 3, 15, 11, 2]' and 'arr2 = [23, 127, 235, 19, 8]', the smallest difference is 3 (between 11 from 'arr1' and 8 from 'arr2').

13. A majority element in an array 'A[]' of size 'n' is an element that appears more than 'n/2' times. Write a program to find the majority element from the array. If no majority element exists, indicate so.

14. Given a string, write a program to check if it is a permutation of a palindrome. For instance, "tactcoa" is a permutation of the palindrome "tacocat".

15. Write a script in C to perform basic string compression using the counts of repeated characters. For example, the string "aaabbbcccaa" would become "a3b3c3a2". If the compressed string is not shorter than the original string, return the original string.

16. Write a program that checks if a string is a rotation of another. For instance, "waterbottle" is a rotation of "erbottlewat".

17. Given an array of integers and a target integer value, write a C program to determine if there are two distinct numbers in the array that sum up to the target value. For example:
   Input: nums = {2, 7, 11, 15} and target = 9
   Output: True

18. Given a collection of intervals, merge any overlapping intervals. For example:
   given '[[1,3],[2,6],[8,10],[15,18]]', return '[[1,6],[8,10],[15,18]]'.

19. Given a string containing just the characters '(', ')', '{', '}', '[' and ']', determine if the input string is valid. The brackets must close in the correct order, "()" and "()[]" are valid but "(]" and "([)]" are not.

20. Write a program to determine if two given strings are isomorphic. Two strings are isomorphic if the characters in one string can be replaced to get the other string. For example, "egg" and "add" are isomorphic, "foo" and "bar" are not.

Submission Link