21-805-0206: Lab 3 - Data Structures Lab

Assignment 1

Instructions:

1. All programs have to be submitted as .cpp files that can be compiled and executed without error. The input & output shall be included in the same file as comments
2. A separate pdf file named as "**rollno_firstName**" shall be submitted for questions that require an explanation (marked with *). This should be **hand written.**
3. Compress all the above as a single .zip file and upload in the moodle page before **30/06/23**

Part 1: Recursion

1. Write a recursive implementation of the factorial function. Recall that n! = 1 × 2 × ... × n, with the special case that 0! = 1.
2. Write a recursive function that, given a number n, returns the sum of the digits of the number n.
3. Write a recursive function that, given a string s, prints the characters of s in reverse order.
4. Write a recursive function that checks whether a string is a palindrome (a palindrome is a string that's the same when reads forwards and backwards.)
5. Write a recursive function that converts a decimal number into its binary representation.

Part 2 : Arrays

6. Write a menu driven program that repeatedly reads an option from the terminal to do the following array operations on array ARR:

   Option 1. Read integer **n** (<=100) , the size of array followed by n integer elements of ARR

   Option 2. Print the elements of array ARR

   Option 3. Read an integer **elem** to search in the array. Print FOUND/SORRY accordingly

   Option 4. Print the largest and smallest element of the array

   Option 5. Exit

   The program should be modular and should contain the following functions :
   main(), read_arr(int[] arr, int n), print_arr(int[] arr, int n), search_arr(int[] arr, int n, int elem), get_max(int[] arr, int n), get_min(int[] arr, int n)

7. * Write a program to find the second largest element of a given integer array. Can you modify it to find the k-th largest element?
8. * Write a program to count the total number of duplicate elements in an unsorted character array in O(n) time complexity.
9. * Write a program to merge two sorted arrays of the same size to get a resultant array which is sorted in the reverse order. Analyse the time complexity of your algorithm.
10. Write a program to read and print a matrix of size m x n. Also find the row sum and the column sum, and print the column number and row number that has the largest sum. Keep your code modular.