MCA Sem-I
CSC15: Lab-I (Algorithmics and Program Design)
Lab Assignments

Deadlines:

Q1-5: Sept 10, 2022

Q6-10: Sept 25, 2022

Q11-15: Oct 10, 2022

Q16-20: Oct 25, 2022

Q21-25: Nov 10, 2022

1. Write a program to exchange the content of two variables without using the third variable.
2. Write two C functions in the same program to do the following:
    Take as input a positive integer 'n' from the user, where n>=0.
    (a) Compute the factorial of 'n' in a iterative fashion.
    (b) Compute the factorial of 'n' in a recursive fashion.
3. Write two C functions in the same program to do the following.
    Take as input a positive integer 'n' from the user.
    (a) Compute the Fibonacci number corresponding to 'n' in a iterative fashion.
    (b) Compute the Fibonacci number corresponding to 'n' in a recursive fashion.
    Compute the number of function calls to any 'fib(i)', where 0<=i<=n.
    In both cases, check what is the largest 'n' for which you can find the Fibonacci number. For any particular 'n', compute and compare the real times taken by the iterative and recursive versions of the program.
4. Write a program to evaluate the function sin(x) as defined by the series expansion,
    (a) $\sin(x) = x/1! - x^3/3! + x^5/5! - x^7/7! + ----$ upto n terms
5. Write a program to find square root of given number n using a user-defined function.
6. Given two positive non-zero integers n and m, write a program for finding their greatest common devisor (gcd).
7. Write a program to reverse the digits of a given integer.
8. Write a program to convert a given decimal number into binary, octal and hexadecimal equivalents.
9. Write a program to compute all the prime factors of a given integer.

10. A Company wants to transmit data over telephone but they are concerned that their phone may be tapped. All of their data is transmitted as four digit integers. They have asked you to write a program that will encrypt their data so that it may be transmitted more securely. Your program should read a four digits integer and encrypt it as follows
    (a) Replace each digit by (the sum of that digit and 7) modulus 10.
    (b) Then swap the first digit with third, and second with the fourth. Write a program for it.
    (c) Then print the encrypted integer. Write a separate program that inputs an encrypted four-digit integer, and decrypt it to form the original number.
11. Write program to generate a uniform set of pseudo-random numbers using linear congruential method. Successive members of the linear congruential sequence (x) are generated using the expression:

$x_{n+1} = (ax_n + b) \bmod m$ for n >= 0, where the parameters a,b,m,x_0 must be chosen in advance according to certain criteria. The parameters a, b and m are referred to as multiplier, increment and modulus respectively and their values should be greater than or equal to zero and m should be greater than x_0, a and b.

12. Given some integer x, write a program to compute the value of x^n where n is positive number considerably greater than 1.

13. Write a program to find all the prime numbers lying between 100 and 200 using user-defined function.

14. Write a program to demonstrate the Longest Common Subsequence.

15. Write a program to implement the algorithm to search an element in an array of N elements using linear search and binary search and determine the time to search the element in each case.

16. Write a program to add and multiply two given matrices of specified dimensions.

17. Write a program to find the maximum and minimum values stored in an array of N integers.

18. Write a program to remove the duplicate values from an ordered array of N elements

19. Write a program to rearrange the elements in an array of N elements so that they appear in order using insertion sort.

20. Write a program to implement *Quick sort* recursively on an unsorted array of N elements and determine the time to sort the elements.

21. Write a program to sort an array of n elements using *Selection sort* and determine the time to sort the elements.

22. Write a program to sort an array of n elements using *Merge sort* and determine the time to sort the elements.

23. In a **mastermind** game, the code maker hides a secret code consisting of 4 digits, and the code breaker is to provide 4-digit guess codes until he gets the code right. The code maker gives feedback in this manner, a *sink* is awarded to a perfect match of a digit plus its position, and a *hit* refers to a right match of digit but in the wrong position. How do you devise an algorithm to provide the correct feedback? First, work on the special case that no digit in the code should be repeated. Then work on the general case where digits can be duplicated. Also implement the algorithm.

24. Our coins come suppose in denominations of 1 cent, 5 cents, 10 cents, 20 cents,50 cents and 1 dollar. Assuming that there are unlimited number of coins, how would you devise a ***coin-change algorithm*** to compute the **minimum** number of coins required to make up a particular amount? For example, for 46 cents you need 4 coins: two 20-cent coins, one 5-cent coin, and one 1-cent coin. Also implement the algorithm.

25. Write a well-styled program, trace and test the same.

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