

**Department Of Information Technology**  
**IT-3<sup>rd</sup> year**

**Subject Code : ITR6C2**

**Subject Name : Design and Analysis of Algorithm**

**Subject Teacher: Dr. Pragya Shukla/ Mr. Ravindra Verma**

**Lab Assignment No. : 1**

**Last date of Submission:** Before 22 Jan 2024

**Note: Analysis the following algorithm to find the running time ( Big O, Theta  $\theta$  and Omega  $\omega$ ).**

- Q1 Write a program for finding the median of a set of positive integers. Make sure you carefully write the input, output and any special conditions or constraints that are to be applicable.
- Q.2 Write a program to find a Factorial of a number n, where n is entered by user using  
**a:** Iterative Method; **b.** Recursive method  
Also analyse the algorithm.
- Q.3 Write and analyse a program to print Fibonacci series up to n terms, where n is entered by user using:  
**a:** Iterative Method; **b.** Recursive method.
- Q.4 Write and analyse both recursive and an iterative program to compute the binomial coefficient.
- Q.5 Implement and analyse the Selection sort algorithm for given keys.
- Q.6 Write and analyse a program to find whether the given number is Armstrong Number or not using  
**a:** Iterative Method; **b.** Recursive method.
- Q.7 Implement and analyse the program for Tower of Hanoi problem using a recursion method.
- Q.8 The pigeonhole principle states that if a function f has n distinct inputs but less than n distinct outputs, then there exist two inputs a and b such that  $a \neq b$  and  $f(a) = f(b)$ .  
Write a program to find a and b such that  $f(a) = f(b)$ . Assume that the function inputs are 1, 2, 3.....and n.

Write a program to find the largest and smallest number from given three numbers using:

- Q. 9    **a:** Iterative Method **b:** Recursive method  
also analyse the program.

In the following C function, let  $n \geq m$ .

```
int GCD(int n, int m){  
    if (n%m==0)  
        return m;  
    n=n%m;  
    return GCD(m,n);  
}
```

- Q10    How many recursive calls are made by this function?

- Q11    Write down the recursive definition for the problem of finding  $n$  Fibonacci numbers. If you did not remember identical subproblems, how many recursive calls would the algorithm make? Now write an alternative recursive definition in such a way that you can compute the Fibonacci numbers in  $O(n)$  time but without the need to have a separate array to remember the previously computed values.

- Q.12    Implement the program for the following operations in singly link list and analyze the time and space complexity:  
**a:** Insertion; **b:** Deletion; **c:** Search; **d:** Count; **e:** Modify

- Q13    Consider the problem of finding the largest and smallest of  $n$  distinct positive integers. Write down the general recursive definition using the concept of 'splitting' of the original list. Analyse the initial solution using (a) recurrence relations and Master Theorem and also using (b) recursion trees generated. Determine the optimal split, develop the final algorithm and present the same.

- Q.14    Write down the recursive definition by a simple modification of Quicksort by choosing a pivot element randomly and splitting the list based on the elements less than or greater than the pivot and then performing recursion. What is the complexity of this scheme in the average case?

- Q15    Write a program to implement the Bubble sort algorithm for given keys. Also evaluate the time and space complexity of your program.

- Q16    Write a program to implement the Selection Sort algorithm for given keys. Also

evaluated the time and space complexity of your program.

Q17

Write a program to implement the Insertion sort algorithm for given keys. Also evaluated the time and space complexity of your program.