

Data Structures and Algorithms**Lab Journal - Lab 4**

Name: _____

Enrollment #: _____

Class/Section: _____

Objective

This lab is aimed at introducing students to recursion and recursive algorithms. Students will be required to solve the given problems using recursive algorithms.

Task 1 :

Give answers to the following.

1. Write the output of the following program.

```
#include<iostream>
using namespace std;
int mystery(int,int);
int main()
{
    int x=3,y=2;
    cout<<"Result = "<<mystery(x,y);
    return 0;
}
int mystery(int a, int b)
{
    if(b==1)
        return a;
    else
        return a + mystery(a, b-1);
}
```

Output:

2.	<p>Let J and K be integers and suppose Q(J, K) is recursively defined by :</p> $Q(J, K) = \begin{cases} 5, & J < K \\ Q(J - K, K + 2) + J, & J \geq K \end{cases}$ <p>Trace and Find Q(5, 3).</p>
3.	<p>Let 'a' and 'b' be integers and suppose Q(a, b) is recursively defined by :</p> $Q(a, b) = \begin{cases} 0, & a < b \\ Q(a - b, b) + 1, & b \leq a \end{cases}$ <p>Find Q(14,3).</p>
5.	<p>Identify the problem with following recursive function.</p> <pre>void recurse(int count) { cout<< count <<"\n"; recurse (count + 1); }</pre>

4.

Given the following function, write the output if the user enters 'abcz' as input.

```
void rev()
{
    char c;
    cin>>c;
    if(c!='z') {
        rev();
        cout<<c;
    }
}
```

Output:

Task 2 :

Implement the following exercises.

Exercise 1

Ackermann's function is defined recursively on non-negative integers as follows.

$A(m, n) = n + 1$	if $m == 0$
$A(m, n) = A(m - 1, 1)$	if $m \neq 0, n == 0$
$A(m, n) = A(m - 1, A(m, n - 1))$	if $m \neq 0, n \neq 0$

Implement it as a recursive function Ackermann(M,N) which takes two positive integers as input and returns a positive integer as result. Once implemented test your program by evaluating Ackermann(2,2).

Exercise 2

Write a function sum(int a[], int size) to (recursively) compute the sum of the elements in an array.

Example Run :

```
int arr[]={1,2,3,4} ;
int result = sum(arr,4) ;
cout<<result<<endl ; //Should print 10
```

Exercise 3

Write a recursive function to print integers from a given number N to 0. When called as `print(10)`, the function should print : 10 9 8 7 6 5 4 3 2 1 0

Exercise 4

Binomial coefficients are normally computed using the following formula.

$$\binom{n}{m} = \frac{n!}{(n-m)!m!}$$

Binomial coefficients can also be computed using the following recursive definition.

$$\binom{n}{m} = \begin{cases} 1 & m = 0, \\ 1 & n = m, \\ \binom{n-1}{m} + \binom{n-1}{m-1} & \text{otherwise.} \end{cases}$$

Write a C++ program to compute binomial coefficients using the mentioned recursive definition.

Implement the given exercises and get them checked by your instructor. If you are unable to complete the tasks in the lab session, deposit this journal alongwith your programs (printed or handwritten) before the start of the next lab session.

S No.	Exercise	Checked By:
1.	Exercise 1	
2.	Exercise 2	
3.	Exercise 3	
3.	Exercise 4	

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