North South University

Department of Electrical and Computer Engineering

CSE 225L.13 (Data Structures and Algorithms Lab)

Lab 16: Recursion

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Objective:

- Master Recursion

What is Recursion:

Recursion is the technique of making a function call itself. This technique provides a way to break complicated problems down into simple problems which are easier to solve. Thus, the corresponding concerned function can be called a ***recursive*** function. A recursive function solves a particular problem by calling a copy of itself and solving smaller subproblems of the original problems. Many more recursive calls can be generated as and when required. Every recursion problem has a base case that can be satisfied by giving a certain value to be returned.

Consider this program where we have to find the sum of numbers from 1 to n.

```
int sumOfNumbers(int n)
{
    if (n == 1){
        return 1;
    } else {
        return n + sumOfNumbers(n-1);
    }
}
int main()
{
    cout << sumOfNumbers(5) << endl;
    return 0;
}
```

Here, the sumOfNumbers(int n) function is used for finding the sum from 1 to n, where the base case is if n is 1; else, the function will return n + sumOfNumbers(n-1), where the function calls itself for a smaller value. Call sumOfNumbers(5), and it will give an output of 15.

Tasks:

Description of Action	Input Values	Expected Output
• Write a recursive function that returns the nth Fibonacci number from the Fibonacci series. Note that the first two numbers are 0 and 1, respectively, and the terms from the second term are the summation of the ***previous two terms.*** • ***int fib(int n);***	3 6	1 5
• Write a recursive function to find the factorial of a number. • ***int factorial(int n);***	3 4	6 24
• Write a recursive function that returns the sum of the digits of an integer. • ***int sumOfDigits(int x);***	1234 358	10 16
• Write a recursive function that finds the minimum element in an array of integers. • ***int findMin(int a[], int size);***	Array: {6, 3, 3, 8, 2} Size: 5	2
• Write a recursive function that finds the sum of the following series. • $1 + 1/2 + 1/4 + 1/8 + ... + 1/2^n$	0 1 2 3	1 1.5 1.75 1.875