**National University of Computer and Emerging Sciences**



**Laboratory Manual**

*for*

# Data Structures Lab

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| Section | BCS-3H |
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# Department of Computer Science

FAST-NU, Lahore, Pakistan

**Objectives:**

In this lab, students will practice:

1. Recursion and its applications

**Problem 1: Finding greatest common divisor (GCD)**

Write a recursive function to find the greatest common divisor (GCD) of two integers using the Euclidean algorithm. The GCD of two numbers is the largest number that divides both of them without leaving a remainder.

**Problem 2: Implementing Tower of Hanoi puzzle**

Write a recursive function to solve the Tower of Hanoi puzzle. The puzzle consists of three rods and a number of disks of different sizes, which can be moved from one rod to another. The puzzle has the following rules:

* Only one disk can be moved at a time.
* A disk can only be placed on top of a larger disk or an empty rod.

**Problem 3: Finding subsets of given string**

Write the recursive method to find all the subsets of given string. Assume that if the given input is “abcd”, the output will be:

Abcd, abc, abd, ab, acd, ac, ad, a, bcd, bc, bd, b, cd, c

**Problem 4: Sum of Digits:**

Write a recursive function to find the sum of the digits of a positive integer n. For example, the sum of the digits of 12345 is 1 + 2 + 3 + 4 + 5 = 15.

**Problem 5: Permutations and Combinations:**

Write recursive functions to generate all permutations and combinations of a given set of elements. You can define these functions to take a set of elements as input and generate all possible permutations or combinations.

**Problem 6: Recursive Backtracking (e.g., Sudoku Solver):**

Implement a recursive backtracking algorithm to solve a specific problem, such as Sudoku or the N-Queens puzzle. These problems often involve making a series of choices and undoing them if they lead to a dead-end solution.