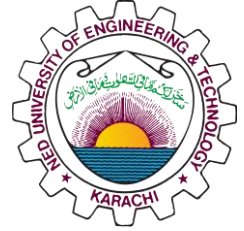




**NED University of Engineering & Technology**  
**Department of Computer Science & Information Technology**  
**CS-159: Data Structures & Algorithms**  
**Fall 2025**



**ASSIGNMENT # 3**

**Submission Deadline: Oct 20<sup>th</sup>, 2025.**

**Submission Guidelines**

Please carefully read the following instructions for submission of the assignment.

- Please submit the assignment before the deadline. It should be clear that submission after due date would not be considered.
- In case plagiarism strict actions will be taken You are advised to avoid submission of copied solution from any other student.
- **Submission:** Submission will only be accepted through GOOGLE CLASSROOM. You need to submit your work in **two** parts. Submission will be incomplete without both the parts.
  1. A single pdf file that contains solutions to all questions. Each answer is supposed to have properly intended and commented code.  
Before submission, rename your pdf file with your roll number.
  2. C/C++ program files for all questions. The file should be renamed as Q1\_CT01 for the for the 1<sup>st</sup> program if roll no. 01 and so on...

**Question 1:**

Write a recursive function to compute the factorial of a non-negative integer n.

**Question 2:**

Create a recursive function that takes a positive integer and returns the sum of its digits. For example, sum\_digits(123) should return 6.

**Question 3:**

Write a recursive function to find the nth number in the Fibonacci sequence. The sequence starts with 0, 1 and each subsequent number is the sum of the previous two.

**Question 4:**

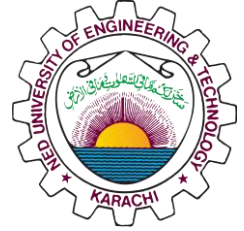
Write a recursive function to reverse a given string. Do not use any loops or built-in reverse functions.

**Question 5:**

Implement a recursive function to check if a given string is a palindrome. A palindrome is a word or phrase that reads the same forwards and backwards.



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**Question 6:**

Write a program to solve the **Towers of Hanoi** puzzle recursively. The function should take the number of disks and the source, destination, and auxiliary pegs as arguments, and print the steps to move the disks.

**Question 7:**

Solve the classic **N-Queens problem** using recursion and backtracking. Place  $n$  queens on an  $n \times n$  chessboard such that no two queens attack each other. Print all possible solutions.

**Question 8:**

Categorize and explain the four main types of recursion:

1. **Direct Recursion:** Where a function calls itself directly.
2. **Indirect Recursion:** Where a function calls another function, which in turn calls the first function.
3. **Tail Recursion:** Where the recursive call is the very last operation in the function.
4. **Non-Tail Recursion:** Where the recursive call is not the last operation, and some computation must be done with the return value.

For each type, provide a small code snippet or pseudo-code example and explain how it fits the category.

**Question 9:**

**Analyze** the following recursive functions and **identify** the type of recursion used in each. **Justify** your answer by explaining why it fits a specific category.

- **Function A:** factorial( $n$ )
- **Function B:** is\_even( $n$ ) and is\_odd( $n$ )
- **Function C:** A function to reverse a string where the recursive call is the last step.