Project Report

In-Class Activity: Comprehensive Binary Tree Traversal and Construction

Objective:

The task was to implement four types of binary tree traversals—preorder, inorder, postorder, and level order—and to validate these implementations with various test cases, including edge cases like empty trees and skewed trees.

Process:

My approach began with defining a basic binary tree node structure, followed by implementing each traversal algorithm. For preorder, inorder, and postorder traversals, I opted for a recursive approach, leveraging the inherent recursive nature of binary trees. For level order traversal, I implemented an iterative approach using a queue to ensure we visit nodes level by level.

Challenges Faced:

1. Understanding Different Traversal Techniques: Initially, distinguishing between the traversal techniques and understanding their practical applications was challenging. It required a clear conceptual understanding to implement them correctly.

2. Implementing Level Order Traversal: The level order traversal was particularly challenging due to its iterative nature, which differed from the recursive approaches of the other traversals. Managing the queue and ensuring that all nodes were visited in the correct order required careful attention.

3. Designing Comprehensive Test Cases: Creating test cases that could effectively validate the correctness and robustness of each traversal function was challenging. It was crucial to cover a wide range of scenarios, including edge cases.

Overcoming Challenges

1. Iterative Approach Mastery: For level order traversal, I engaged with several examples and closely examined the use of queues in binary tree traversals. Practice and experimentation with queue operations enabled me to effectively implement the iterative level order traversal.

2. Systematic Test Case Development: To ensure comprehensive testing, I started with basic cases and gradually increased complexity, considering different tree shapes and sizes. I also included special cases like empty trees and highly skewed trees to test the traversals' robustness under extreme conditions.