Experiment-6

Name: Khushi kumari
UID: 22BCS14714
Branch: BE-CSE
Section/Group: 640/B
Semester: 6th
Date of Performance: 21/02/25
Subject Name: AP LAB-II
Subject Code: 22CSP-351

1. Aim:

A tree is a hierarchical data structure that consists of nodes connected by edges. Unlike linear data structures like arrays and linked lists, trees are non-linear, making them ideal for representing hierarchical relationships such as file systems, database indexes, and decision-making processes.

2. Introduction to the Searching and Sorting:

Tree Traversal Methods:
Traversal is the process of visiting nodes in a tree.

1. **Depth-First Search (DFS)**
- Explores as deep as possible before backtracking.
- Preorder (Root → Left → Right): Used for copying a tree.
- Inorder (Left → Root → Right): Used in Binary Search Trees (BSTs) to retrieve sorted values.
- Postorder (Left → Right → Root): Used for deleting trees (deletes child nodes before the parent).

2. **Breadth-First Search (BFS)**
- Also called Level Order Traversal.
- Explores all nodes at one level before moving to the next.

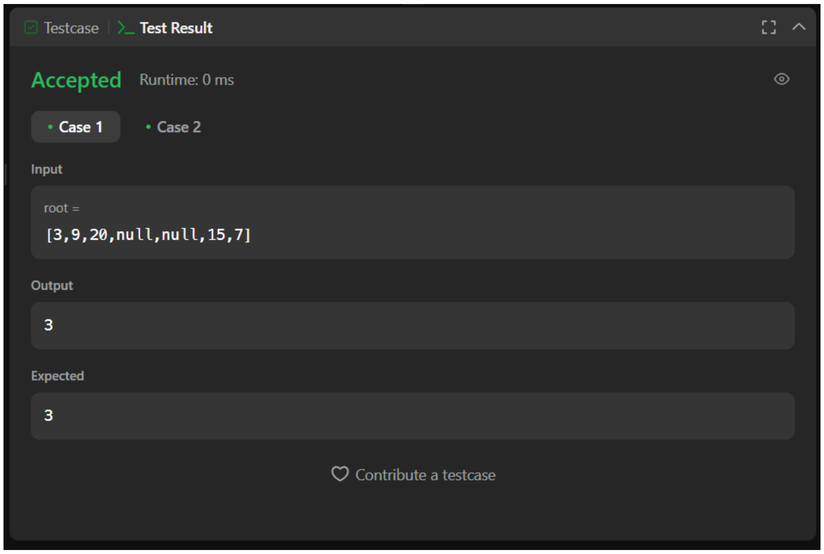
3. Implementation/Code:

- **104 Maximum Depth of Binary Tree:**

```
import java.util.*;
class Solution {
    public int maxDepth(TreeNode root) {
        if (root == null) return 0;
        Queue<TreeNode> queue = new LinkedList<>();
        queue.add(root);
        int depth = 0;
        while (!queue.isEmpty()) {
            int size = queue.size();
            depth++;
            for (int i = 0; i < size; i++) {
                TreeNode node = queue.poll();
                if (node.left != null) queue.add(node.left);
                if (node.right != null) queue.add(node.right);
```

```
            }
        }
        return depth;
    }
}
```

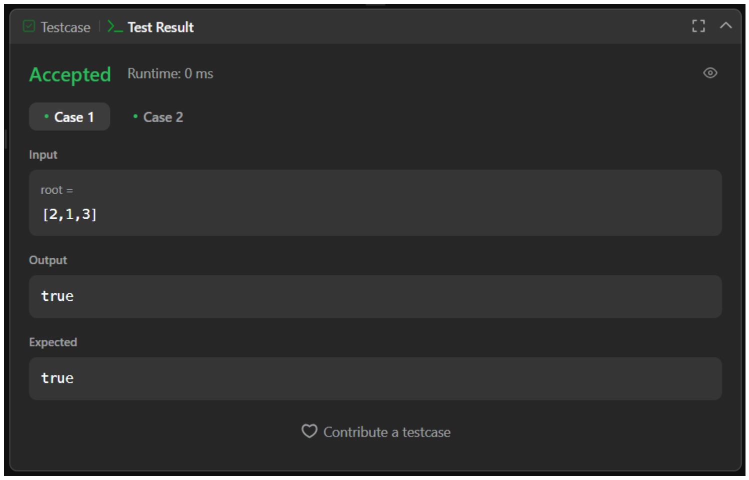
104Output:



- **98 Validate Binary Search Tree:**

```
import java.util.Stack;
class Solution {
    public boolean isValidBST(TreeNode root) {
        Stack<TreeNode> stack = new Stack<>();
        TreeNode current = root;
        TreeNode prev = null;
        while (!stack.isEmpty() || current != null) {
            while (current != null) {
                stack.push(current);
                current = current.left;
            }
            current = stack.pop();
            if (prev != null && current.val <= prev.val) {
                return false;
            }
            prev = current;
            current = current.right;
        }
        return true;
    }
}
```

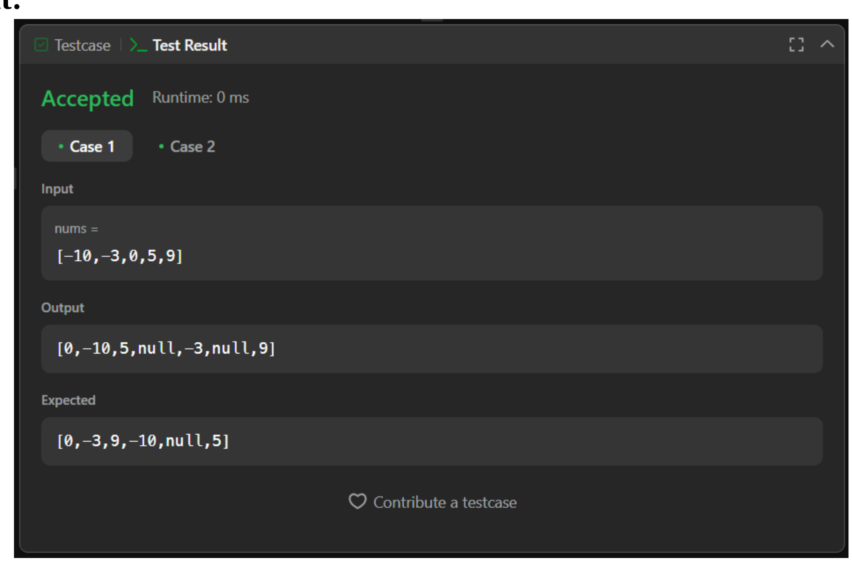
98 Output:



- **108 Convert Sorted Array to Binary Search Tree:**

```
class Solution {
   public TreeNode sortedArrayToBST(int[] nums) {
      return buildBST(nums, 0, nums.length - 1);
   }
   private TreeNode buildBST(int[] nums, int left, int right) {
      if (left > right) return null; // Base case
      int mid = (left + right) / 2;  // Find middle index
      TreeNode root = new TreeNode(nums[mid]); // Create root node
      root.left = buildBST(nums, left, mid - 1);  // Left Subtree
      root.right = buildBST(nums, mid + 1, right); // Right Subtree
      return root;
   }
}
```

108 Output:



- **94 Binary Search Tree Inorder Traversal:**

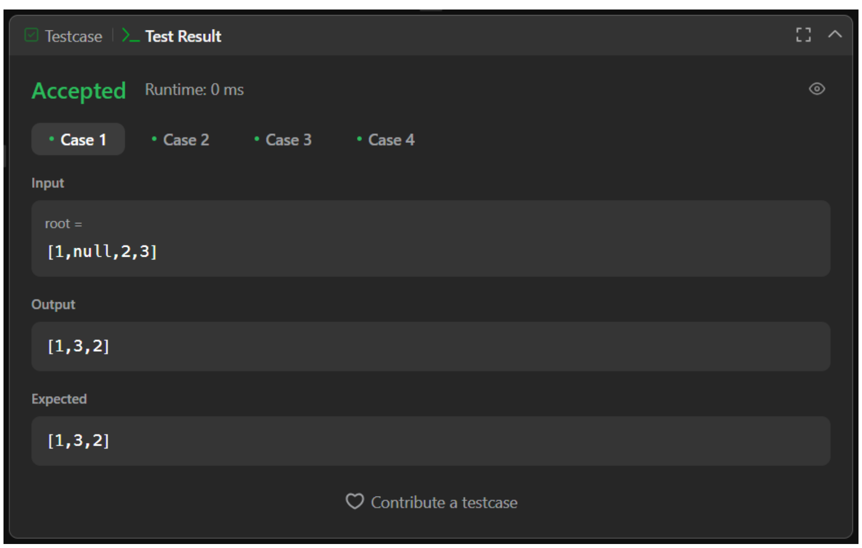
```
import java.util.*;

class Solution {
    public List<Integer> inorderTraversal(TreeNode root) {
        List<Integer> result = new ArrayList<>();
        inorder(root, result);
        return result;
    }

    private void inorder(TreeNode node, List<Integer> result) {
        if (node == null) return;

        inorder(node.left, result);  // Left
        result.add(node.val);         // Root
        inorder(node.right, result); // Right
    }
}
```

94 Output:



4. Learning Outcome

➢ Understand the breaking down the sorted array into smaller parts to build a height-balanced BST.

➢ Understanding binary search tree beyond simple sorted arrays.

➢ How to validate if a binary tree is a BST by checking left and right subtrees recursively.