Experiment-6

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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.

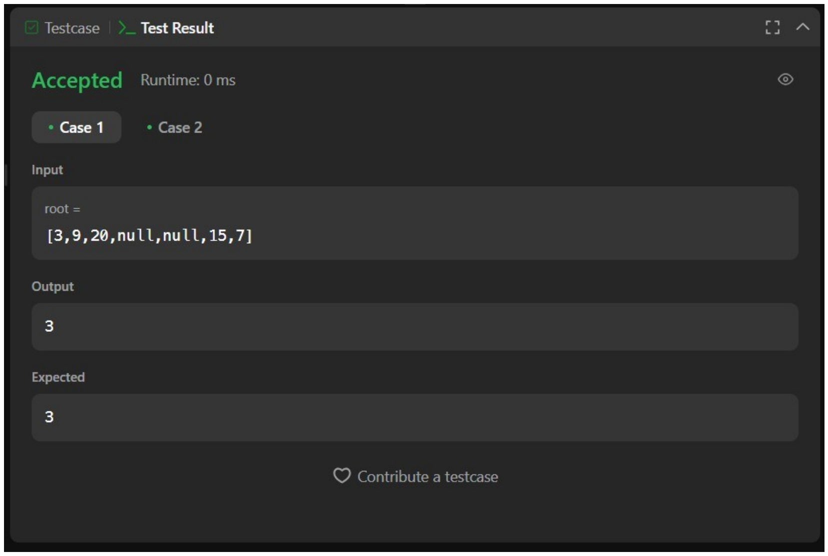
3. Implementation/Code:

** 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;
      }
    }
```

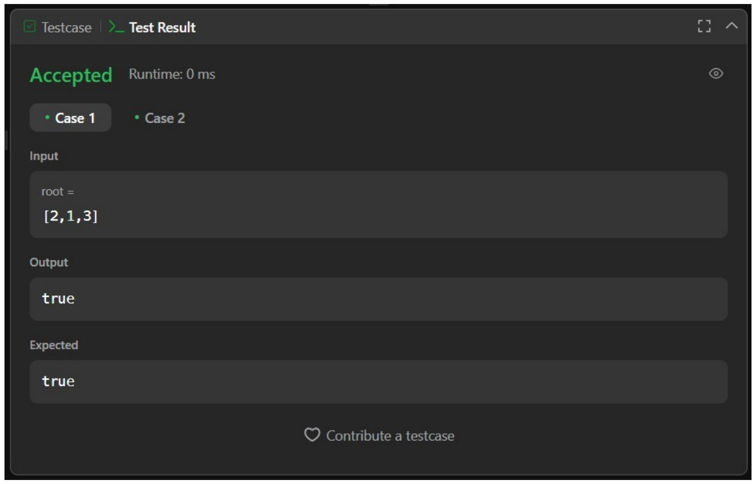
104Output:



** 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;
    }
}
```

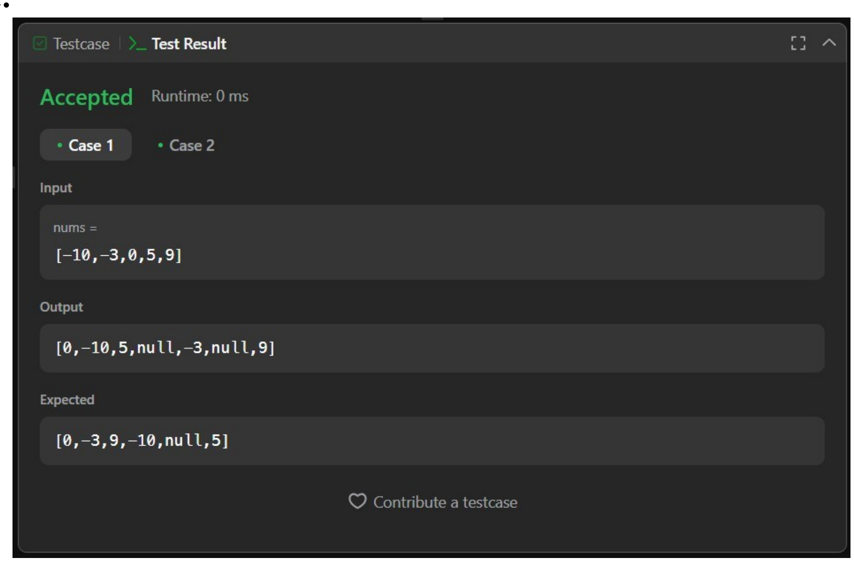
98 Output:



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:



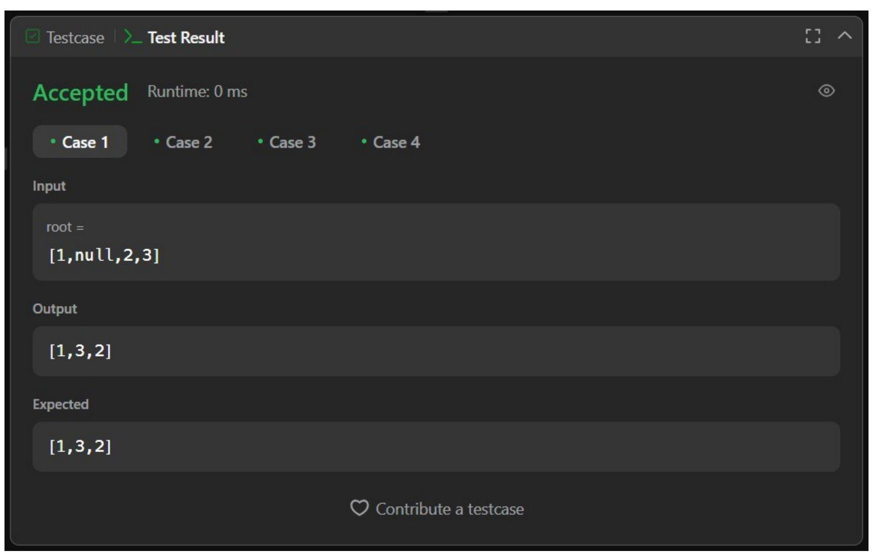
- **94 Binary Search Tree Inorder Traversal:** import java.util.*;

```
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 heightbalanced 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.