



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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Experiment-6

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Section/Group: 640/B

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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: <https://leetcode.com/problems/maximum-depth-of-binary-tree/submissions/1558056773/>

□ 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);        }
        }
    }
}
```

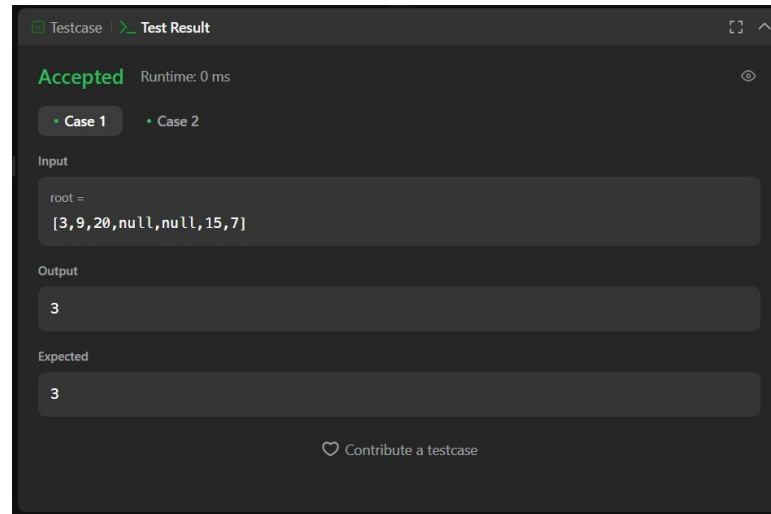


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```
        return depth;
    }
}
```

104 Output:



□ **98 Validate Binary Search Tree:** <https://leetcode.com/problems/validate-binary-search-tree/submissions/1558059026/>

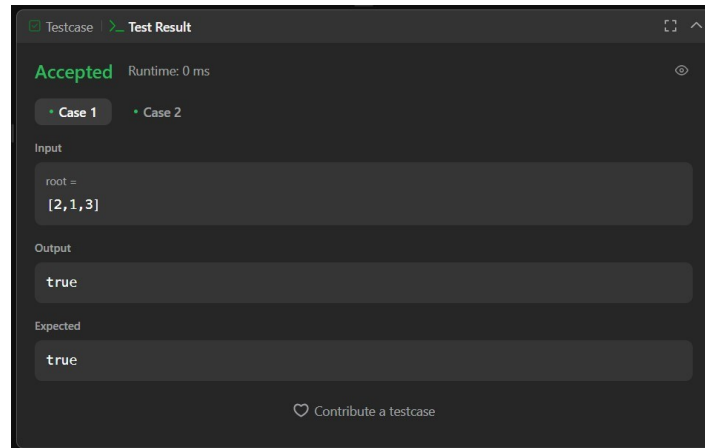
```
import java.util.Stack; class Solution {
    public boolean isValidBST(TreeNode root) {
        Stack<TreeNode> stack = new Stack<>();
        TreeNode current = root;
        TreeNode prev = null;
        while (!stack.isEmpty() || current != null) {
            while (current != null) {
                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:



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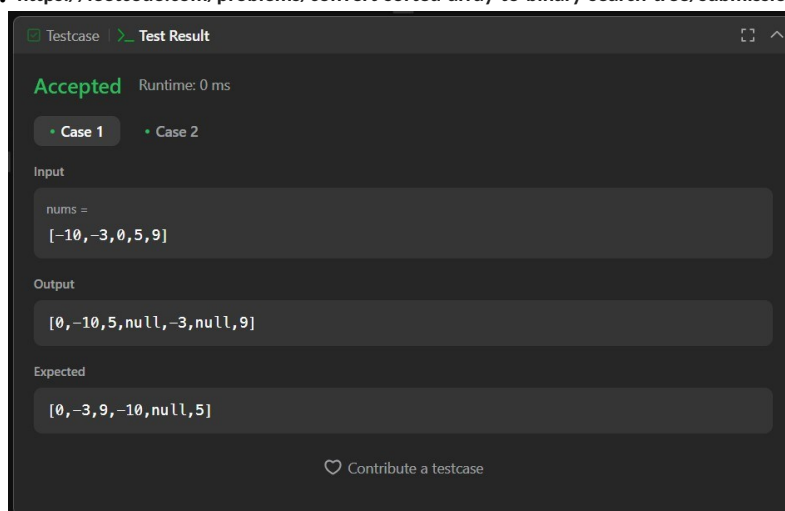
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108 Convert Sorted Array to Binary Search Tree:

```
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: <https://leetcode.com/problems/convert-sorted-array-to-binary-search-tree/submissions/1558063550/>



94 Binary Search Tree Inorder Traversal

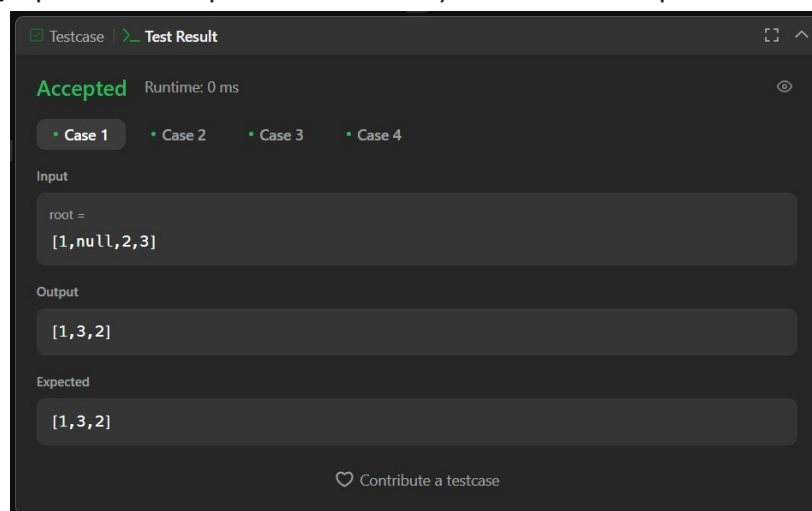
```
import java.util.*;

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

    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: <https://leetcode.com/problems/construct-binary-tree-from-inorder-and-postorder-traversal/submissions/1558067176/>



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.