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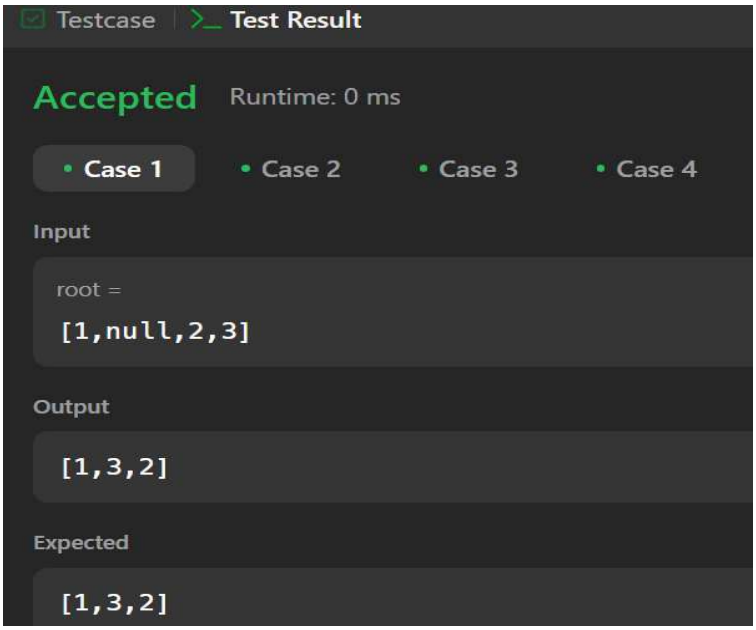
Ques 1. Binary Tree Inorder Traversal.

Code:

```
class Solution {
public:
    void inorder(TreeNode* root, vector<int>& result) {
        if (!root) return;
        inorder(root->left, result);
        result.push_back(root->val);
        inorder(root->right, result);
    }

    vector<int> inorderTraversal(TreeNode* root) {
        vector<int> result;
        inorder(root, result);
        return result;
    }
};
```

Output:

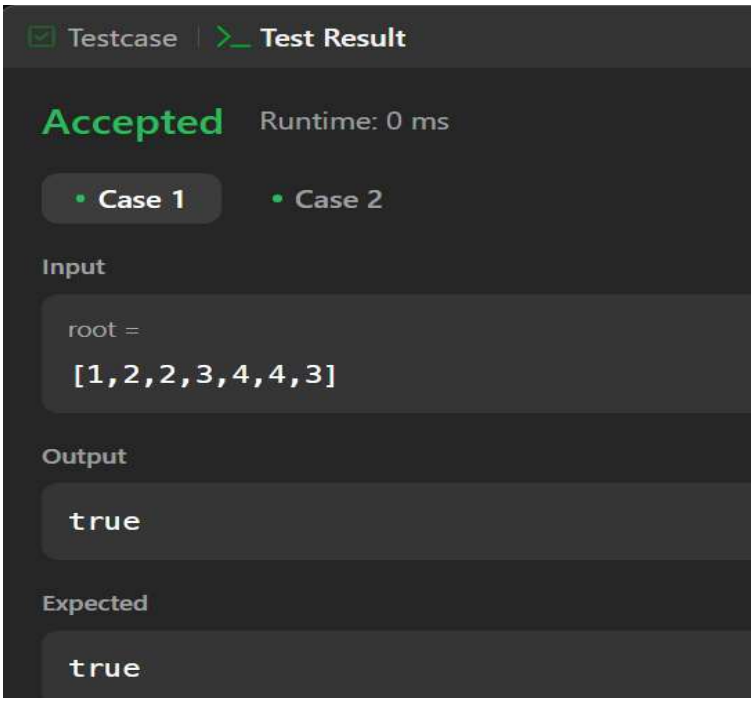


Ques 2. Symmetric Tree.

Code:

```
class Solution {
public:
    bool isMirror(TreeNode* t1, TreeNode* t2) {
        if (!t1 && !t2) return true;
        if (!t1 || !t2) return false;
        return (t1->val == t2->val) &&
               isMirror(t1->left, t2->right) &&
               isMirror(t1->right, t2->left);
    }
    bool isSymmetric(TreeNode* root) {
        if (!root) return true;
        return isMirror(root->left, root->right);
    }
};
```

Output:

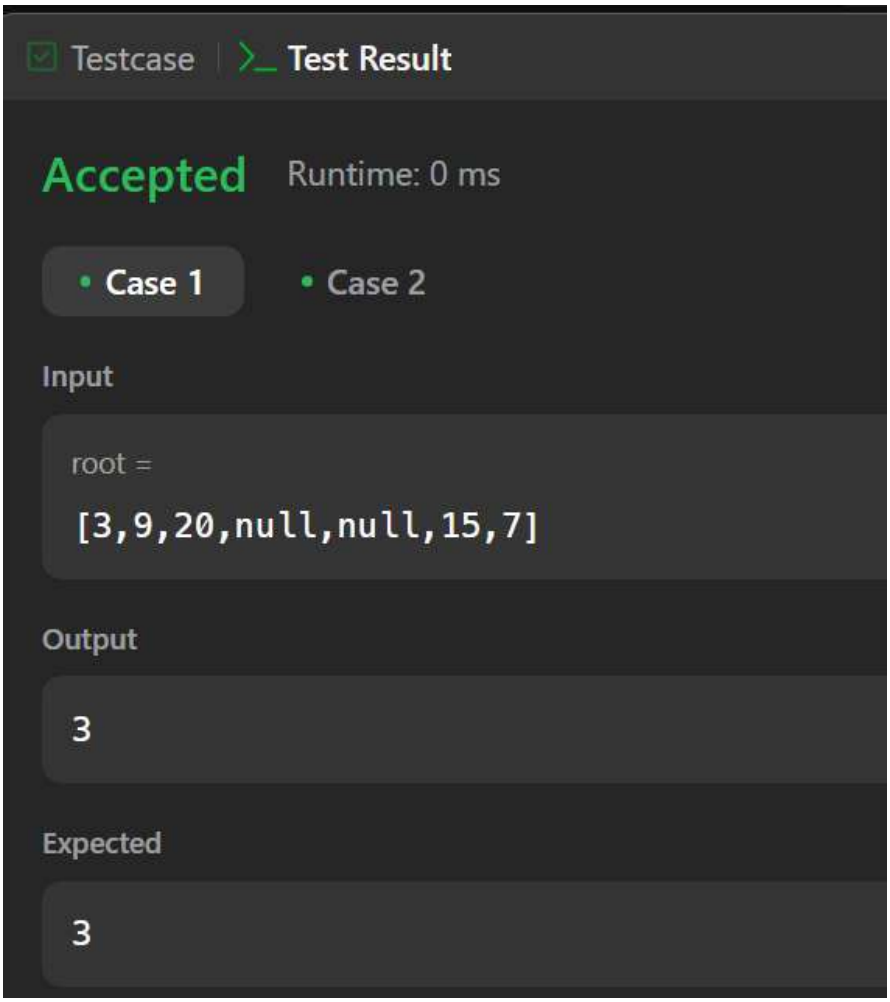


Ques 3. Maximum Depth of Binary Tree.

Code:

```
class Solution {
public:
    int maxDepth(TreeNode* root) {
        if (!root) return 0;
        return 1 + max(maxDepth(root->left), maxDepth(root->right));
    }
};
```

Output:



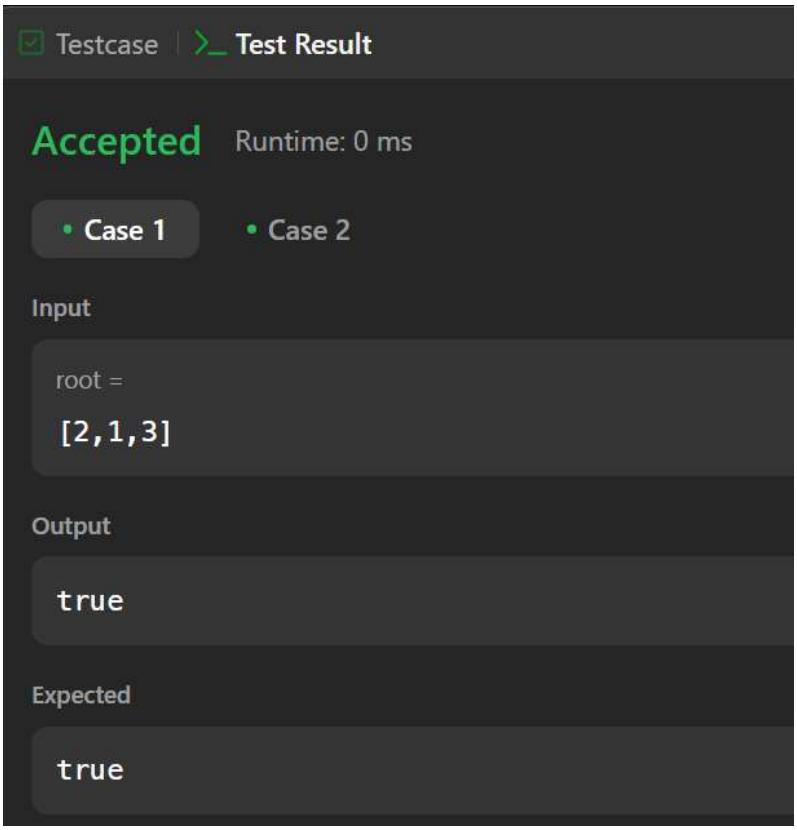
Ques 4. Validate Binary Search Tree.

Code:

```
class Solution {
public:
    bool validate(TreeNode* node, long minVal, long maxVal) {
        if (!node) return true;
        if (node->val <= minVal || node->val >= maxVal) return false;
        return validate(node->left, minVal, node->val) && validate(node->right, node->val, maxVal);
    }

    bool isValidBST(TreeNode* root) {
```

```
        return validate(root, LONG_MIN, LONG_MAX);
    }
};
```

Output:



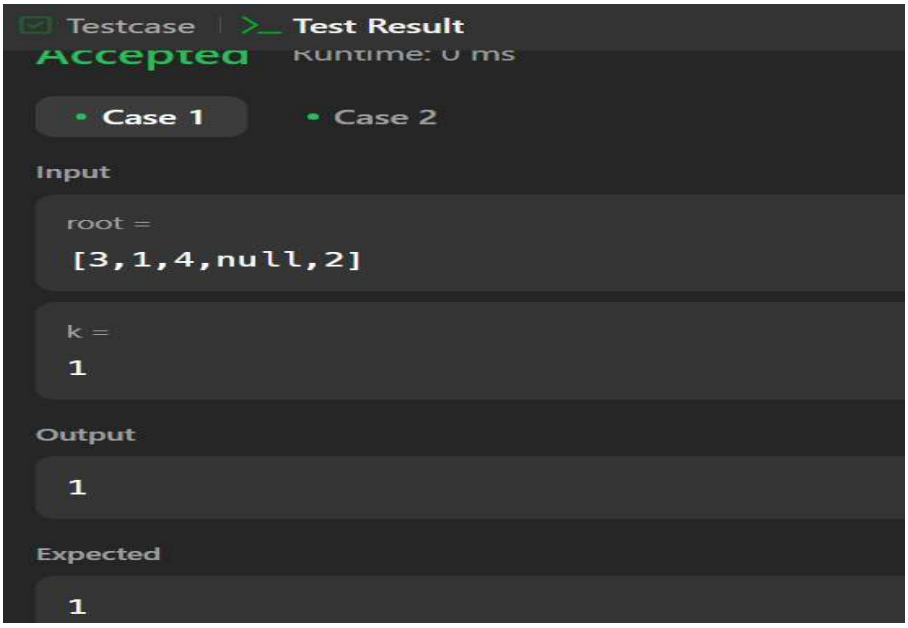
Ques 5. Kth Smallest Element ina BST.

Code:

```
class Solution {
public:
    void inorder(TreeNode* root, vector<int>& elements) {
        if (!root) return;
        inorder(root->left, elements);
        elements.push_back(root->val);
        inorder(root->right, elements);
    }
```

```
    int kthSmallest(TreeNode* root, int k) {
        vector<int> elements;
        inorder(root, elements);
        return elements[k - 1]; // Since k is 1-indexed
    }
};
```

Output:



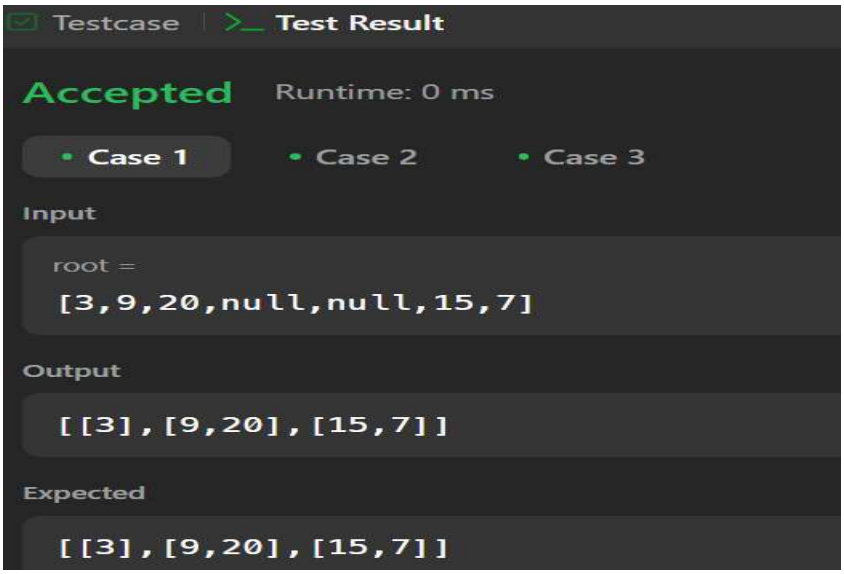
Ques 6. Binary Tree Level Order Traversal.

Code:

```
class Solution {
public:
    vector<vector<int>> levelOrder(TreeNode* root) {
        vector<vector<int>> result;
        if (!root) return result;
        queue<TreeNode*> q; q.push(root);
        while (!q.empty()) {
            int size = q.size();
            vector<int> level;
```

```
            for (int i = 0; i < size; i++) {
                TreeNode* node = q.front();   q.pop();
                level.push_back(node->val);
                if (node->left) q.push(node->left);
                if (node->right) q.push(node->right);
            }
            result.push_back(level); }
        return result; }
};
```

Output:



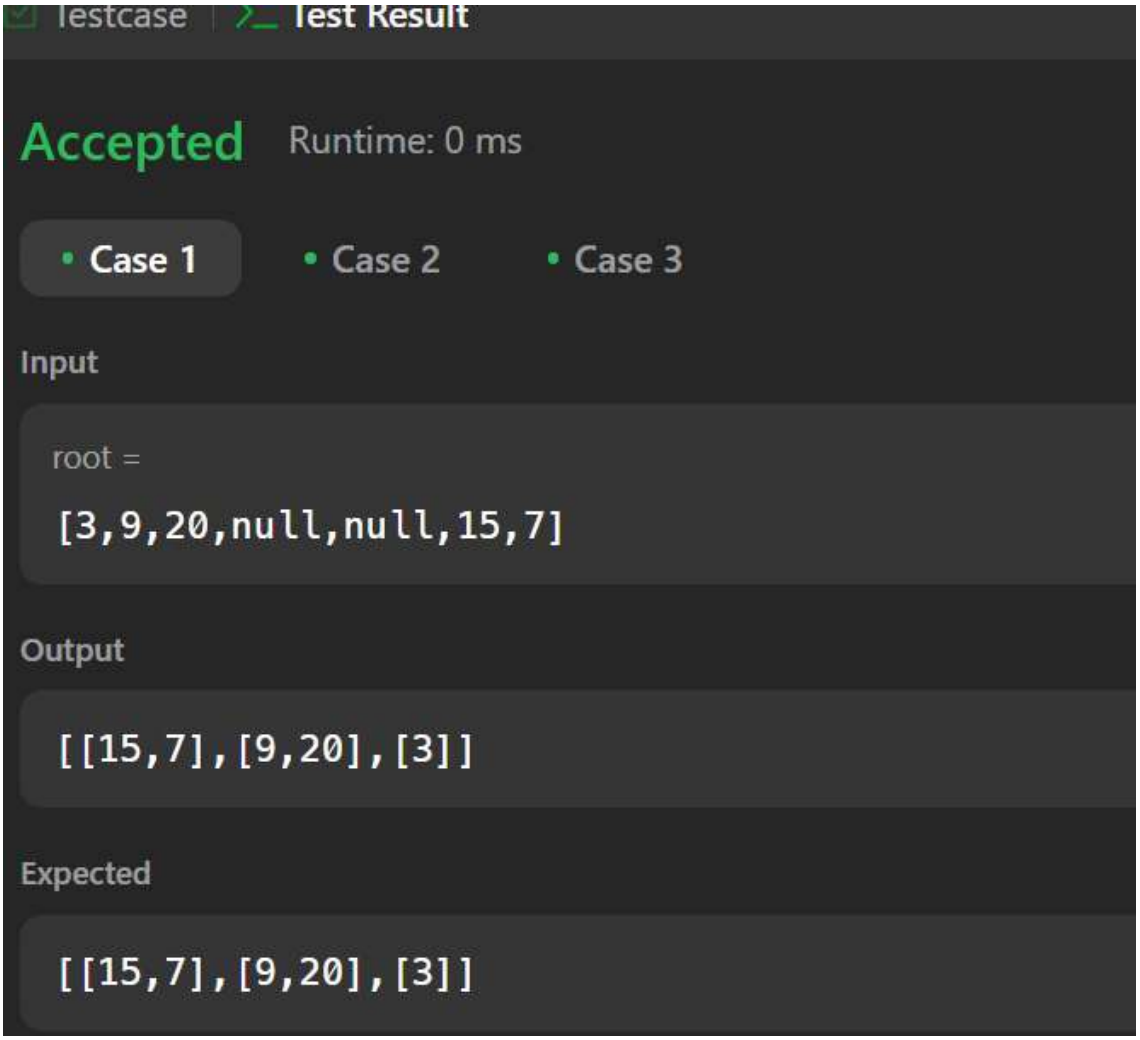
Ques 7. Binary Tree Level Order Traversal II.

Code:

```
class Solution {
public:
    vector<vector<int>> levelOrderBottom(TreeNode* root) {
        vector<vector<int>> result;
        if (!root) return result;
        queue<TreeNode*> q;
        q.push(root);
```

```
        while (!q.empty()) {
            int size = q.size();
            vector<int> level;
            for (int i = 0; i < size; i++) {
                TreeNode* node = q.front();
                q.pop();
                level.push_back(node->val);
                if (node->left) q.push(node->left);
                if (node->right) q.push(node->right);
            }

            result.push_back(level);
        }

        reverse(result.begin(), result.end());
        return result;
    }
};
```

Output:



Ques 8. Binary Tree Zigzag Level Order Traversal.

Code:

```
class Solution {
public:
    vector<vector<int>> zigzagLevelOrder(TreeNode* root) {
        vector<vector<int>> result;
        if (!root) return result;

        queue<TreeNode*> q;
        q.push(root);
        bool leftToRight = true;

        while (!q.empty()) {
            int size = q.size();
            deque<int> level;  // Use deque for flexible insertion

            for (int i = 0; i < size; i++) {
                TreeNode* node = q.front();
                q.pop();

                if (leftToRight)
                    level.push_back(node->val);
                else
                    level.push_front(node->val);

                if (node->left) q.push(node->left);
                if (node->right) q.push(node->right);
            }

            result.push_back(vector<int>(level.begin(), level.end()));
            leftToRight = !leftToRight;  // Toggle direction
        }
```

```
        return result;
    }
};
```

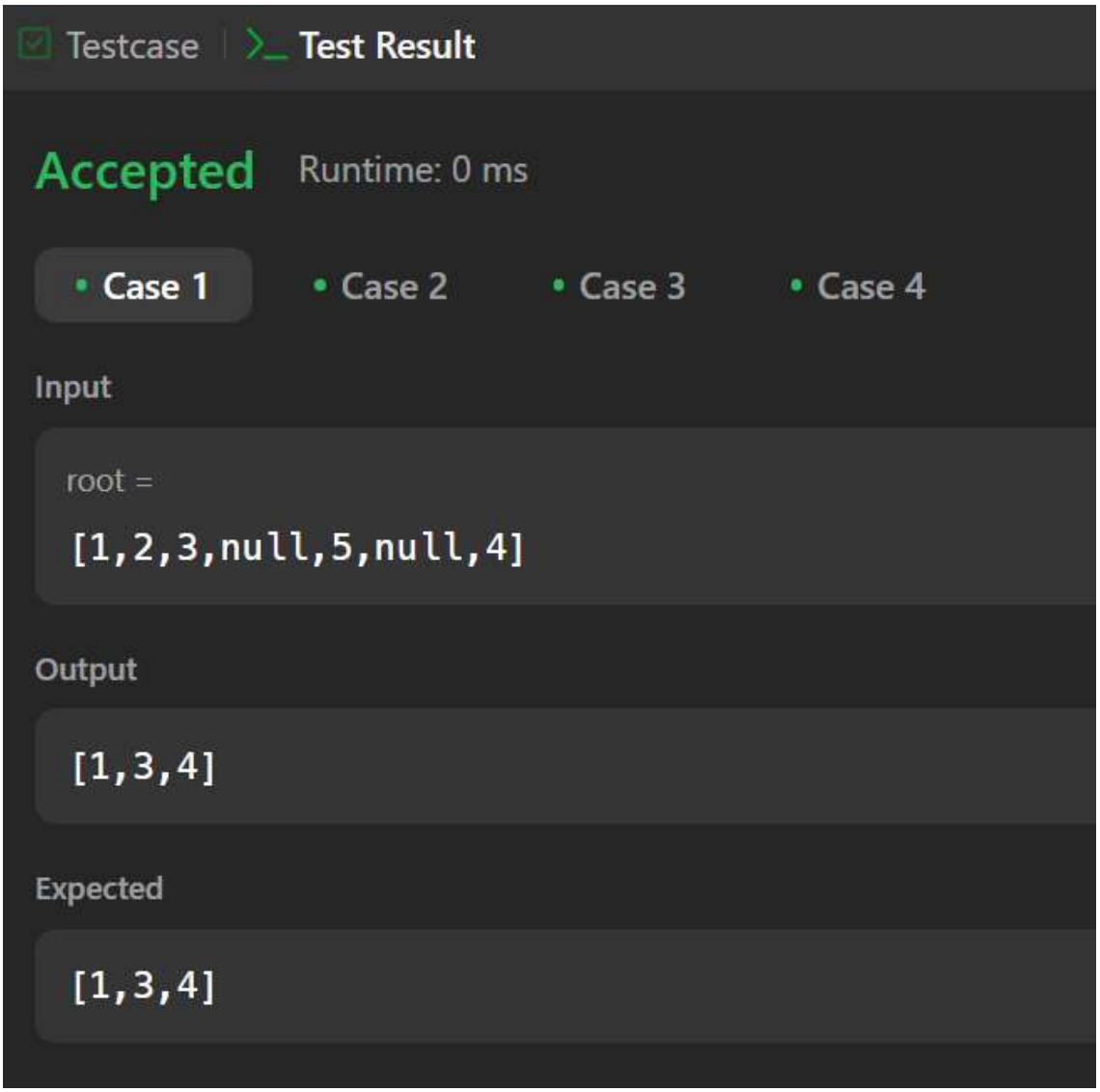
Output:

Ques 9. Binary Tree Right Side View.

Code:

```
class Solution {
public:
    vector<int> rightSideView(TreeNode* root) {
        vector<int> result;
        if (!root) return result;

        queue<TreeNode*> q;
        q.push(root);

        while (!q.empty()) {
            int size = q.size();
            int rightmost = 0;

            for (int i = 0; i < size; i++) {
                TreeNode* node = q.front();
                q.pop();
                rightmost = node->val;  // Store last node of the level

                if (node->left) q.push(node->left);
                if (node->right) q.push(node->right);
            }

            result.push_back(rightmost);
        }

        return result;
    }
};
```

Output:



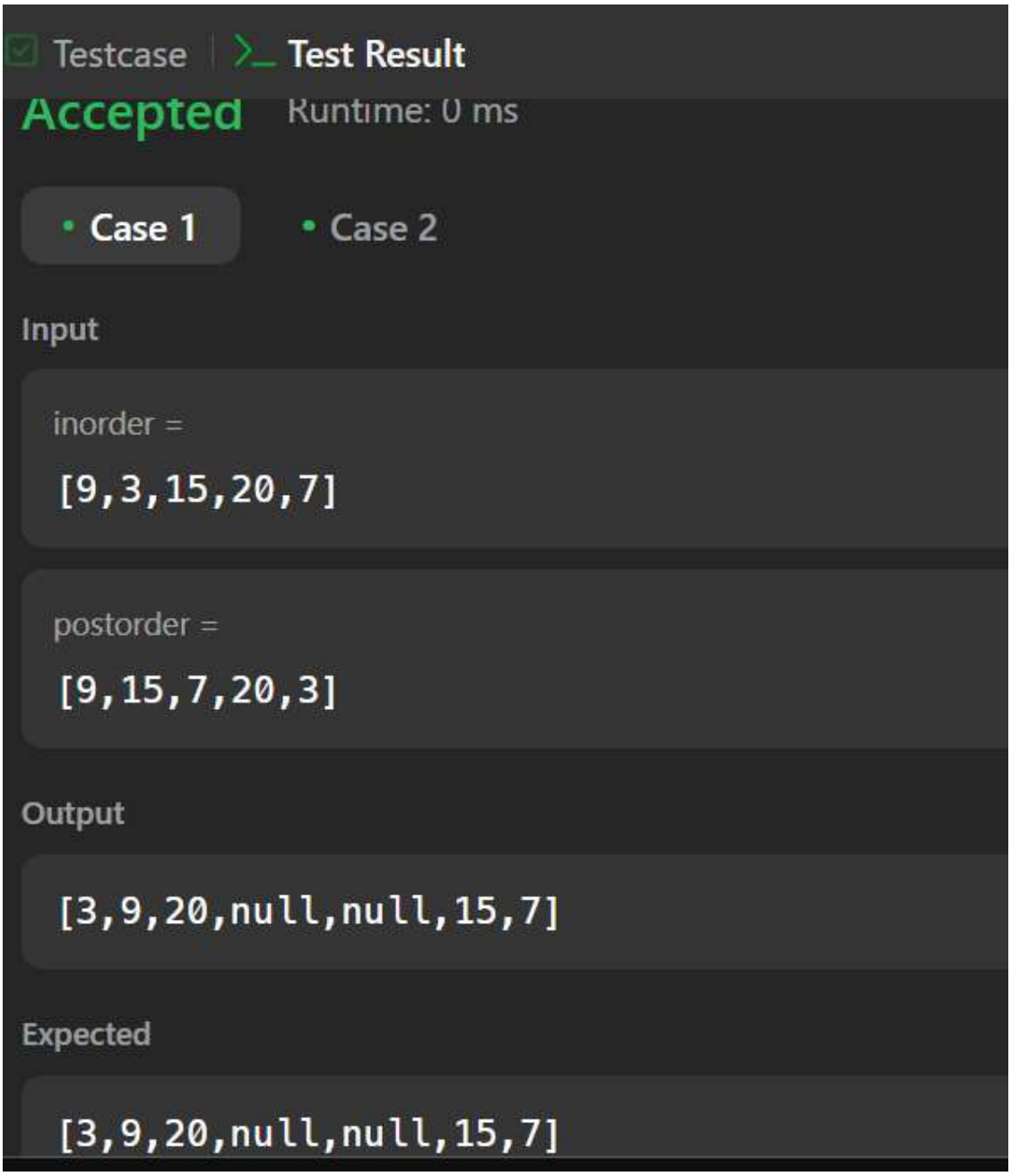
Ques 10. Construct Binary Tree from Inorder and Postorder Traversal.

Code:

```
class Solution {
public:
    unordered_map<int, int> inorderMap; // To store inorder value -> index mapping
    int postIndex; // To track the current root index in postorder

    TreeNode* buildTreeHelper(vector<int>& inorder, vector<int>& postorder, int left, int right) {
        if (left > right) return nullptr; // Base case

        // Get the root from the postorder traversal
        int rootVal = postorder[postIndex--];
        TreeNode* root = new TreeNode(rootVal);

        // Get index of root in inorder array
        int inorderIdx = inorderMap[rootVal];

        // Build right subtree first (since postorder processes left first, we process right first)
        root->right = buildTreeHelper(inorder, postorder, inorderIdx + 1, right);
        root->left = buildTreeHelper(inorder, postorder, left, inorderIdx - 1);

        return root;
    }

    TreeNode* buildTree(vector<int>& inorder, vector<int>& postorder) {
        postIndex = postorder.size() - 1;

        // Store inorder indices for quick lookup
        for (int i = 0; i < inorder.size(); i++) {
            inorderMap[inorder[i]] = i;
        }
```

```
        return buildTreeHelper(inorder, postorder, 0, inorder.size() - 1);
    }
};
```

Output:

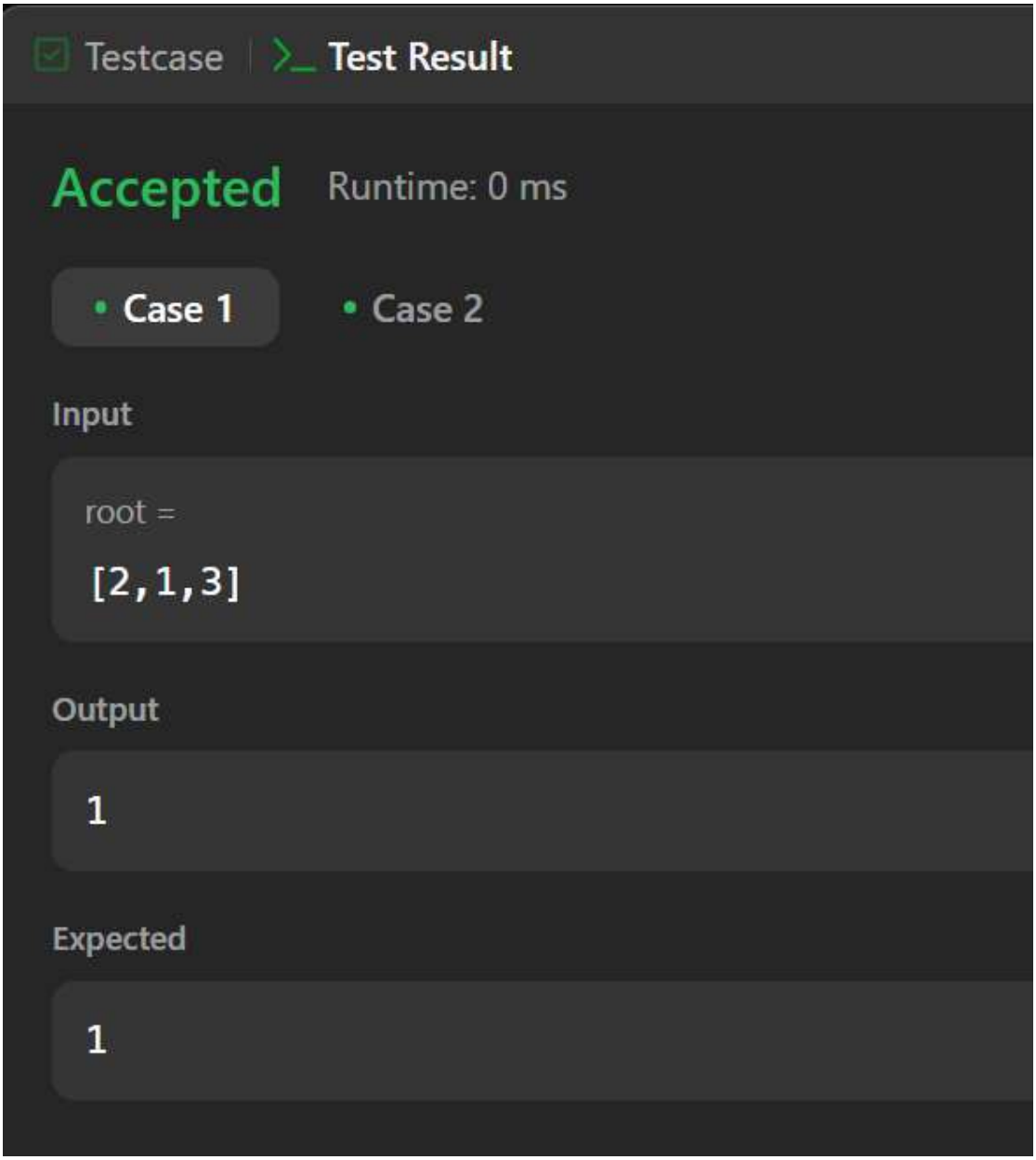


Ques 11. Find Bottom Left Tree Value.

Code:

```
class Solution {
public:
    int findBottomLeftValue(TreeNode* root) {
        queue<TreeNode*> q;
        q.push(root);
        int bottomLeft = root->val; // Initialize with root value

        while (!q.empty()) {
            int size = q.size();
            bottomLeft = q.front()->val; // First element in this level

            for (int i = 0; i < size; i++) {
                TreeNode* node = q.front();
                q.pop();

                // Push left child first (ensures leftmost node is encountered first)
                if (node->left) q.push(node->left);
                if (node->right) q.push(node->right);
            }
        }
        return bottomLeft;
    }
};
```

Output:

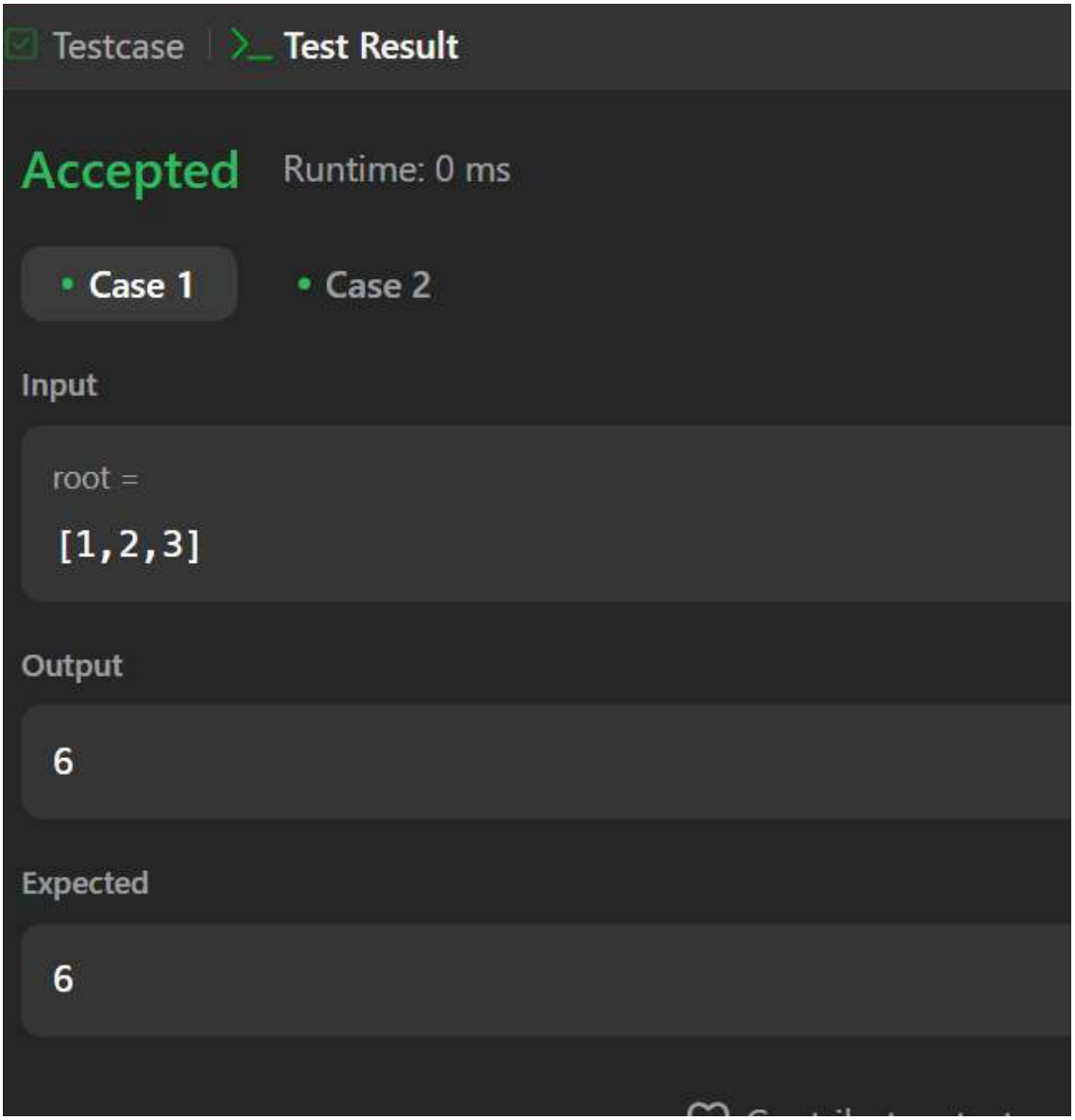


Ques 12. Binary Tree Maximum Path Sum.

Code:

```
class Solution {
public:
    int maxSum = INT_MIN;

    int maxGain(TreeNode* node) {
        if (!node) return 0;

        // Compute max sum for left and right subtrees, ignoring negative sums
        int leftGain = max(0, maxGain(node->left));
        int rightGain = max(0, maxGain(node->right));

        // Compute the maximum path sum passing through this node
        int pathSum = node->val + leftGain + rightGain;

        // Update global maximum sum
        maxSum = max(maxSum, pathSum);

        // Return max path sum including this node and at most one child
        return node->val + max(leftGain, rightGain);
    }

    int maxPathSum(TreeNode* root) {
        maxGain(root);
        return maxSum;
    }
};
```

Output:



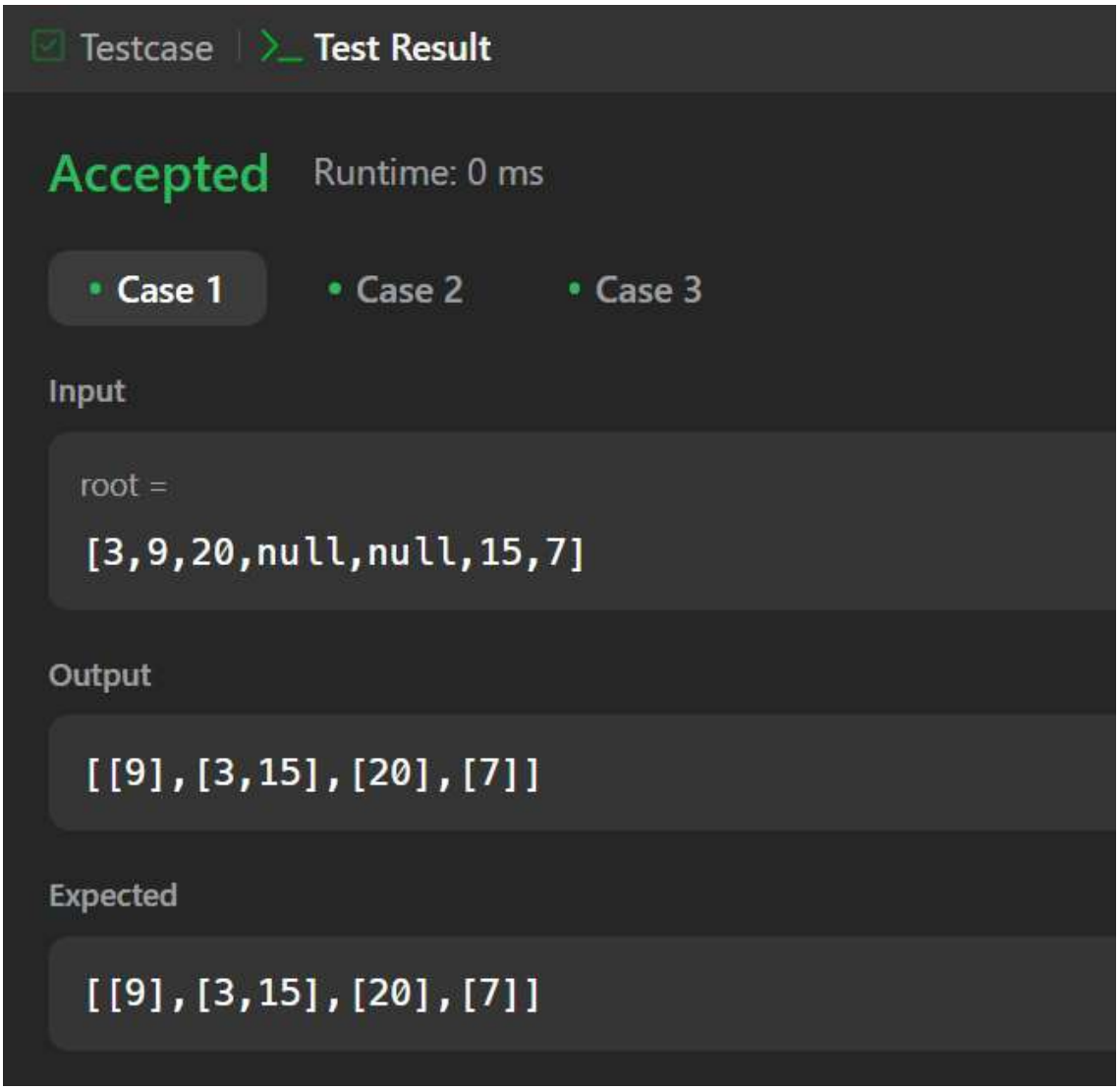
Ques 13. Vertical Order Traversal of a Binary Tree.

Code:

```
class Solution {
public:
    vector<vector<int>> verticalTraversal(TreeNode* root) {
        map<int, vector<pair<int, int>>> colMap; // {col: [(row, value)]}
        queue<pair<TreeNode*, pair<int, int>>> q; // {node, (row, col)}

        q.push({root, {0, 0}}); // Start with root at (0,0)

        while (!q.empty()) {
            auto [node, pos] = q.front();
            q.pop();
            int row = pos.first, col = pos.second;

            colMap[col].push_back({row, node->val});

            if (node->left) q.push({node->left, {row + 1, col - 1}});
            if (node->right) q.push({node->right, {row + 1, col + 1}});
        }

        vector<vector<int>> result;
        for (auto &[col, nodes] : colMap) {
            // Sort by row first, then by value
            sort(nodes.begin(), nodes.end());
            vector<int> colVals;
            for (auto &[row, val] : nodes) colVals.push_back(val);
            result.push_back(colVals);
        }

        return result;
    }
```

};

Output:


Testcase
Test Result
Accepted
Runtime: 0 ms
Case 1
Case 2
Case 3
Input
root =
[3,9,20,null,null,15,7]
Output
[[9],[3,15],[20],[7]]
Expected
[[9],[3,15],[20],[7]]