ASSIGNMENT -3 (ADVANCED PROGRAMMING)

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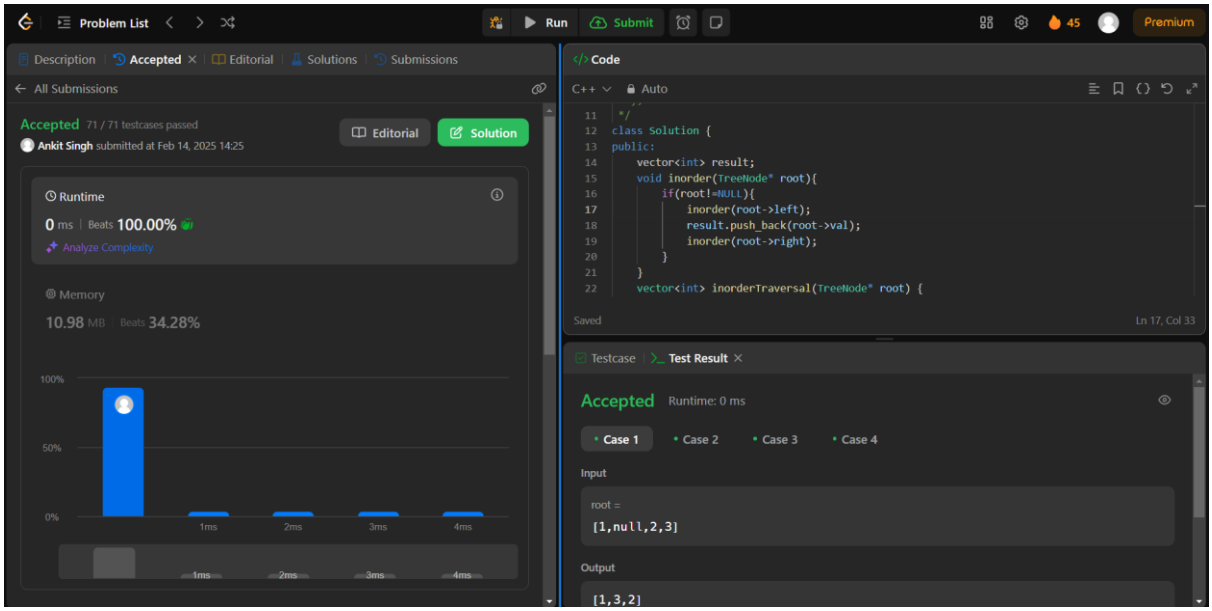
1. **Problem 1:** Binary Tree Inorder Traversal (94)
2. **Code:**

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

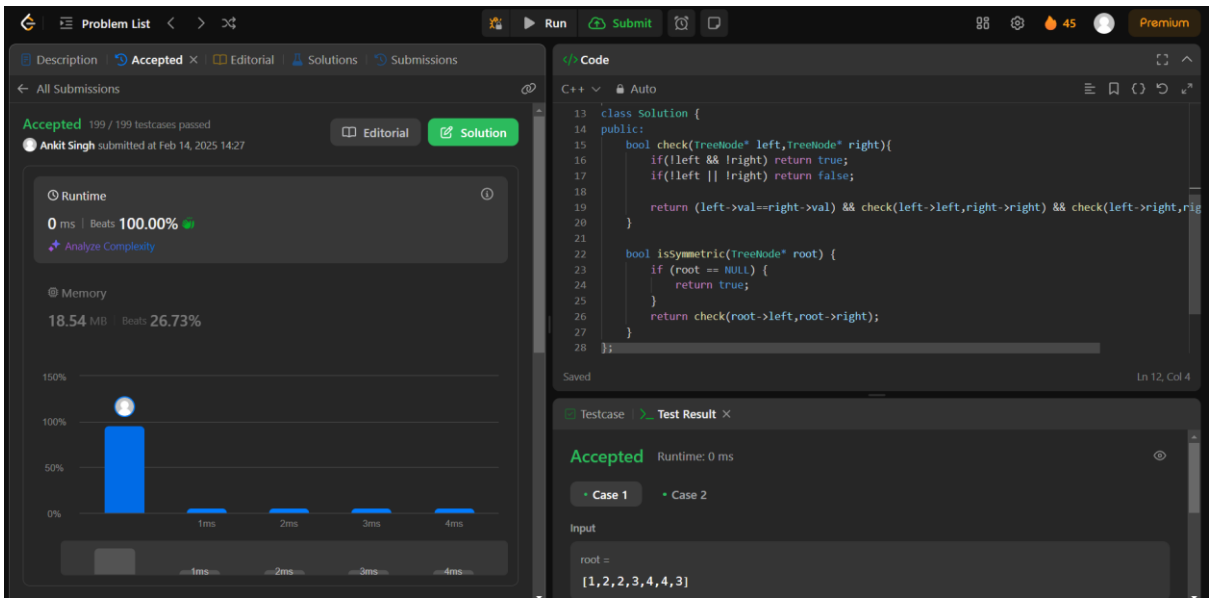
3. **Output:**



1. **Problem 2:** Symmetric Tree (101)
2. **Code:**

```
Class Solution {
public:
    bool check(TreeNode* left,TreeNode* right){
        if(!left && !right) return true;
        if(!left || !right) return false;

        return (left->val==right->val) && check(left->left,right->right) &&
check(left->right,right->left );
    }

    bool isSymmetric(TreeNode* root) {
        if (root == NULL) {
            return true;
        }
        return check(root->left,root->right);
    }
};
```

3. **Output:**

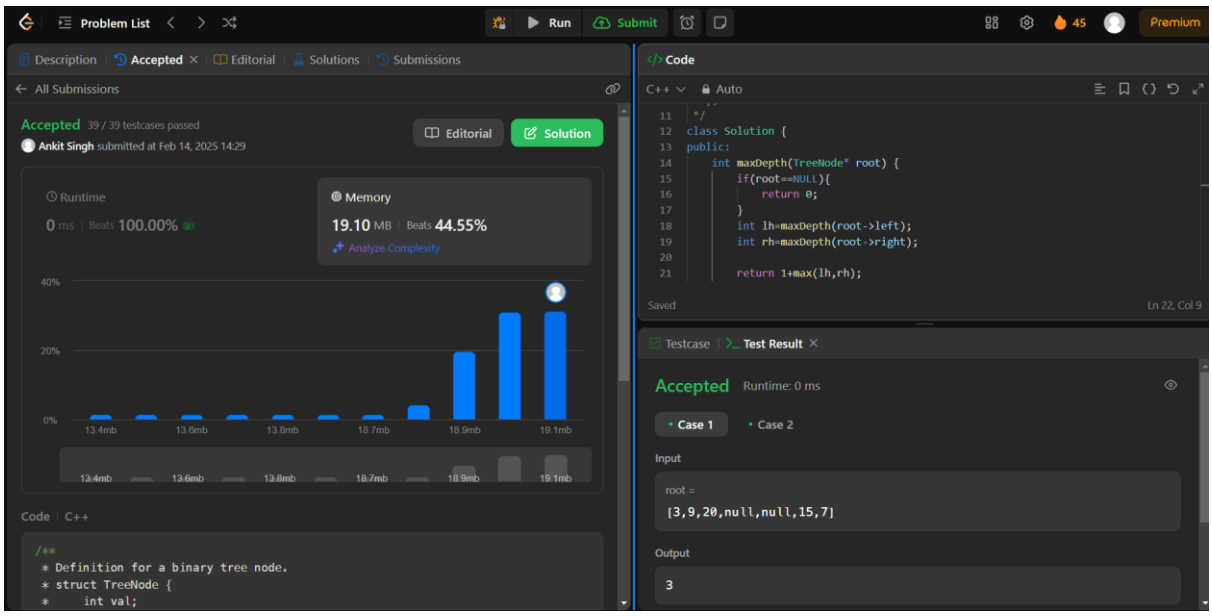


1. **Problem 3:** Maximum Depth of Binary Tree (104)

2. **Code:**

```
class Solution {
public:
    int maxDepth(TreeNode* root) {
        if(root==NULL){
            return 0;
        }
        int lh=maxDepth(root->left);
        int rh=maxDepth(root->right);

        return 1+max(lh,rh);
    }
}
```

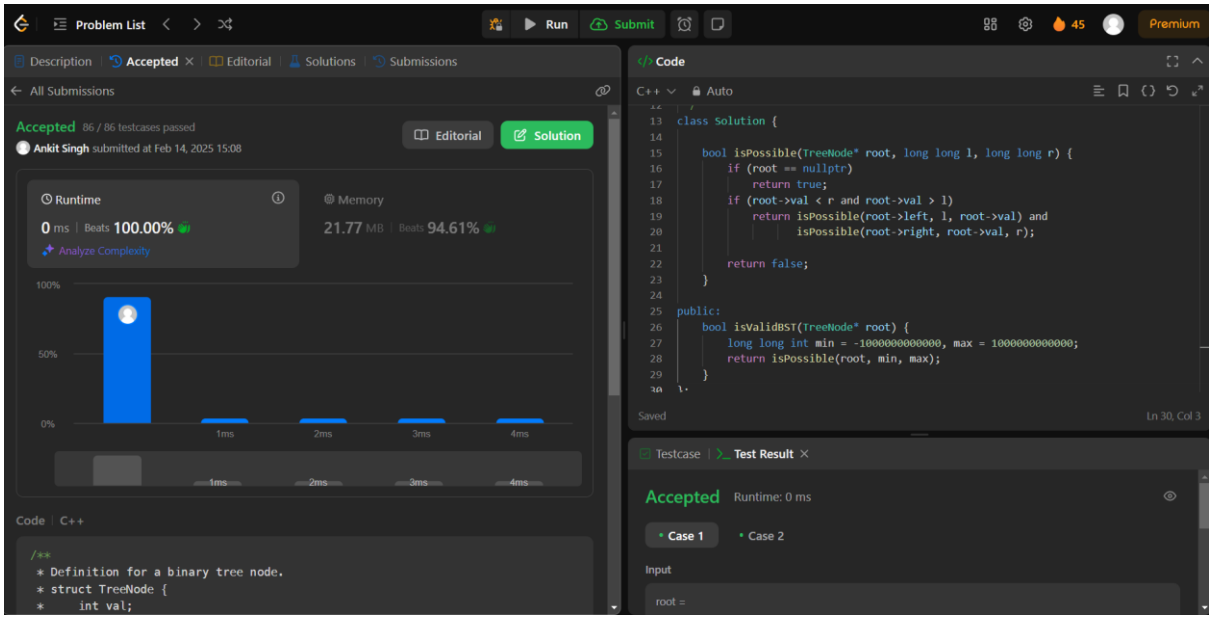
3. **Output:**



1. **Problem 4:** Validate Binary Search Tree (98)
2. **Code:**

```
class Solution {

    bool isPossible(TreeNode* root, long long l, long long r) {
        if (root == nullptr)
            return true;
        if (root->val < r and root->val > l)
            return isPossible(root->left, l, root->val) and
                   isPossible(root->right, root->val, r);

        return false;
    }

public:
    bool isValidBST(TreeNode* root) {
        long long int min = -1000000000000, max = 1000000000000;
        return isPossible(root, min, max);
    }
};
```

3. **Output:**

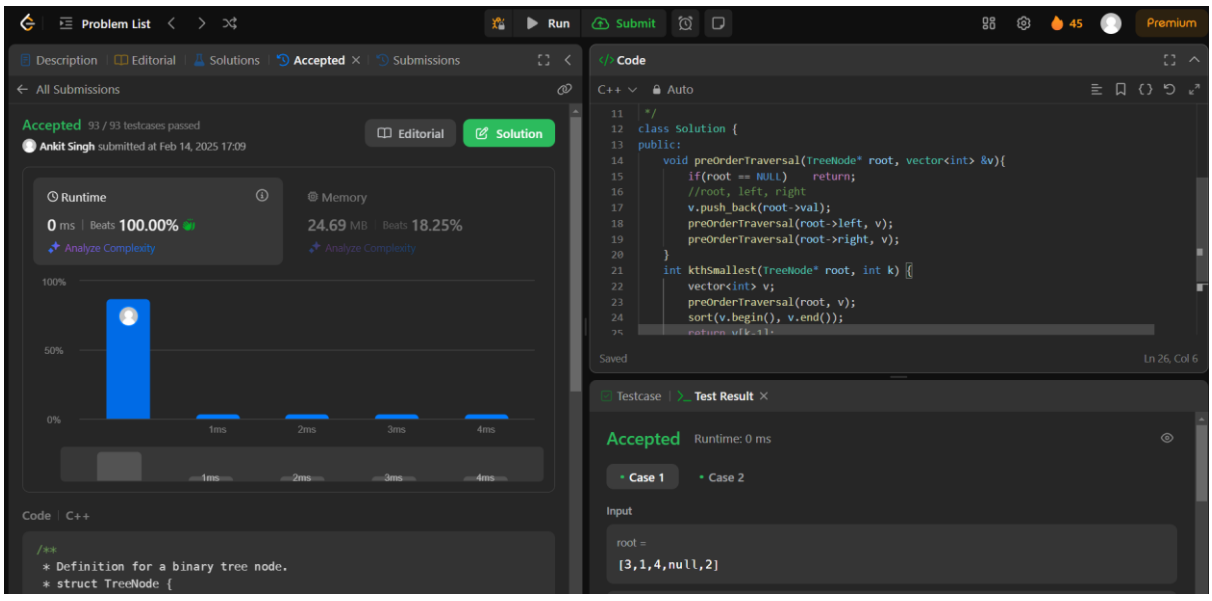


1.Problem 5: Kth Smallest Element in a BST (230)

2. Code:

```
class Solution {
public:
    void preOrderTraversal(TreeNode* root, vector<int> &v){
        if(root == NULL)    return;
        //root, left, right
        v.push_back(root->val);
        preOrderTraversal(root->left, v);
        preOrderTraversal(root->right, v);
    }
    int kthSmallest(TreeNode* root, int k) {
        vector<int> v;
        preOrderTraversal(root, v);
        sort(v.begin(), v.end());
        return v[k-1];
    }
};
```

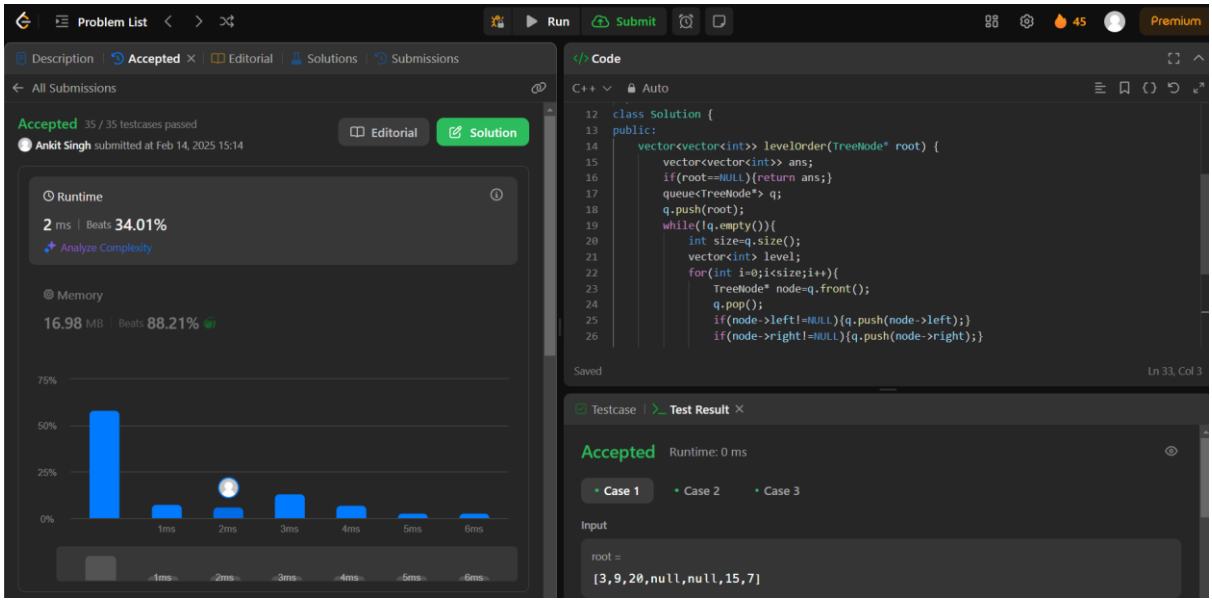
3. Output:



1. **Problem 6:** Binary Tree Level Order Traversal (102)
2. **Code:**

```
class Solution {
public:
    vector<vector<int>> levelOrder(TreeNode* root) {
        vector<vector<int>> ans;
        if(root==NULL){return ans;}
        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();
                if(node->left!=NULL){q.push(node->left);}
                if(node->right!=NULL){q.push(node->right);}
                level.push_back(node->val);
            }
            ans.push_back(level);
        }
    return ans;
    }
};
```

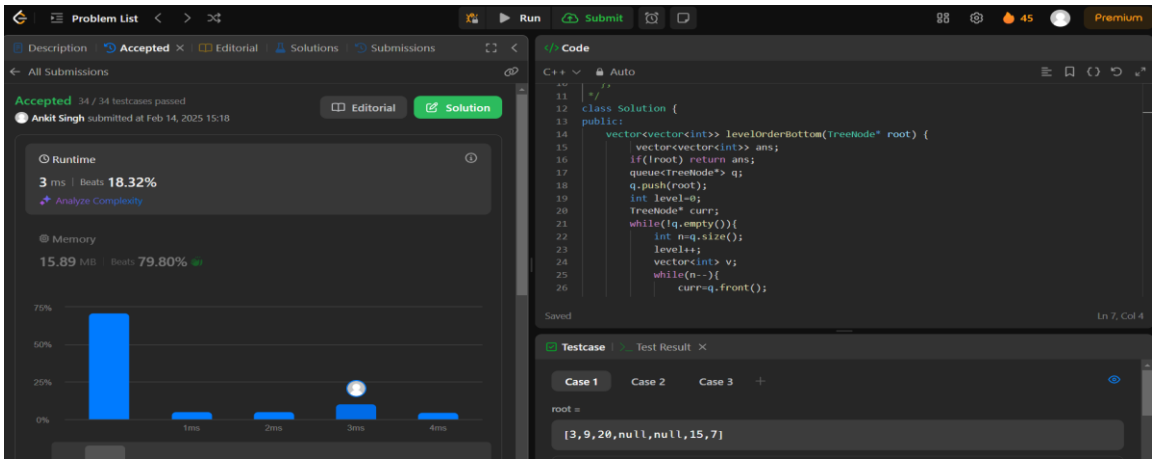
3. **Output:**



1. **Problem 7:** Binary Tree Level Order Traversal II (107)
2. **Code:**

```
class Solution {
public:
    vector<vector<int>> levelOrderBottom(TreeNode* root) {
         vector<vector<int>> ans;
        if(!root) return ans;
        queue<TreeNode*> q;
        q.push(root);
        int level=0;
        TreeNode* curr;
        while(!q.empty()){
            int n=q.size();
            level++;
            vector<int> v;
            while(n--){
                curr=q.front();
                v.push_back(curr->val);
                q.pop();
                if(curr->left) {
                    q.push(curr->left);
                }
                if(curr->right) {
                    q.push(curr->right);
                }
            }

            ans.push_back(v);
        }
        reverse(ans.begin(), ans.end());
        return ans;
    }
};
```

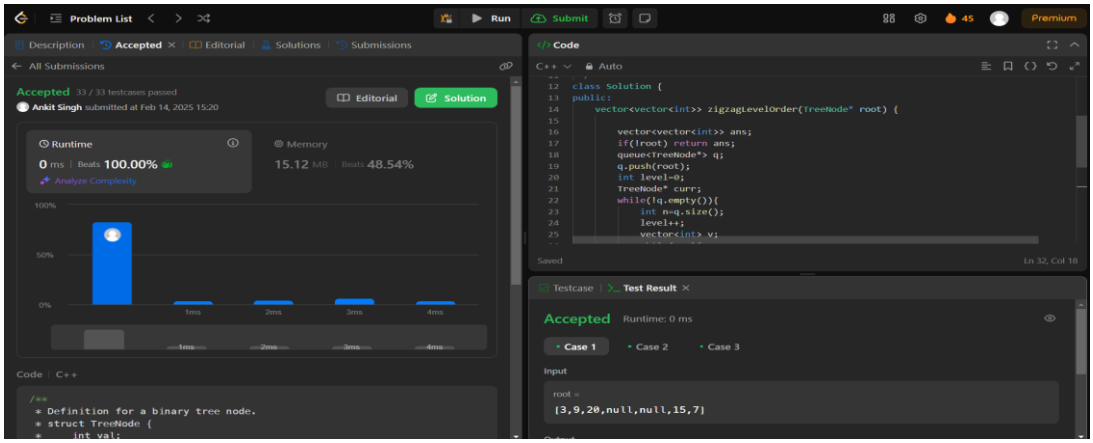
3. **Output:**



1. **Problem 8:** Binary Tree Zigzag Level Order Traversal (103)
2. **Code:**

```
class Solution {
public:
    vector<vector<int>> zigzagLevelOrder(TreeNode* root) {

        vector<vector<int>> ans;
        if(!root) return ans;
        queue<TreeNode*> q;
        q.push(root);
        int level=0;
        TreeNode* curr;
        while(!q.empty()){
            int n=q.size();
            level++;
            vector<int> v;
            while(n--){
                curr=q.front();
                v.push_back(curr->val);
                q.pop();
                if(curr->left) {
                    q.push(curr->left);
                }
                if(curr->right) {
                    q.push(curr->right);
                }
            }
            if(level%2==0) reverse(v.begin(), v.end());
            ans.push_back(v);
        }
        return ans;
    }
};
```

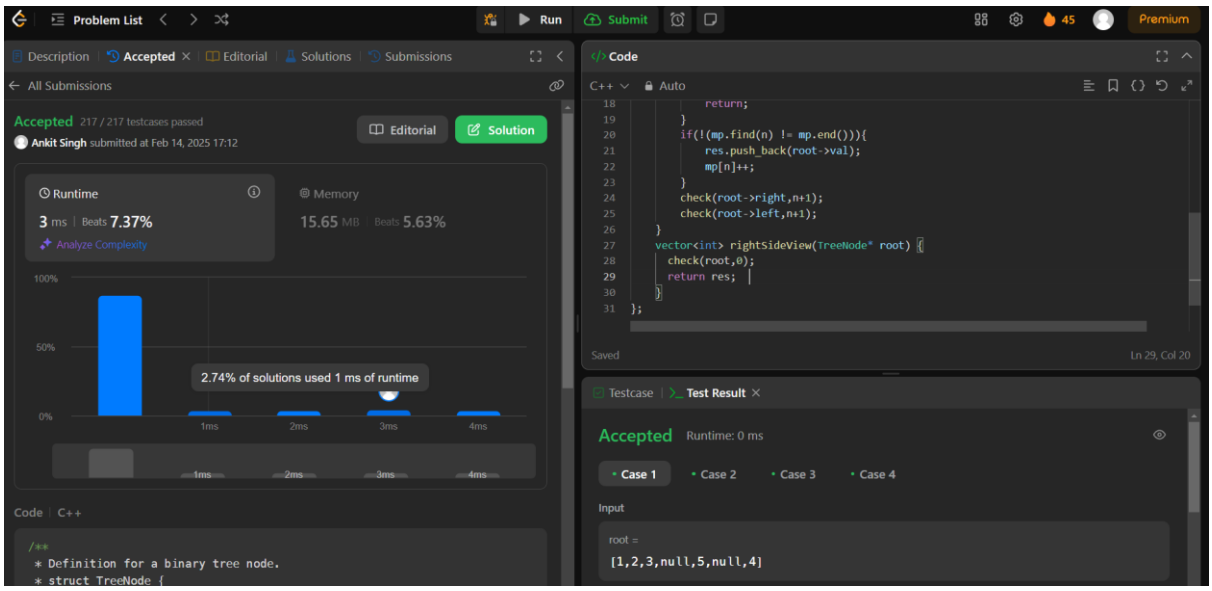
3. **Output:**



1. **Problem 9:** Binary Tree Right Side View (199)
2. **Code:**

```
class Solution {
public:
    vector<int> res;
    unordered_map<int,int> mp;
    void check(TreeNode* root,int n){
        if(!root){
            return;
        }
        if(!(mp.find(n) != mp.end())){
            res.push_back(root->val);
            mp[n]++;
        }
        check(root->right,n+1);
        check(root->left,n+1);
    }
    vector<int> rightSideView(TreeNode* root) {
      check(root,0);
      return res;
    }
};
```

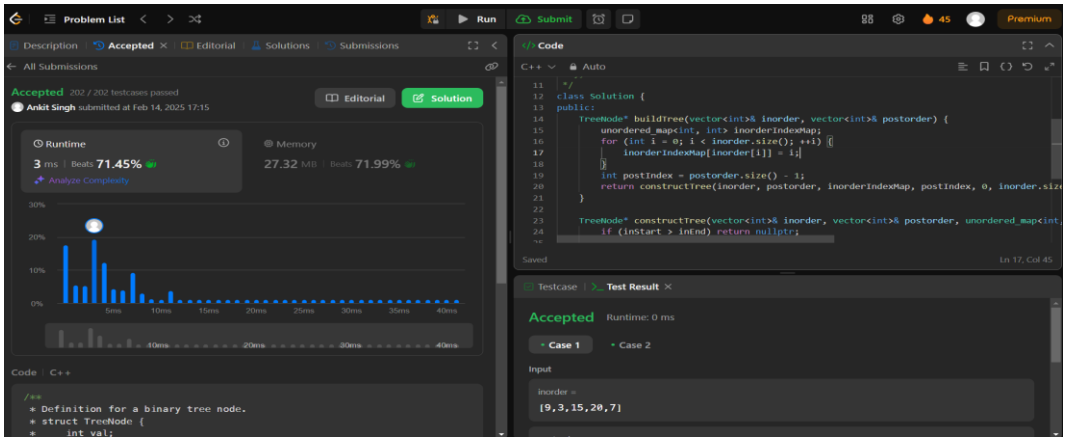
3. **Output:**



1. **Problem 10**: Construct Binary Tree from Inorder and Postorder Traversal (106)
2. **Code:****

```
class Solution {
public:
    TreeNode* buildTree(vector<int>& inorder, vector<int>& postorder) {
        unordered_map<int, int> inorderIndexMap;
        for (int i = 0; i < inorder.size(); ++i) {
            inorderIndexMap[inorder[i]] = i;
        }
        int postIndex = postorder.size() - 1;
        return constructTree(inorder, postorder, inorderIndexMap, postIndex, 0,
inorder.size() - 1);
    }

    TreeNode* constructTree(vector<int>& inorder, vector<int>& postorder,
unordered_map<int, int>& inorderIndexMap, int& postIndex, int inStart, int inEnd)
{
        if (inStart > inEnd) return nullptr;

        int rootVal = postorder[postIndex--];
        TreeNode* root = new TreeNode(rootVal);
        int rootIndex = inorderIndexMap[rootVal];

        root->right = constructTree(inorder, postorder, inorderIndexMap,
postIndex, rootIndex + 1, inEnd);
        root->left = constructTree(inorder, postorder, inorderIndexMap, postIndex,
inStart, rootIndex - 1);

        return root;
    }
};
```

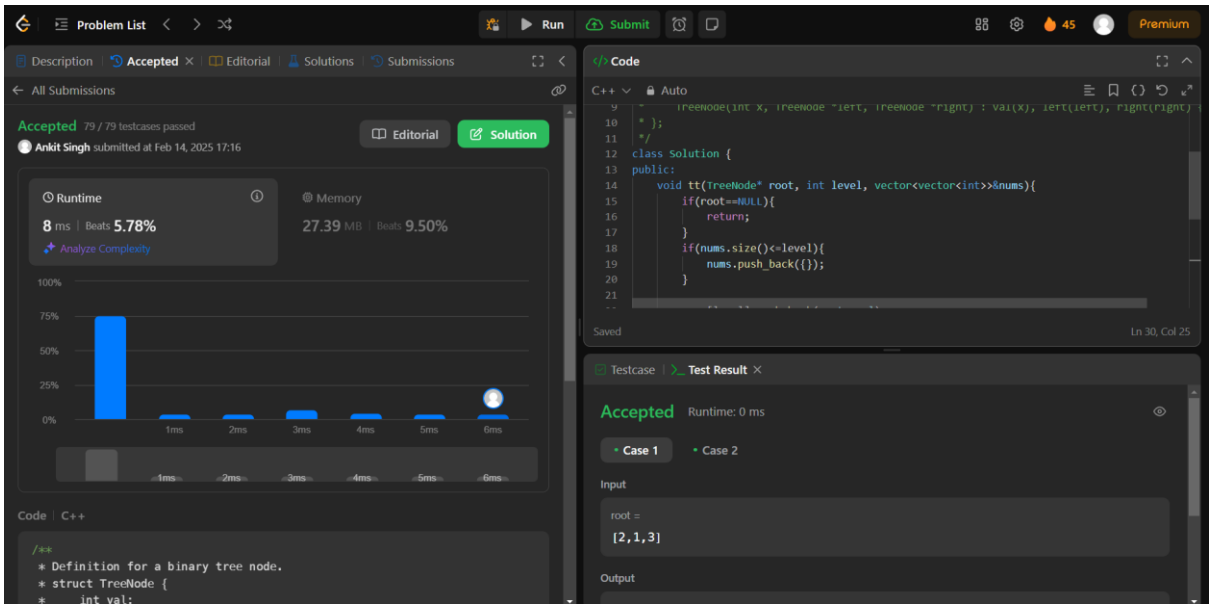
3. **Output:**



1. **Problem 11:** Find Bottom Left Tree Value (513)
2. **Code:**

```
class Solution {
public:
    void tt(TreeNode* root, int level, vector<vector<int>>&nums){
        if(root==NULL){
            return;
        }
        if(nums.size()<=level){
            nums.push_back({});
        }

        nums[level].push_back(root->val);

        tt(root->right,level+1,nums);
        tt(root->left,level+1,nums);

    }
    int findBottomLeftValue(TreeNode* root) {
       vector<vector<int>>nums;
        tt(root,0,nums);
        return nums.back().back();
    }
};
```

3. **Output:**

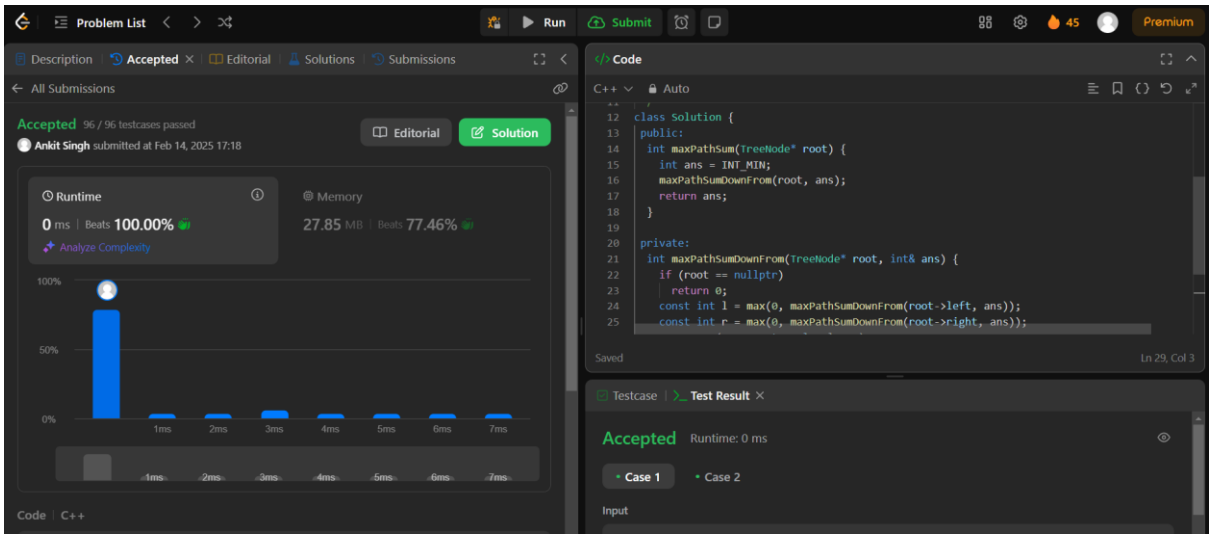


1. **Problem 12:** Binary Tree Maximum Path Sum (124)

2. Code:

```
class Solution {
public:
    vector<vector<int>> levelOrder(TreeNode* root) {
        vector<vector<int>> ans;
        if(root==NULL){return ans;}
        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();
                if(node->left!=NULL){q.push(node->left);}
                if(node->right!=NULL){q.push(node->right);}
                level.push_back(node->val);
            }
            ans.push_back(level);
        }
    return ans;
    }
};
```

3. Output:

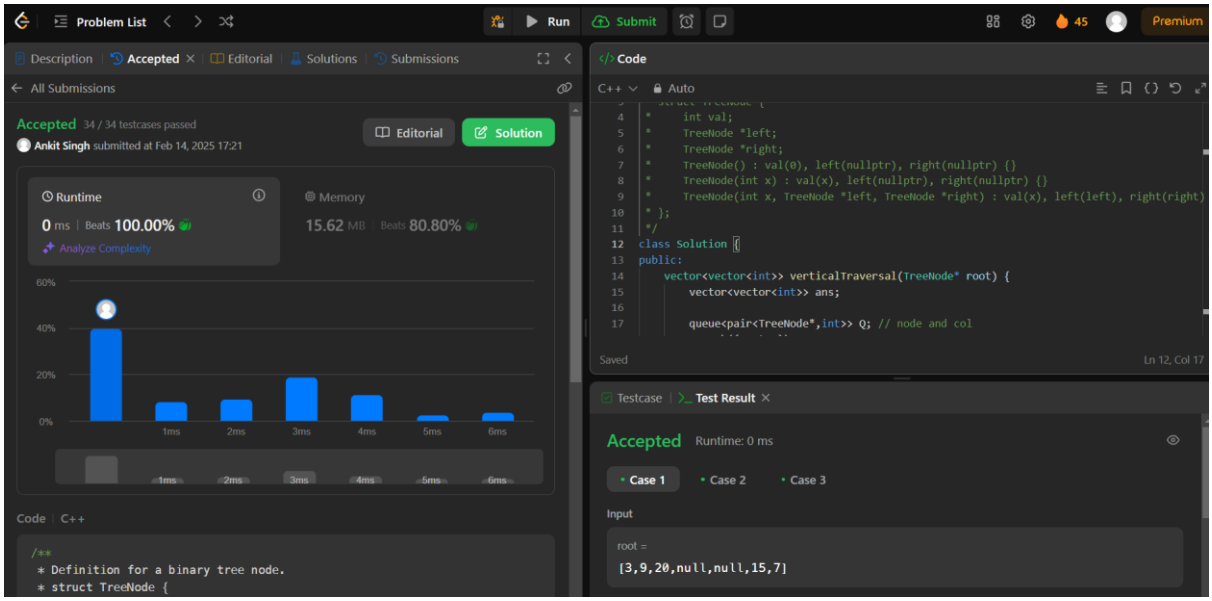


1. **Problem 13:** Vertical Order Traversal of a Binary Tree (987)

2. **Code:**

```
class Solution {
public:
    vector<vector<int>> verticalTraversal(TreeNode* root) {
        vector<vector<int>> ans;

        queue<pair<TreeNode*,int>> Q; // node and col
        Q.push({root,0});
        int depth=0;
        while(!Q.empty()){
            int s=Q.size();
            while(s--){
                auto [node,col]=Q.front();
                Q.pop();
                ans.push_back({col,depth,node->val});
                if(node->left!=nullptr) Q.push({node->left,col-1});
                if(node->right!=nullptr) Q.push({node->right,col+1});
            }
            depth++;
        }

        sort(ans.begin(),ans.end());

        vector<vector<int>> final;
        vector<int> temp;
        int curr=ans[0][0];
        for(int i=0;i<ans.size();i++){
            if(ans[i][0]==curr) temp.push_back(ans[i][2]);
            else{
                final.push_back(temp);
                temp.clear();
                curr=ans[i][0];
                temp.push_back(ans[i][2]);
            }
        }
        if(!temp.empty()) final.push_back(temp);
        return final;

    }
};
```

3. Output:


Problem List
Run
Submit
Premium
Description
Accepted
Editorial
Solutions
Submissions
All Submissions
Accepted 34 / 34 testcases passed
Ankit Singh submitted at Feb 14, 2025 17:21
Editorial
Solution
Runtime
0 ms | Beats 100.00%
Analyze Complexity
Memory
15.62 MB | Beats 80.80%
60%
40%
20%
0%
1ms
2ms
3ms
4ms
5ms
6ms
Code | C++
/**
* Definition for a binary tree node.
* struct TreeNode {
Code
C++
Auto
int val;
TreeNode *left;
TreeNode *right;
TreeNode() : val(0), left(nullptr), right(nullptr) {}
TreeNode(int x) : val(x), left(nullptr), right(nullptr) {}
TreeNode(int x, TreeNode *left, TreeNode *right) : val(x), left(left), right(right)
* };
*/
class Solution {
public:
vector<vector<int>> verticalTraversal(TreeNode* root) {
vector<vector<int>> ans;
queue<pair<TreeNode*,int>> Q; // node and col
Saved
Ln 12, Col 17
Testcase | Test Result
Accepted Runtime: 0 ms
Case 1
Case 2
Case 3
Input
root =
[3,9,20,null,null,15,7]