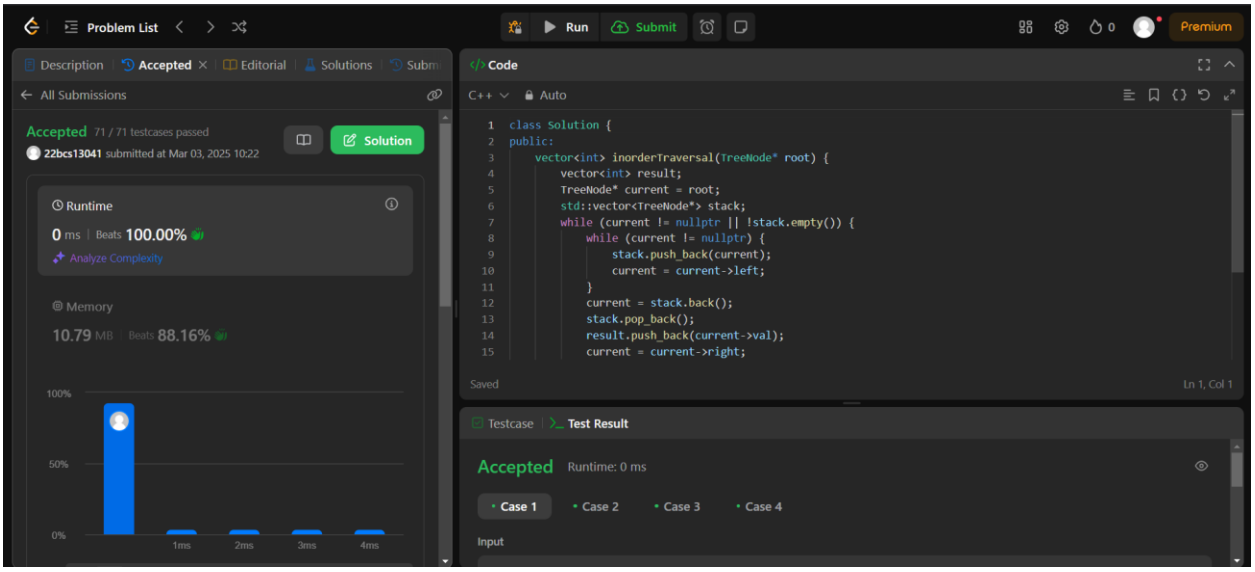
Name: Pranjal Singh

UID: 22BCS13041

Batch: FL_IoT 601 'A'

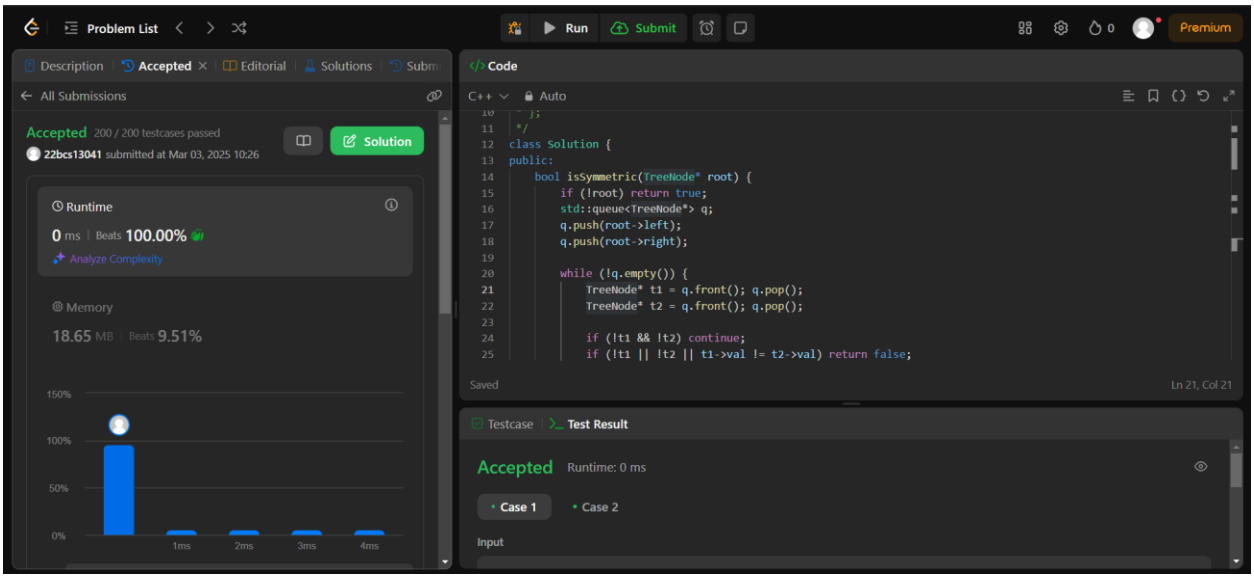
1. Binary Tree Inorder Traversal

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

    while (root != nullptr || !stack.empty()) {
      while (root != nullptr) {
        stack.push(root);
        root = root->left;
      }
      root = stack.top(), stack.pop();
      ans.push_back(root->val);
      root = root->right;
    }

    return ans;
  }
};
```



2. Symmetric Tree

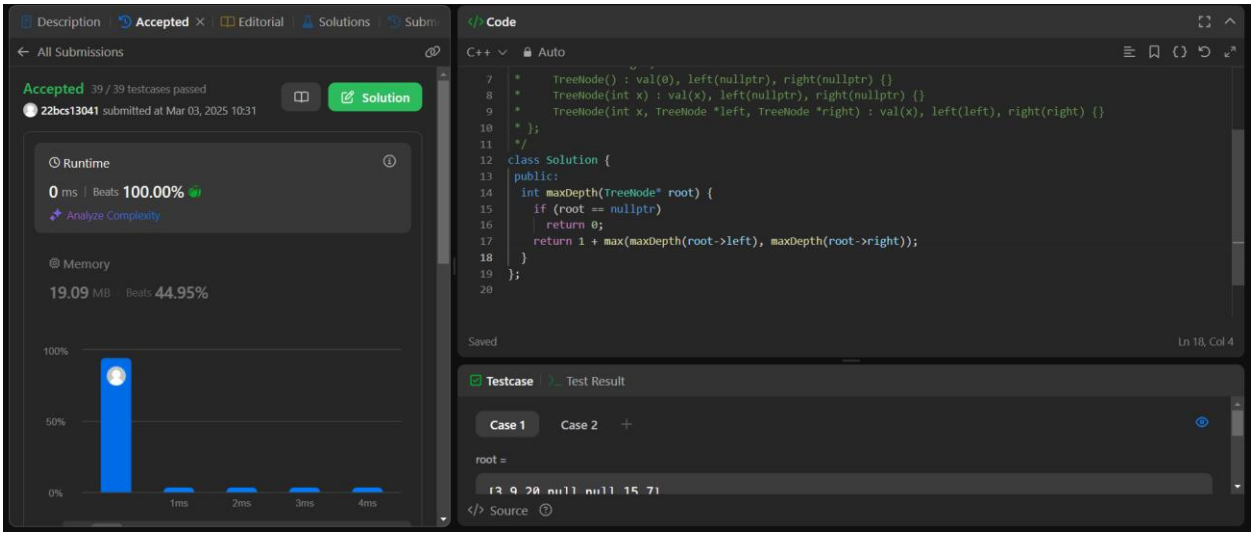
```
class Solution {
 public:
  bool isSymmetric(TreeNode* root) {
    return isSymmetric(root, root);
  }

 private:
  bool isSymmetric(TreeNode* p, TreeNode* q) {
    if (!p || !q)
      return p == q;

    return p->val == q->val &&                  //
           isSymmetric(p->left, q->right) &&  //
           isSymmetric(p->right, q->left);
  }
};
```



3 .Maximum Depth of Binary Tree

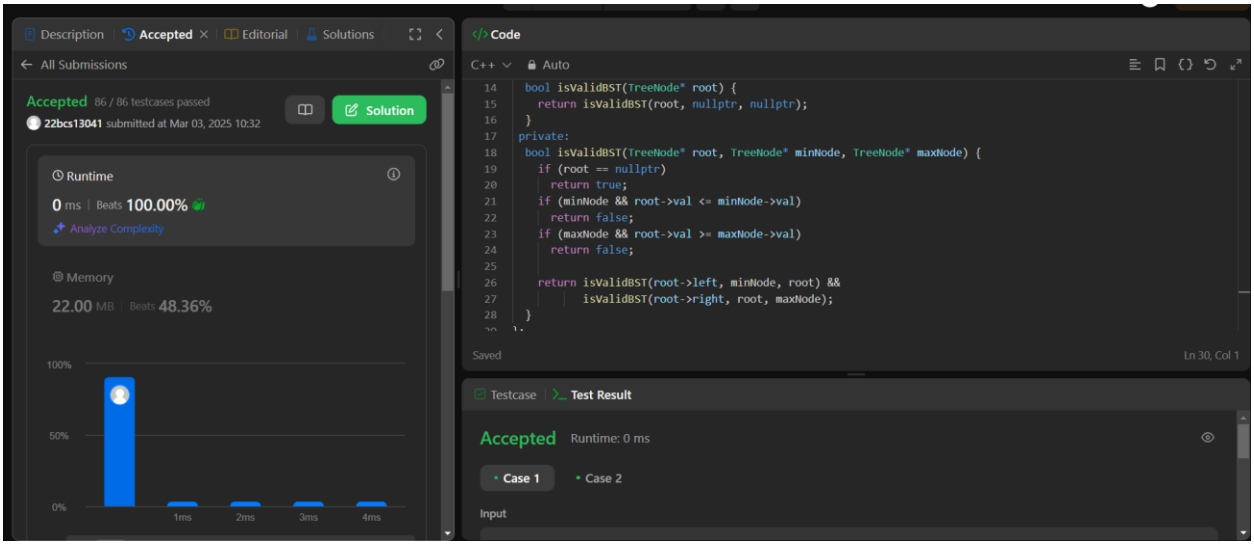
```
class Solution {
 public:
  int maxDepth(TreeNode* root) {
    if (root == nullptr)
      return 0;
    return 1 + max(maxDepth(root->left), maxDepth(root->right));
```

};



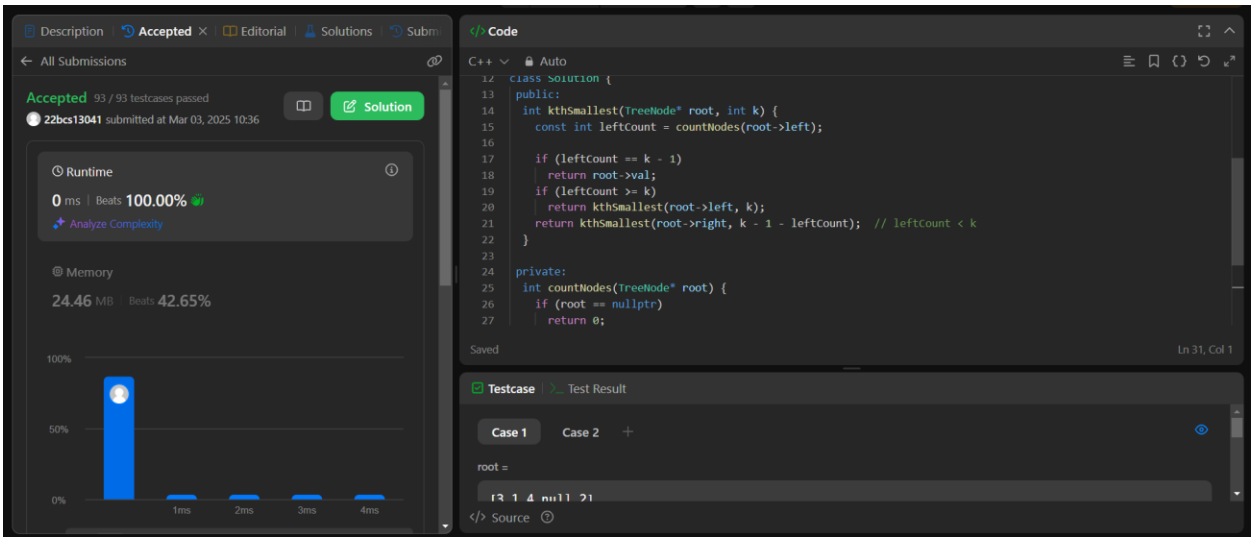
4. Validate Binary Search Tree

```
class Solution {
 public:
  bool isValidBST(TreeNode* root) {
    return isValidBST(root, nullptr, nullptr);
  }
 private:
  bool isValidBST(TreeNode* root, TreeNode* minNode, TreeNode* maxNode) {
    if (root == nullptr)
      return true;
    if (minNode && root->val <= minNode->val)
      return false;
    if (maxNode && root->val >= maxNode->val)
      return false;

    return isValidBST(root->left, minNode, root) &&
           isValidBST(root->right, root, maxNode);
  }
};
```



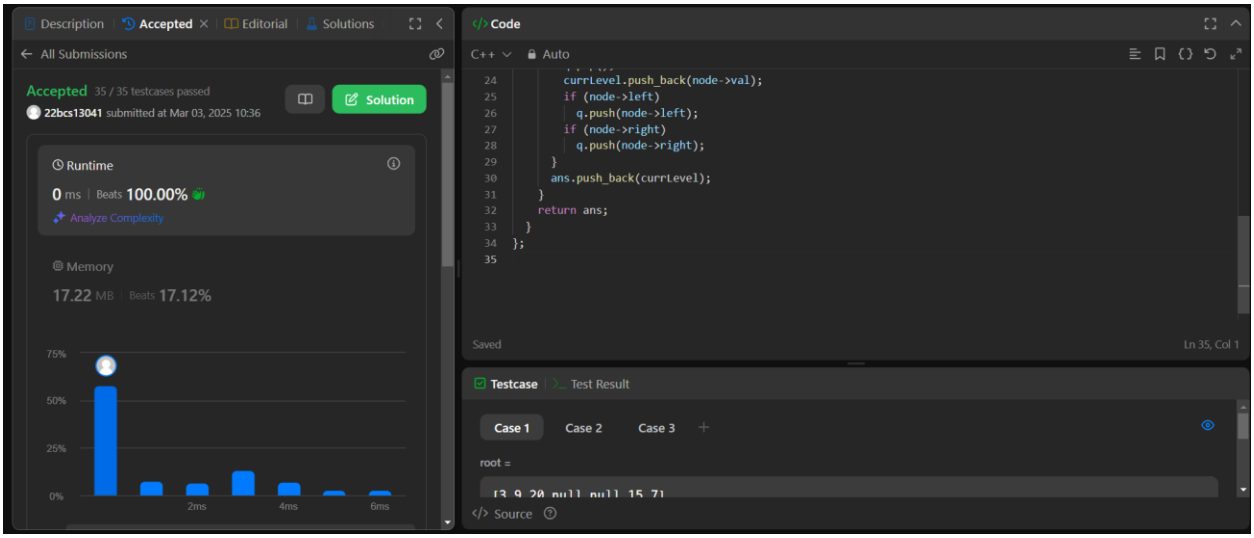
5.Kth Smallest Element in a BST

```cpp
class Solution {
 public:
  int kthSmallest(TreeNode* root, int k) {
    const int leftCount = countNodes(root->left);

    if (leftCount == k - 1)
      return root->val;
    if (leftCount >= k)
      return kthSmallest(root->left, k);
    return kthSmallest(root->right, k - 1 - leftCount);  // leftCount < k
  }

 private:
  int countNodes(TreeNode* root) {
    if (root == nullptr)
      return 0;
    return 1 + countNodes(root->left) + countNodes(root->right);
  }
};
```



6. Binary Tree Level Order Traversal

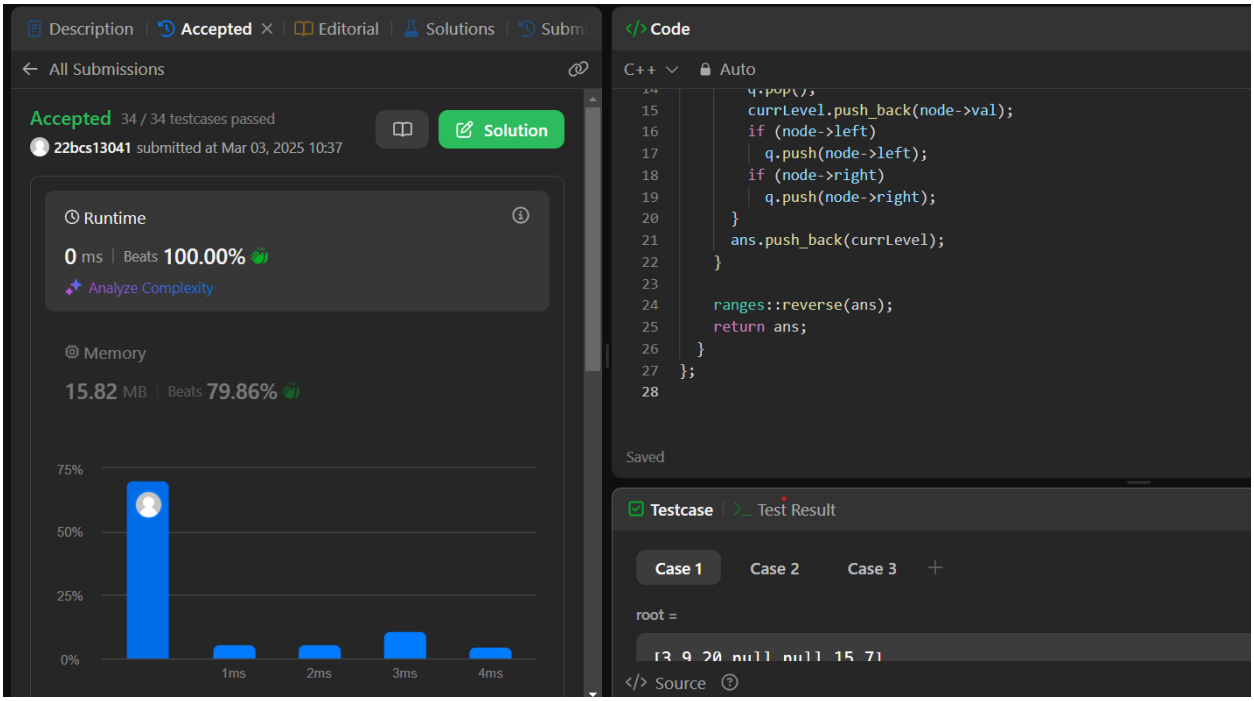
```
class Solution {
 public:
  vector<vector<int>> levelOrder(TreeNode* root) {
    if (root == nullptr)
      return {};
    vector<vector<int>> ans;
    queue<TreeNode*> q{{root}};
    while (!q.empty()) {
      vector<int> currLevel;
      for (int sz = q.size(); sz > 0; --sz) {
        TreeNode* node = q.front();
        q.pop();
        currLevel.push_back(node->val);
        if (node->left)
          q.push(node->left);
        if (node->right)
          q.push(node->right);
      }
      ans.push_back(currLevel);
    }
    return ans;
  }
};
```



7. Binary Tree Level Order Traversal II

```
class Solution {
 public:
  vector<vector<int>> levelOrderBottom(TreeNode* root) {
    if (root == nullptr)
      return {};

    vector<vector<int>> ans;
    queue<TreeNode*> q{{root}};

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

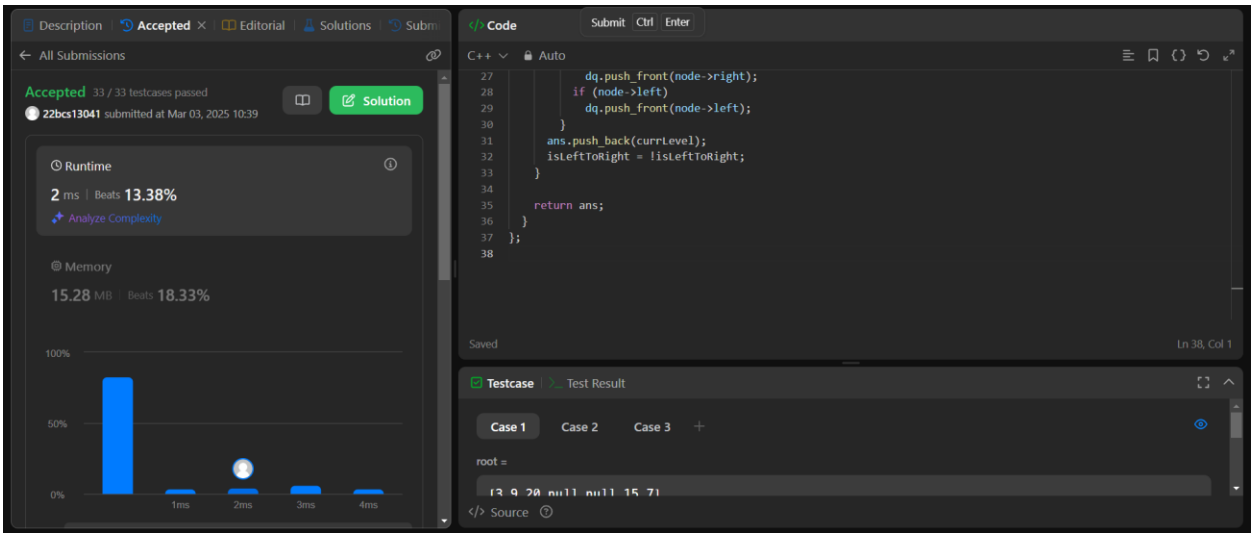
```
    ranges::reverse(ans);
    return ans;
  }
};
```



8. .Binary Tree Zigzag Level Order Traversal

```
class Solution {
 public:
  vector<vector<int>> zigzagLevelOrder(TreeNode* root) {
    if (root == nullptr)
      return {};

    vector<vector<int>> ans;
    deque<TreeNode*> dq{{root}};
    bool isLeftToRight = true;

    while (!dq.empty()) {
      vector<int> currLevel;
      for (int sz = dq.size(); sz > 0; --sz)
        if (isLeftToRight) {
          TreeNode* node = dq.front();
          dq.pop_front();
          currLevel.push_back(node->val);
```

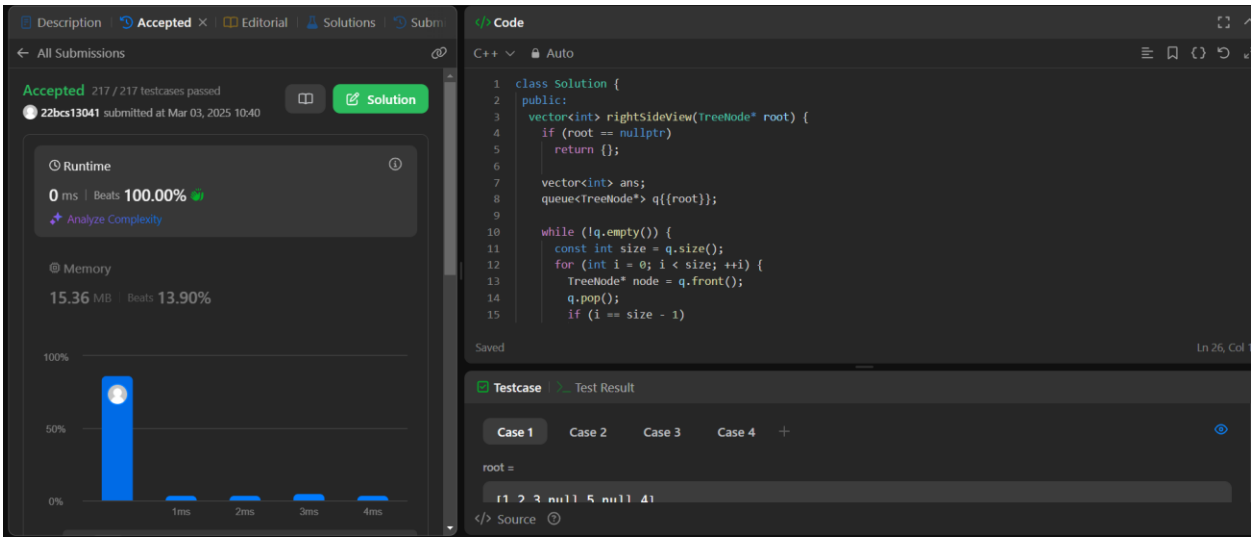
```
        if (node->left)
          dq.push_back(node->left);
        if (node->right)
          dq.push_back(node->right);
      } else {
        TreeNode* node = dq.back();
        dq.pop_back();
        currLevel.push_back(node->val);
        if (node->right)
          dq.push_front(node->right);
        if (node->left)
          dq.push_front(node->left);
      }
    ans.push_back(currLevel);
    isLeftToRight = !isLeftToRight;
   }

   return ans;
  }
};
```



9. Binary Tree Right Side View

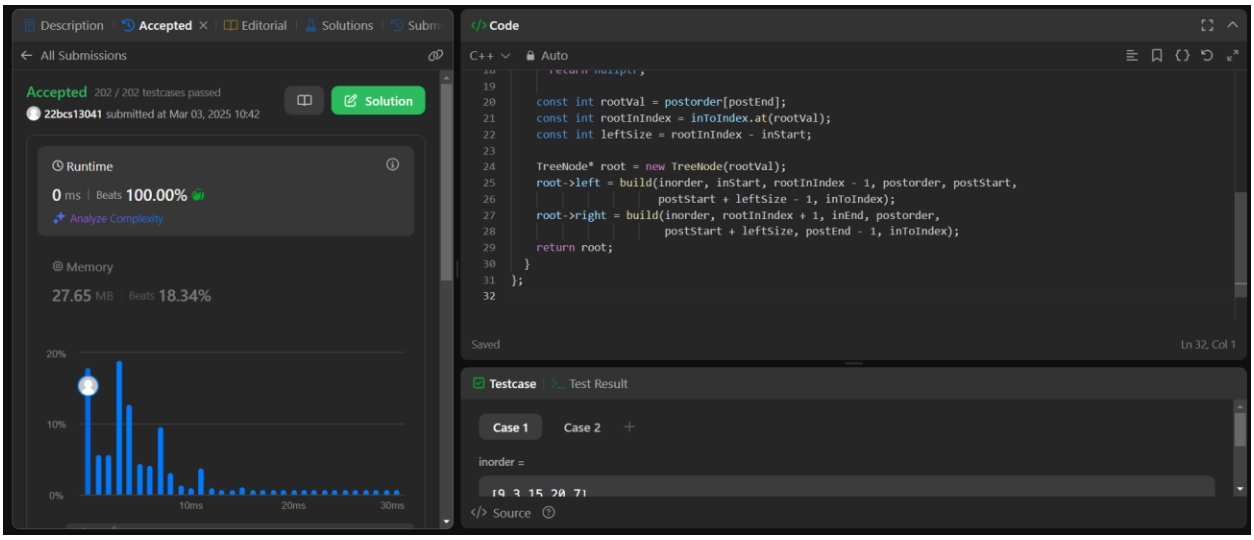
```
class Solution {
 public:
  vector<int> rightSideView(TreeNode* root) {
    if (root == nullptr)
```

```
    return {};

  vector<int> ans;
  queue<TreeNode*> q{{root}};

  while (!q.empty()) {
    const int size = q.size();
    for (int i = 0; i < size; ++i) {
      TreeNode* node = q.front();
      q.pop();
      if (i == size - 1)
        ans.push_back(node->val);
      if (node->left)
        q.push(node->left);
      if (node->right)
        q.push(node->right);
    }
  }
  return ans;
 }
};
```



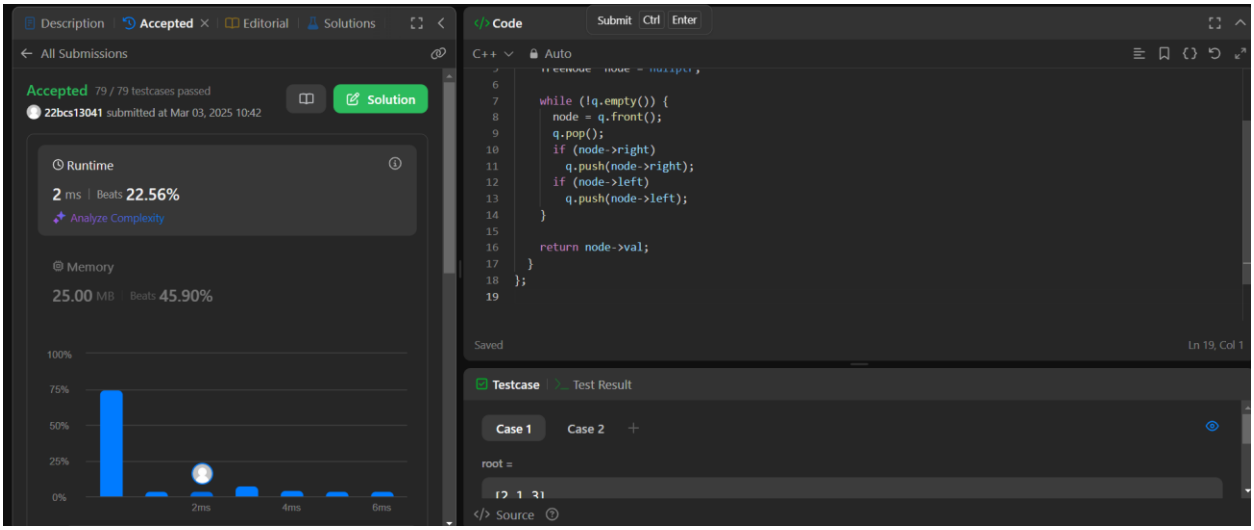
10. Construct Binary Tree from Inorder and Postorder Traversal

```
class Solution {
 public:
  TreeNode* buildTree(vector<int>& inorder, vector<int>& postorder) {
    unordered_map<int, int> inToIndex;

    for (int i = 0; i < inorder.size(); ++i)
      inToIndex[inorder[i]] = i;

    return build(inorder, 0, inorder.size() - 1, postorder, 0,
                 postorder.size() - 1, inToIndex);
  }

 private:
  TreeNode* build(const vector<int>& inorder, int inStart, int inEnd,
                  const vector<int>& postorder, int postStart, int postEnd,
                  const unordered_map<int, int>& inToIndex) {
    if (inStart > inEnd)
      return nullptr;

    const int rootVal = postorder[postEnd];
    const int rootInIndex = inToIndex.at(rootVal);
    const int leftSize = rootInIndex - inStart;

    TreeNode* root = new TreeNode(rootVal);
    root->left = build(inorder, inStart, rootInIndex - 1, postorder, postStart,
                       postStart + leftSize - 1, inToIndex);
    root->right = build(inorder, rootInIndex + 1, inEnd, postorder,
                        postStart + leftSize, postEnd - 1, inToIndex);
    return root;
  }
};
```



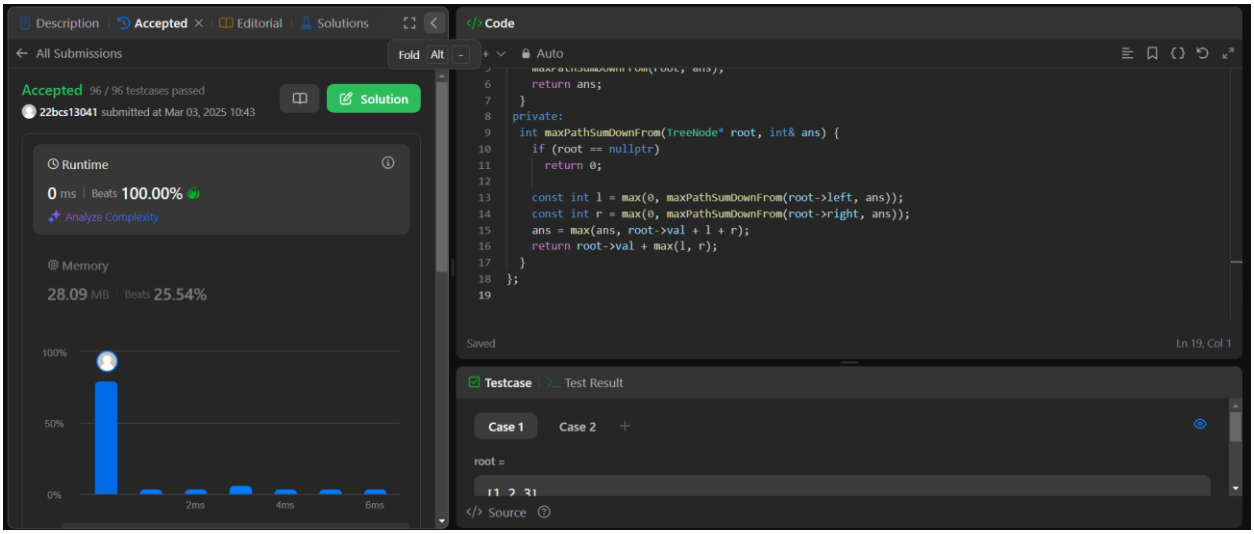
11. Find Bottom Left Tree Value

```
class Solution {
 public:
  int findBottomLeftValue(TreeNode* root) {
    queue<TreeNode*> q{{root}};
    TreeNode* node = nullptr;

    while (!q.empty()) {
      node = q.front();
      q.pop();
      if (node->right)
        q.push(node->right);
      if (node->left)
        q.push(node->left);
    }

    return node->val;
  }
};
```



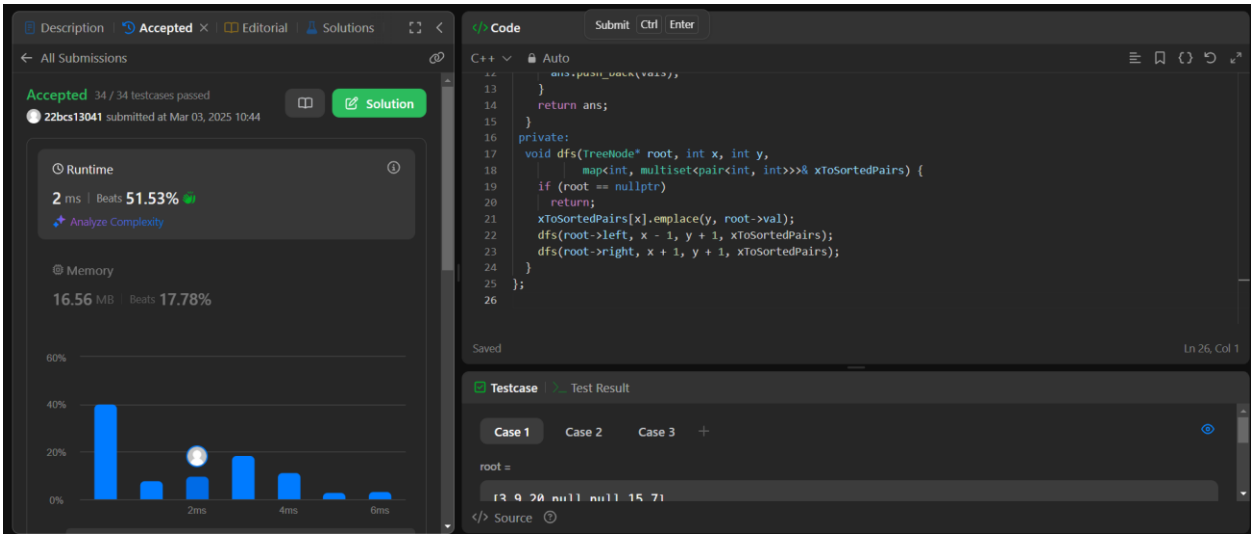
12. [Binary Tree Maximum Path Sum]

```cpp
class Solution {
 public:
  int maxPathSum(TreeNode* root) {
    int ans = INT_MIN;
    maxPathSumDownFrom(root, ans);
    return ans;
  }
 private:
  int maxPathSumDownFrom(TreeNode* root, int& ans) {
    if (root == nullptr)
      return 0;

    const int l = max(0, maxPathSumDownFrom(root->left, ans));
    const int r = max(0, maxPathSumDownFrom(root->right, ans));
    ans = max(ans, root->val + l + r);
    return root->val + max(l, r);
  }
};
```



13. .Vertical Order Traversal of a Binary Tree

```
class Solution {
 public:
  vector<vector<int>> verticalTraversal(TreeNode* root) {
    vector<vector<int>> ans;
    map<int, multiset<pair<int, int>>> xToSortedPairs;

    dfs(root, 0, 0, xToSortedPairs);
    for (const auto& [_, pairs] : xToSortedPairs) {
      vector<int> vals;
      for (const pair<int, int>& pair : pairs)
        vals.push_back(pair.second);
      ans.push_back(vals);
    }
    return ans;
  }
 private:
  void dfs(TreeNode* root, int x, int y,
           map<int, multiset<pair<int, int>>>& xToSortedPairs) {
    if (root == nullptr)
      return;
    xToSortedPairs[x].emplace(y, root->val);
    dfs(root->left, x - 1, y + 1, xToSortedPairs);
    dfs(root->right, x + 1, y + 1, xToSortedPairs);
  }
};
```


Description
Accepted
Editorial
Solutions
All Submissions
Accepted 34 / 34 testcases passed
22bcs13041 submitted at Mar 03, 2025 10:44
Solution
Runtime
2 ms | Beats 51.53%
Analyze Complexity
Memory
16.56 MB | Beats 17.78%
60%
40%
20%
0%
2ms
4ms
6ms
Code
Submit Ctrl Enter
C++
Auto
}
return ans;
}
private:
void dfs(TreeNode* root, int x, int y,
map<int, multiset<pair<int, int>>>& xToSortedPairs) {
if (root == nullptr)
return;
xToSortedPairs[x].emplace(y, root->val);
dfs(root->left, x - 1, y + 1, xToSortedPairs);
dfs(root->right, x + 1, y + 1, xToSortedPairs);
}
};
Saved
Ln 26, Col 1
Testcase
Test Result
Case 1
Case 2
Case 3
root =
[3,9,20,null,null,15,7]
Source