Experiment-5

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Subject Name: AP LAB-II | **Subject Code: 22CSP-351**

Problem- 1

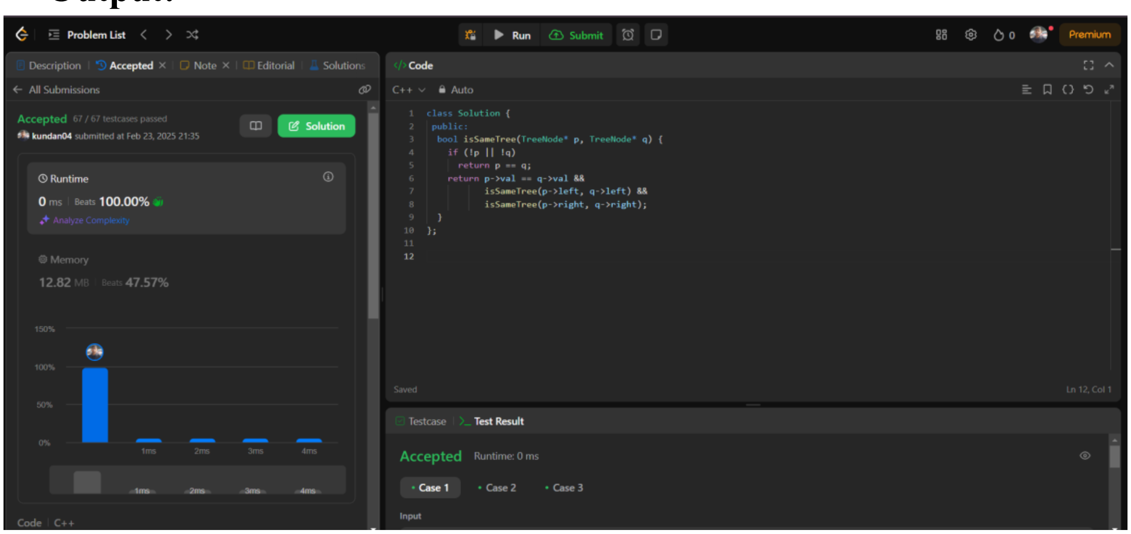
1. Aim:

Given the roots of two binary trees p and q , write a function to check if they are the same or not. Two binary trees are considered the same if they are structurally identical, and the nodes have the same value.

2. Implementation/Code: Backend:

```
class Solution {
 public:
  bool isSameTree(TreeNode* p, TreeNode* q) {
    if (!p || !q)
      return p == q;
    return p->val == q->val &&
           isSameTree(p->left, q->left) &&
           isSameTree(p->right, q->right);
  }};
```

3. Output:



Problem- 2

1. **Aim:** Given the root of a binary tree, check whether it is amirror of itself (i.e., symmetric around its center).

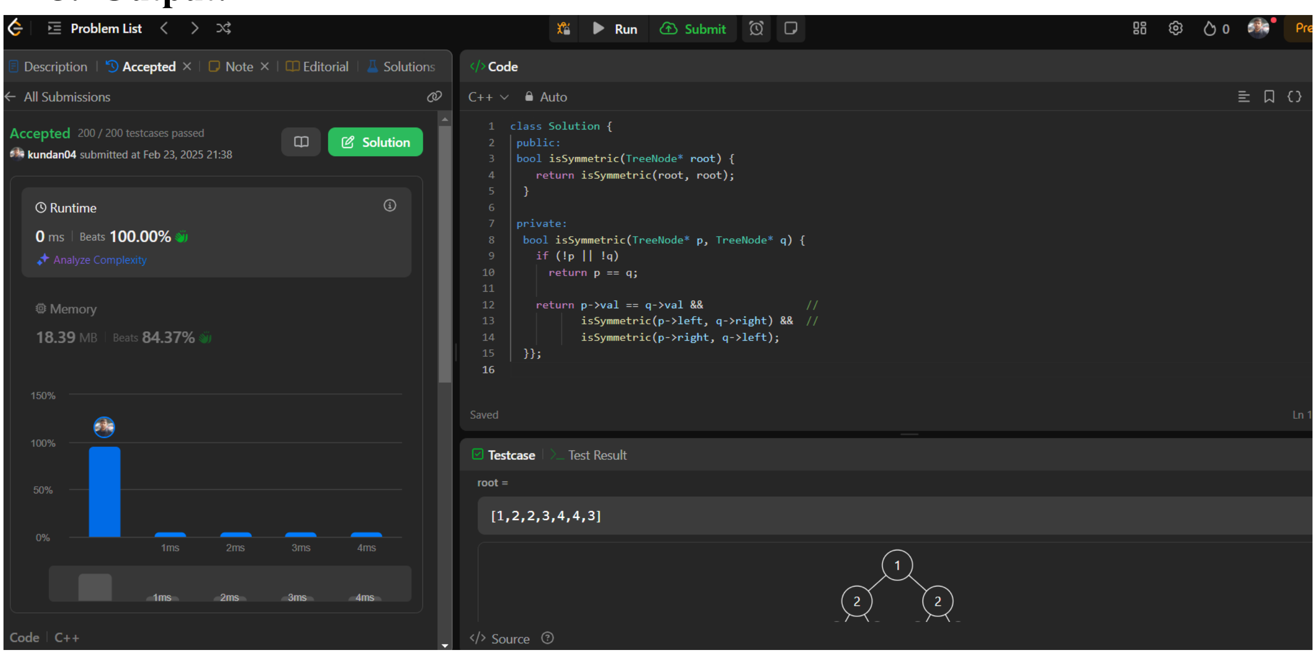
2. **Implementation/Code: Backend:**

```
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. **Output:**

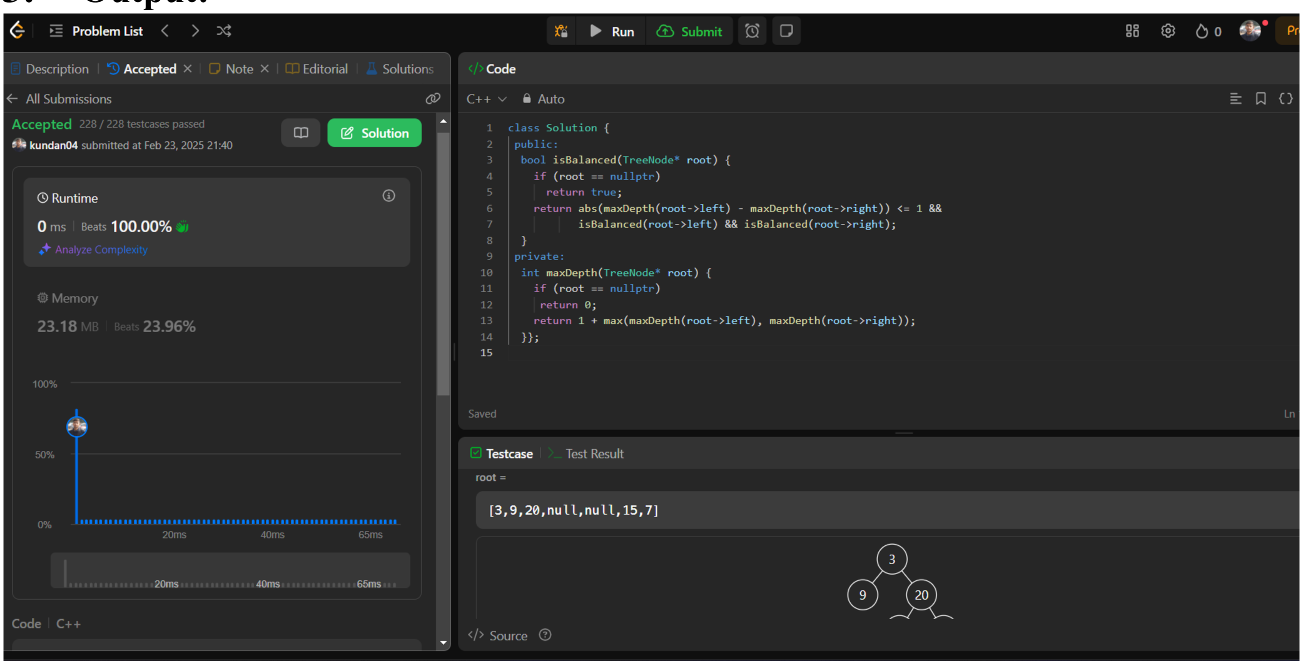


Problem- 3

1. **Aim:** Given a binary tree, determine if it is height - balanced.
2. **Implementation/Code: Backend:**

```
class Solution {
 public:
  bool isBalanced(TreeNode* root) {
    if (root == nullptr)
      return true;
    return abs(maxDepth(root->left) - maxDepth(root->right)) <= 1 &&
           isBalanced(root->left) && isBalanced(root->right);
  }
 private:
  int maxDepth(TreeNode* root) {
    if (root == nullptr)
    return 0;
    return 1 + max(maxDepth(root->left), maxDepth(root->right));
  }};
```

3. **Output:**



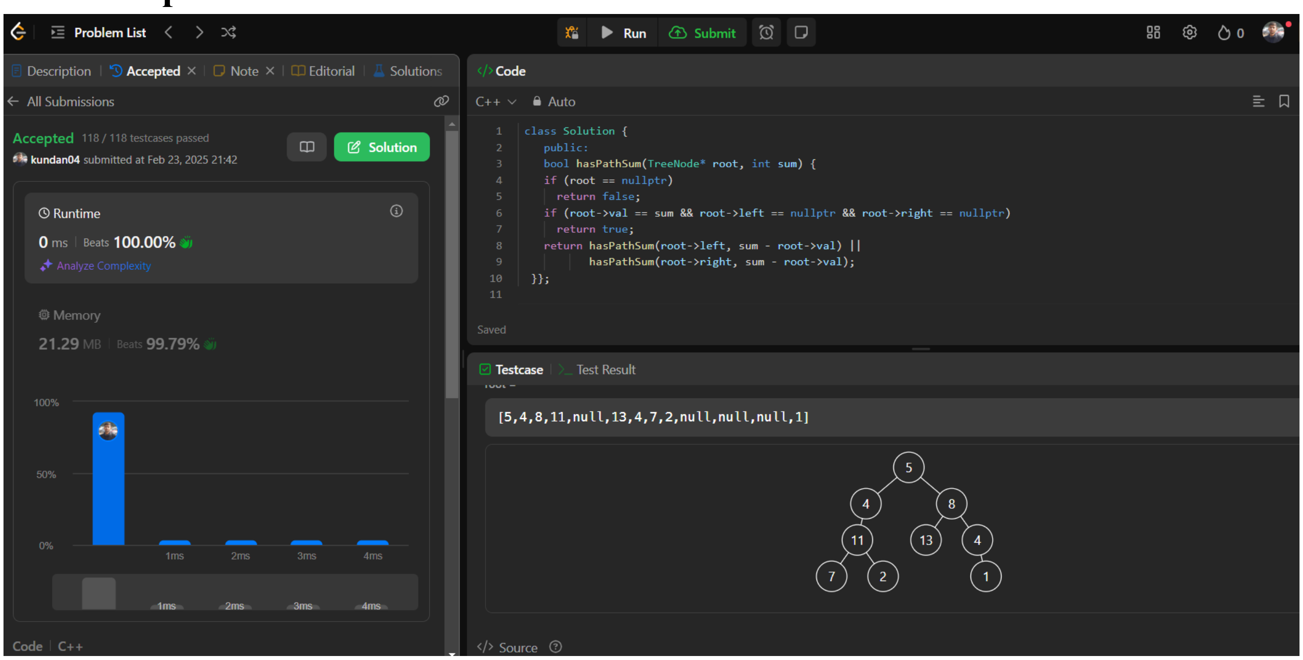
Problem- 4

1. Aim: Given the root of a binary tree and an integer target Sum, return true if the tree has a root-to-leaf path such that adding up all the values along the path equals target Sum. A leaf is a node with no children

2. Implementation/Code: Backend:

```cpp
class Solution {
public:
bool hasPathSum(TreeNode* root, int sum) {
  if (root == nullptr)
  return false;
if (root->val == sum && root->left == nullptr && root->right == nullptr)
  return true;
return hasPathSum(root->left, sum - root->val) ||
       hasPathSum(root->right, sum - root->val);
}};
```

3. Output:



Problem- 5

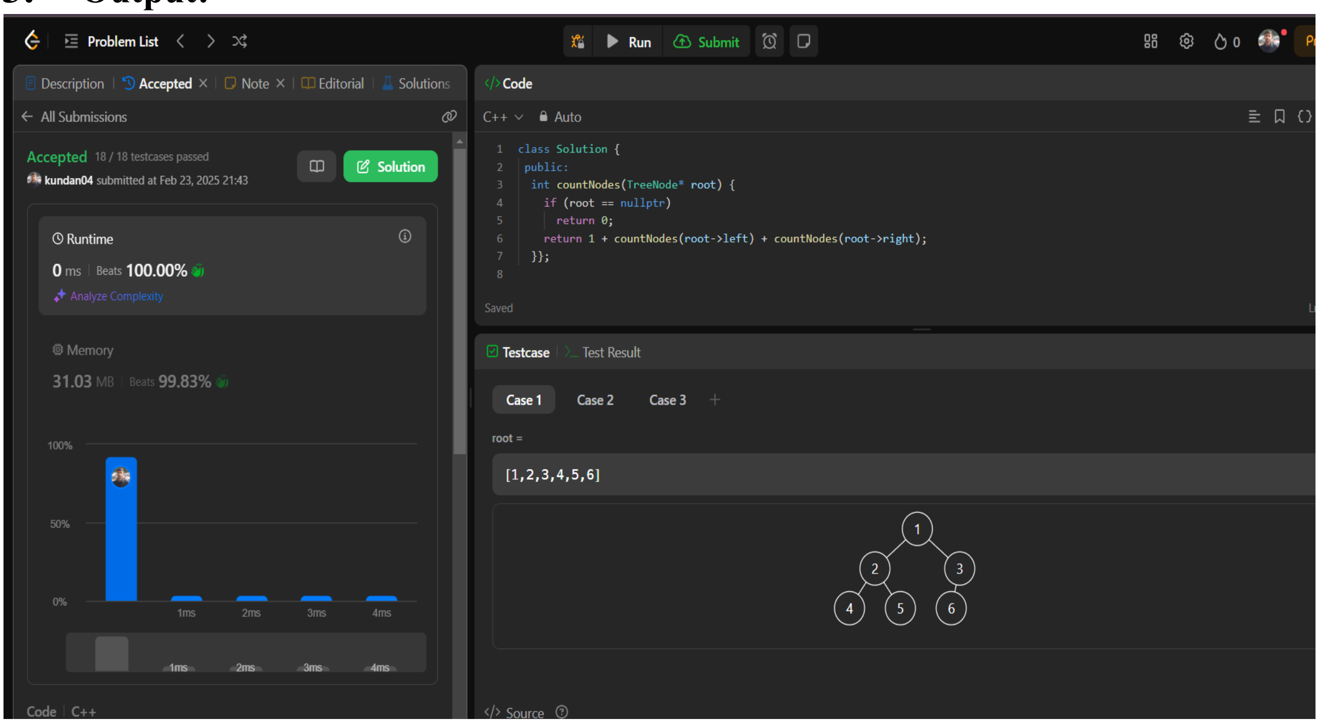
1. Aim:

Given the root of a complete binary tree, return the number of the nodes in the tree. According to Wikipedia, every level, except possibly the last, is completely filled in a complete binary tree , and all nodes in the last level are as far left as possible. It can have between 1 and 2hnodes CO3 inclusive at the last level h. Design an algorithm that runs in less than O(n) time complexity.

2. Implementation/Code: Backend:

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

3. Output:



Problem- 6

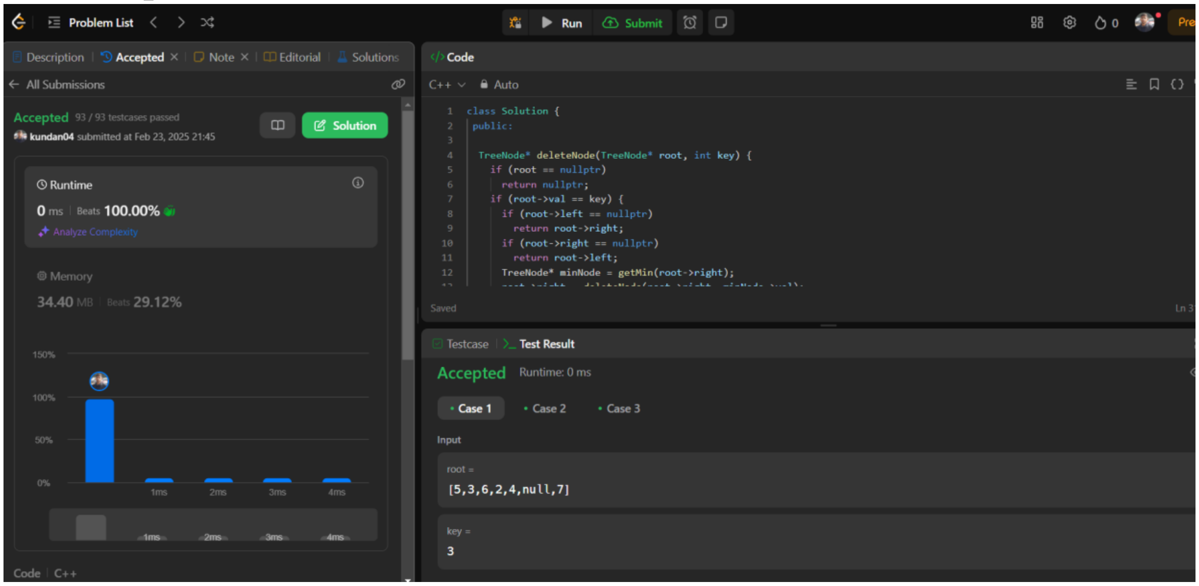
1. **Aim:**

Given a root node reference of a BST and a key, delete the node with the given key in the BST. Return the root node reference (possibly updated) of the BST. Basically, the deletion can be divided into two stages: Search for a node to remove. If the node is found, delete the node.

2. **Implementation/Code: Backend:**

```
class Solution {
 public:
  TreeNode* deleteNode(TreeNode* root, int key) {
    if (root == nullptr)
      return nullptr;
    if (root->val == key) {
      if (root->left == nullptr)
        return root->right;
      if (root->right == nullptr)
        return root->left;
      TreeNode* minNode = getMin(root->right);
      root->right = deleteNode(root->right, minNode->val);
      minNode->left = root->left;
      minNode->right = root->right;
      root = minNode;
    } else if (root->val < key) {
      root->right = deleteNode(root->right, key);
    } else {  // root->val > key
      root->left = deleteNode(root->left, key);
    }
    return root;
  }
private:
  TreeNode* getMin(TreeNode* node) {
    while (node->left != nullptr)
      node = node->left;
    return node;
  }
};
```

3. Output:



Problem- 7

1. Aim:

Given the root of a binary tree, return the length of the diameter of the tree. The diameter of a binary tree is the length of the longest path between any two nodes in a tree. This path may or may not pass through the root. The length of a path between two nodes is represented by the number of edges between them.

2. Implementation/Code: Backend:

```
class Solution {
 public:
  int diameterOfBinaryTree(TreeNode* root) {
    int ans = 0;
    maxDepth(root, ans);
    return ans;
  }

 private:
  int maxDepth(TreeNode* root, int& ans) {
    if (root == nullptr)
      return 0;
```

```cpp
      const int l = maxDepth(root->left, ans);
      const int r = maxDepth(root->right, ans);
      ans = max(ans, l + r);
      return 1 + max(l, r);
    }
  };
```

3. Output: