Experiment- 5

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Subject Name: AP Lab - 2 **Subject Code:** 22CSP-351

1. Aim: Binary Tree Zigzag level order traversal

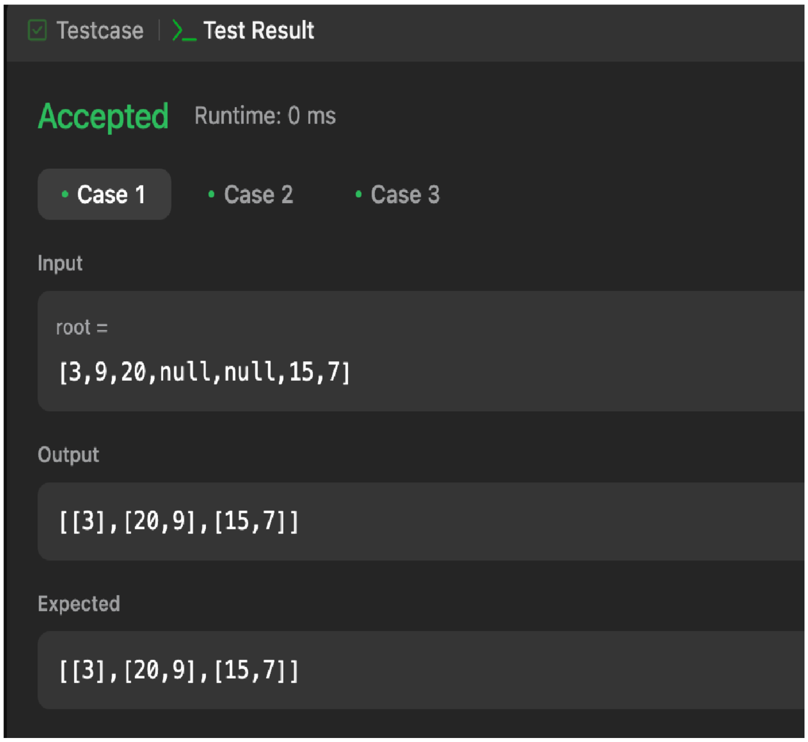
2. Objective:

Given the root of a binary tree, return the zigzag level order traversal of its nodes' values. (i.e., from left to right, then right to left for the next level and alternate between).

3. Implementation/Code:

```
class Solution { public:
   void solve(vector<vector<int>>& ans, TreeNode* temp, int level) {
if (temp == NULL) return;        if (ans.size() <= level)
ans.push_back({});        if (level % 2 == 0)
ans[level].push_back(temp->val);        else
ans[level].insert(ans[level].begin(), temp->val);        solve(ans, temp-
>left, level + 1);        solve(ans, temp->right, level + 1);
   }

   vector<vector<int>> zigzagLevelOrder(TreeNode* root) {
vector<vector<int>> ans;        solve(ans, root, 0);
      return ans;
   }
};
```

4.Output :



5.Learning Outcome:

1. **Understand the traversal process of a binary tree in a zigzag manner.**
2. **Learn how to efficiently manipulate data structures (vectors) while performing level-order traversal.**
3. **Implement an optimal traversal approach using recursion and alternating insertions.**
4. **Analyze the time complexity of the traversal process, which runs in O(N) time.**

<u>QUESTION 2</u>

1. **Aim:** Construct Binary Tree from Inorder and Postorder Traversal

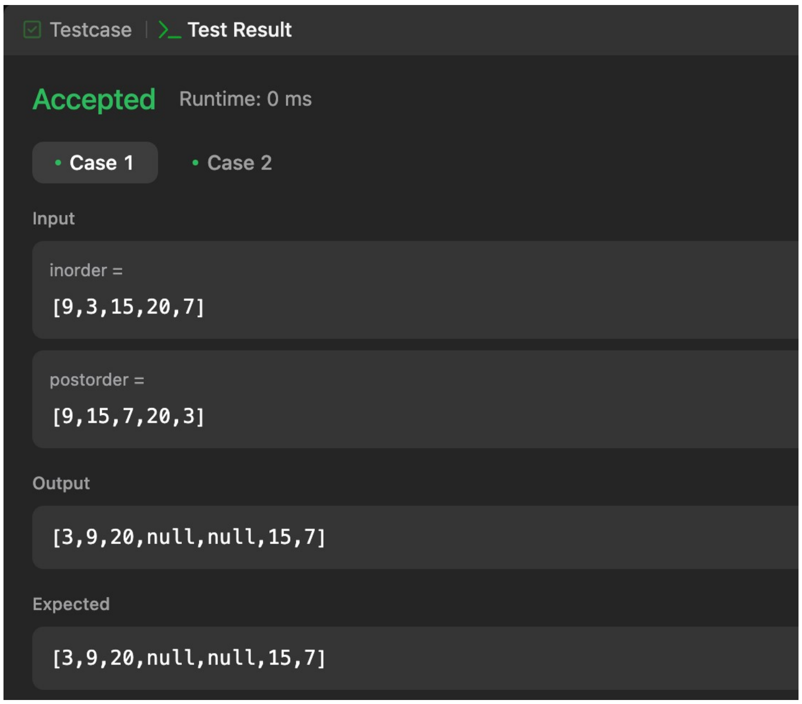
2. **Objective:**

   Given two integer arrays inorder and postorder where inorder is the inorder traversal of a binary tree and postorder is the postorder traversal of the same tree, construct and return the binary tree.

3. **Implementation/Code:**

```
class Solution { public:
 TreeNode* solve(vector<int>&inorder, int InStart, int InEnd, vector<int>& postorder,
int PostStart, int PostEnd, map<int, int>&mpp){     if(InStart>InEnd || PostStart>
PostEnd) return NULL;

   TreeNode* node = new TreeNode(postorder[PostEnd]);

   int node_position = mpp[node->val];

   int leftLen = node_position - InStart;

   node->left = solve(inorder,InStart, node_position-1, postorder, PostStart, PostStart +
leftLen-1, mpp);
   node->right = solve(inorder,node_position+1, InEnd, postorder, PostStart+leftLen,
PostEnd-1, mpp);
return node;  }
   TreeNode* buildTree(vector<int>& inorder, vector<int>& postorder) {
map<int, int>mpp;
       for(int i=0;i<inorder.size();++i){
mpp[inorder[i]] = i;
       }

       TreeNode* root = solve(inorder, 0, inorder.size()-1, postorder, 0, postorder.size()-1,
mpp);
       return root;
   }
};
```

4.Output:



5.Learning Outcome:

1. **Understand the concept of constructing a binary tree using inorder and postorder traversals.**
2. **Learn how to efficiently find root positions using a hash map for quick lookups.**
3. **Implement a recursive approach to build the tree while maintaining correct left and right subtree boundaries.**
4. **Analyze the time complexity of O(N) due to optimized hash map lookups for element positioning.**