EXPERIMENT-6

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Semester: 6th **Subject Code:** 22ITP-351

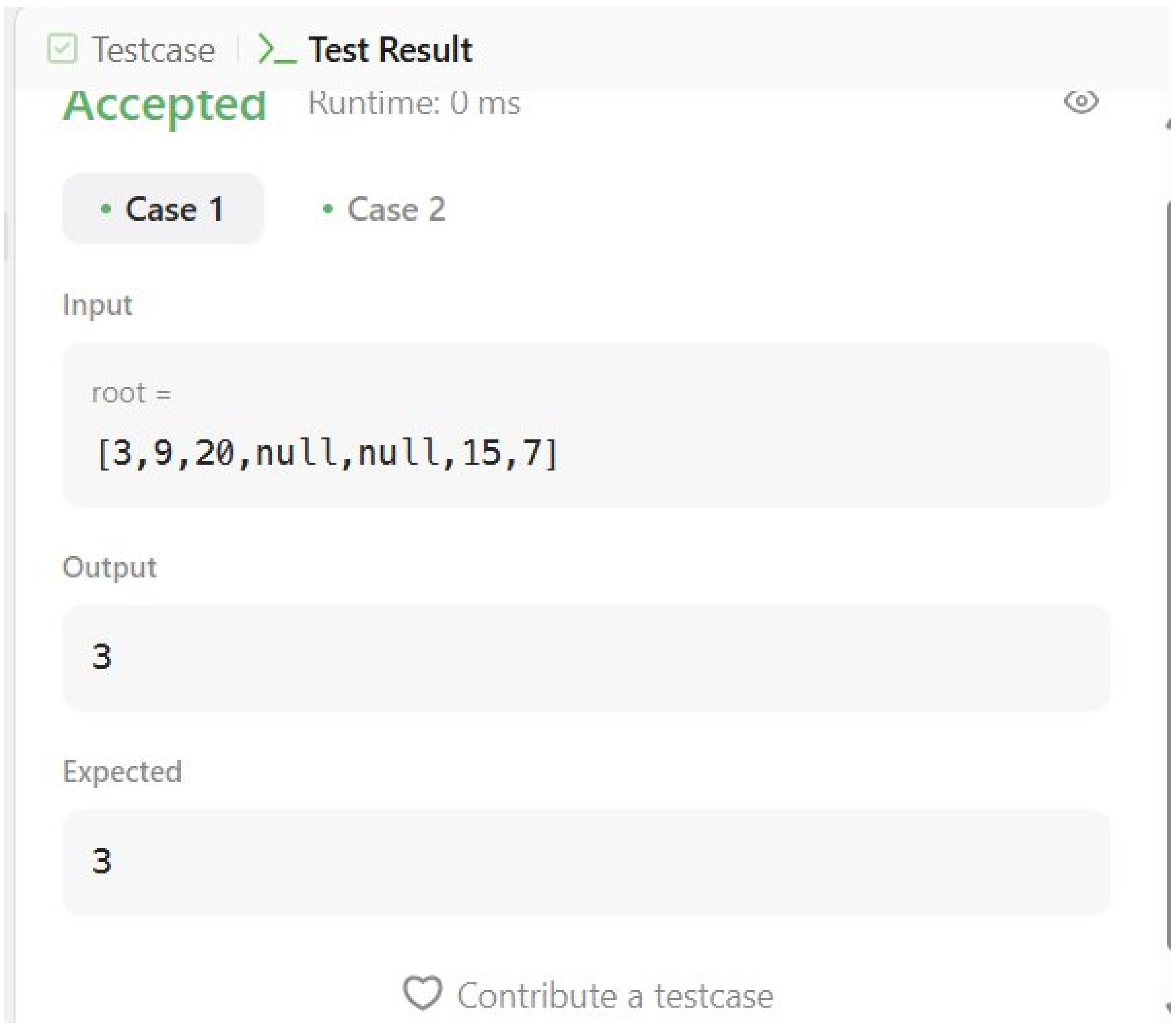
PROBLEM-1

AIM:-

Maximum Depth of Binary Tree

CODE:-

```
/**
 * Definition for a binary tree node.
 * struct TreeNode {
 *     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:
    int maxDepth(TreeNode* root) {
        if(root==nullptr){
            return 0;
        }
        int leftdepth=maxDepth(root->left);
        int rightdepth=maxDepth(root->right);

        return 1+max(leftdepth,rightdepth);
    }
};
```


Testcase | >_ Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

root =

```
[3,9,20,null,null,15,7]
```

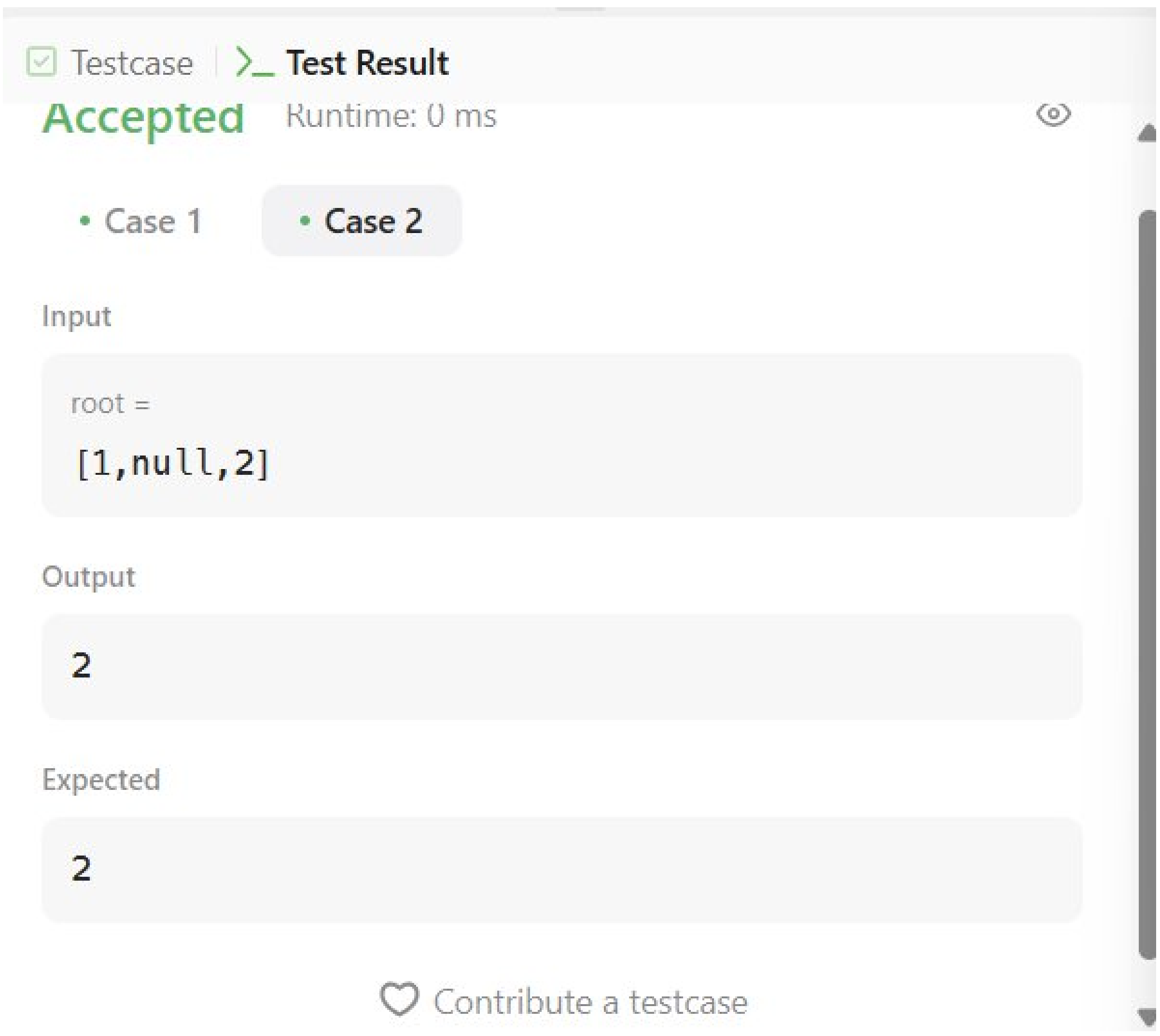
Output

```
3
```

Expected

```
3
```

Contribute a testcase


Testcase | >_ Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

root =

```
[1,null,2]
```

Output

```
2
```

Expected

```
2
```

Contribute a testcase

PROBLEM-2

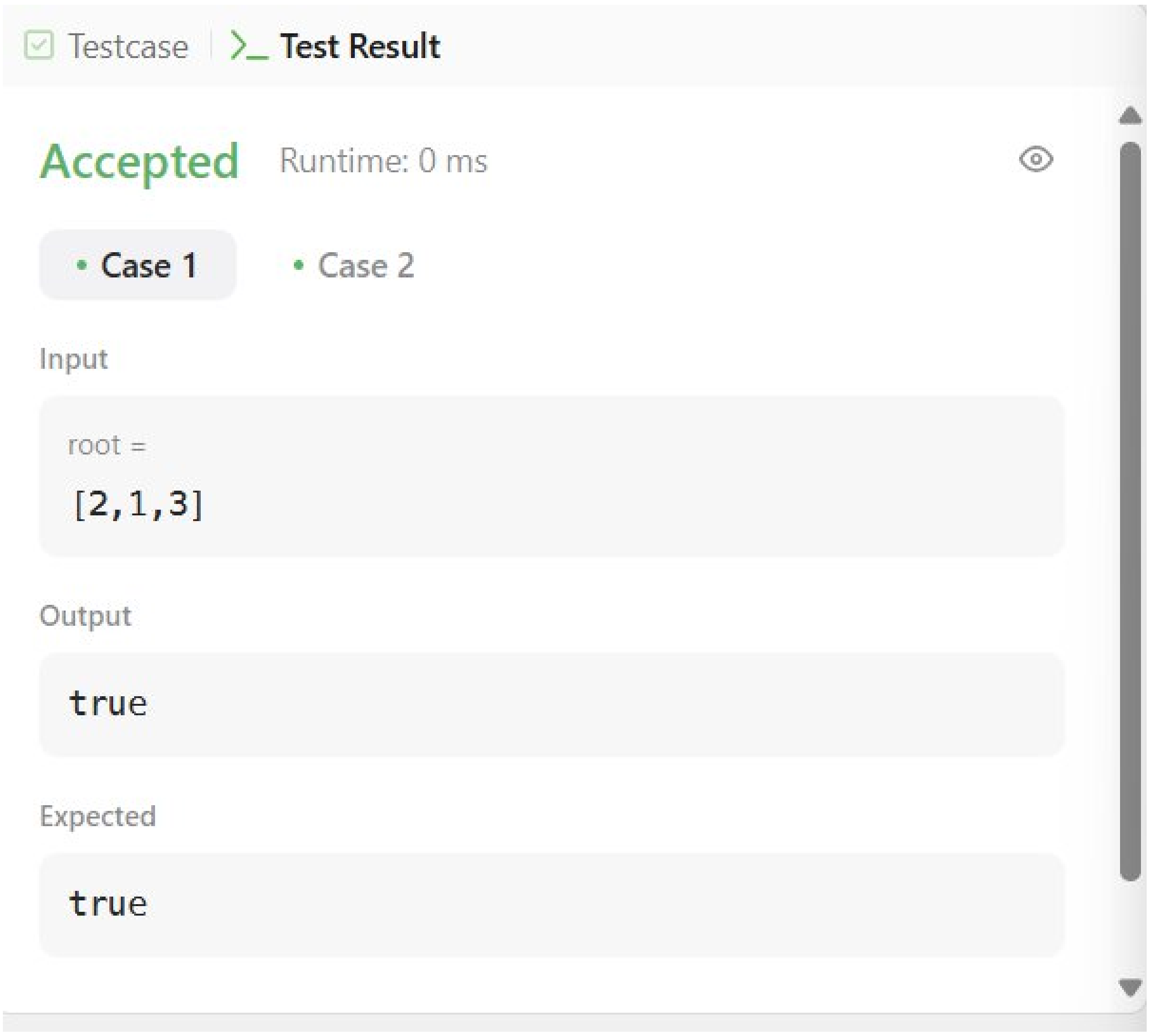
AIM:-

Validate Binary Search Tree

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);
    else return false;
}

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

OUTPUT:-


Testcase
Test Result

Accepted Runtime: 0 ms

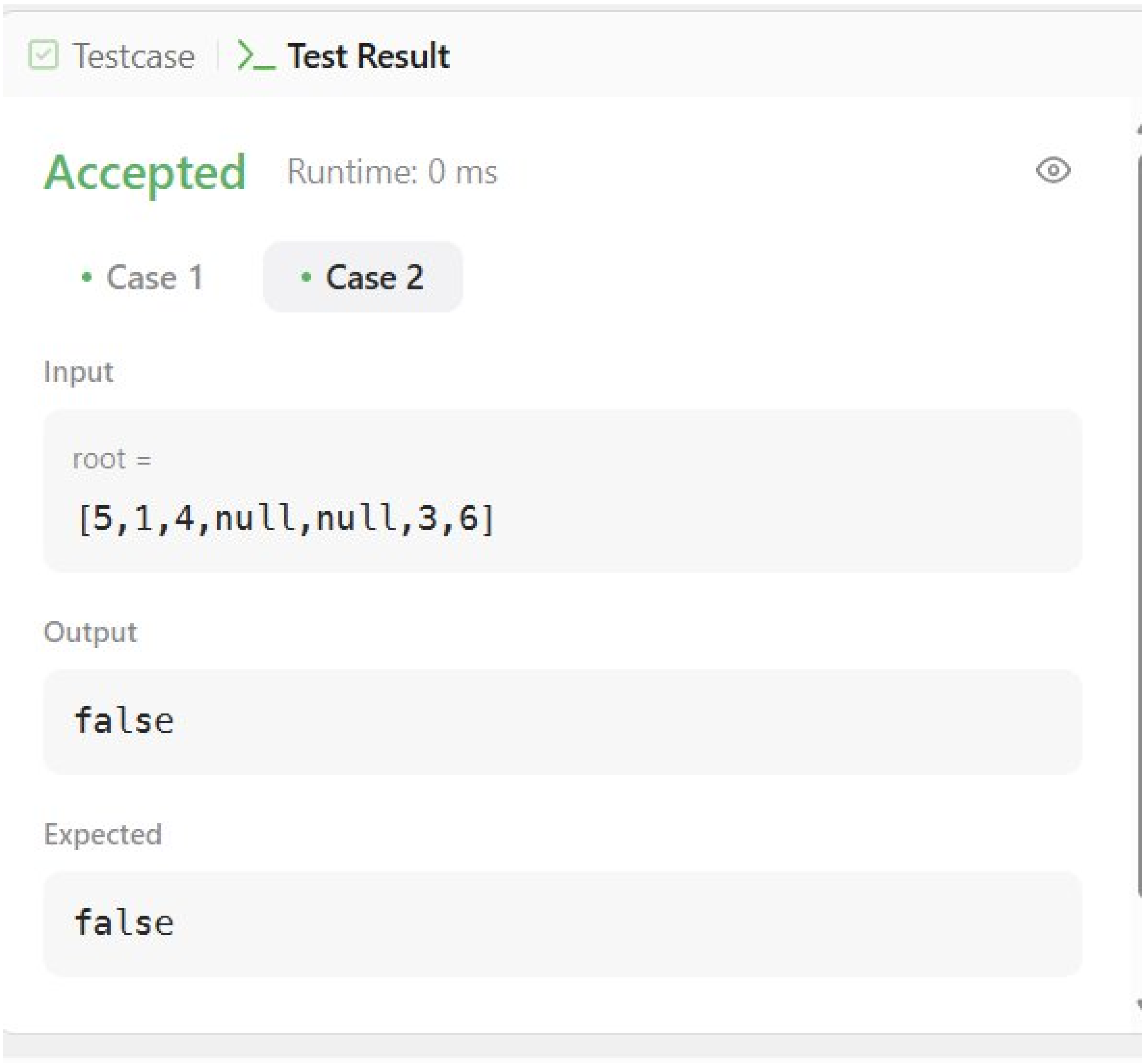
Case 1 Case 2

Input

root =
```
[2,1,3]
```

Output
```
true
```

Expected
```
true
```


Testcase
Test Result

Accepted Runtime: 0 ms

Case 1 Case 2

Input

root =
```
[5,1,4,null,null,3,6]
```

Output
```
false
```

Expected
```
false
```

PROBLEM-3

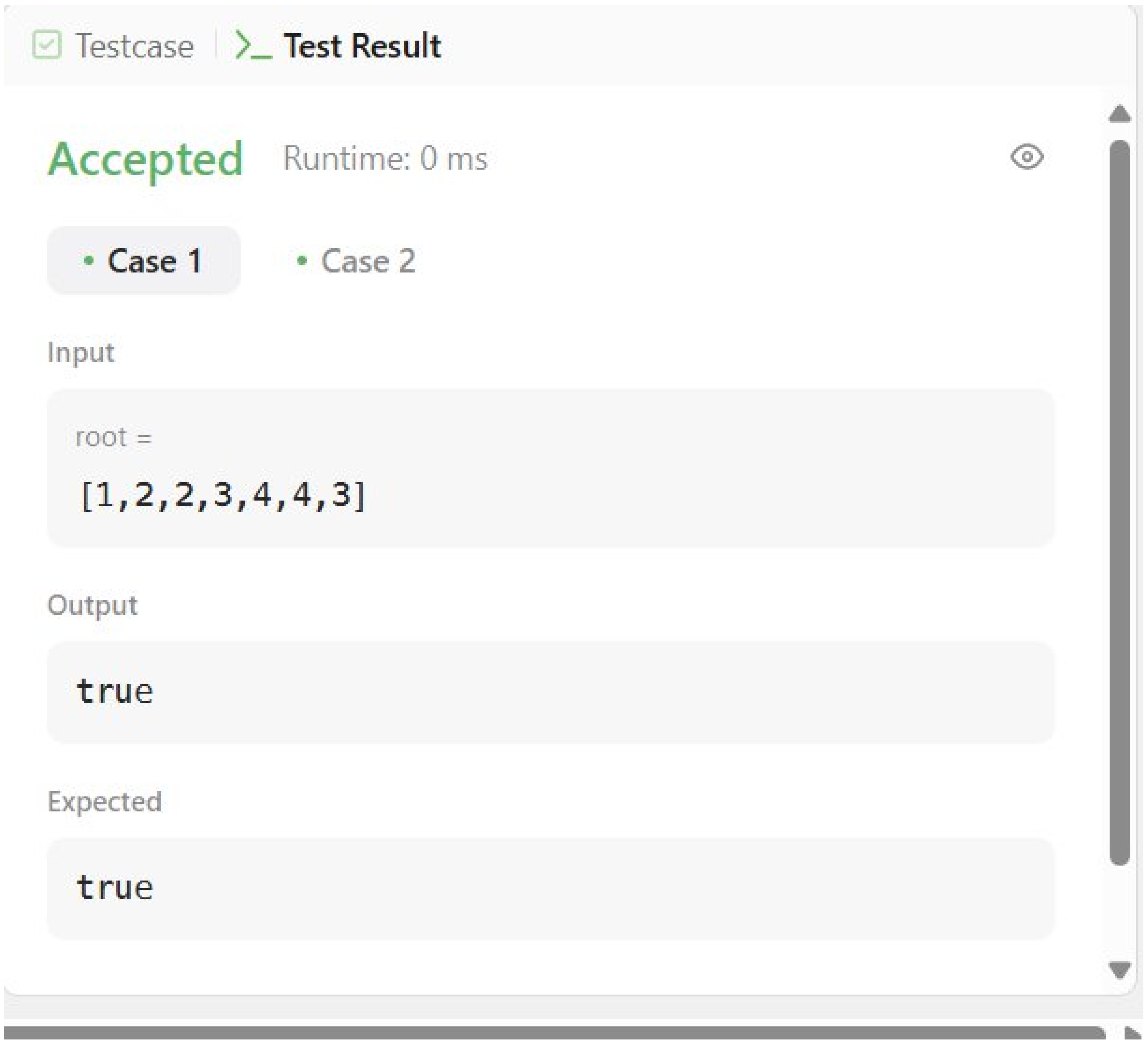
AIM:-

Symmetric Tree

CODE:-

```
class Solution {     public int
numDecodings(String s) {          if
(s.charAt(0) == '0') {              return 0;
        }

        int n = s.length();
int[] dp = new int[n + 1];
dp[0] = dp[1] = 1;


        for (int i = 2; i <= n; i++) {              int one =
Character.getNumericValue(s.charAt(i - 1));              int two
= Integer.parseInt(s.substring(i - 2, i));


            if (1 <= one && one <= 9) {
                dp[i] += dp[i - 1];
            }
            if (10 <= two && two <= 26) {
                dp[i] += dp[i - 2];
            }
        }

        return dp[n];
    }
}
```

OUTPUT:-



Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

root =

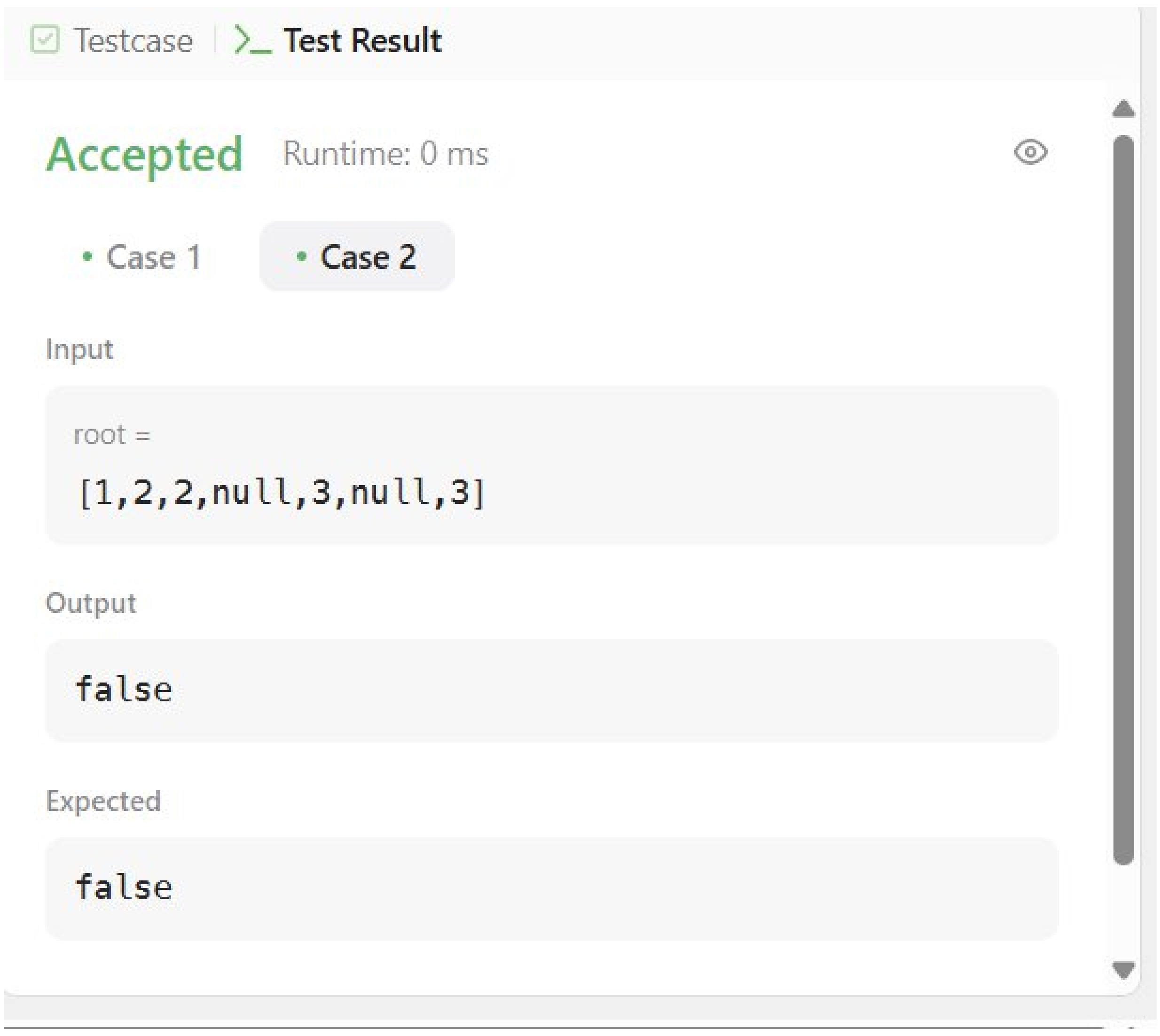
```
[1,2,2,3,4,4,3]
```

Output

```
true
```

Expected

```
true
```



Testcase | Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

root =

```
[1,2,2,null,3,null,3]
```

Output

```
false
```

Expected

```
false
```

PROBLEM-4

AIM:-

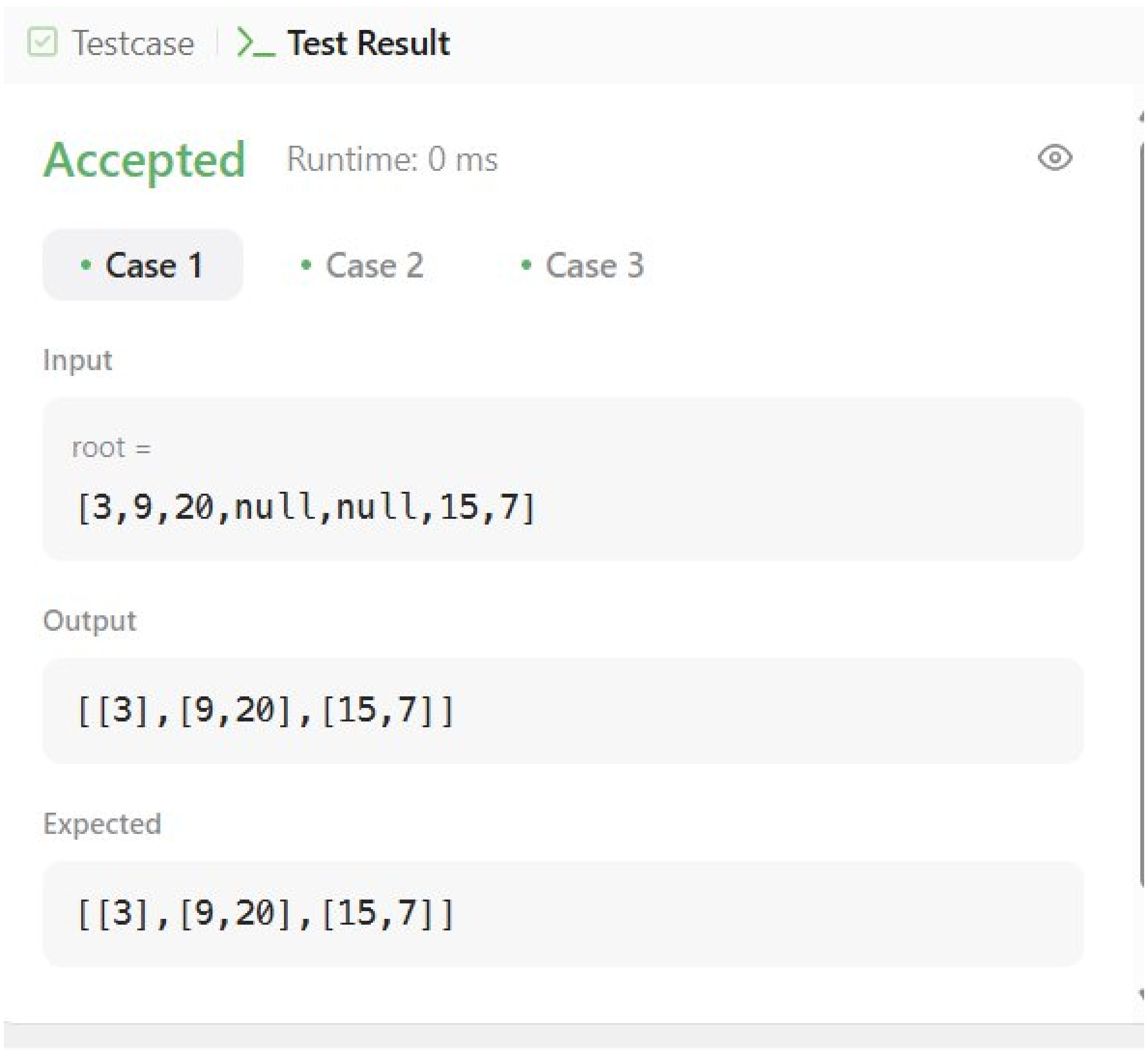
Binary Tree Level

Order Traversal

CODE:-

```
class Solution {     public int coinChange(int[]
coins, int amount) {         int[] minCoins = new
int[amount + 1];         Arrays.fill(minCoins,
amount + 1);         minCoins[0] = 0;

        for (int i = 1; i <= amount; i++) {             for (int j = 0; j < coins.length;
j++) {                 if (i - coins[j] >= 0) {                     minCoins[i] =
Math.min(minCoins[i], 1 + minCoins[i - coins[j]]);
                }
            }
        }

        return minCoins[amount] != amount + 1 ? minCoins[amount] : -1;
    }
```

} **OUTPUT:-**



Testcase | Test Result

Accepted Runtime: 0 ms

Case 1 Case 2 Case 3

Input

root =

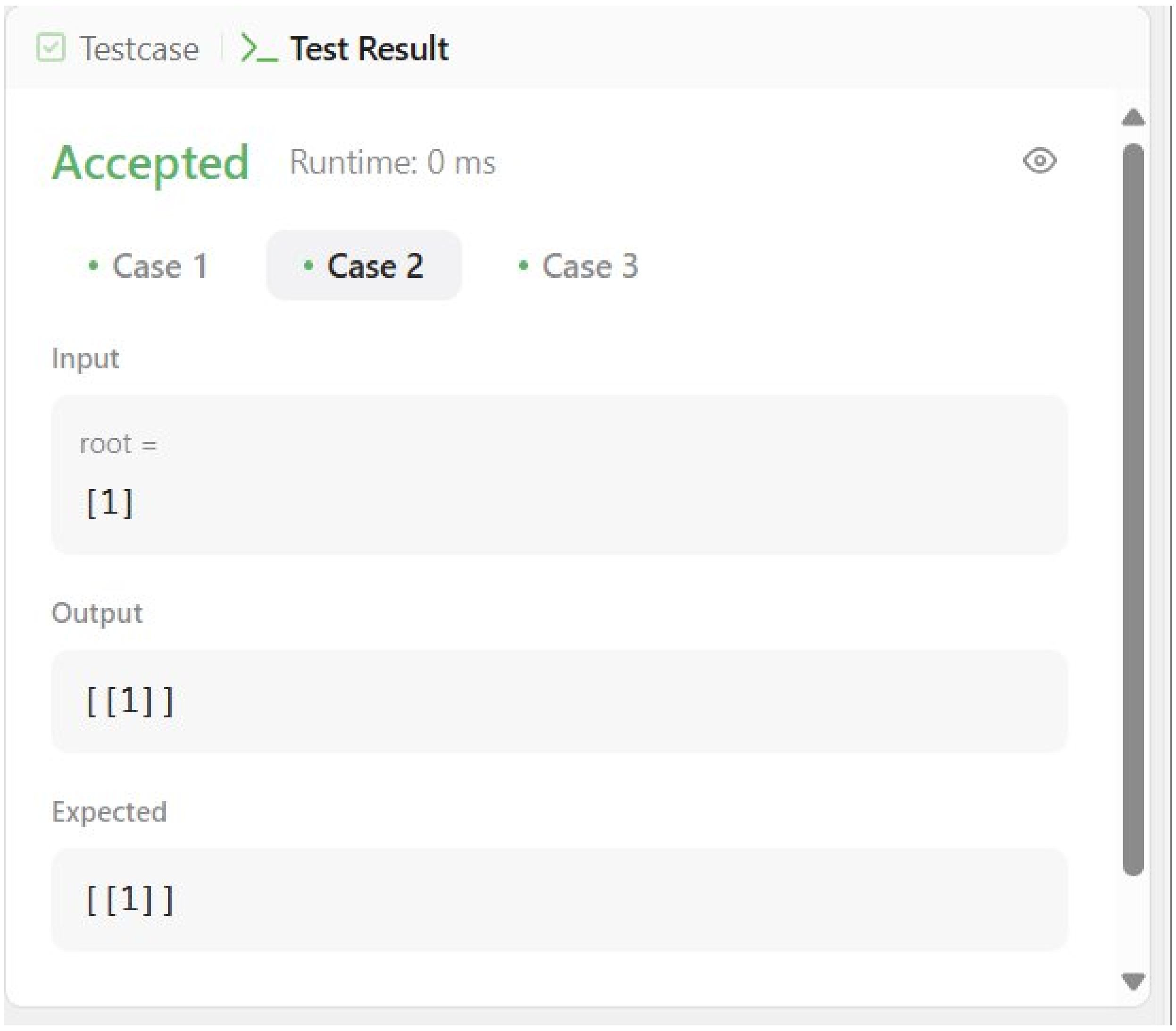
```
[3,9,20,null,null,15,7]
```

Output

```
[[3],[9,20],[15,7]]
```

Expected

```
[[3],[9,20],[15,7]]
```



Testcase | Test Result

Accepted Runtime: 0 ms

Case 1 Case 2 Case 3

Input

root =

```
[1]
```

Output

```
[[1]]
```

Expected

```
[[1]]
```

PROBLEM-5

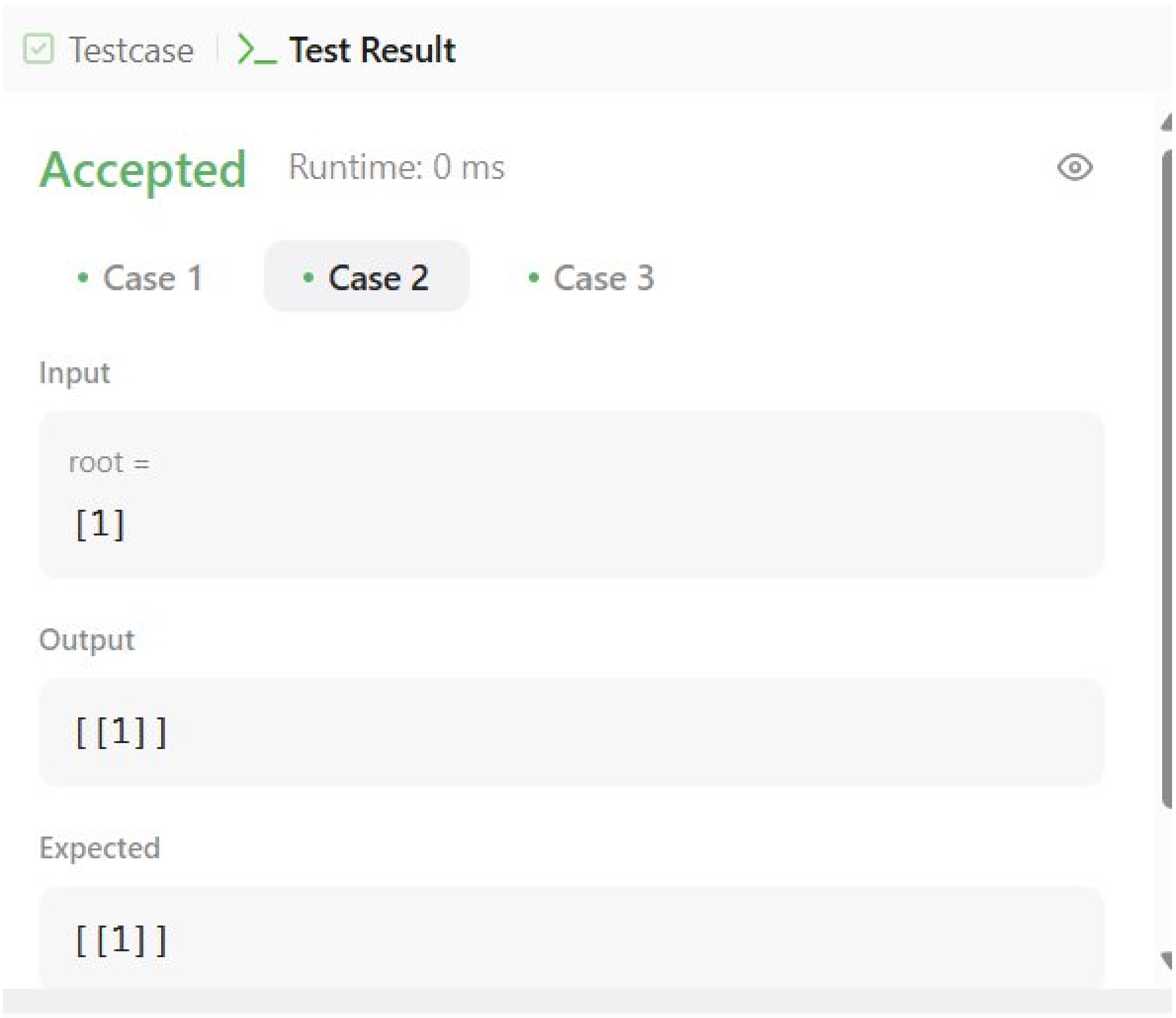
AIM:-

Convert Sorted Array to Binary Search

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

OUTPUT:


Testcase
Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2 • Case 3

Input

root =
```
[1]
```

Output
```
[[1]]
```

Expected
```
[[1]]
```

PROBLEM-6

AIM:-

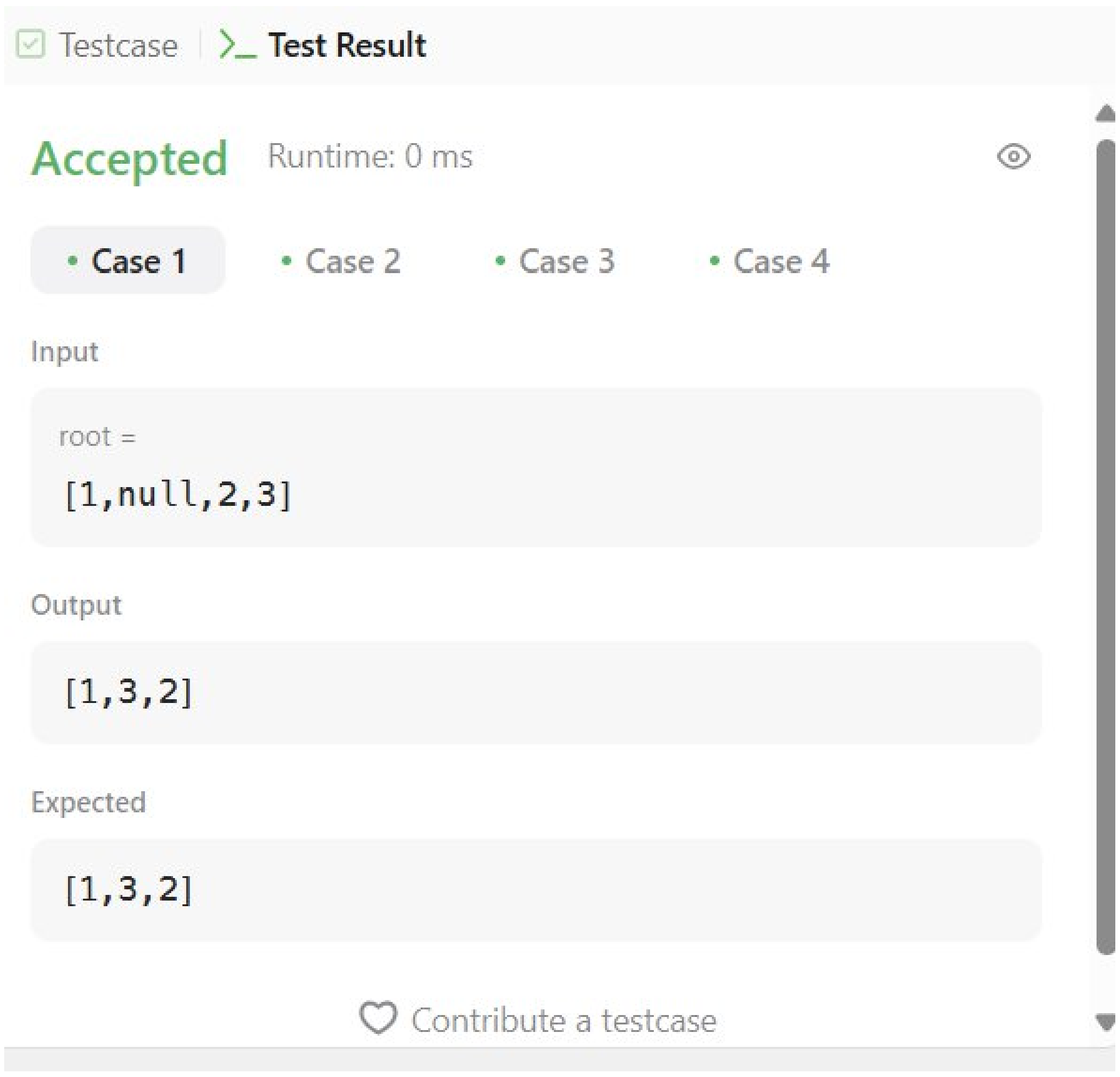
Binary Tree

Inorder Traversal

CODE:-

```
/**
 * Definition for a binary
tree node.
 * struct TreeNode {
 *     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:
      void
inorder(TreeNode*
root,vector<int>&nums)
{
        if(root==NULL){
            return ;
        }

inorder(root
->left,nums);
nu
ms.p
ush_back
(root->val);


inorder(root
->right,nums);



      }
    vector<int>
inorderTraversal(TreeN
ode* root) {
        vector<int>nums;
        inorder(root,nums);
        return nums;
    }
};
```

OUTPUT:-



Testcase | Test Result

Accepted Runtime: 0 ms

Case 1 · Case 2 · Case 3 · Case 4

Input

root =

```
[1,null,2,3]
```

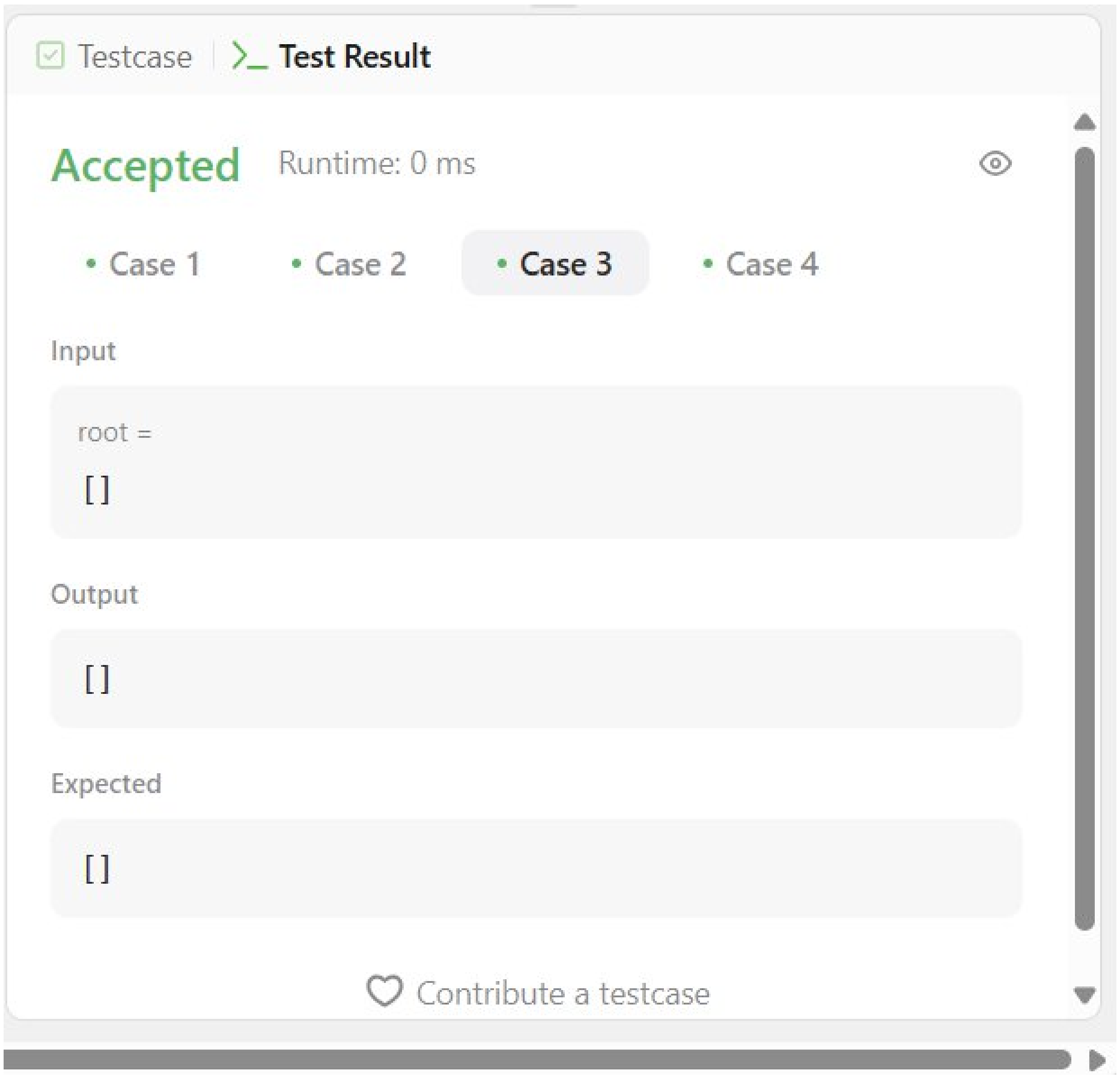
Output

```
[1,3,2]
```

Expected

```
[1,3,2]
```

Contribute a testcase



Accepted Runtime: 0 ms

• Case 1 • Case 2 • Case 3 • Case 4

Input

root =

```
[]
```

Output

```
[]
```

Expected

```
[]
```

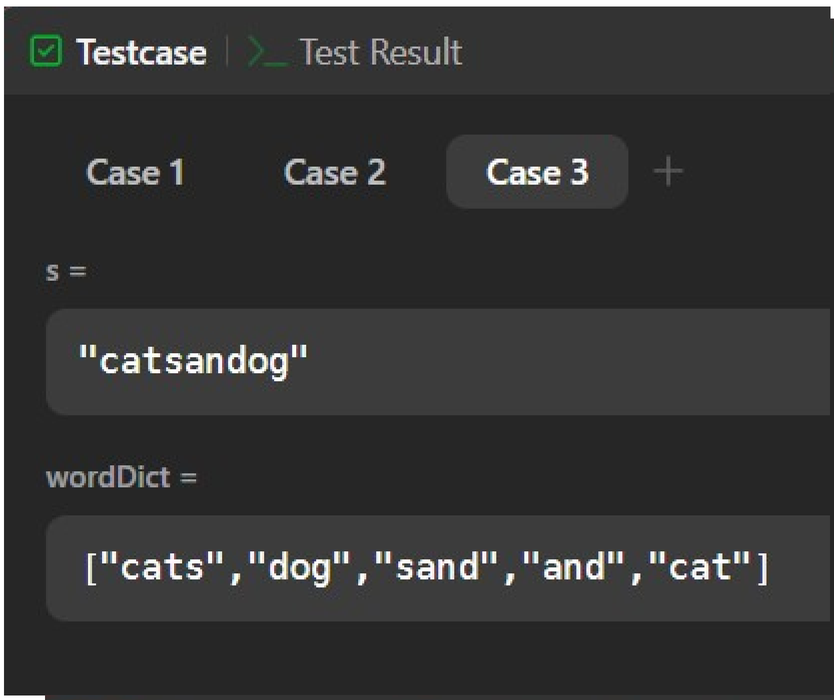
PROBLEM-7

AIM:-

Binary Zigzag Level Order Traversal

CODE:- import

```
java.util.*;

class Solution {     public List<String> wordBreak(String s,
List<String> wordDict) {
        Set<String> wordSet = new HashSet<>(wordDict);
        Map<Integer, List<String>> memo = new HashMap<>();

        return backtrack(s, 0, wordSet, memo);
    }
    private List<String> backtrack(String s, int start, Set<String> wordSet, Map<Integer,
List<String>> memo) {         if (memo.containsKey(start)) {             return
memo.get(start);
        }

        List<String> result = new ArrayList<>();

        if (start == s.length())
{             result.add("");
return result;
        }

        for (int end = start + 1; end <= s.length(); end++) {
            String word = s.substring(start, end);

            if (wordSet.contains(word)) {
                List<String> sublist = backtrack(s, end, wordSet, memo);
for (String sub : sublist) {                     if (sub.isEmpty())
{                         result.add(word);
                    } else {
                        result.add(word + " " + sub);
                    }
                }
            }
        }
                memo.put(start, result);
return result;
    }
}
```

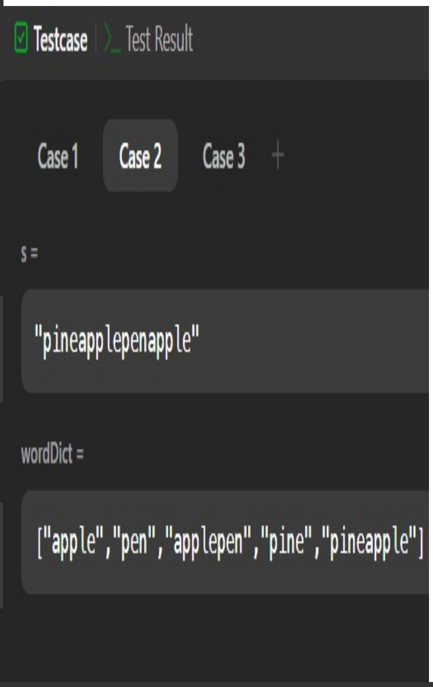


s =

"catsandog"

wordDict =

["cats","dog","sand","and","cat"]

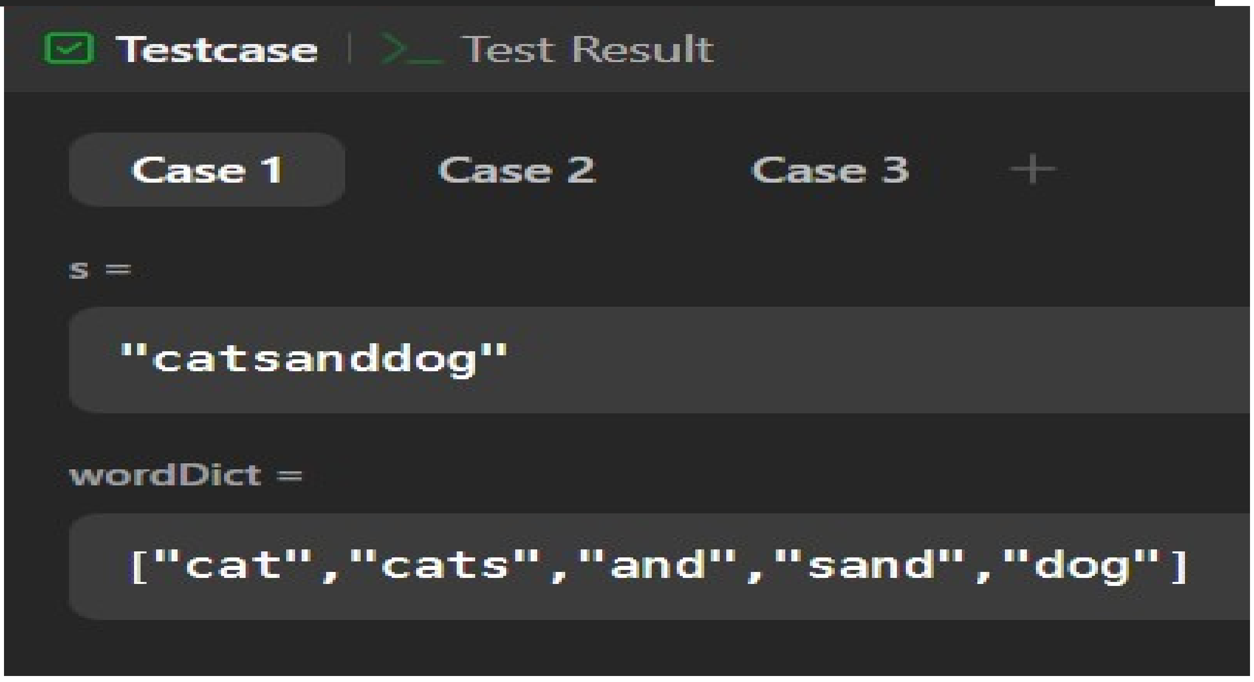


s =

"pineapplepenapple"

wordDict =

["apple","pen","applepen","pine","pineapple"]



s =

"catsanddog"

wordDict =

["cat","cats","and","sand","dog"]

Problem 8:

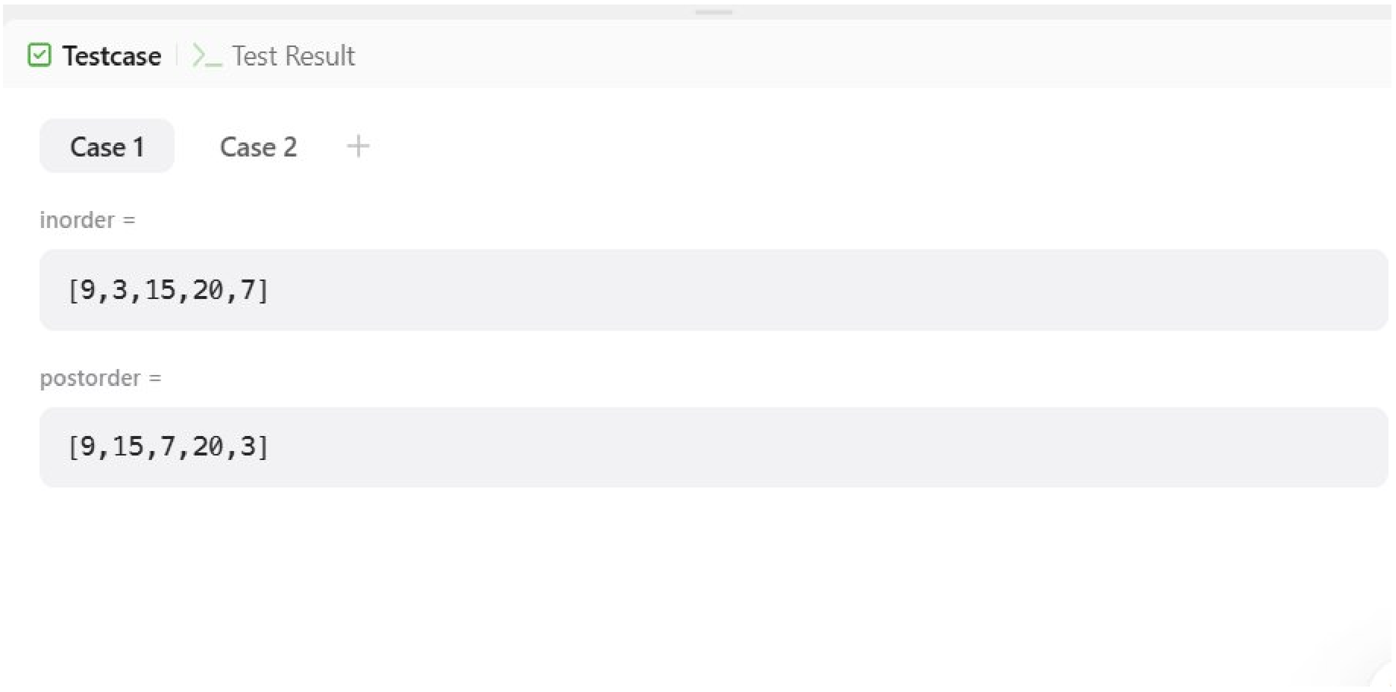
Construsct a binary tree:

CODE:

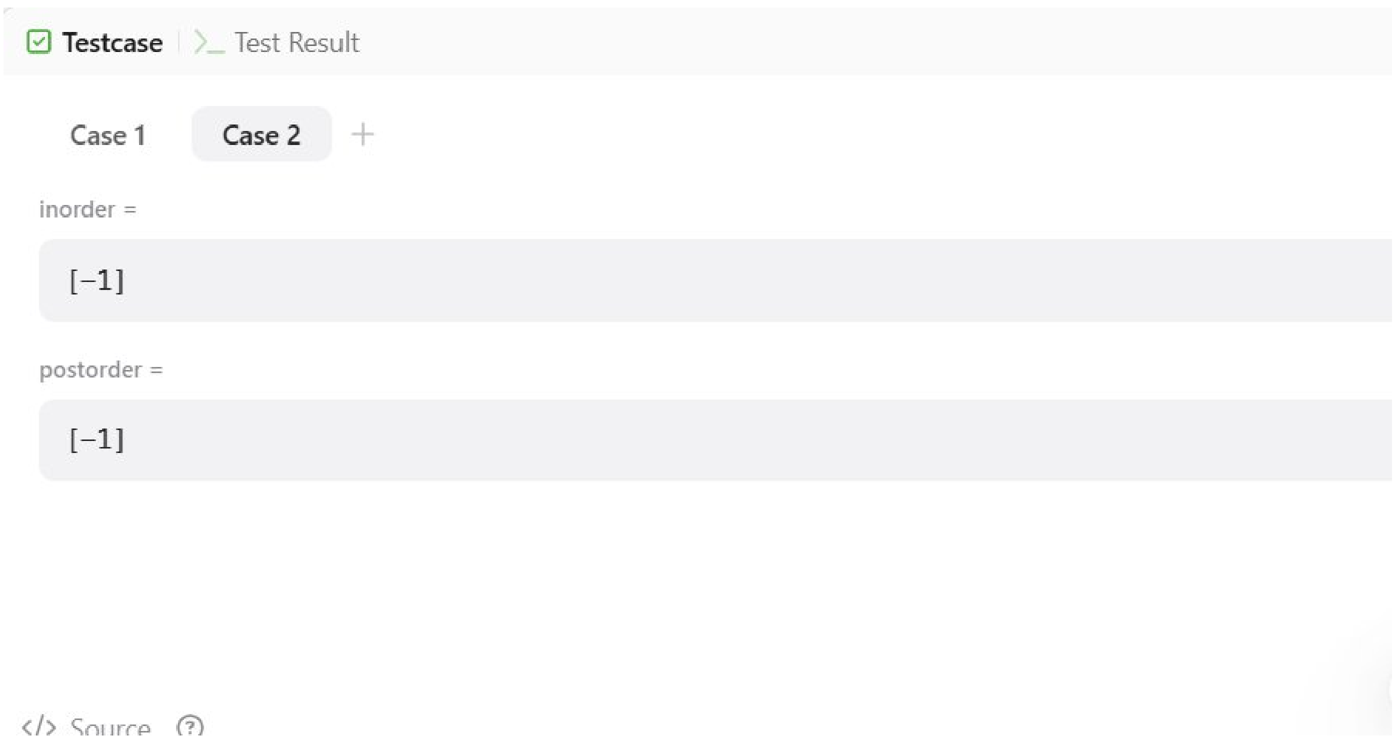
```
/**
 * Definition for a binary tree node.
 * struct TreeNode {
 *     int val;
 *     TreeNode *left;
 *     TreeNode *right;
 *     TreeNode() : val(0), left(nullptr), right(nullptr) {}
 *     TreeNode(int x) : val(x), left(nullptr), right(nullptr) {}
 *     TreeNode(int x, TreeNode *left, TreeNode *right) : val(x), left(left), right(right) {}
 * };
 */
class Solution {
public:
 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;
    }
};
```

OUTPUT:



```
inorder =
[9,3,15,20,7]

postorder =
[9,15,7,20,3]
```


Testcase | Test Result

Case 1 | Case 2

```
inorder =
[-1]

postorder =
[-1]
```

</> Source

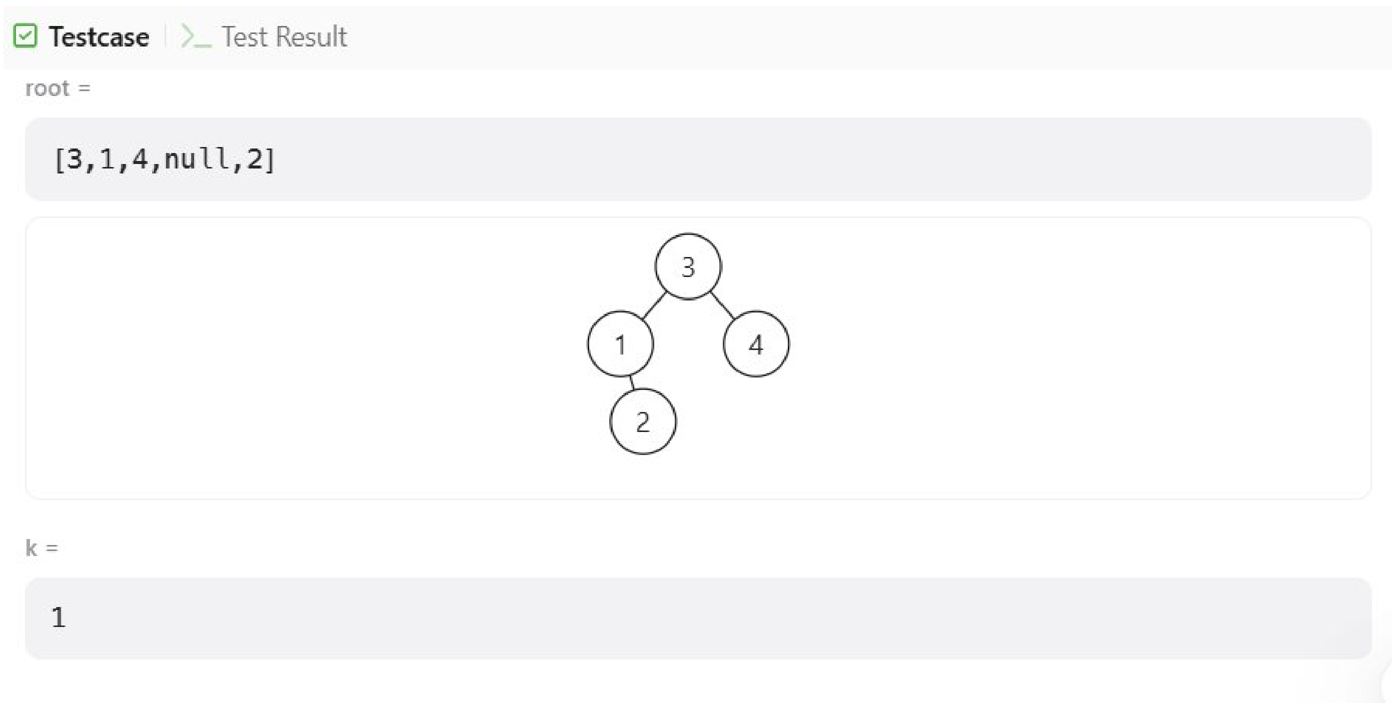
PROBLEM -9

Print KTH element

CODE

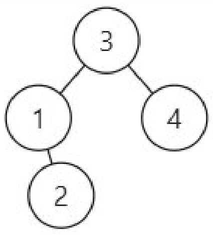
```
# Definition for a binary tree node.
# class TreeNode:
#     def __init__(self, val=0, left=None, right=None):
#         self.val = val
#         self.left = left
#         self.right = right
class Solution:
    def kthSmallest(self, root: Optional[TreeNode], k: int) -> int:
        arr=[]
        def inorder(root):
            if root:
                inorder(root.left)
                arr.append(root.val)
                inorder(root.right)
        inorder(root)
        return arr[k-1]
```

OUTPUT:


Testcase | Test Result

root =

```
[3,1,4,null,2]
```



k =

```
1
```

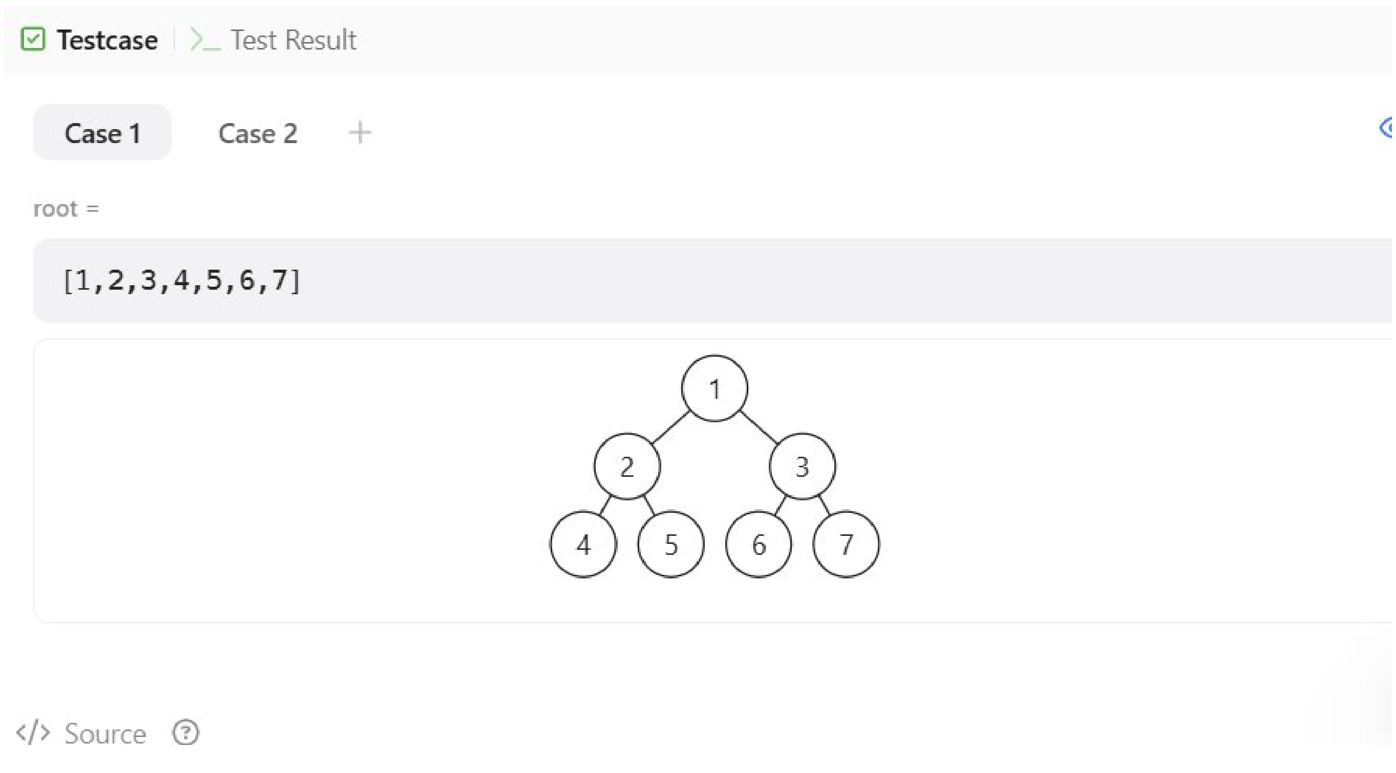
PROBLEM -10

Populating next right pointers

Code:

```
class Solution {
public:
    Node* connect(Node* root) {
        if(!root) return nullptr;
        queue<Node*> q;
        q.push(root);
        while(size(q)) {
            Node* rightNode = nullptr;                    // set rightNode to null initially
            for(int i = size(q); i; i--) {              // traversing each level
                auto cur = q.front(); q.pop();           // pop a node from current level and,
                cur -> next = rightNode;                // set its next pointer to rightNode
                rightNode = cur;                        // update rightNode as cur for next iteration
                if(cur -> right)                        // if a child exists
                    q.push(cur -> right),               // IMP: push right first to do right-to-left BFS
                    q.push(cur -> left);                // then push left
            }
        }
        return root;
    }
};
```

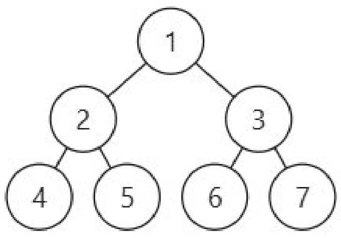
OUTPUT:


Testcase | Test Result

Case 1 | Case 2 | +

root =

```
[1,2,3,4,5,6,7]
```



Source