

## Binary Tree Solutions

Solution 1:

Time Complexity :  $O(h)$

Space Complexity:  $O(1)$

```
import java.util.*;
class Solution{

    static class Node{
        int data;
        Node left;
        Node right;
    };

    static Node newNode(int data){
        Node temp = new Node();
        temp.data = data;
        temp.left = temp.right = null;
        return (temp);
    }

    static boolean isUnivalTree(Node root){

        if (root == null){
            return true;
        }

        if (root.left != null
            && root.data != root.left.data)
            return false;

        if (root.right != null
            && root.data != root.right.data)
            return false;

        return isUnivalTree(root.left)
            && isUnivalTree(root.right);
    }
}
```

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```
}

public static void main(String[] args){

    Node root = newNode(1);
    root.left = newNode(1);
    root.right = newNode(1);
    root.left.left = newNode(1);
    root.left.right = newNode(1);
    root.right.right = newNode(1);

    if (isUnivalTree(root)) {
        System.out.print("YES");
    }
    else{
        System.out.print("NO");
    }
}
}
```

Solution 2 :

Time Complexity :  $O(n)$

Space Complexity:  $O(n)$

```
class Node{
    int data;
    Node left, right;

    public Node(int item)
    {
        data = item;
        left = right = null;
    }
}

class Solution{
    Node root;

    void mirror(){
        root = mirror(root);
    }
}
```

```
Node mirror(Node node){
    if (node == null)
        return node;

    /* do the subtrees */
    Node left = mirror(node.left);
    Node right = mirror(node.right);

    /* swap the left and right pointers */
    node.left = right;
    node.right = left;

    return node;
}

void inOrder(){
    inOrder(root);
}

void inOrder(Node node){
    if (node == null)
        return;

    inOrder(node.left);
    System.out.print(node.data + " ");

    inOrder(node.right);
}

public static void main(String args[]){
    BinaryTree tree = new BinaryTree();
    tree.root = new Node(1);
    tree.root.left = new Node(2);
    tree.root.right = new Node(3);
    tree.root.left.left = new Node(4);
    tree.root.left.right = new Node(5);

    System.out.println("Inorder traversal of input tree is :");
    tree.inOrder();
    System.out.println("");
    tree.mirror();
    System.out.println("Inorder traversal of binary tree is : ");
    tree.inOrder();
}
```

```
}
```

### Solution 3 :

Time Complexity :  $O(n)$

Space Complexity:  $O(1)$

```
class Solution {  
  
    static class Node {  
        int data;  
        Node left, right;  
    }  
  
    static Node newNode(int data){  
        Node newNode = new Node();  
        newNode.data = data;  
        newNode.left = null;  
        newNode.right = null;  
        return (newNode);  
    }  
  
    static Node deleteLeaves(Node root, int x){  
        if (root == null)  
            return null;  
        root.left = deleteLeaves(root.left, x);  
        root.right = deleteLeaves(root.right, x);  
  
        if (root.data == x && root.left == null && root.right == null) {  
            return null;  
        }  
        return root;  
    }  
  
    static void inorder(Node root){  
        if (root == null)  
            return;  
        inorder(root.left);
```

```
        System.out.print(root.data + " ");
        inorder(root.right);
    }

    public static void main(String[] args){
        Node root = newNode(10);
        root.left = newNode(3);
        root.right = newNode(10);
        root.left.left = newNode(3);
        root.left.right = newNode(1);
        root.right.right = newNode(3);
        root.right.right.left = newNode(3);
        root.right.right.right = newNode(3);
        deleteLeaves(root, 3);
        System.out.print("Inorder traversal after deletion : ");
        inorder(root);
    }
}
```

#### Solution 4 :

Time Complexity :  $O(n \cdot n)$

Space Complexity:  $O(n \cdot n)$

```
import java.util.HashMap;
public class Solution {

    static HashMap<String, Integer> m;
    static class Node {
        int data;
        Node left;
        Node right;
        Node(int data){
            this.data = data;
            left = null;
            right = null;
        }
    }
}
```

```

static String inorder(Node node){
    if (node == null)
        return "";

    String str = "(";
    str += inorder(node.left);
    str += Integer.toString(node.data);
    str += inorder(node.right);
    str += ")";

    if (m.get(str) != null && m.get(str)==1 )
        System.out.print( node.data + " ");

    if (m.containsKey(str))
        m.put(str, m.get(str) + 1);
    else
        m.put(str, 1);

    return str;
}

static void printAllDups(Node root){
    m = new HashMap<>();
    inorder(root);
}

public static void main(String args[]){
    Node root = null;
    root = new Node(1);
    root.left = new Node(2);
    root.right = new Node(3);
    root.left.left = new Node(4);
    root.right.left = new Node(2);
    root.right.left.left = new Node(4);
    root.right.right = new Node(4);
    printAllDups(root);
}
}

```

Solution 5 :

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Time Complexity :  $O(n)$

Space Complexity:  $O(1)$

```
class Node {

    int data;
    Node left, right;

    public Node(int item) {
        data = item;
        left = right = null;
    }
}

class Res {
    public int val;
}

class Solution {
    Node root;
    int findMaxUtil(Node node, Res res) {

        if (node == null)
            return 0;

        int l = findMaxUtil(node.left, res);
        int r = findMaxUtil(node.right, res);

        int max_single = Math.max(Math.max(l, r) + node.data,
                                   node.data);

        int max_top = Math.max(max_single, l + r + node.data);

        res.val = Math.max(res.val, max_top);

        return max_single;
    }

    int findMaxSum() {
```

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```
        return findMaxSum(root);
    }

    int findMaxSum(Node node) {

        Res res = new Res();
        res.val = Integer.MIN_VALUE;

        findMaxUtil(node, res);
        return res.val;
    }

    public static void main(String args[]) {
        Solution tree = new Solution();
        tree.root = new Node(10);
        tree.root.left = new Node(2);
        tree.root.right = new Node(10);
        tree.root.left.left = new Node(20);
        tree.root.left.right = new Node(1);
        tree.root.right.right = new Node(-25);
        tree.root.right.right.left = new Node(3);
        tree.root.right.right.right = new Node(4);
        System.out.println("maximum path sum is : " +
                           tree.findMaxSum());
    }
}
```