

# Java - DSA

## Trees

### 1. Build Tree from given Preorder Sequence

```
//Build a Tree from its Preorder traversal

public class BinaryTreesYT {
    static class Node {
        int data;
        Node left;
        Node right;

        Node(int data) {
            this.data = data;
            this.left = null;
            this.right = null;
        }
    }

    static class BinaryTree {
        static int idx = -1;
        public static Node buildTree(int nodes[]) {
            idx++;
            if(nodes[idx] == -1) {
                return null;
            }
            Node newNode = new Node(nodes[idx]);
            newNode.left = buildTree(nodes);
            newNode.right = buildTree(nodes);
            return newNode;
        }
    }

    public static void main(String args[]) {
        int nodes[] = {1, 2, 4, -1, -1, 5, -1, -1, 3, -1, 6, -1, -1};
        BinaryTree tree = new BinaryTree();

        Node root = tree.buildTree(nodes);
        System.out.println(root.data);
    }
}
```

```
}
```

## 2. Tree Traversals

### a. Preorder

```
public static void preorder(Node root) {  
    if(root == null) {  
        System.out.print(-1+" ");  
        return;  
    }  
    System.out.print(root.data+" ");  
    preorder(root.left);  
    preorder(root.right);  
}
```

### b. Inorder

```
public static void inorder(Node root) {  
    if(root == null) {  
        System.out.print(-1+" ");  
        return;  
    }  
    inorder(root.left);  
    System.out.print(root.data+" ");  
    inorder(root.right);  
}
```

### c. Postorder

```
public static void postorder(Node root) {  
    if(root == null) {  
        System.out.print(-1+" ");  
        return;  
    }  
    postorder(root.left);  
    postorder(root.right);  
    System.out.print(root.data+" ");  
}
```

#### d. Level Order

```
public static void levelOrder(Node root) {
    if(root == null) {
        return;
    }
    Queue<Node> q = new LinkedList<>();
    q.add(root);
    q.add(null);
    while(!q.isEmpty()) {
        Node curr = q.remove();
        if(curr == null) {
            System.out.println();
            //queue empty
            if(q.isEmpty()) {
                break;
            } else {
                q.add(null);
            }
        } else {
            System.out.print(curr.data+" ");
            if(curr.left != null) {
                q.add(curr.left);
            }
            if(curr.right != null) {
                q.add(curr.right);
            }
        }
    }
}
```

### 3. Height of Tree

```
public static int height(Node root) {
    if(root == null) {
        return 0;
    }

    int leftHeight = height(root.left);
    int rightHeight = height(root.right);
    return Math.max(leftHeight, rightHeight) + 1;
}
```

```
}
```

#### 4. Count of Nodes of Tree

```
public static int countOfNodes(Node root) {  
    if(root == null) {  
        return 0;  
    }  
  
    int leftNodes = countOfNodes(root.left);  
    int rightNodes = countOfNodes(root.right);  
    return leftNodes + rightNodes + 1;  
}
```

#### 5. Sum of Nodes of Tree

```
public static int sumOfNodes(Node root) {  
    if(root == null) {  
        return 0;  
    }  
  
    int leftSum = sumOfNodes(root.left);  
    int rightSum = sumOfNodes(root.right);  
    return leftSum + rightSum + root.data;  
}
```

#### 6. Diameter of Tree - Approach1 $O(N^2)$

```
public static int diameter(Node root) {  
    if(root == null) {  
        return 0;  
    }  
  
    int diam1 = height(root.left) + height(root.right) + 1;  
    int diam2 = diameter(root.left);  
    int diam3 = diameter(root.right);  
  
    return Math.max(diam1, Math.max(diam2, diam3));  
}
```

## 7. Diameter of Tree - Approach2 O(N)

```
public static TreeInfo diameter(Node root) {
    if(root == null) {
        return new TreeInfo(0, 0);
    }

    TreeInfo leftTI = diameter(root.left);
    TreeInfo rightTI = diameter(root.right);

    int myHeight = Math.max(leftTI.height, rightTI.height) + 1;

    int diam1 = leftTI.height + rightTI.height + 1;
    int diam2 = leftTI.diam;
    int diam3 = rightTI.diam;

    int myDiam = Math.max(diam1, Math.max(diam2, diam3));

    return new TreeInfo(myHeight, myDiam);
}
```

## 8. Subtree of another tree

```
public boolean isIdentical(TreeNode root,TreeNode subRoot){
    if(subRoot == null && root == null){
        return true;
    }
    if(root == null || subRoot == null){
        return false;
    }
    if(root.val == subRoot.val){
        return isIdentical(root.left, subRoot.left) &&
isIdentical(root.right, subRoot.right);
    }
    return false;
}

public boolean isSubtree(TreeNode root, TreeNode subRoot) {
    if(subRoot == null){
        return true;
    }
    if(root == null){
        return false;
    }
    if(root.val == subRoot.val && isSubtree(root.left, subRoot) && isSubtree(root.right, subRoot))
        return true;
    return false;
}
```

```
    }  
    if(isIdentical(root, subRoot)){  
        return true;  
    }  
    return isSubtree(root.left, subRoot) || isSubtree(root.right, subRoot);  
}
```