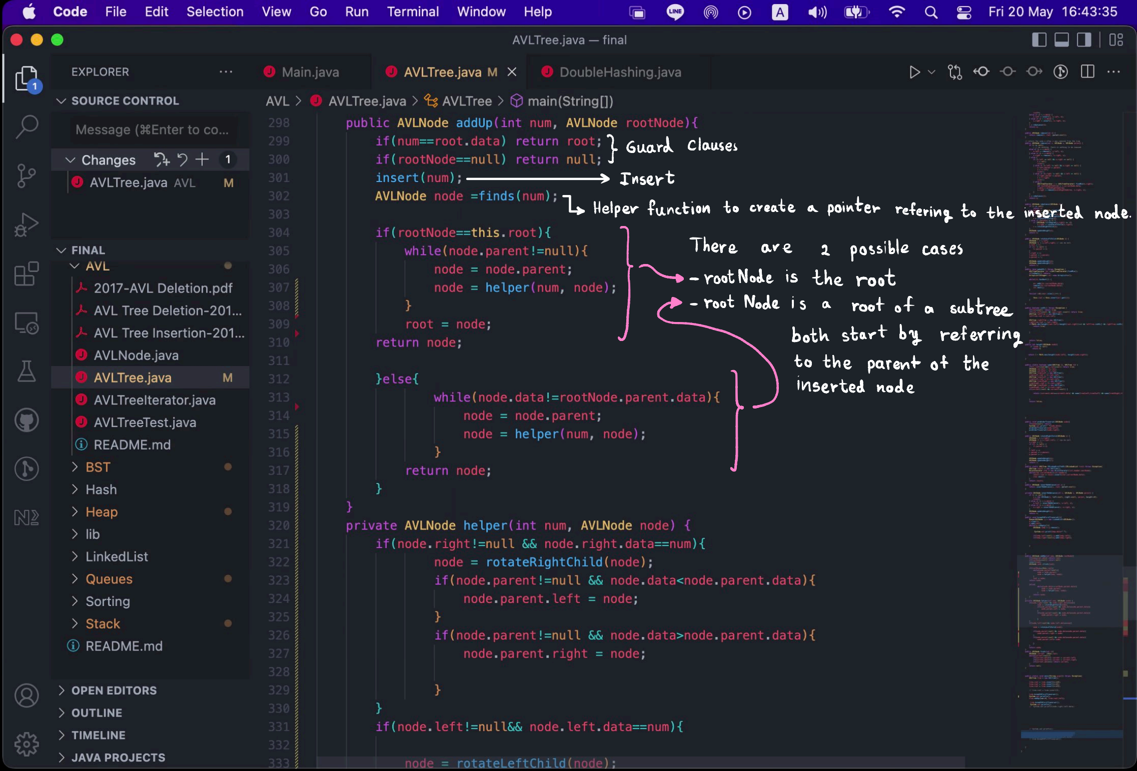


```java
    public AVLNode addUp(int num, AVLNode rootNode){
        if(num==root.data) return root;
        if(rootNode==null) return null;
        insert(num);
        AVLNode node =finds(num);

        if(rootNode==this.root){
            while(node.parent!=null){
                node = node.parent;
                node = helper(num, node);
            }
            root = node;
        return node;

        }else{
                while(node.data!=rootNode.parent.data){
                    node = node.parent;
                    node = helper(num, node);
                }
            return node;
        }
    }
    private AVLNode helper(int num, AVLNode node) {
        if(node.right!=null && node.right.data==num){
                node = rotateRightChild(node);
                if(node.parent!=null && node.data<node.parent.data){
                    node.parent.left = node;
                }
                if(node.parent!=null && node.data>node.parent.data){
                    node.parent.right = node;

                }
        }
        if(node.left!=null&& node.left.data==num){

            node = rotateLeftChild(node);
```

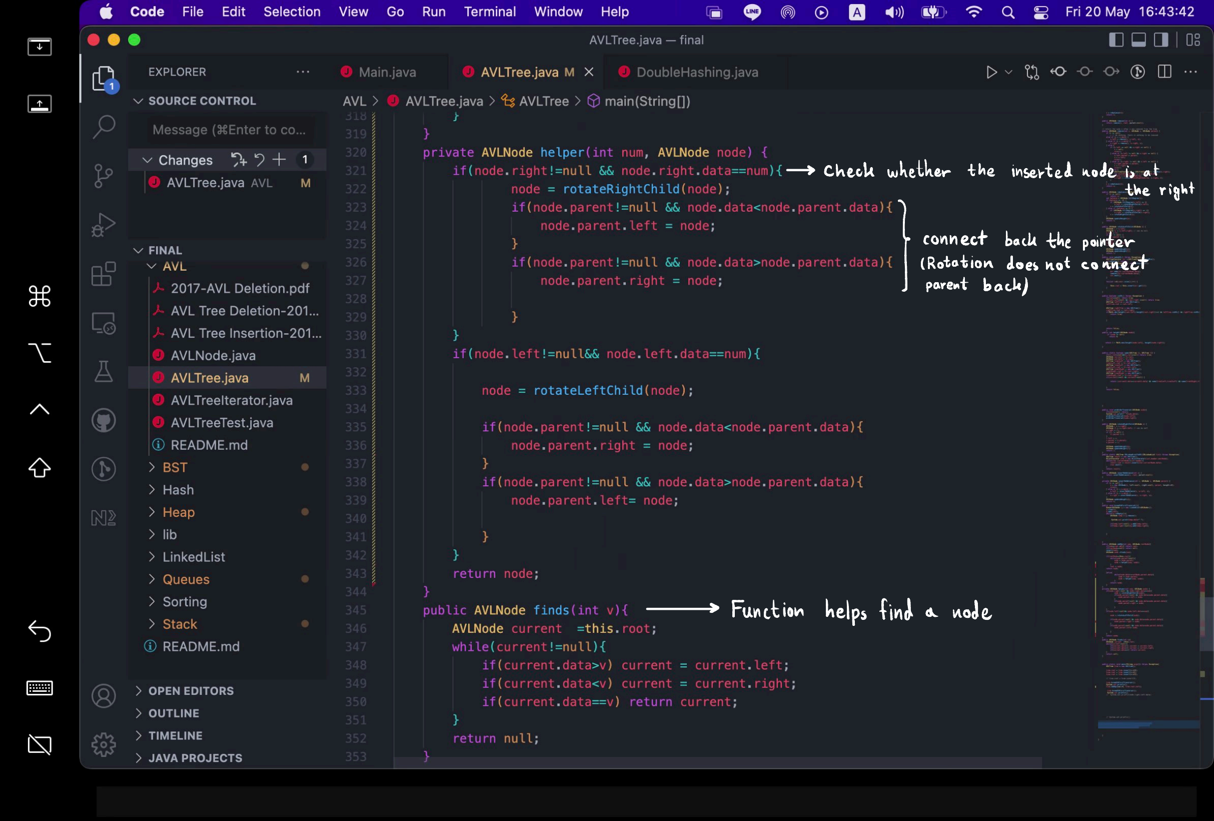
} Guard Clauses

→ Insert

↳ Helper function to create a pointer refering to the inserted node.

There are 2 possible cases
- rootNode is the root
- root Node is a root of a subtree

both start by referring to the parent of the inserted node



```java
        }
    }
    private AVLNode helper(int num, AVLNode node) {
        if(node.right!=null && node.right.data==num){
                node = rotateRightChild(node);
                if(node.parent!=null && node.data<node.parent.data){
                    node.parent.left = node;
                }
                if(node.parent!=null && node.data>node.parent.data){
                    node.parent.right = node;

                }
        }
        if(node.left!=null&& node.left.data==num){

            node = rotateLeftChild(node);

            if(node.parent!=null && node.data<node.parent.data){
                node.parent.right = node;
            }
            if(node.parent!=null && node.data>node.parent.data){
                node.parent.left= node;

            }
        }
        return node;
    }
    public AVLNode finds(int v){
        AVLNode current  =this.root;
        while(current!=null){
            if(current.data>v) current = current.left;
            if(current.data<v) current = current.right;
            if(current.data==v) return current;
        }
        return null;
    }
```

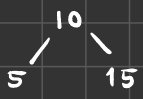
$\longrightarrow$ Check whether the inserted node is at the right

connect back the pointer (Rotation does not connect parent back)

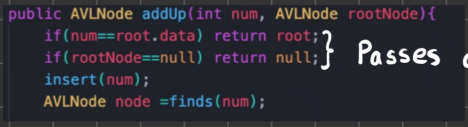
$\longrightarrow$ Function helps find a node

Example

Tree



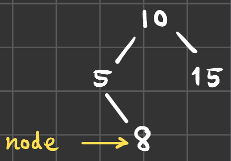
call addUp (8, root)

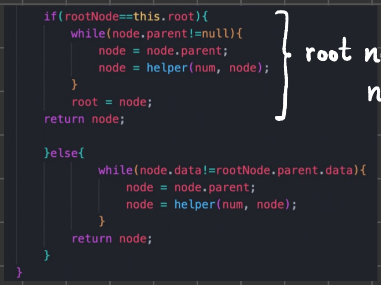


```java
public AVLNode addUp(int num, AVLNode rootNode){
    if(num==root.data) return root;
    if(rootNode==null) return null;
    insert(num);
    AVLNode node =finds(num);
```

} Passes all Guard clause

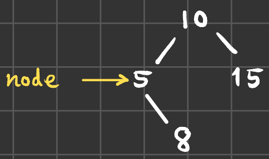
A new AVLNode is inserted & node points to it.

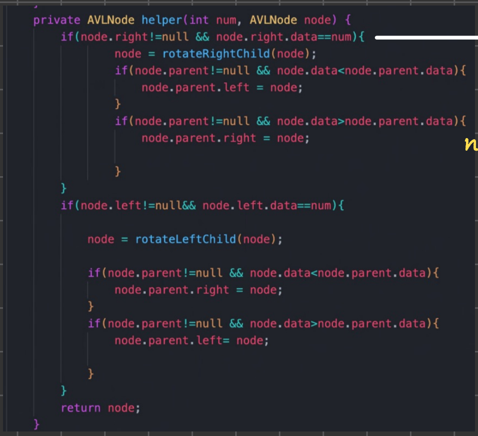




```java
    if(rootNode==this.root){
        while(node.parent!=null){
            node = node.parent;
            node = helper(num, node);
        }
        root = node;
    return node;

    }else{
            while(node.data!=rootNode.parent.data){
                node = node.parent;
                node = helper(num, node);
            }
        return node;
    }
}
```

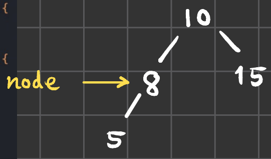
} root node passed into method
node now points to 5
& helper (8, node) is called





```java
    private AVLNode helper(int num, AVLNode node) {
        if(node.right!=null && node.right.data==num){
                node = rotateRightChild(node);
                if(node.parent!=null && node.data<node.parent.data){
                    node.parent.left = node;
                }
                if(node.parent!=null && node.data>node.parent.data){
                    node.parent.right = node;

                }
        }
        if(node.left!=null&& node.left.data==num){

            node = rotateLeftChild(node);

            if(node.parent!=null && node.data<node.parent.data){
                node.parent.right = node;
            }
            if(node.parent!=null && node.data>node.parent.data){
                node.parent.left= node;

            }
        }
        return node;
    }
```

$\longrightarrow$ condition met & rotation is performed

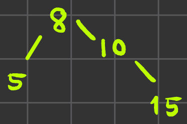


connection of node 10 & node 8 is made

but node. parent = 10 ≠ null so loop continues

helper (8, node) is called

↑ Refers to node 10



done.