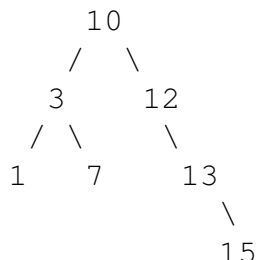


## 1 Law and Order

Write the pre-order, in-order, post-order, DFS, and BFS traversal of the following binary search tree. Assume for DFS and BFS, process child nodes left to right.



## 2 Is This a BST?

The following code should check if a given binary tree is a BST. However, for some binary trees, it is returning the wrong answer. Think about an example of a binary tree for which the method fails. Then, write `isBSTGood` so that it is correct. **Hint:** You will find `Integer.MIN_VALUE` and `Integer.MAX_VALUE` helpful.

```

public static boolean isBSTBad(TreeNode T) {
    if (T == null) {
        return true;
    } else if (T.left != null && T.left.val > T.val) {
        return false;
    } else if (T.right != null && T.right.val < T.val) {
        return false;
    } else {
        return isBSTBad(T.left) && isBSTBad(T.right);
    }
}

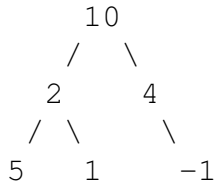
public static boolean isBSTGood(TreeNode T) {
    return isBSTHelper(
    );
}

public static boolean isBSTHelper(
    ) {
}

```

### 3 Sum Paths

Define a root-to-leaf path as a sequence of nodes from the root of a tree to one of its leaves. Write a method `printSumPaths(TreeNode T, int k)` that prints out all root-to-leaf paths whose values sum to  $k$ . For example, if `RootNode` is the binary tree rooted in 10 in the diagram below and  $k$  is 13, then the program will print out 10 2 1 on one line and 10 4 -1 on another.



(a) Provide your solution by filling in the code below:

```
public static void printSumPaths(TreeNode T, int k) {
    if (T != null) {
        sumPaths(
    }
}

public static void sumPaths(TreeNode T, int k, String path) {

}
}
```

(b) What is the worst case running time of the `printSumPaths` in terms of  $N$ , the number of nodes in the tree? What is the worst case running time in terms of  $h$ , the height of the tree?