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.

```
10
 / \
3  12
 / \ \ 
1  7 13
 \ 
  15
```

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.

```java
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.

```
   10
   /  \
  2   4
 / \  /  \
5 1  -1
```

(a) Provide your solution by filling in the code below:
```
public static void printSumPaths(TreeNode T, int k) {
    if (T != null) {
        // your solution here
    }
}
```
```
public static void sumPaths(TreeNode T, int k, String path) {
    // your solution here
}
```

(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?