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#538 Convert BST to Greater Tree

Python O(n) solution by DFS approach.

Hint:

1.

Recall that node value of BST always follows the rule: **value of Right sub-tree** ≧ **valud of Current node** ≧ **value of Left sub-tree**

2.

In addition, in-order traversal to BST generates the sequence with ascending order. In-order traversal ordering: (Left sub-tree, Current node, Right sub-tree)

3.

With symmetry, **reversed in-order traversal** to **BST** gives us the **sequence** with **descending order**. Reversed in-order traversal ordering: (Right sub-tree, Current node, Left sub-tree)

4.

Finally, we can **build greater tree by maintaining a variable** to **accumulate greater nodes' values**, based on reversed in-order traversal ordering.

Algorithm:

Step_#1:

Maintain a **global variable** to **keep accumulation value** of greater nodes

Step_#2:

From root node, start **DFS traversal** with the **reversed in-order**: (Right sub-tree, Current node, Left sub-tree)

Also, update accumulation value, and value of current node on each run.

Implementation:

```
class Solution:
    def convertBST(self, root: TreeNode) -> TreeNode:

        accumulation = 0

        def converter( node: TreeNode) -> TreeNode:

            if not node:
                # Base case (also known as stop condition)
                # empty node or empty tree
                return None

            else:
                # General case:
                # DFS down to next level with reversed in-order traversal


                if node.right:
                    converter( node.right )

                # update accumulation and assign to current node
                nonlocal accumulation
                accumulation += node.val
                node.val = accumulation

                if node.left:
```

```
                    converter( node.left )

                return node

        # ---------------------------------

        return converter(root)
```

Related leetcode challenge:

Leetcode #94 Binary Tree Inorder Traversal

Leetcode #98 Validate Binary Search Tree

Leetcode #1038 Binary Search Tree to Greater Sum Tree

Reference:

[1] Wiki: Inorder traversal of binary tree

[2] Wiki: Binary search tree

[3] Python official docs about nonlocal statement