



Self Balancing Tree

by [vatsalchanana](#)

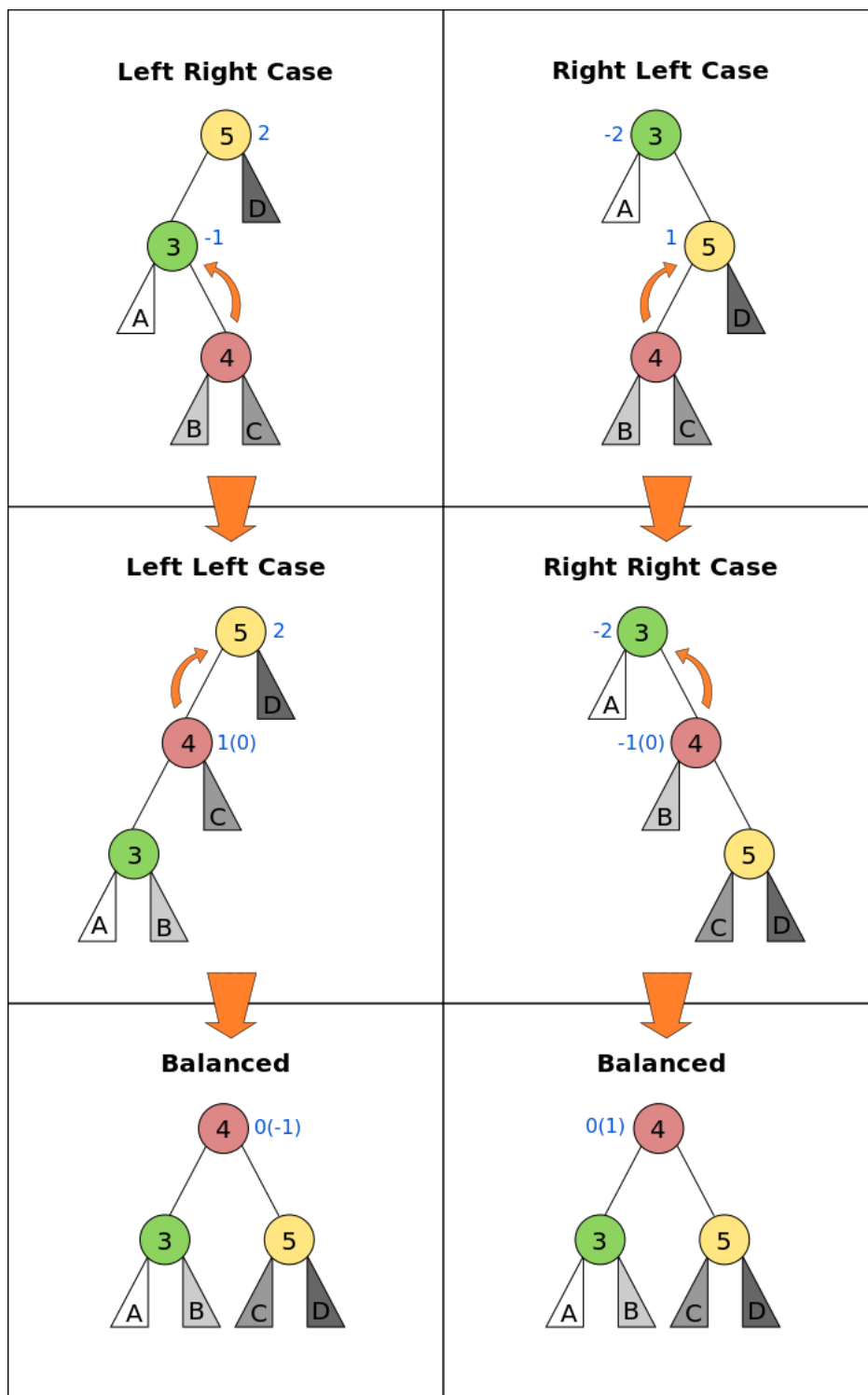
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An AVL tree (Georgy Adelson-Velsky and Landis' tree, named after the inventors) is a self-balancing binary search tree. In an AVL tree, the heights of the two child subtrees of any node differ by at most one; if at any time they differ by more than one, rebalancing is done to restore this property.

We define balance factor for each node as :

$$\text{balanceFactor} = \text{height}(\text{left subtree}) - \text{height}(\text{right subtree})$$

The balance factor of any node of an AVL tree is in the integer range $[-1, +1]$. If after any modification in the tree, the balance factor becomes less than -1 or greater than $+1$, the subtree rooted at this node is unbalanced, and a rotation is needed.



(https://en.wikipedia.org/wiki/AVL_tree)

You are given a pointer to the root of an AVL tree. You need to insert a value into this tree and perform the necessary rotations to ensure that it remains balanced.

Input Format

You are given a function,

```
node *insert(node * root,int new_val)
{
    }
}
```

'node' is defined as :

```
struct node
{
    int val;           //value
    struct node* left; //left child
    struct node* right; //right child
    int ht;           //height of the node
} node;
```

You only need to complete the function.

Note: All the values in the tree will be distinct. Height of a Null node is -1 and the height of the leaf node is 0.

Output Format

Insert the new value into the tree and return a pointer to the root of the tree. Ensure that the tree remains balanced.

Sample Input



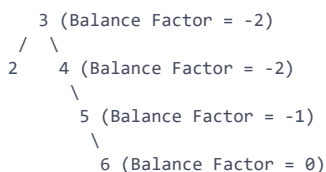
The value to be inserted is 6.

Sample Output



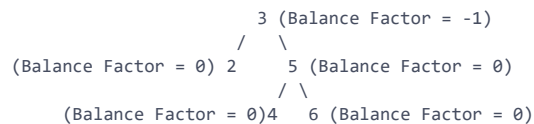
Explanation

After inserting 6 in the tree, the tree becomes:



Balance Factor of nodes 3 and 4 is no longer in the range [-1,1]. We need to perform a rotation to balance the tree. This is the right right case. We perform a single rotation to balance the tree.

After performing the rotation, the tree becomes :




f t in

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Difficulty: Medium

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C++



```
1  ▾ /* Node is defined as :
2  typedef struct node
3  {
4      int val;
5      struct node* left;
6      struct node* right;
7      int ht;
8  } node; */
9
10
11 node * insert(node * root,int val)
12 ▾ {
13
14
15 }
16
```

Line: 1 Col: 1

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