Self Balancing Tree

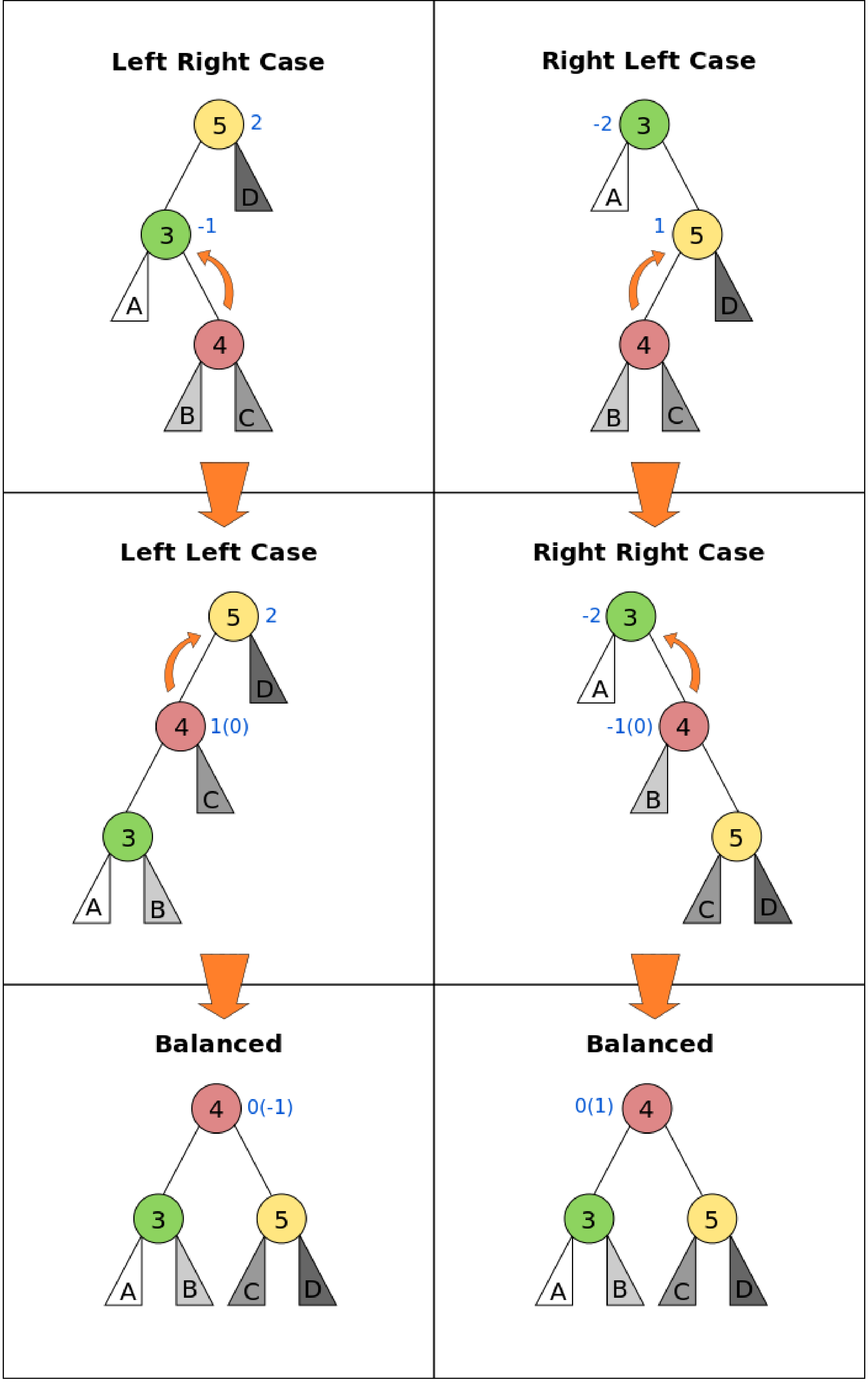
HackerRank

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 :

```
balanceFactor = height(left subtree) - height(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

```
    3
  /  \
 2    4
       \
        5
```

The value to be inserted is 6.

Sample Output

```
    3
  /  \
 2    5
     / \
    4   6
```

Explanation

After inserting 6 in the tree. the tree becomes:

```
    3 (Balance Factor = -2)
  /  \
```

```
  2     4 (Balance Factor = -2)
         \
          5 (Balance Factor = -1)
           \
            6 (Balance Factor = 0)
```

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 :

```
                              3 (Balance Factor = -1)
                            /   \
       (Balance Factor = 0) 2     5 (Balance Factor = 0)
                                 / \
            (Balance Factor = 0)4   6 (Balance Factor = 0)
```