AVL Insertion

This lesson will cover the insertion operation in AVL trees, discussing all the four insertion cases.

We'll cover the following

Introduction

Insertion in AVL trees is done the same way that BST insertion is done. However, when a node is inserted into a BST it usually becomes *unbalanced*, i.e., the tree has a node which has a left-right subtree height difference greater than 1. So, AVL trees have to be rebalanced after insertion, unlike BSTs. To re-balance the tree, we need to perform a 'rotation'. But before going deep let's look at AVL tree rebalancing case-by-case.

Let's look at terms that we will be using while re-balancing the tree.

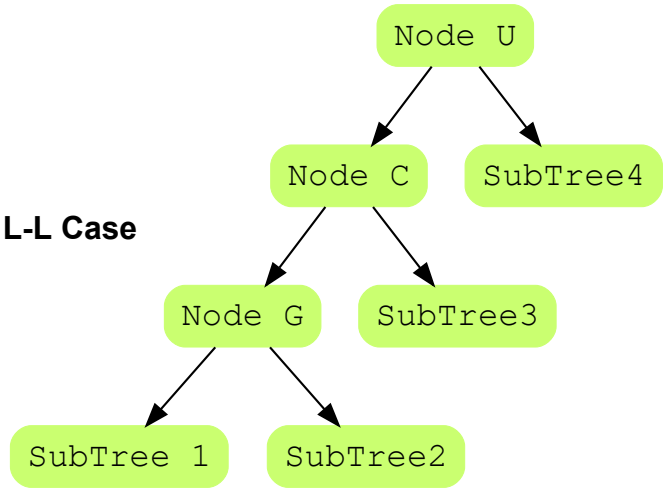
```
Node U – an unbalanced node
Node C – child node of node U
Node G – grandchild node of node U
```

Insertion Cases

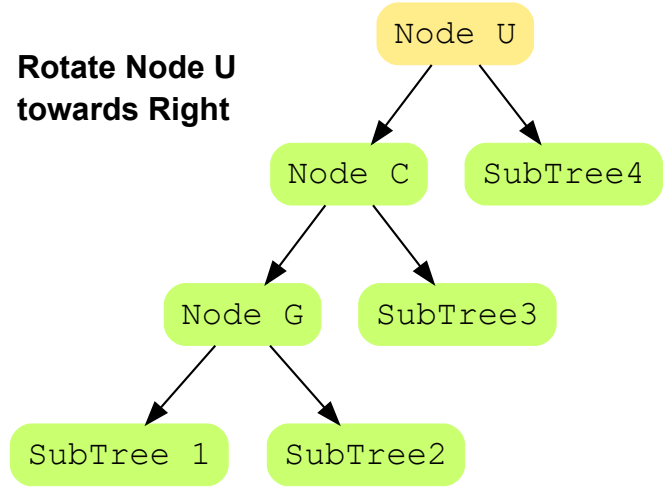
To rebalance the tree, we will perform rotations on the subtree with Node U being the root node. There are two types of rotations (left and right). We came across four different scenarios based on the arrangements of Nodes U, C, and G.

```
Left-Left: Node C is the left-child of Node U, and Node G is left-child of Node C

Left-Right: Node C is the left-child of Node U, and Node G is right-child of Node C

Right-Right: Node C is the right-child of Node U, and Node G is right-child of Node C

Right-Left: Node C is right-child of Node U, and Node G is left-child of Node C
```

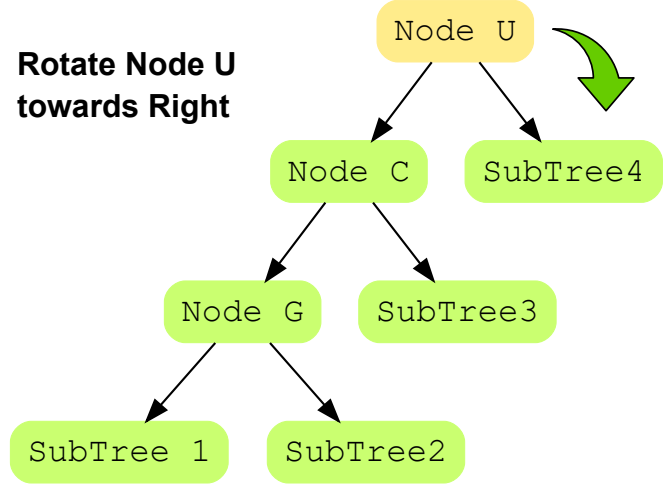
Case 1: Left-Left



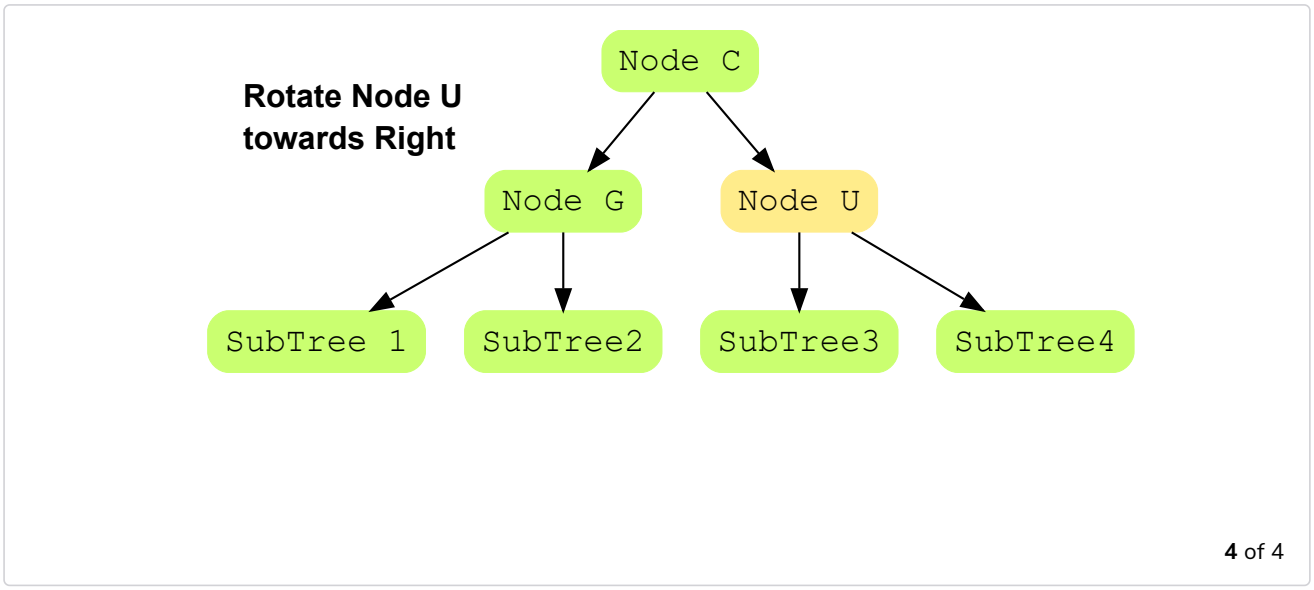
1 of 4



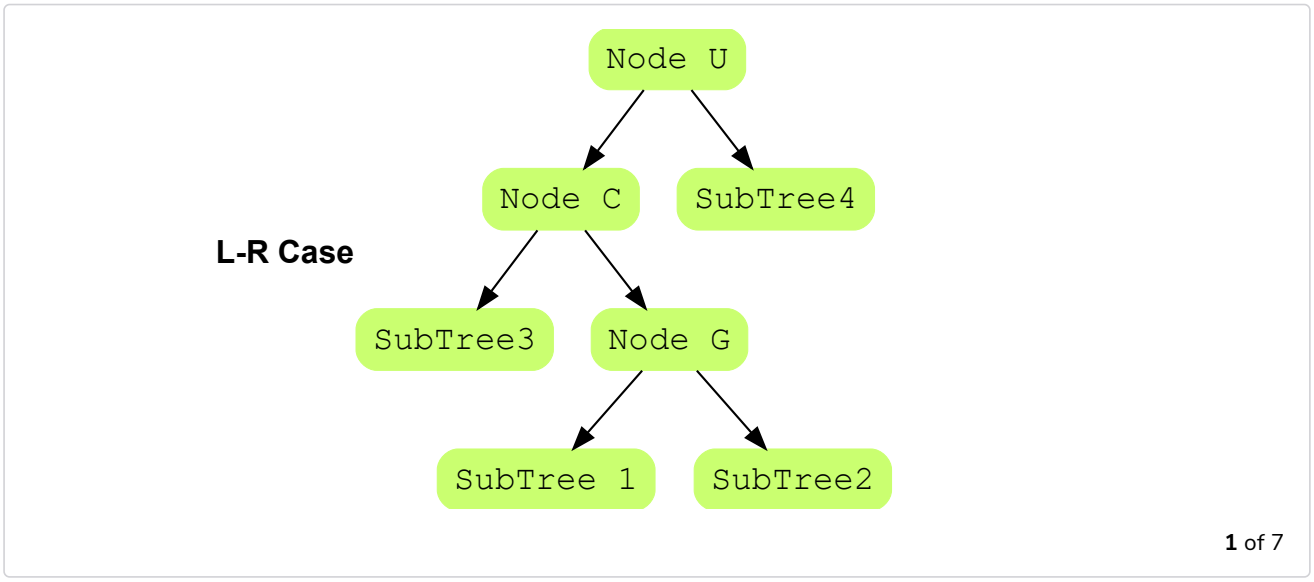
2 of 4

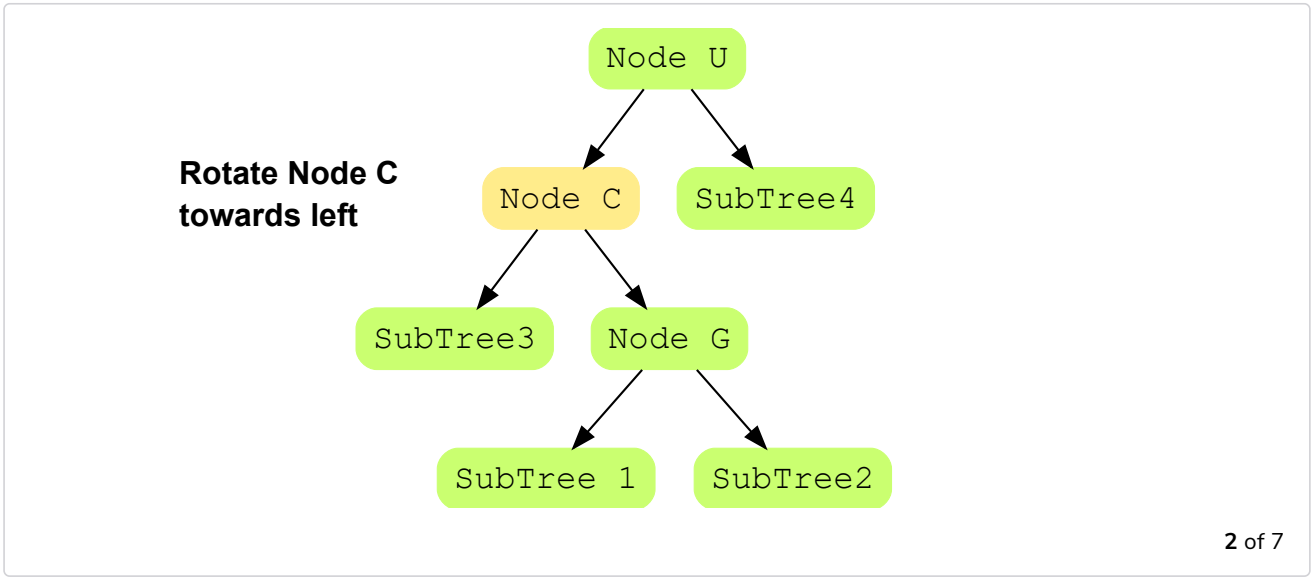


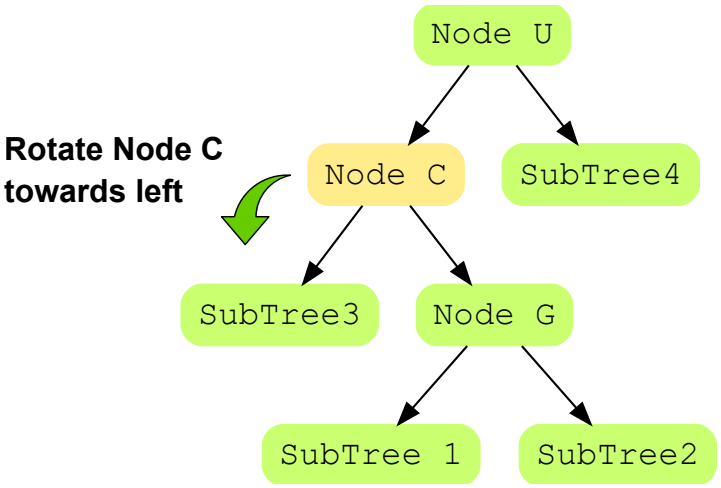
3 of 4



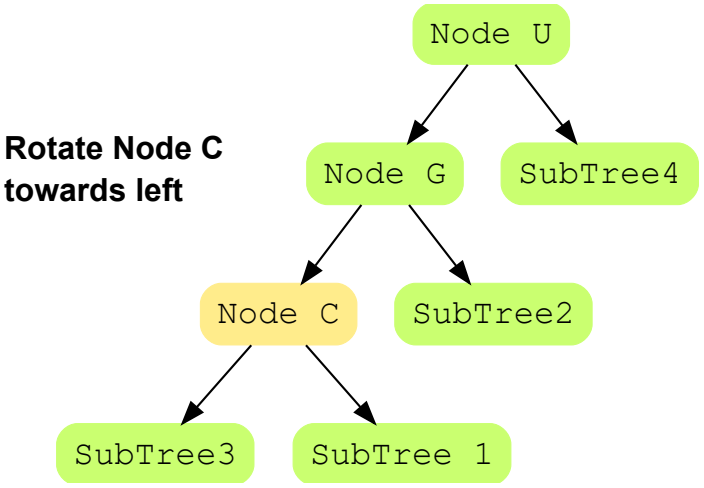
Case 2: Left-Right



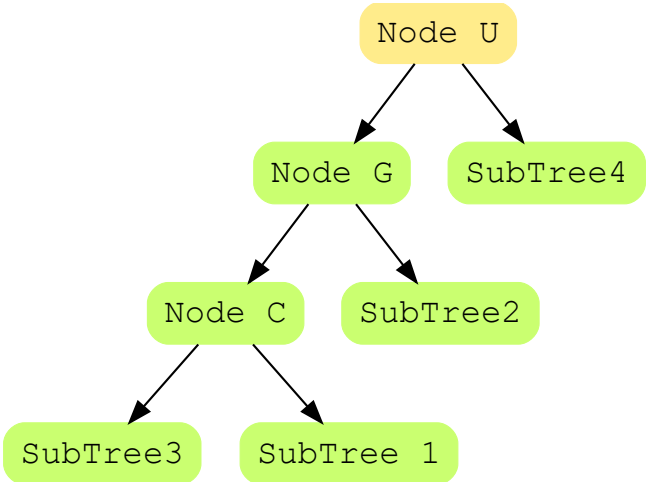




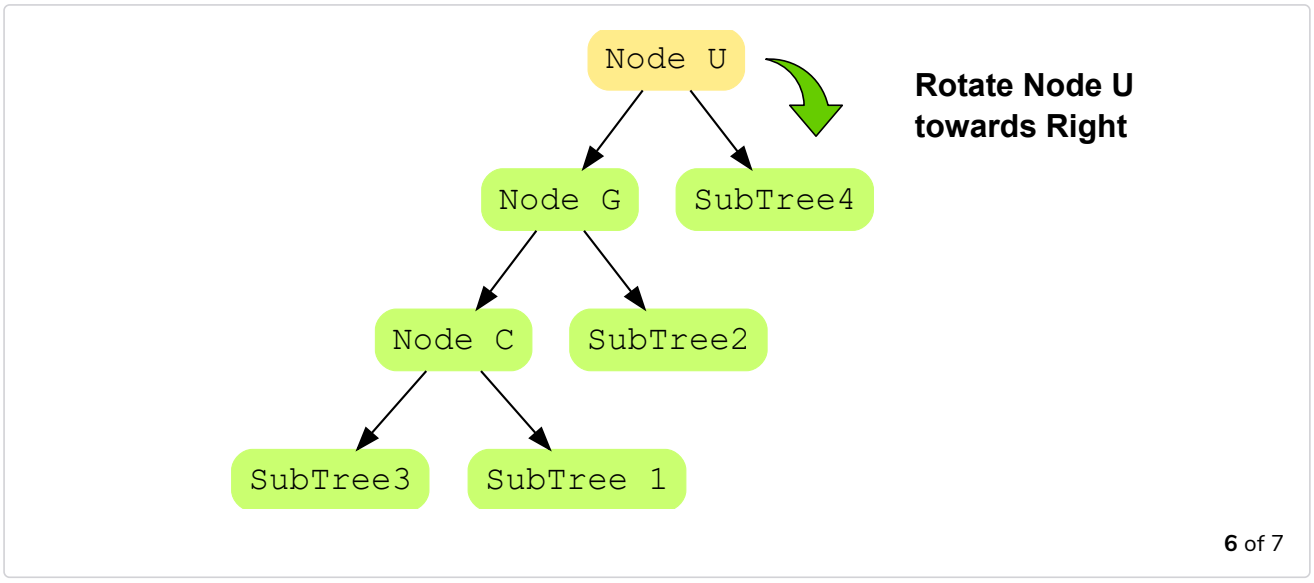
3 of 7

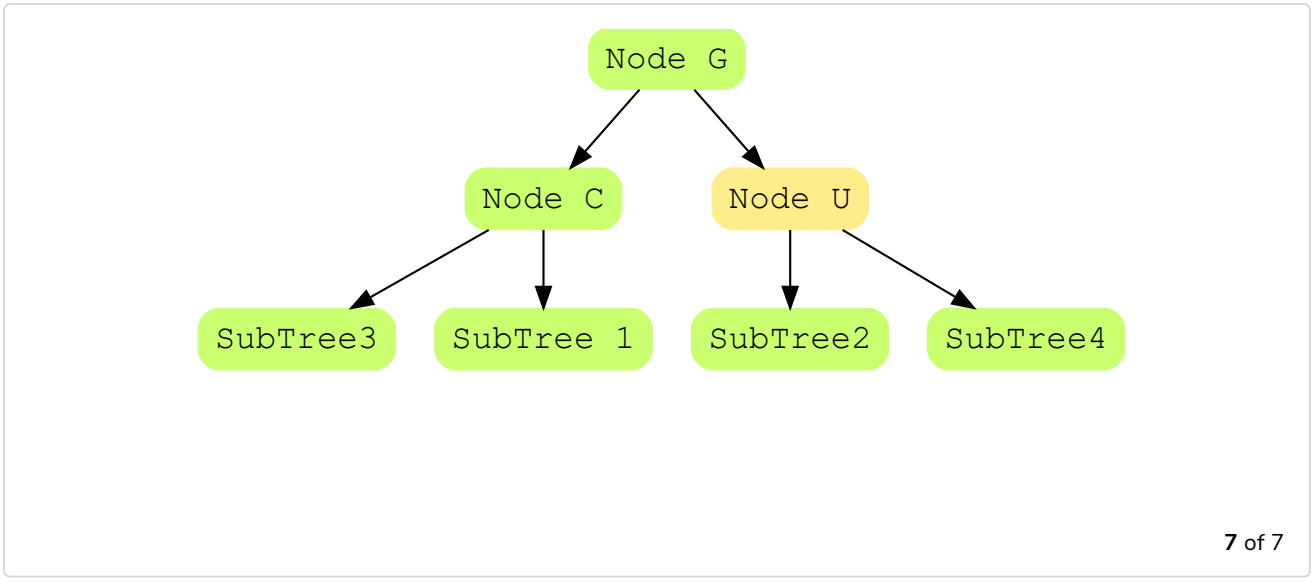


4 of 7

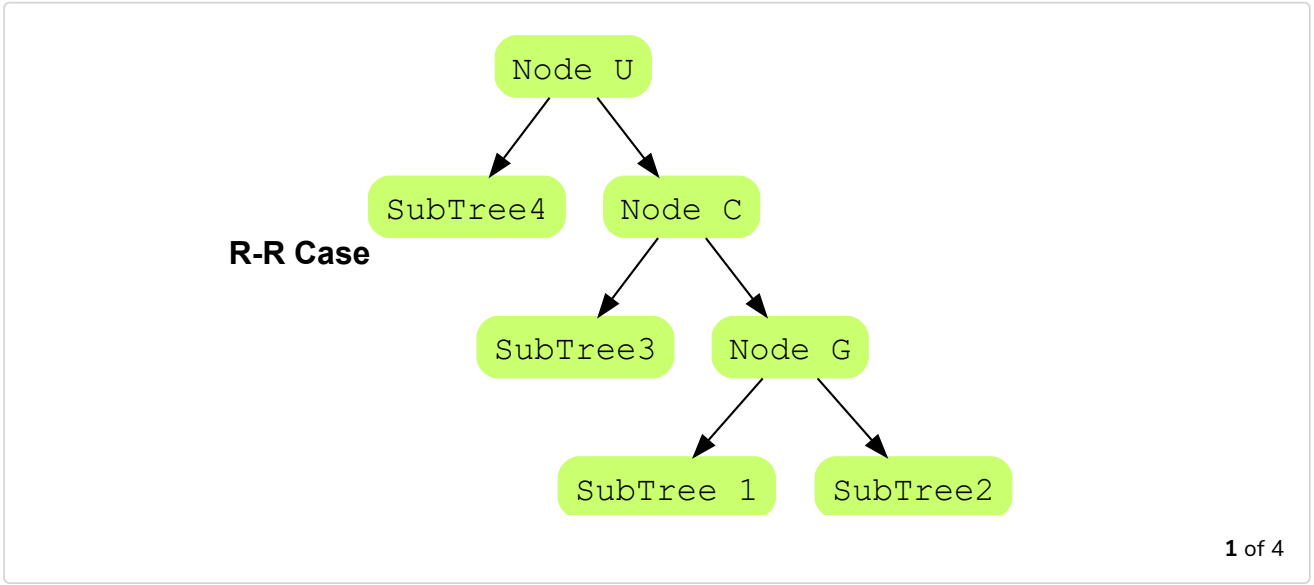


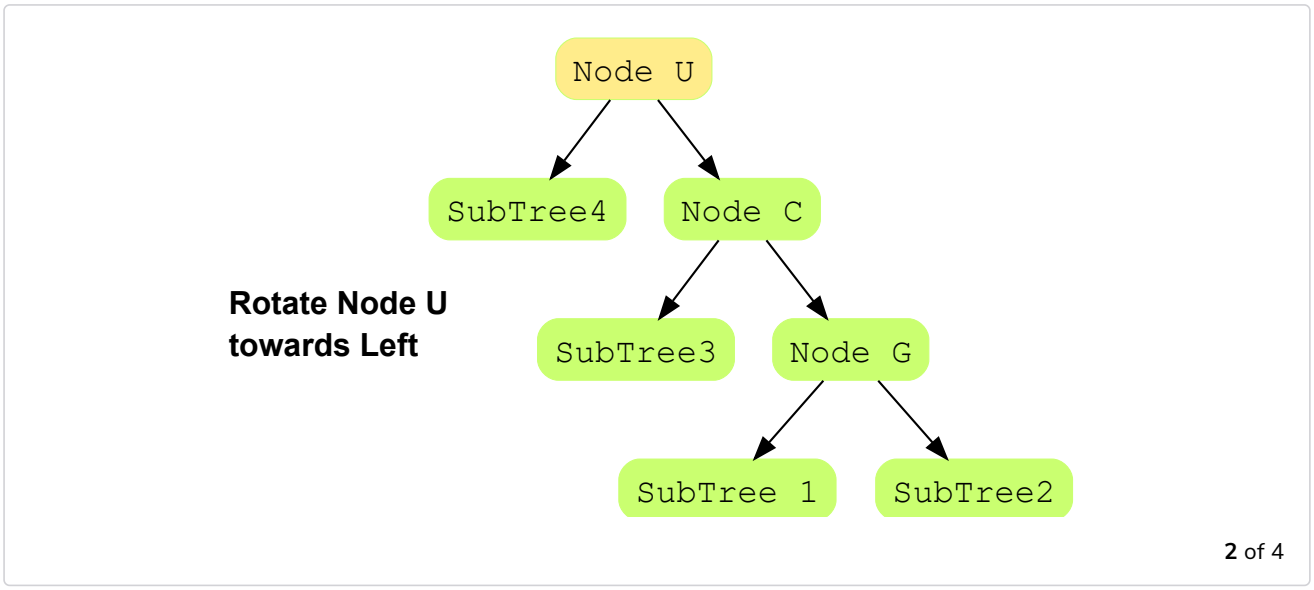
5 of 7

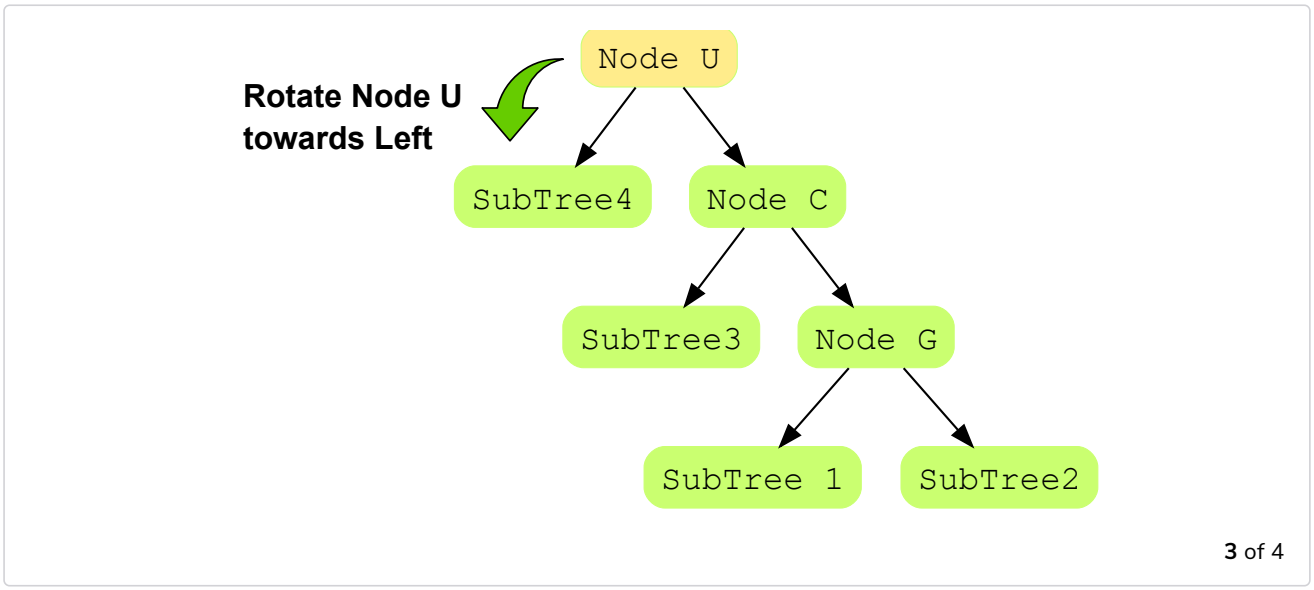


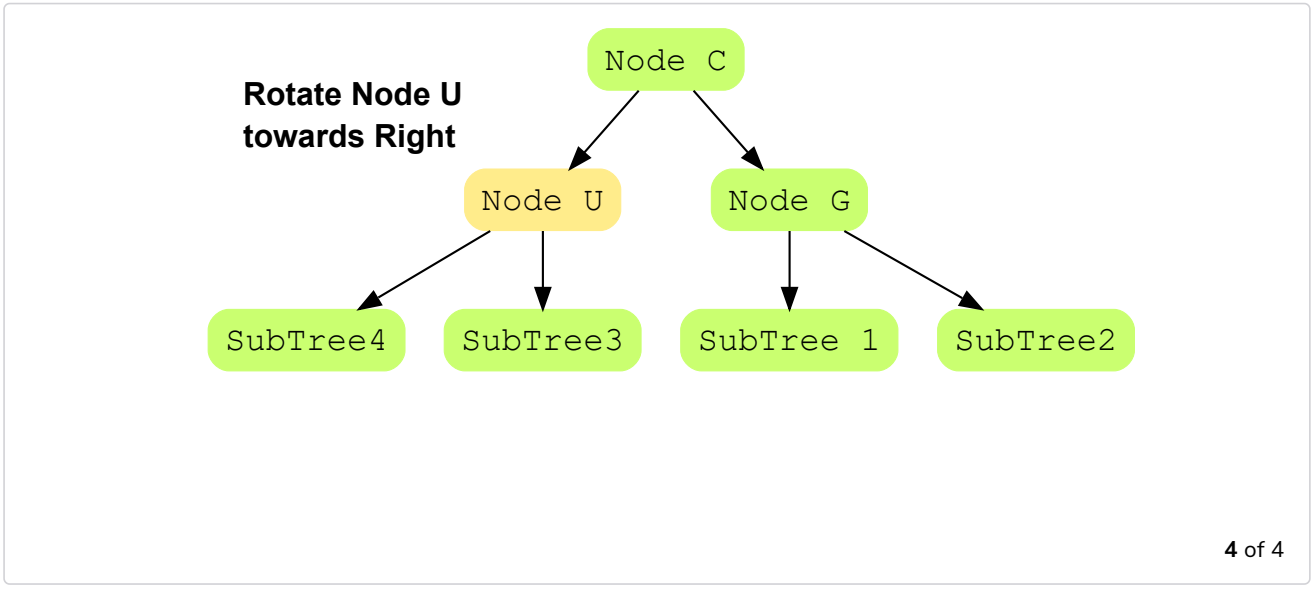


Case 3: Right-Right

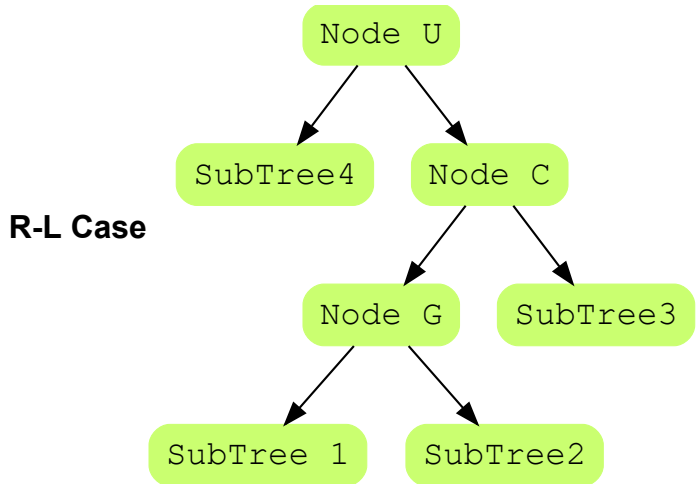


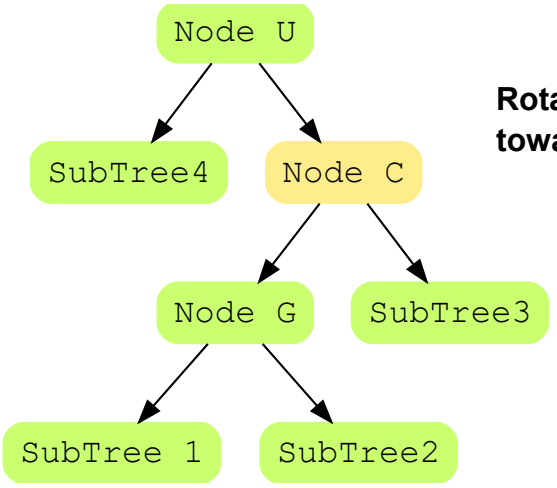


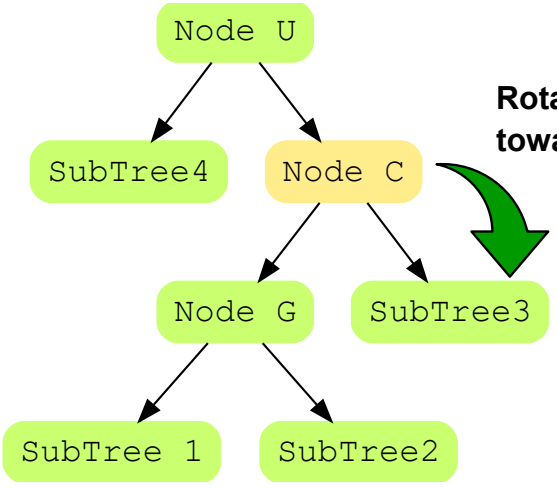


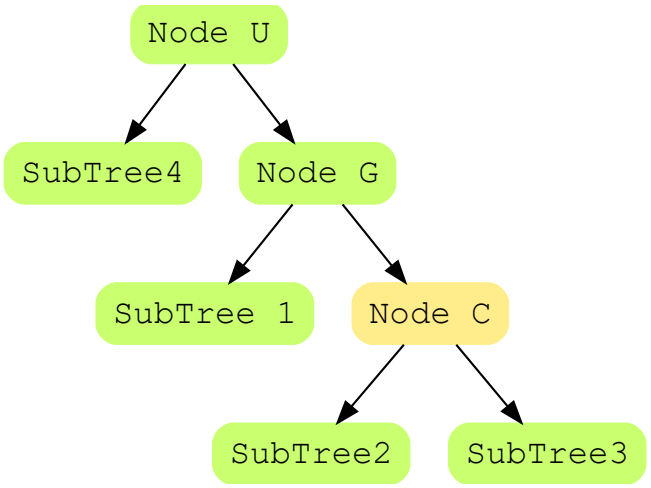


Case 4: Right-Left

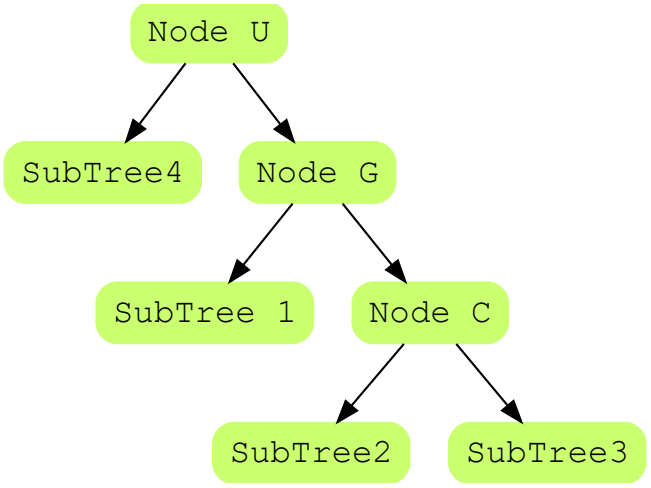

R-L Case
Node U
SubTree4
Node C
Node G
SubTree3
SubTree 1
SubTree2


Node U
SubTree4
Node C
Node G
SubTree3
SubTree 1
SubTree2
Rotate Node C
towards right


Node U
SubTree4
Node C
Node G
SubTree3
SubTree 1
SubTree2
Rotate Node C
towards right

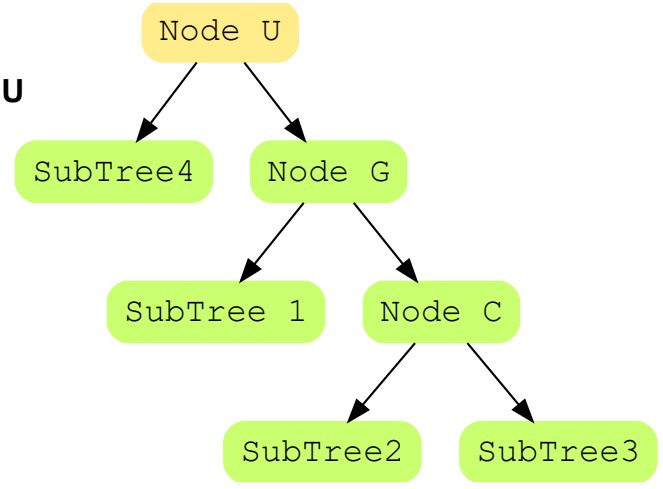


4 of 8

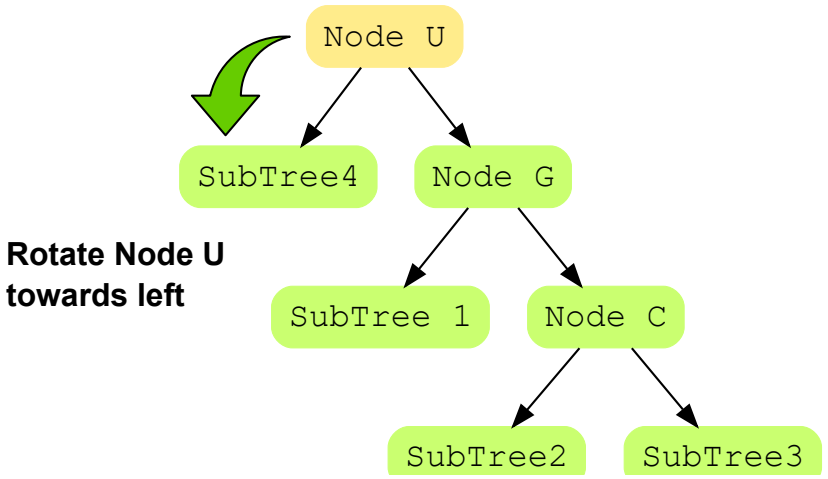


5 of 8

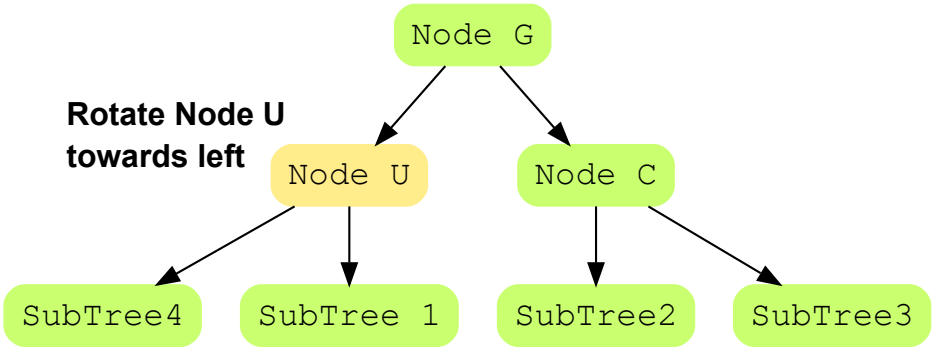
Rotate Node U towards left



6 of 8



7 of 8



8 of 8

That's it on AVL tree insertion! Lets move on to AVL tree deletion in the next chapter!

Back
What is an AVL Tree?

Next
AVL Deletion

Mark as Completed

Report an Issue

Ask a Question (https://discuss.educative.io/tag/avl-insertion__introduction-to-trees__data-structures-for-coding-interviews-in-python)