# Lab: AVL Tree Insertion

This document defines the lab for ["Data Structures – Advanced (C#)" course @ Software University](https://softuni.bg/trainings/3113/data-structures-advanced-with-csharp-october-2020).

Please submit your solutions (**source code**) of all below described problems in [Judge](https://judge.softuni.bg/Contests/2574/01-B-Trees-2-3-Trees-and-AVL-Trees-Lab).

## AVL Tree Insertion

You are given a skeleton that supports the following operations:

* **Node<T> Root** returns the root of the AVL tree
* **bool Contains(T** **item)** checks if an element exists
* **void EachInOrder(Action<T> action)** performs an action in order on each element
* **void Insert(T item)** inserts an item into the tree

|  |
| --- |
| public class AVL<T> where T : IComparable<T>  {  private Node<T> root;  public Node<T> Root { get { return this.root; } }  public bool Contains(T item) { … }  public void Insert(T item) { … }  public void EachInOrder(Action<T> action) { … }  } |

And a node class:

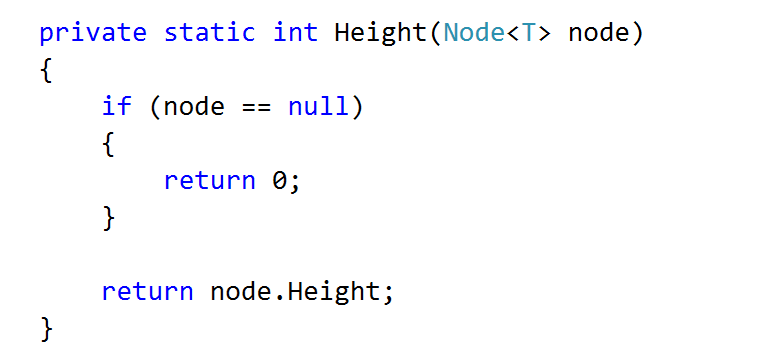
|  |
| --- |
| public class Node<T> where T : IComparable<T>  {  public T Value;  public Node<T> Left;  public Node<T> Right;  public int Height;  public Node(T value)  {  this.Value = value;  this.Height = 1;  }  } |

Your task is to balance the tree after each insertion.

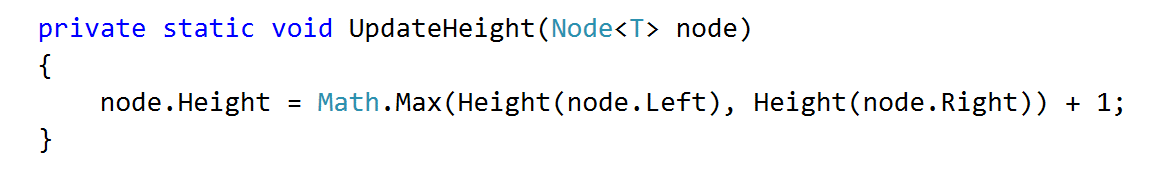
### Height

First, you should update the height of all nodes along an insertion path

You will need a method to find a node's height



And a method to update a node's height



Consider when it is appropriate to update the height of a node

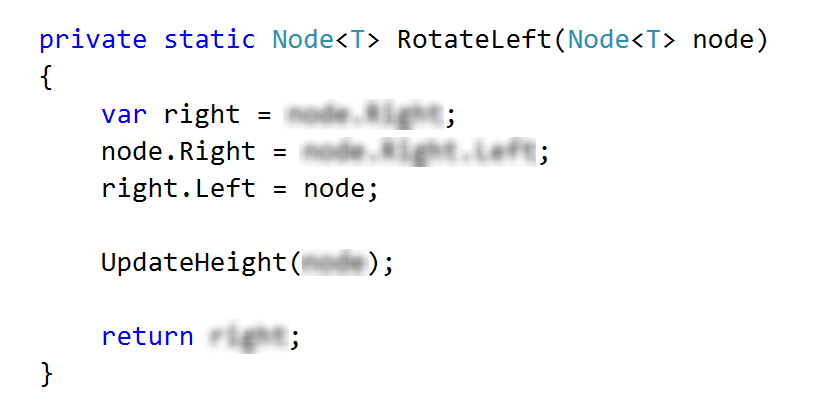


Check if Height tests pass



### Rotations

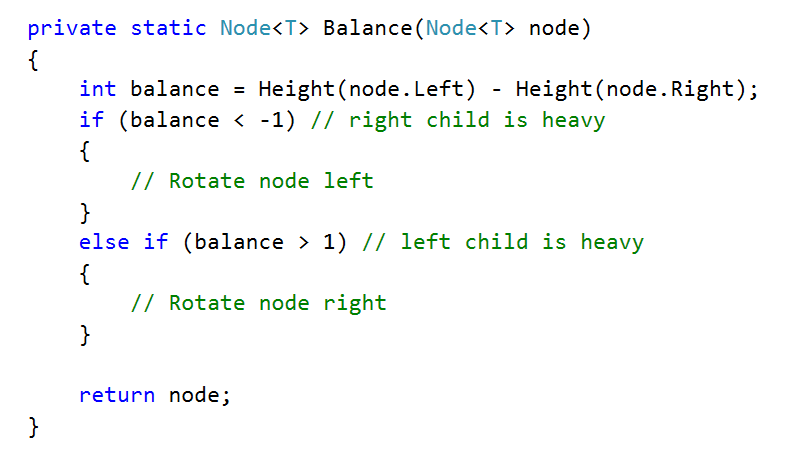
If you find it difficult to imagine the links that need to be updated in a rotation, refer to the presentation



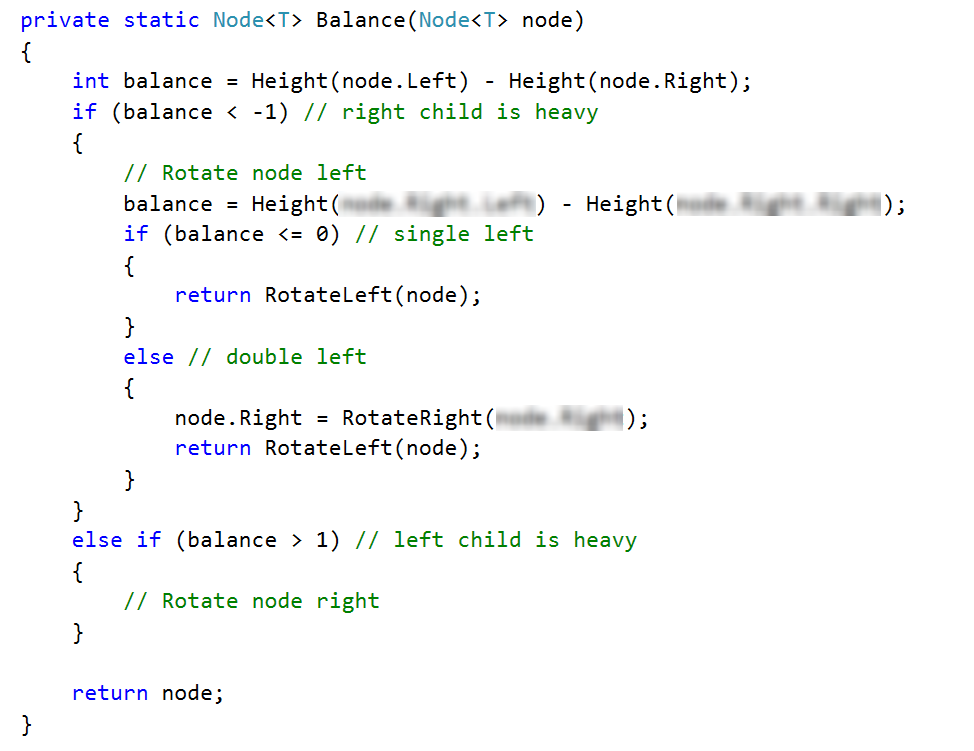
The right rotation is analogous.

### Balancing

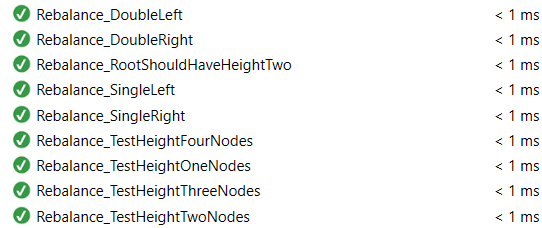
Start by creating the method



The first case (first if statement)



Right rotation is analogous to the left. Make sure that all tests pass:



Congratulations, you have completed the lab for AVL Trees.