What makes a tree 'balanced'?

In this chapter, we are going to study what makes a tree balanced. We are also going to look at a high-level description of the algorithm used to determine if a given tree is balanced.

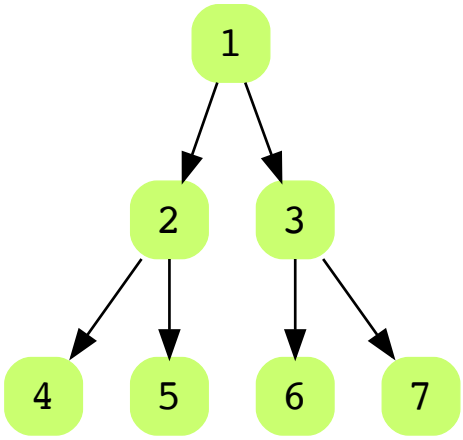
We'll cover the following

Introduction#

A binary tree is height-balanced if, for each node in the tree, the difference between the height of the right subtree and the left subtree is at most one.

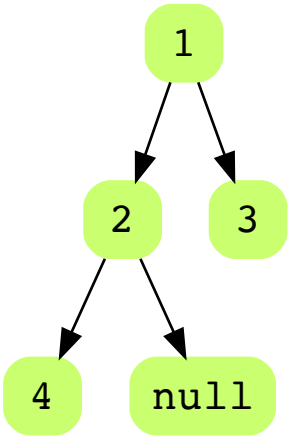
$$|Height(LeftSubTree) - Height(RightSubTree)| <= 1$$

Look at the illustration below of a height-balanced tree. Notice how the left and right sub-trees all appear at the same height.



Checking if a binary tree is balanced#

Try to guess if the following tree is balanced or not before looking at the answer!



Show Hint

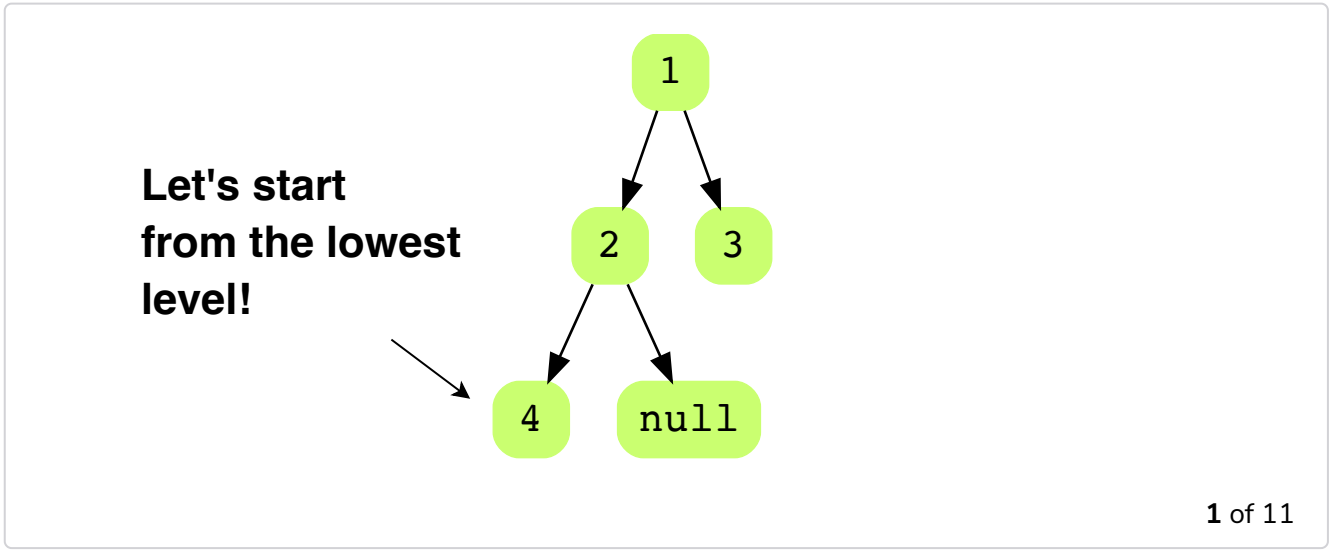
This tree is height-balanced! How did we determine that? Lets go through break our thought process down into a series of steps to find out.

High-level Algorithm to determine if a tree is height-balanced#

1. Start from the leaf nodes and move towards the root
2. Along with traversing the tree, compute heights of the *left-subtree* and *right-subtree* of each node. The height of a leaf node is always **0**
3. At each node, check if the difference between the height of the left and right sub-tree is more than **1**, if so, it means that the tree is not balanced.
4. If you have completely traversed the tree and haven't caught the above condition, then the tree is balanced.

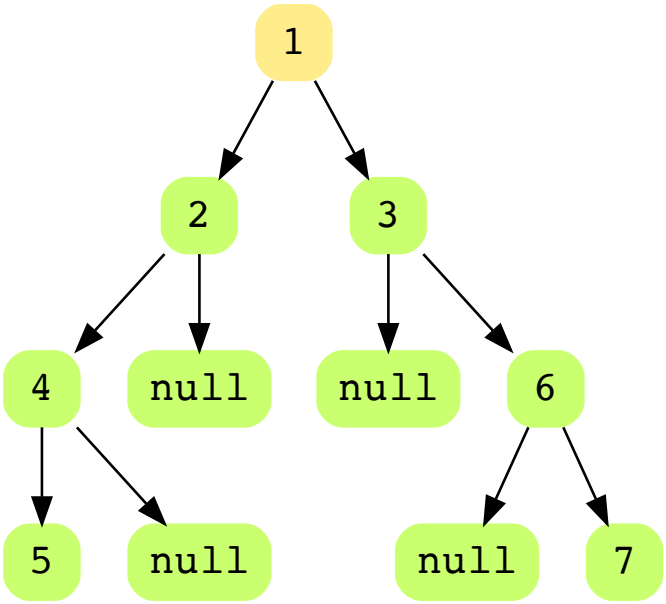
Example#

Implementing what we learned from the above four steps in the illustration below. Here, *HLT* means the height of the Left Tree and *HRT* means the height of the right tree:



Quiz:#

Now, to test your concept about checking if a tree is balanced or not, check the example below and try to solve it on a piece of paper. For help, you have a hint down below, but try to do it yourself first!



Q Is the above tree balanced?

A) Yes

B) No

Submit Answer

Reset Quiz

In the upcoming lessons, we will go through a bunch of different types of trees one at a time, starting from Binary Tree, some further types to their

more complex versions like 2-3 and AVL Trees etc.