CS 225

#19: BST Balance

March 12, 2021 · *G Carl Evans*

Binary Search Tree (BST) Finale

Q: How does our data determine the height?

1 3 2 4 5 7 6 vs. 4 2 3 6 7 1 5

Q: How many different ways are there to insert data into a BST?

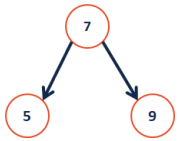
Q: What is the average height of every arrangement?

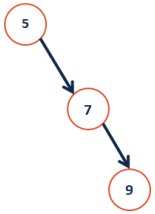
....what's the intuition for this argument?

operation	BST Avg. Case	BST Worst Case	Sorted Array	Sorted List
find				
insert				
delete				
traverse				

Height Balance on BST

What tree makes you happier?



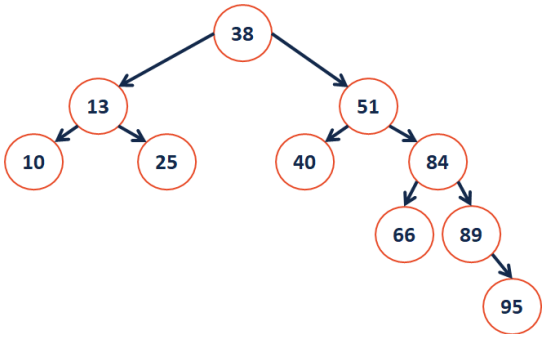


Let us describe the **balance** (**b**) of a BST to be:

- If **b** is negative:
- If **b** is positive:

We define a BST tree T to be **height balanced** if:

A node is considered to be **out of balance** it's not height balanced.
What is the lowest node that is out of balance?



Brining a tree back into balance
Goal: Create a strategy to bring a BST back into balance after an operation has caused the three to be out of balance.

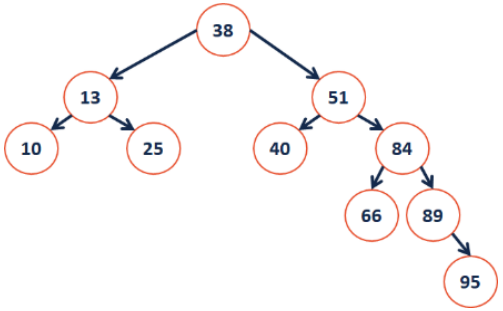
A **Tree Rotation** is an operation that maintains two properties:

1.

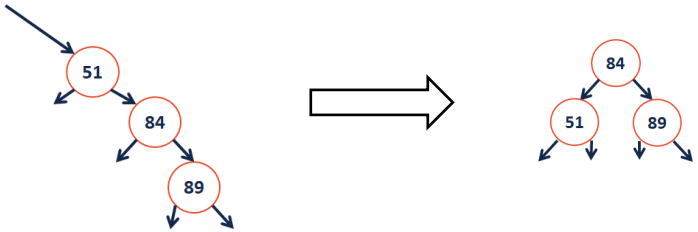
2.

Example 1: Defining a Rotation

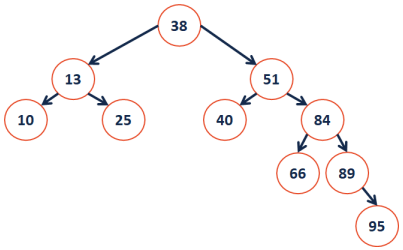
1. Where is the deepest point of imbalance in the tree: ➔



2. Perform a left rotation to balance this tree:

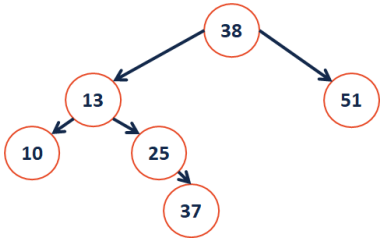


Implementing a left rotation:



Example 2: A Complex Rotation

Rotation #1:



Rotation #2:

BST Rotation Summary:

1. Four kinds of rotations (L, R, LR, and RL)
2. All rotations are local
3. All rotations run in constant time, O(1)
4. BST property is maintained!

Overall Goal:

...and we call these trees:

CS 225 – Things To Be Doing:
1. mp_mosaics EC due **Monday** **2.** lab_huffman due Sunday **3.** Daily POTDs