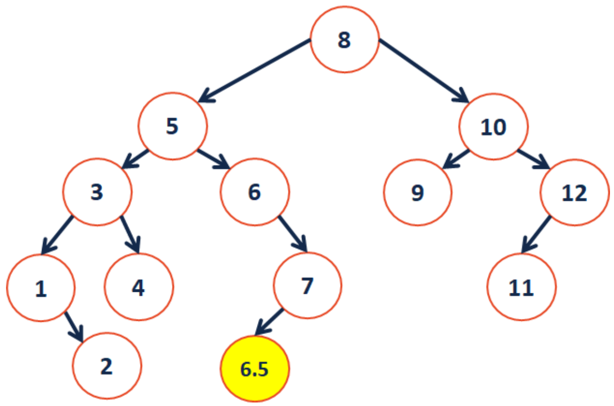
CS 225

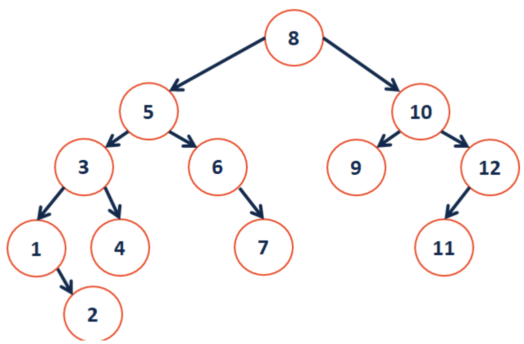
#21: AVL Analysis

March 17, 2021 · *Brad Solomon*

AVL Insertion



AVL Removal



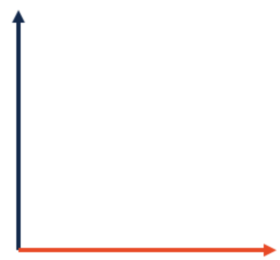
Running Times:

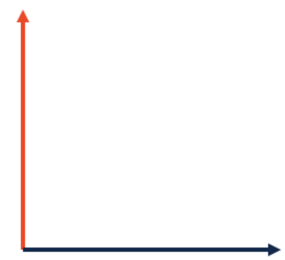
	AVL Tree
find	
insert	
remove	

Motivation:

Big-O is defined as:

Let **f(n)** describe the height of an AVL tree in terms of the number of nodes in the tree (**n**). Visually, we can represent the big-O relation:





$f(n) \le c \times g(n)$: Provides an upper bound:

The height of the tree, **f(n)**, will always be less than **$c \times g(n)$** for all values where **$n > k$**.

$f^{-1}(h) \ge c \times g^{-1}(h)$: Provides a lower bound:

The number of nodes in the tree, **$f^{-1}(h)$**, will always be greater than **$c \times g^{-1}(h)$** for all values where **$n > k$**.

Plan of Action:
Goal: Find a function that defines the lower bound on **n** given **h**.

Given the goal, we begin by defining a function that describes the smallest number of nodes in an AVL of height **h**:

Theorem:
An AVL tree of height **h** has at least ______________________.

I. Consider an AVL tree and let **h** denote its height.

II. Case: _________________

III. Case: __________________

IV. Case: _________________

Inductive hypothesis (IH):

Proving our IH:

V. Using a proof by induction, we have shown that:

...and by inverting our finding:

Summary of Balanced BSTs:

Advantages	Disadvantages

CS 225 – Things To Be Doing:
1. Final Project Teams due March 26th!   **2.** mp_mosaic due on March 29th!   **3.** lab_trees due on March 28th!   **4.** Daily POTDs are ongoing!