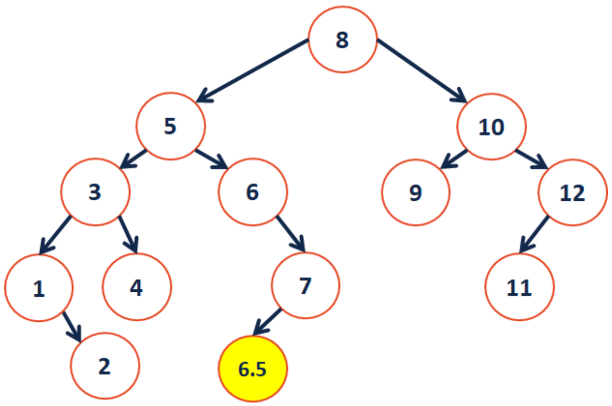
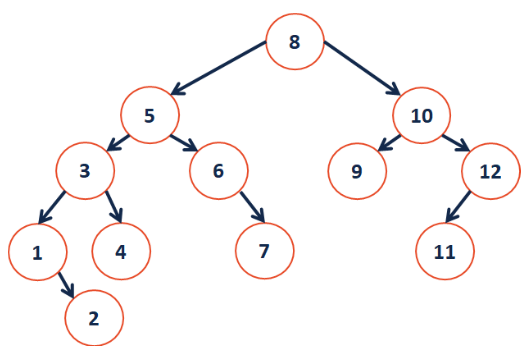
#20: AVL Analysis

October 14, 2020 · *G Carl Evans*

AVL Insertion



AVL Removal



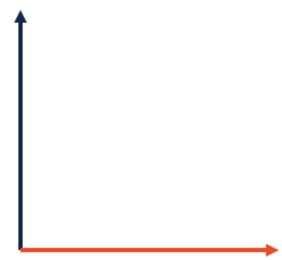
Running Times:

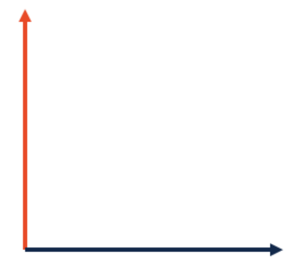
	AVL Tree
find	
insert	
remove	

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:





$f(n) \leq c \times g(n)$: Provides an <u>upper bound</u>:

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

$f^{-1}(h) \geq c \times g^{-1}(h)$: Provides a <u>lower bound</u>:

The number of nodes in the tree, **$f^{-1}(h)$**, will always be <u>greater than</u> **c** × **$g^{-1}(h)$** 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. mp_traversals due Monday! 2. lab_avl starts today 3. Daily POTDs are ongoing!