AVL Trees

**Goal - invariant of AVL tree**
Maintain height balance.
- That is, the height of every node's left and right subtrees differ by no more than 1.

**Calculating Height**
- height of null node is -1
- height of a leaf is 0
- a node's height is the max height of its subtrees + 1

**Maintaining Balance**
- recalculate height after insertion
- rotate after insertion to balance but only if needed
- rotate from above

**When Do Rotations Happen?**
- start with an AVL tree that is balanced
- insert into appropriate child
- recalculate height after insertion
- when at parent after insertion, compare heights of children
- if child that had insert is now two taller than its sibling, need to rotate
- rotations restore height balance

**What Happens In a Rotation?**
- involves parent, a child, and a grandchild
- grandchild is where insertion was
- node with middle value ("inner child") becomes parent
- parent will become a child as will other involved node
- subtrees hanging off these will be connected to the balanced node to form the balanced tree