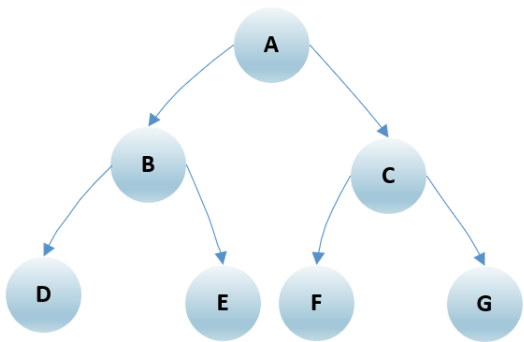
PLAYBOOK NOTES – BINARY SEARCH TREE TERMINOLOGY

What is a binary tree?

A binary tree is a data structure like a link list, except that are two links for every node. Although you can call these links anything you want, but they are best known as left and right.

Example 1:



Root Node:

A root node is the top of the tree. In the picture above, A is the root node.

Levels of a Tree:

The tree above has 3 levels.

- A is on level 0
- B and C are on level 1
- D E F and G are on level 2

Parents / Children:

A parent node is a node with at least one sub-node.

A child node is a node with a parent above it.

- B is a parent node for it's children node D and E.
- C is a parent node for it's children node F and G
- A is a parent node for it's children B and C

Leaf Node

A leaf node is a node with no children.

- Nodes D E F and G are all leaf nodes

Height of a Tree

The height of a tree is determined by the longest path from the root node to a leaf node.

In example 1, the height is 3

Subtree

A subtree is any node and its descendants

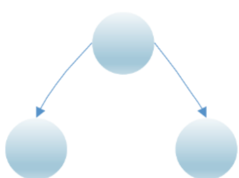
Binary Search Tree (BST)

The parent node is greater than all the left subtrees and less than the right subtrees

Full Tree:

A full tree will have ($2^h – 1$) nodes (h equals the height of the tree). This means that all the leaf nodes at the deepest level will exist.

<u>Example 2</u>:

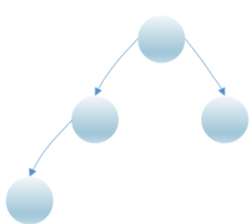


In this example, the height is 2. ($2^2 – 1 = 3$ nodes). Since there are three nodes, this tree is full.

Complete Tree:

A tree that is a full tree from the top node down to level (h – 1) (h equal the height of the tree).

<u>Example 3</u>:



In example 3, the tree is not full, but it is complete. The height of the tree is 3 and looking the first two levels (3 -1 = 2), the tree is full. So, this tree is complete.

Balanced Tree:

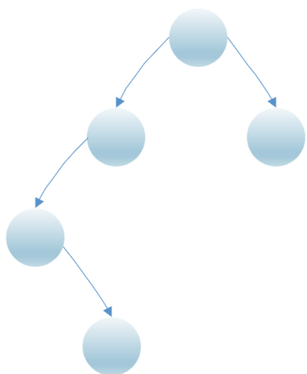
A tree where the left and right subtrees of any node have a height that differs by no more than 1

In the previous example, you can see the left side of the root node

In example 3, the tree is balanced.

The following example, the tree is not balanced.

Example 4:



The left side has a height of 4 and the right side has a height of 2. (4 – 2 = 2) and 2 > 1.

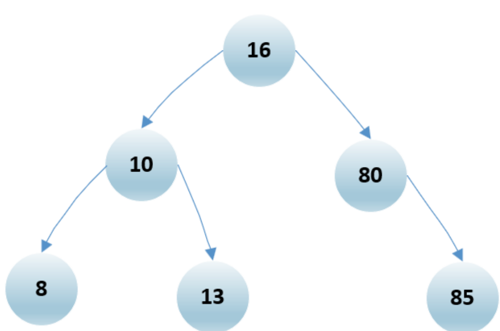
Therefore, the tree is not balanced.

Binary Search Tree (BST):

A binary search tree is a tree in which all nodes to the left of a node are less in value and all nodes to the right of a node are greater in value.

The following is an example of a binary search tree:

Example 5:



POP QUIZ: Is this tree in example 5 Full, Balanced, and Complete?

Traversing Algorithms:

1. Pre-Order Traverse
   - Visit the node
   - Move to the left node
   - Move to the right node

2. In-Order Traverse
   - Move to the left node
   - Visit the node
   - Move to the right node

3. Post-Order Traverse
   - Move to the left node
   - Move to the right node
   - Visit the node