Trees

If I'm in Boston, where did I come from? Kansas

How do I get from Den-Florida?
Den-Texas-Florida

Shortest path from Den to Texas?
Direct Den-Texas, not Den-Kansas-Texas

Simple map

Each city is a node
Each edge links two city nodes
From each node, there are two next nodes
From each node, there is one place that you come from.

Trees

Hierarchical data structure
In linked list, next and previous pointers create linear structure
□↔□↔□
Trees: parent and child pointers

Each node has a parent.
Each node is a parent to 0, 1, ... X children

Binary tree

Each node has 0, 1, 2 children

Node properties

3 pointers
parent
left child
right child
data

Ex:

20 node
parent = 10 node
left child = 19 node
right child = 21 node

Tree features

Top of tree is root
Ex: 10 node is root

If node doesn't have left child, then leftchild = null.

Same is true for right child.

Leaf node - node at bottom of branch, where left and right child are null.

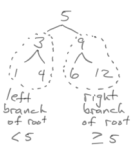
Binary Search Tree (BST)

Special case of binary tree where data is ordered.

BST - for any node in the tree, nodes in the left branch have values < node. Nodes in the right branch have values ≥ node.

Ex:

5 is root



How to build a BST

Simplest: tree constructed as data read. Same data in different order could produce different tree.

Ex: Build BST from values
4, 2, 6, 9, 1, 3

4, add 4 as root
p=null, lc=null
rc=null

p=parent
lc=leftchild
rc=rightchild

2, 2<4
p=4, lc=null
rc=null,
4→lc=2

6, 6>4
p=4, lc=null
rc=null
4→rc=6

9, 9>4, 9>6
p=6, lc=null,
rc=null
6→rc=9

1, 1<4, 1<2
p=2
2→lc=1

3, 3<4, 3>2
p=2
2→rc=3

Question:
Build BST from
10, 12, 3, 1, 4, 10, 11