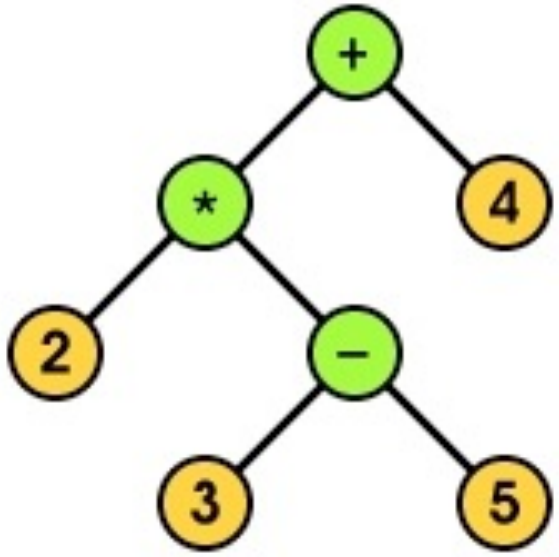
Announcements

MP4 available, due 10/16, 11:59p.

Binary tree, recursive definition:



A *binary tree* T is either

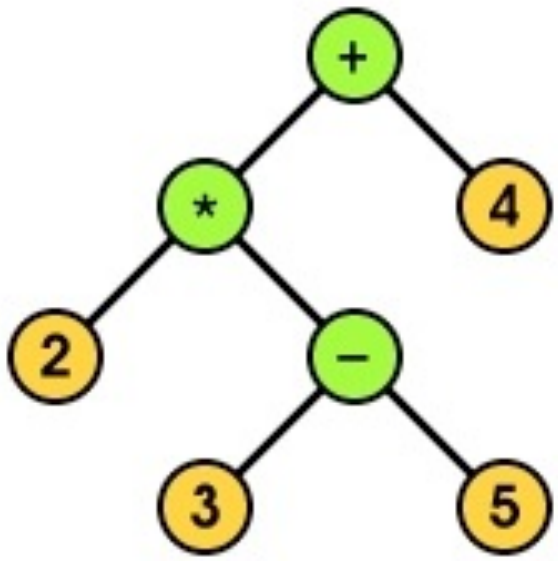
-

OR

-

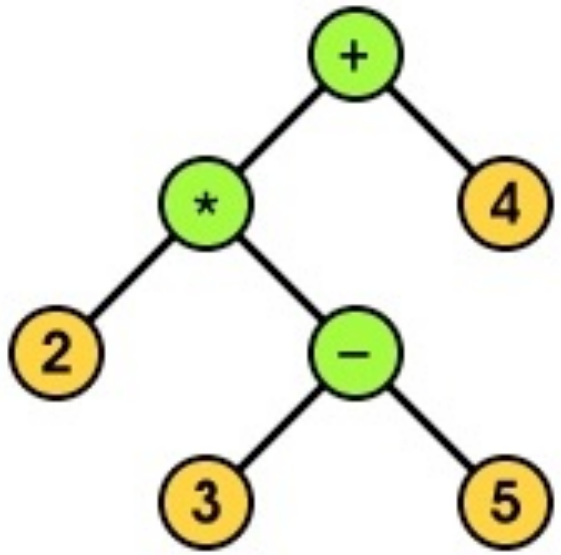
An (important) example of a function on a binary tree:

height(t) -- length of longest path from root to a leaf



Given a tree T, write a recursive defn of the height of T, height(T):

Full Binary tree: a tree in which every node has 2 or 0 children



F is a full binary tree if and only if:

- F={} OR,
- F={r, T_L, T_R}, and

Perfect Binary tree:

Perfect tree of height h, P_h:

- P_{-1} is an empty tree
- if h > -1, then P_h is {r, T_L, T_R}, where T_L and T_R are P_{h-1}.

P_0:

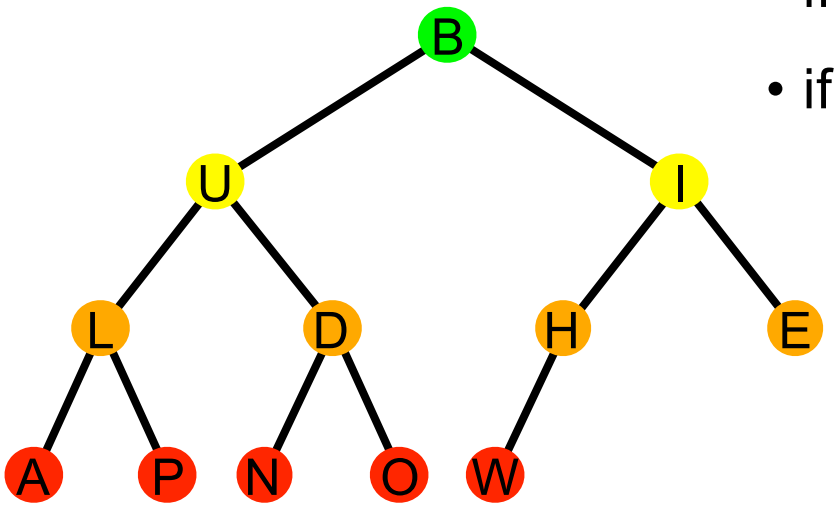
P_2:

P_1:

Check for understanding:

How many nodes in a perfect tree of height h?

Complete Binary tree: for any level k in [0,h-1], level k has 2^k nodes, and on level h, all nodes are pushed to the left.



Complete tree of height h, C_h:

- if h= -1, then C_h is {}
- if h > -1, then C_h is {r, T_L, T_R}, and either:

T_L is _____ and T_R is _____

OR

T_L is _____ and T_R is _____

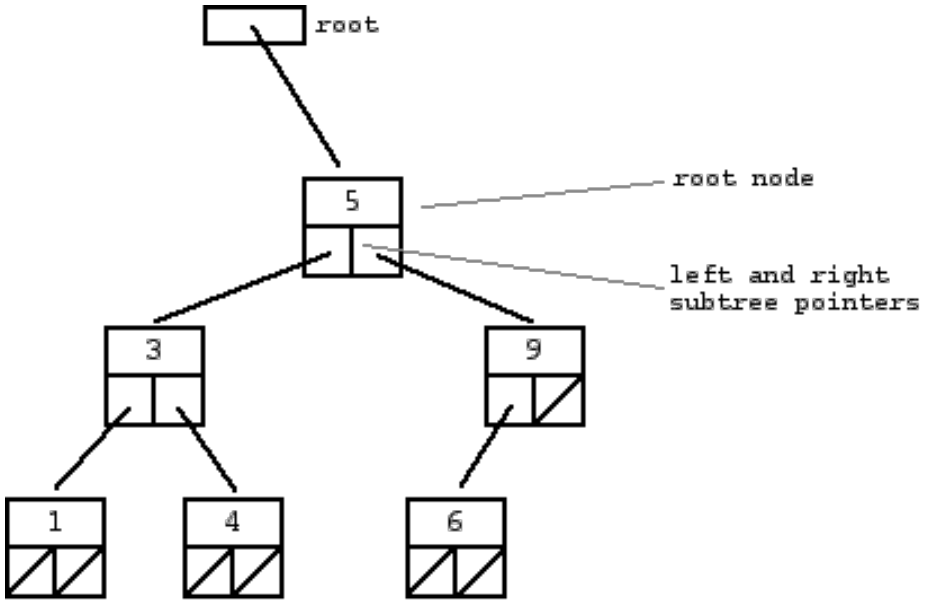
http://xlinux.nist.gov/dads//HTML/completeBinaryTree.html

Check for understanding:

Is every full tree complete?

Is every complete tree full?

Rooted, directed, ordered, binary trees

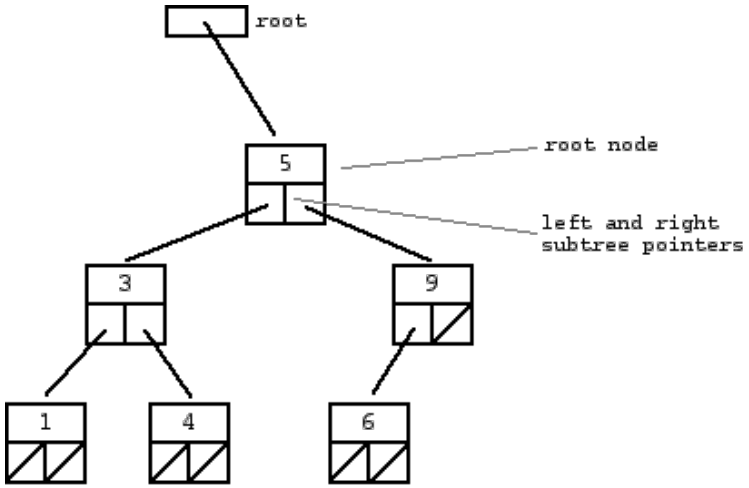


Tree ADT:

- insert
- remove
- traverse

```
template <class T>
class tree{
public:
…
private:
   struct treeNode{
      T data;
      treeNode * left;
      treeNode * right;
   };
   treeNode * root
…
};
```

Theorem: if there are n data items in a binary tree, then there are _____ null pointers.



Traversal