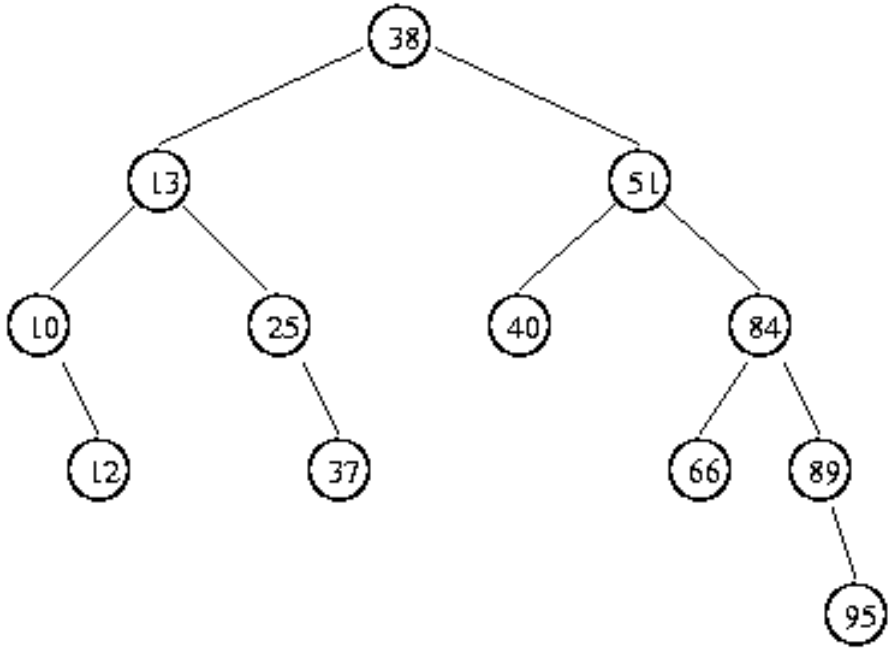
Announcements

MP5 available, due 10/30, 11:59p. EC due 10/23, 11:59p.

TODAY: balanced BST (intro)

http://www.qmatica.com/DataStructures/Trees/AVL/AVLTree.html



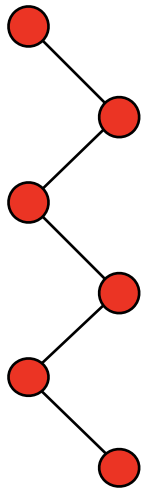
Running times:

- insert
- remove
- find
- traverse

Binary Search Tree - miscellaneous characteristics and analysis

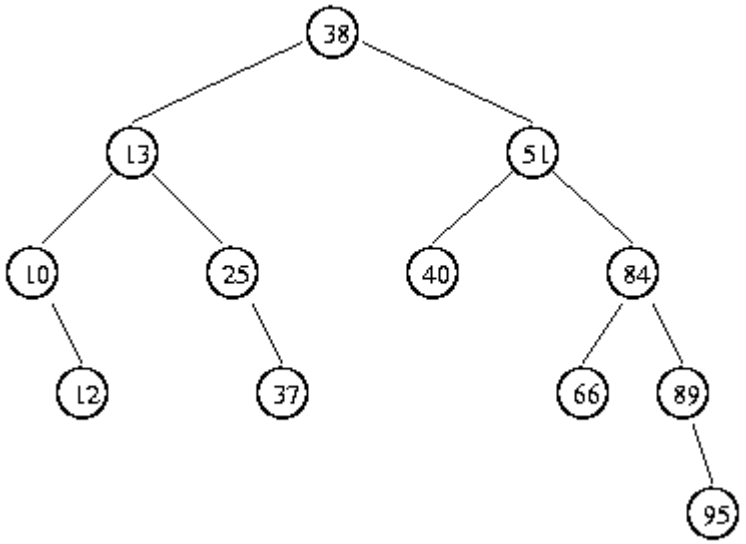
```
BST<int> myT;
myT.insert(2);
myT.insert(7);
myT.insert(15);
myT.insert(22);
myT.insert(28);
…
```

Give a sequence of inserts that result in a tree that looks like:



How many “bad” n-item trees are there?

Binary Tree -



The *algorithms* on BST depend on the height (h) of the tree.

The *analysis* should be in terms of the amt of data (n) the tree contains.

So we need relationships between h and n.

$$h \geq f(n)$$

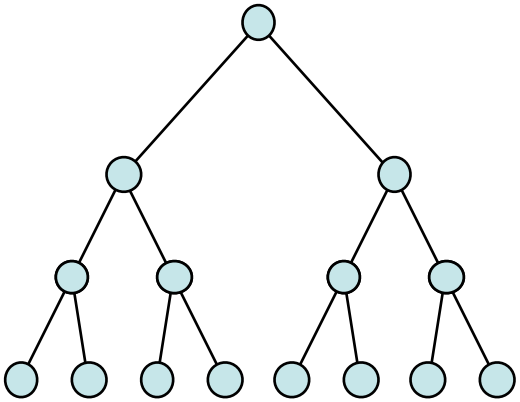
$$h \leq g(n)$$

Reminder:

height(T) is:

- _____ if T is empty
- 1 + max{height(T_L), height(T_R)}, otherwise

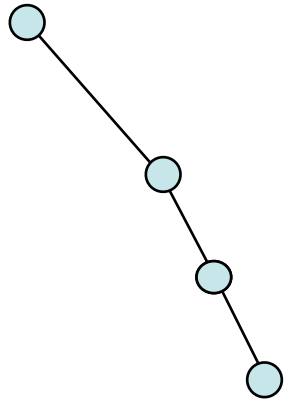
Binary Tree (theory moment #1)



what is maximum number of nodes in a tree of height h?

what is the least possible height (h) for a tree of n nodes?

Binary Tree (theory moment #2)



what is minimum number of nodes (n) in a tree of height h?

what is the greatest possible height (h) for a tree of n nodes?

thus: lower bd on ht _____, upper bd on ht _____, good news or bad?

Binary Search Tree -

The height of a BST depends on the order in which the data is inserted into it.

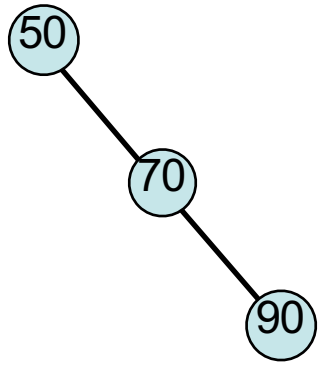
ex. 1 3 2 4 5 7 6 vs. 4 2 3 6 7 1 5

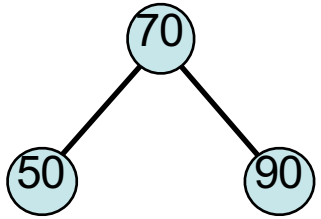
How many different ways are there to insert n keys into a tree?

Avg height, over all arrangements of n keys is _____.

operation	avg case	worst case	sorted array	sorted list
find				
insert				
delete				
traverse				

something new… which tree makes you happiest?





The “height balance” of a tree T is:

$$b = height(T_L) - height(T_R)$$

A tree T is “height balanced” if:

-
-

Binary Search Tree - is this tree “height balanced”?