12 - 8 days (approx), extra office hours next week.
- End up this aft (last exercise...).

CSC148 fall 2013

binary search tree

week 8

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Outline

performance

binary search tree

big-oh
We want to measure **algorithm** performance, independent of hardware, programming language, random events.

Focus on the size of the input, call it $n$. How does this affect the resources (e.g. processor time) required for the output? If the relationship is linear, our algorithm’s complexity is $O(n)$—roughly proportional to the input size $n$. 
list searching

$\mathcal{O}(\log n)$.

$n \leq 2^k$

$\log n \leq k$

You’ve already seen algorithms for seeing whether an element is contained in a list:

[97, 36, 48, 73, 156, 947, 56, 236]

What is the performance of these algorithms in terms of list size? What about the analogous algorithm for a tree?

$\mathcal{O}(\log n)$ → binary search.

$\mathcal{O}(n)$ → linear search.

If list is already sorted, try binary search.
a more efficient binary tree

We need to impose a sorting condition on binary trees. A **binary search tree** is:

- a binary tree
- left subtree of every node contains only values smaller than those of that node
- right subtree of every node contains only values greater than those of that node
Binary search of a list allowed us to ignore (roughly) half the list. Searching a binary search tree allows us to ignore the left or right subtree.

If we’re searching the tree rooted at node $n$ for value $v$, then one of three situations are possible:

- node $n$ has value $v$
- $v$ is less than node $n$’s value, so we should search to the left
- $v$ is more than node $n$’s value, so we should search to the right
Inserting is closely related to finding a node:

- if we find a node in our tree, no need to insert it!
- otherwise, we find the spot it should be, and insert it there.
deleting is a bit trickier, because there are several scenarios to consider, even after we’ve figured out which node we wish to delete:

- if the node we wish to delete is a leaf, just delete it
- if the node we wish to delete has exactly one child, replace it with the other
- if the node we wish to delete has two children, replace it with the largest child in its left subtree...

You should draw some diagrams until you understand these scenarios.
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