Announcement

CS 180 - Search Trees

at online. Updated now, so free at home lectures scheduled. Lecture notes should be
midterm on Thursday in class.
review session held in class. Info due Wed.

CS 180 - Search Trees
Topics on this exam:

- Linked lists (end of Chapters 9-10)

Vectoring

Listening

Sorting

Trees

Heaps

3 no coding - see HW problems

Note: Asymptotic running times are fair game also!
A binary search tree is a node structure such that each node
veys { than or equal to \( v \).
- Keys stored in the left subtree are
- Keys stored in the right subtree are
  - keys less than or equal to \( v \)
  - keys greater than \( v \).
 preorder

Q: What type of traversal will print the elements in sorted order?
How do we search for an element in the tree?
return v
else if at a leaf

return find (v) -> right)
else if find (v) < k

else if key (v) <= k

\[ \text{return } v \]
\[ \text{if } \text{key}(v) = k \]

else \text{ would belong}

key < or \( \leq \) the last node whose

\( \text{output: } \text{node } \text{of } \text{it } \text{st. either } w, \text{holds} \)

\( \text{Input: key } k \text{ to search } \text{for a node } v \text{ in tree} \)

TreeSearch (k,v)
begin

\[ O(n) \]

end

in \( O(n) \) time

\[ \leq O(n) \]

\( \text{(Visit at most one node per level)} \)

\( \text{Where } h = \text{height of the tree} \)

\( \text{Recursively at most } O(h^2) \) times

\( \text{Spread } O(1) \) time at each node

How long does searching take?
Update Operations

- How do we insert?

```plaintext
insert(53)
insert(44)
insert(12)
```

- The tree looks like this:
null
Search time $\mathcal{O}(1)$ to add or remove a single node.
How deep is each tree (in terms of nodes in tree)?
by at most 1,
the distance of v's chilean differs
- for any internal nod e v of T
  attempt to fo r the tree balanced
  AVL trees
  A bility tree structure: