Lecture 10, Tuesday 5/8/01

Searching in B-Tree

- Check if "current node" is =x or =NIL.
```
      Equal to x    -- return,
      Equal to NIL  -- return "not found"
else:
   if x ≤ current key  ----  search in the left tree
   otherwise search in the right tree.
```
- "Go down the tree, turning right/left as appropriate…"
- Running time: O(h), h=height of the tree.
- Note that this was impossible to do with a heap !

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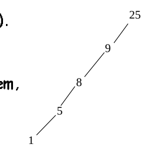
Inserting into B-Tree

- Insertion: search for key, and put it in the first empty space.
- Insertion takes O(h).
- Sort:
  - » Insert item-by-item,
  - » in-order walk.
  - » $O(n^2)$…



- Min/max - go all the way left or all the way right.

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Relation to Quicksort

- Randomly permute input.
- Consider example: 3 1 8 2 6 7 5
  - » Quicksort chooses 3, then compares 1,8,2,6,7,5 to 3.
    Then chooses 2, compares 1 to 2
    chooses 8, compares 6,7,5 to 8.
  - » B-Tree: chooses 3, places as root
    Then chooses 1, compares with 3, put in place.
    chooses 2, compares with 1, 3, put in place
    etc…
  - » Overall, same comparisons, only different order !!

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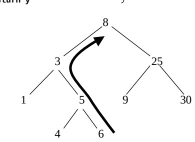
Successor/Predecessor

- **Successor:**
```
If right(x) != NIL,  return TreeMin(right(x))      <-- Easy case
y=parent(x)
while y != NIL & x=right(y)
      x=y
      y=parent(x)                                  <-- Go up the tree to the LEFT
return y
```



- **Successor of 6 is 8.**

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Deletion

- 3 Cases:
  - » No children
  - » 1 child
  - » 2 children
- 3rd case: put successor(x) instead of x.
  - » B-Tree property satisfied.
  - » Delete "hole" using case 1 or 2. (successor does not have left child !)

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