1 CS3134 #6

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2 Administrivia

- The bookstore definitely has books…
- Bug in compareTo example on page 107
  - Should be "s1.compareTo(s2)" in the table header
- HW1 updates

3 Agenda

- Finish writing out some Java list code
- Basic big-Oh notation
- Begin sorting

4 Lists

- Ordered Insert
  - Book has a cleverer technique; see page 60
  - Once you find the Insert point, work from the bottom up
- Ordered Find
  - Book page 57; very similar to what I did, but some subtle differences

5 Costs

- How much do each of the previous entries cost in the *worst case*?
  - Most are linear, some are unit
- Binary search is special – it's better than linear time
  - Divide the range by half until too small to divide further == # of comparisons needed
  - Reverse: what's the range that can be covered with *n* steps? (Book page 63)
  - i.e., $r = 2^s$
  - What's this expressed as in terms of s?
    - $s = \log_2 r$
  - Algorithm grows *logarithmically*

6 Formalizing costs

- Terminology differs based on details; we'll go light
- Time to insert one element is some constant *K*
  - e.g., T(N) = K
- Time to search for an element is T(N) = K * N
- "Big-Oh Notation": upper-bound on worst-case time
  - We drop the constant K – for *sufficiently large N*, the constant is unimportant
  - The idea of doubling your computer's speed is embedded in K
  - T(N) = O(N), for example

7 Examples of costs

- For lists using arrays?
  - Linear search: O(N)
  - Etc.
  - Draw a graph of the comparative costs, page 72
- What are bad about arrays?

- Slow search in unordered, slow insert in ordered – can we speed both? Yes
- Fixed size
- But it's easy
- You can write your own Vector if you want

8 Sorts

- Applets!
- Bubble (p. 85)
  - Sort pairwise repeatedly
  - Biggest placed each time
- Selection (p. 89)
  - Search for smallest, swap with first
  - Search for smallest, swap with second
- Insertion (p. 95)
  - Take the next one, and put it into the existing sorted subset
- All O(n^2)
  - But they're not the exact same performance
- Let's write out a little bit of psuedocode for each

9 Next time…

- Finish sorts
- Stacks