Slide 1

Administrivia

- Reminder: Reading quiz due today. 11:59pm.
- Next reading quiz coming soon, and/or also homework.

Slide 2

Analyzing Efficiency, Revisited

- Note that in analyzing running time of algorithms, in the two examples shown in Chapter 2, we didn't attempt anything very fine-grained, but focused on determining an order of growth that would let us predict, for sufficiently large input, which algorithm would be faster — i.e., we were concerned with the *asymptotic efficiency* of the algorithm.
- Several types of asymptotic effciency, and worth noting that can be applied to any functions, not just ones that represent program running times.

Slide 3

Types of Asymptotic Efficiency

- O-notation represents an *upper bound* on a function — i.e., something that grows at least as fast as the function being bounded, possibly faster. E.g., $2n^2$ is $O(n^2)$, and also $O(n^4)$. (This one you've probably seen in other CS classes.)
- Ω-notation represents a *lower bound* on a function — i.e., it grows no faster than the function being bounded, and might grow slower. E.g., $2n^2$ is $\Omega(n)$.
- Θ-notation represents a *tight bound* on a function — no more and no less.

Slide 4

Formal Definition

- We say $f \in O(g(n))$ exactly when:
  There exist constants c and n_0 such that for all $n \geq n_0$, $f(n) \leq cg(n)$.
- This captures the idea we have in mind — that for sufficiently large n, $f(n)$ grows no faster than $g(n)$.
- There are similar definitions for $\Omega(g(n)$ and $\Theta(g(n))$.

Slide 5

Common Running Times

- Linear ($O(n)$), quadratic ($O(n^2)$), other polynomial (($O(n^m)$).
- Logarithmic ($O(\log n)$), linearithmic ($O(n \log n)$). $O(\log n)$ grows slower than linear. Note that the base used for the logarithm doesn't matter for order of growth.
- Exponential ($O(2^n)$). Grows faster than anything polynomial. Here too the base doesn't matter for order of growth.
- Factorial $(O(n!))$. Grows still faster.

Slide 6

Minute Essay

- I've missed kind of a lot of classes. I was going to try to record some extra make-up lectures, but I'm not sure that makes sense — might be better to just move on. Thoughts?