Slide 1

Administrivia

- Code for sorted binary tree class will be on Web soon. Could be interesting to try your own version — without recursion?
- Grades for Homework 4 mailed. Homework 5 being graded. If you're struggling with something, ask for help!
- Homework 7 design due today at 11:59pm. Questions?

Slide 3

Multithreading Basics

- What's a thread? Conceptually, a sequence of steps executed one at a time.
- "Multithreading" — similar to operating system's "multitasking" — execute more than one thread (application) in effect at the same time. Why?
  - For better performance, if there's more than one CPU.
  - Because it's a good mental model — e.g., for GUIs.
- Threads can share variables — useful, but risks "race conditions". For this and other reasons, sometimes want one thread to wait for another to do something.

Slide 2

Minute Essay From Last Lecture

- Show what a heap looks like after inserting 5, 4, -1, 10, 6, 20.

  (Let's do this at the board . . .)

Slide 4

Threads in Java

- `Thread` class provides basic functionality. To start a new thread, make a `Thread` object and call its `start` method. Two choices:
  - Create a `Thread` with an object that implements `Runnable` — `run` method has code to execute.
  - Define a subclass of `Thread` that has a `run` method with code to execute.
- Inter-thread interaction based on "monitors" (see o/s or parallel-programming textbooks):
  - Every object (and every class) has a lock.
  - `synchronized` methods must acquire lock — so only one at a time can run.
  - `wait` gives up the lock and sleeps; `notify` and `notifyAll` wake up one/all sleeping thread(s).

Threads in Java, Continued

- `Thread.sleep` to make current thread sleep for some interval.

- Can set thread priorities — sometimes useful, but not a substitute for proper synchronization.

Slide 5

Minute Essay

- Are there features you want to add to your game, but you have no idea how?

Slide 7

Examples

- Example of multithreading for performance . . .

- Example of multithreading for GUI . . .

- Example of multithreading with `wait` and `notify` . . .

Slide 6