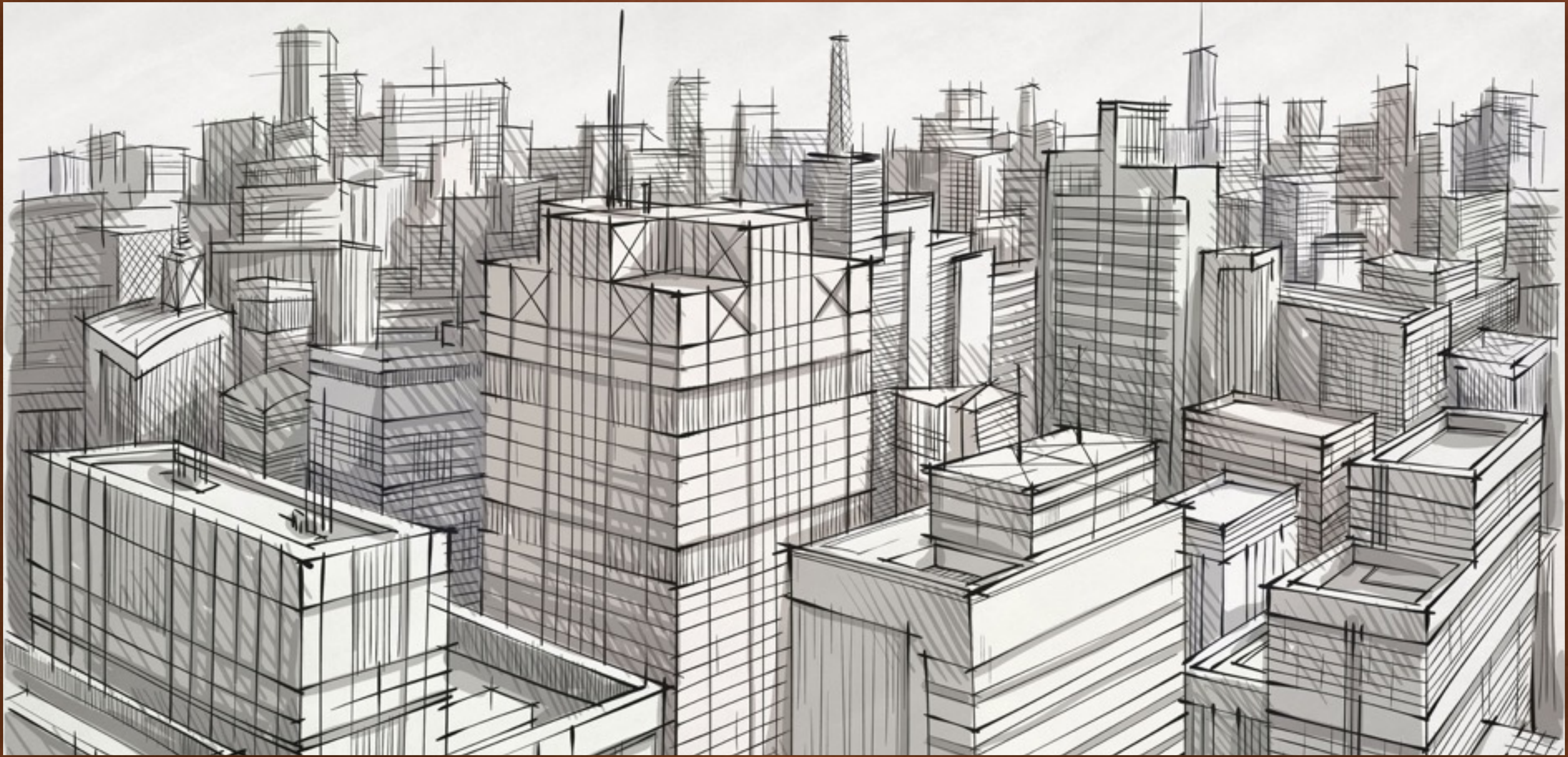
CS1530, LECTURE 13: CONCURRENT PROGRAMMING IN JAVA

BILL LABOON



LAST CLASS

- We discussed -
  - The benefits and drawbacks of multi-threaded programming
  - Thread usage in Java
    - Thread and Runnable classes, synchronization
  - Issues with threading (data races, deadlock, livelock)
    - Some attempts to ameliorate them (lock hierarchy, analysis, randomized polling)

THIS CLASS

- Using the Java library to avoid many of those issues
- Specifically, many helpful classes in java.util.concurrent

ATOMIC VARIABLES

- Variables that can be accessed atomically
  - That is, can do complex operations such as increment atomically
  - Avoids data races
- Built-in synchronization
- Atomic.java

COLLECTIONS

- Some built-in collections are thread-safe, some are not
- HashMap vs Hashtable
  - HashMap IS NOT thread-safe
  - Hashtable IS thread-safe
    - But really you should start using ConcurrentHashMap…
- Be sure to look at API description to determine which you are using!

THREAD SAFETY IS NOT FREE

- Usually performance decreases, even in “non-threaded” applications
- Remember that if you are programming in Java, you are actually ALWAYS dealing with a threaded application running on the JVM
- Try timing HashMap.java vs Hashtable.java

BUT DOES IT MATTER?

- If you are not sharing mutable state, never a problem!
- The garbage collector is not going to come and mess up your variables.
- (Otherwise 401 would have been MUCH more difficult!)
- NoShared.java vs UnnecessaryShared.java

LET THE JAVA.UTIL.CONCURRENT DESIGNERS WORRY

- "Don't roll your own crypto"
- Don't do more synchronization than you have to
- Most common data structures already have thread-safe version
- java.util.concurrent package in Java

JAVA.UTIL.CONCURRENT EXAMPLE

- Semaphore
- ThreadPoolExecutor
- Blocking Queue
- CountdownLatch
- Copy-on-Write ArrayList