Lecture 10
Midterm Review
Topics Covered

- Parallel / concurrent / distributed systems
- Nondeterminism
- Procedural abstraction
- Processes and threads
- Scheduling
- Context switching
- Threads as objects in Java
  - Thread class
  - Runnable interface
  - Thread states
- User vs. daemon threads
- Thread safety
- Data races
- Race conditions
- Class specifications, correctness
- Thread safety
- Atomicity
- Locks
  - Intrinsic / monitor locks
- Synchronized blocks, methods
- Reentrant locks
- Locks and performance
- Locking protocols
- Deadlock
- Waits-for graphs
- Deadlock prevention
- Built-in atomic memory access in Java
- Synchronization and visibility
- Volatile variables / fields
- Locking and visibility in Java
- Java Memory model
- Event sequences
- Program order
- "happens-before" and data races
- Sequential consistency
- Properly synchronized
- Object publishing and escape
- Indirect publishing
- Improper object construction and escape of this
- Safe object construction via factory methods
- Thread confinement
- Stack confinement
- ThreadLocal
- Immutable objects and final fields
- Initialization safety
- Safe publication
- Effectively immutable objects