

# Computer Science 161: Operating Systems

## Midterm Topics

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March 19, 2007

### 1 Deadlines

- (03/22/2007): Midterm in class.
- (03/24/2007 - 04/01/2007): **Spring** (into action designing ASST3 so it doesn't) **Break** (your spirit and crush your soul).
- (04/03/2007): ASST3 Design Document due.

### 2 Midterm Topics

This is **NOT** an exhaustive list, but it should be a good guide for studying. You should understand all the concepts listed below and generally how they might be implemented (not just how the concept is implemented in OS161). For the various algorithms/policies, this means that given a description of an example system, you should be able to trace to completion the steps that the algorithm/policy would take.

#### 2.1 General OS Concepts

- Interrupts – Hardware vs. Software
- System Calls
- User vs. Kernel Mode / Protection Rings / Privileged Instructions
- Kernel Models – Executive, Modular, Monolithic, Microkernel, Hybrid

#### 2.2 Threads / Processes

- Address Space Layout / Limits
- Segments – Reserved, Stack, Heap, BSS, Data, Text
- CPU States – Ready, Running, Sleeping
- Process/Thread Control Block (PCB/TCB)
- Process Creation – fork, exec
- Context Switching
- User vs. Kernel Threads

## 2.3 Synchronization

- Memory Sharing
- Critical Section Requirements
- Locks – Spinlocks, Blocking Locks
- Semaphores – Binary, Counting
- Condition Variables / Monitors
- Synchronization Problems / Solutions
  - Race Conditions
  - Deadlock
  - Starvation / Priority Inversion

## 2.4 Scheduling

- Preemptive vs. Cooperative
- Batch vs. Interactive
- Scheduling Goals / Tradeoffs
- Scheduling Policies
  - First Come, First Served (FCFS)
  - Round Robin (RR)
  - Shortest Job First (SJF) / Shortest Remaining Time First (SRTF)
  - Priority
  - Lottery
  - Multilevel Feedback Queues (MLFQ)

## 2.5 Virtual Memory

- VM Goals / Requirements
- Partition Strategies – Fixed, Variable, **Paging**
- Memory Management Unit (MMU) / Translation Lookaside Buffer (TLB)
- Address Translation
- Page Faults
- Page Tables – Single Level vs. Multilevel
- Demand Paging / Copy-On-Write
- Swapping
- Page Evictions – Clean / Dirty / Static Pages
- Eviction Policies

- Random
  - Longest Future Access (OPT / MIN)
  - First In, First Out (FIFO)
  - Least Recently Used (LRU) / LRU Clock
- Physical Frame Allocation / Pitfalls
  - VM  $\leftrightarrow$  Context Switching Interplay

### 3 Conclusion

Whew. This may seem like a really long list, but there is a fair amount of overlap, and if you've been paying attention in lecture, most of this should seem pretty familiar (but that doesn't mean you shouldn't refresh yourself on the details). The best way to know whether your understanding of a topic is sufficiently detailed is to look at last year's midterm as an example. Good luck studying and on the midterm!