CSC 139 Operating System Principles – Spring 2020

Midterm 2 Study Guide

Exam Policies:

* Closed book, closed notes. One double-sided cheat sheet is allowed.
* Calculator is allowed.
* 75 minutes.

Ch. 6&7 – Process Synchronization

* Race condition
* Critical section
* Hardware based solutions to critical section problem
  + Test-and-set method
* Mutex locks
* Semaphores \*
  + Binary and counting
  + wait() and signal()
* Deadlock and starvation
* Classical concurrency problems and their semaphore-based solutions \*
  + Bounded-buffer problem
  + Readers-writers problem
  + Dining philosophers problem
* Monitor
  + Condition variable and its wait/signal operations

Ch. 8 – Deadlocks

* Definition, four necessary conditions
* Resource-allocation graph
* Three approaches to handle deadlocks
* Deadlock prevention
  + How to deny one of the deadlock conditions
  + Pros and cons
* Deadlock avoidance
  + Resource allocation states, safe and unsafe states, safe sequence
  + Banker’s algorithm, safety test, pros and cons \*
* Deadlock detection and recovery
  + From resource allocation graph to wait-for graph
  + Detection and recovery issues
  + Pros and cons

Ch. 9 – Memory Management

* Logical address space
  + Base and limit registers
* Compiled code addresses bind to relocatable addresses
  + Compile time, load time, execution time
  + Static relocation vs. Dynamic relocation
* Page-based vs. segment-based memory management
  + Addressing mechanism
* Hardware support
  + MMU
  + registers
  + cache
* Contiguous memory allocation
  + Storage allocation problem and its solutions \*
    - first-fit, best-fit, and worst-fit
  + Internal fragmentation
  + External fragmentation
* Physical memory
  + frames
* Logical memory
  + pages
* Page tables \*
  + Page number, page offset
  + Page table entry, page table size
* Translation Look-aside Buffer (TLB)
* Valid and invalid bits
* Multilevel page tables
* Inverted page tables
* Hashed page tables

Ch. 10 – Virtual Memory

* Virtual memory
  + Benefits
* Page fault
  + Generation and handling
  + Performance: effective access time \*
* Kernel memory allocation +
  + Buddy allocator vs. slab allocator
* Demand paging \*
  + Page replacement policies: FIFO, MIN (a.k.a. OPT), LRU, etc.
  + Thrashing

\* Possible calculation and long questions

+ May be skipped