# CMSC 412 Midterm #1 (Spring 2010)

Name _____     Signature _____

(1) This exam is closed book, closed notes, and closed neighbor. No calculators are permitted. Violation of any of these rules will be considered academic dishonestly.

(2) You have 70 minutes to complete this exam.  If you finish early, you may turn in your exam at the front of the room and leave.  However if you finish during the last ten minutes of the exam please remain seated until the end of the exam so you don't disturb others. Failure to follow this direction will result in points being deducted from your exam.

(3) Write all answers on the exam.  If you need additional paper, I will provide it. Make sure your name is on any additional sheets.

(4) Partial credit will be given for most questions assuming I can figure out what you were doing.

(5) Please write neatly. Print your answers if your handwriting is hard to read.  If you write something, and wish to cross it out, simply put an X through it.  Please indicate if your answer continues onto another page.

| Question | Possible | Score |
|----------|----------|-------|
| 1 | **20** | |
| 2 | **20** | |
| 3 | **20** | |
| 4 | **12** | |
| 5 | **8** | |
| 6 | **20** | |
| Total | **100** | |

1.)     (20 points) Define and explain the following terms:

    a)      kernel

    b)      critical section

    c)      memory protection

    d)      process control block (PCB)

2.)   (20 points) Synchronization: Given an implementation of binary semaphores (i.e. a V operation on a binary semaphore with a value of 1 does not change the value of the semaphore), implement counting semaphores.  Show any variables or semaphores you use and their initial values.

Semaphore and variable declarations:

P():

V():

3.)     (20 Points) Scheduling

   a)     Why would a scheduling algorithm that gave priority to processes based on how much
          time they have consumed (i.e. processes whose total CPU time is higher have higher
          priority) be a bad idea?

   b)     Explain how short-term and medium-term scheduling are different?  What issues are
          each concerned with?

4.)    (12 points) Given a test-and-set instruction, write an implementation of swap(a,b) atomic instruction.

5.)    (8 points)  What are the four conditions required for deadlock?

6.)     (20 points) Project

   a)      Why does project #2 have the system call Sys_RegDeliver?  What does it do?

   b)      The project used Spawn_Program(<program name>) to implement process creation.
           What would you have to change in the system to support UNIX style process creation
           with two system calls: Fork() followed by Exec(<program name>)?

   c)      Given that all memory in the system is mapped into the kernel's address space, why is
           there a function in the kernel called Copy_From_User?