CMSC 412 Midterm #2 (Spring 2016)

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.

(6) Cell phones must be turned off (not just vibrate) during the exam. A cell phone ringing during the exam will result in 10 points being deduced from your score.

Question	Possible	Score
1	**20**	
2	**20**	
3	**20**	
4	**20**	
5	**20**	
Total	**100**	

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

    a)   Negative ACL

    b)   Set uid bit

    c)   Bankers Algorithm

    d)   Dirty bit

2.)   (20 points) Memory Systems

a)   (8 points) Consider an architecture with a two-level page table, but without a TLB. Accessing a memory location takes 100ns. Accessing a disk block takes an average of 10ms. What percentage of accesses can result in page faults if the average access time needs to be less than 350ns?

b)   (6 points) Why is having a processor that supports a single "large reach" map of an arbitrary numbers of page frames from a contiguous region of physical memory to a virtual range useful?   Explain what performance gains are possible, and one type of application that can use this type of mapping?

c)   (6 points) Name two parts of the OS kernel that can't be made pageable

3.)   (20 Points) Synchronization: Use binary semaphores to implement a solution to the standard readers/writers problem (i.e. readers preferred) that allows either a single writer or at most five readers at a time. Show all variable and semaphore declarations and initial values.

4.)   (20 points) File Systems

a)   (7 points) When hard links are added to a tree based file system it can then be a DAG which can make tools such as disk usage harder to write. Does adding symbolic links instead allow for DAGs? Are there any additional concerns for these types of tools with symbolic links?

b)   (7 points) Describe two reasons a first fit policy for allocating disk blocks might result in lower performance or available storage for files.

c)   (6 points) Consider a disk with 512 byte blocks. If you used a single block to implement a bit vector free list, how big of disk could you support?

5.)   (20 points) Project

    a)   (6 points) If you leave the 0th entry in the 0th page table (i.e. 0th page dir entry) as invalid, what happens to the physical memory associated with this page?

    b)   (6 points) Why do you need to pin the page while waiting for the disk to read the data for that page form the mapped file?

    c)   (8 points) In the project, writes to the memory region of a mapped file resulted in changes the file.   If you wanted to allow files to be mapped into memory, but that any modifications to memory should not result in changes to the file, how could you do this (you may not use a second copy of the file)?