CMSC 412 Final (Spring 2016)

Name _____ Signature _____

(1) This exam is closed book, closed notes, and closed neighbor.

(2) You have 110 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.

(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	**30**	
2	**30**	
3	**20**	
4	**25**	
5	**20**	
6	**25**	
Total	**150**	

1.) (30 points) Define (or explain) the following terms:

a) Ethernet MAC Address

b) Public key cryptography

c) Bélády's anomaly

d) Bakery Algorithm

e) Flash vs. Magnetic storage

2.) (30 points) Processes

a) When processes fork, they make an exact copy of the stack. Explain why forking threads can't make an exact copy of the stack.

b) Give an example of a situation (application domain) where it is reasonable to allow for a scheduling algorithm to allow processes to starve for time periods of seconds or minutes.

c) List three things that are typically stored as part of a process context in the PCB.

3.) (20 Points) Synchronization:

a) Given an implementation of atomic swap (i.e. swap(a, b) exchanges the values in the variables a and b). Implement a spin lock and unlock

Lock(int &lock):

Unlock(int &lock):

b) Why is disabling interrupts not sufficient for mutual exclusion in a multi-core system?

4.) (25 Points) GeekOS

a) Why is there a secondary boot loader that runs in 16 bit mode after the code in the boot sector, but before the full 32-bit kernel is started?

b) What is the purpose of the VFS layer in Geek OS?

c) Why was it necessary to identity map pages in the geekOS virtual memory system?

5.) (20 points) Effective Access Time:

a) Given a goal of an effective access time of 120ns, a main memory access time of 100ns, page directories and page tables that are pinned in memory, a page fault miss rate of 0.001%, and that reads to stable storage (e.g., disk) take 1ms and writes 100ms. Assume all memory frames are always in use, what percentage of the pages frames can be dirty and still meet the effective access time goal?

b) How do super pages improve the effective access time for programs? What access patterns do they help the least with?

6.) (25 points) Disks

a) Explain why a defragmenter is not required in an extent based file system, but can still improve performance. Make sure to explain what usage patterns benefit from defragmentation.

b) Show the completion time of each of the disk requests using the three algorithms listed. Assume that once the disk head starts to move, any request that arrives will not be considered until the pending seek completes. It takes one unit of time to seek one sector and the head starts at track 10.

Arrival Time	Track Requested	FCFS	Shortest Seek First	Scan	C-Scan
0	8				
4	3				
7	25				
8	18				