

CMSC 412 Final (Spring 2010)

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.

Question	Possible	Score
1	25	
2	25	
3	25	
4	25	
5	10	
6	15	
7	25	
Total	150	

1.) (25 points) Define (or explain) the following terms:

a) Display Protection

b) Safe Sequence (with regard to deadlock)

c) One Time Pad

d) Trojan Horse

e) Routing

- 3.) (25 Points) Synchronization: Implement a hybrid synchronization interface that uses a busy wait with atomic-swap and a binary semaphore to provide mutual exclusion. The implementation should call atomic-swap at most 100,000 times and if it has not acquired mutex, it should use a semaphore to block until it is woken up to try again. Show the fields needed in the supplied struct.

Declarations

```
struct hybridSync {
```

```
};
```

Lock:

Unlock

- 4.) (25 Points) The GeekOS file-system currently allows for users but not groups. Explain what would be required to add groups to the file protection system. Specifically:

List and describe any new system calls needed:

Changes to data stored on disk:

Changes to the open system call:

5.) (10 points) Memory & the project: Currently the GeekOS system does not allow for malloc by user processes. Explain would you need to add to the kernel to support malloc?

6.) (15 points) Given the following disk requests and arrival times, show the completion times for each request under the following disk scheduling policies: FCFS and SCAN. The head is initially at track 0 and it takes 0 time to read a track, but 1 time unit to move the head one track.

Requested Track	Arrival Time	FCFS Time	SCAN Time
50	0		
0	10		
100	40		
90	100		

7.) (25 points) File Systems

- a) Explain why file systems have caches for both name to inode translation and for the disk blocks themselves.
- b) Consider two file systems each using 4KB disk blocks, and 32-bit values to store disk block numbers. One uses a file allocation table and the second uses hybrid indexed allocation (12 direct, 1 indirect, 1 double indirect, and 1 triple indirect block). Assume the name lookup is complete (i.e. we know the inode number or first block of the file). How many disk reads are required to read 100 bytes at offset 4GB ($4 \cdot 1024^3$ bytes) into a file for each file system type. Please show the work for how you got your answer.