

## CMSC 412 Midterm #2 (Spring 2014)

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 deducted from your score.

| Question | Possible   | Score |
|----------|------------|-------|
| 1        | <b>20</b>  |       |
| 2        | <b>20</b>  |       |
| 3        | <b>20</b>  |       |
| 4        | <b>20</b>  |       |
| 5        | <b>20</b>  |       |
| Total    | <b>100</b> |       |

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

a) Super page

b) Extent based file system

c) Bankers Algorithm

d) Inverted page table

2.) (20 points) Memory Systems

- a) (7 points) Consider an x86-64 like architecture with a hardware TLB (with an access time of 1 ns for a hit or miss), a four level page structure (4 levels of 512 entries each). Memory access time is 100ns. Assume all memory fits into RAM (i.e. no page faults to disk). What TLB hit rate is required to achieve an effective access time (EAT) of 105ns?
- b) (6 points) What is a typical use for the accessed/referenced bit on the x86 memory management unit (MMU)? What sets the bit? What clears it?
- c) (7 points) Why is a base/limit register pair less flexible than a conventional page table?

3.) (20 Points) Synchronization: You need to synchronize the process of getting and making coffee in the CS department lounge. In the department, there are two types of coffee urns (regular and decaf) and one coffee maker. If someone goes to get a cup of coffee of one type, and that pot is empty they make a new pot of that type of coffee. Provide a solution using semaphores (include variable declarations and initial semaphore values) to the coffee problem that ensures:

- Only one person at a time is taking coffee out of the decaf urn
- Only one person at a time is taking coffee out of the regular urn
- Only one urn is on the coffee maker at a time
- If one type of coffee is being made, people requesting coffee of the other type can get it if it is available.

You may assume there exists a function `emptyUrn(bool checkDecaf)` that returns true if the coffee urn indicated by the parameter is empty.

4.) (20 points) File Systems

- a) (6 points) Why does the default installation of NTFS not check directory permissions, but only checks file permissions?
- b) (8 points) What are the differences between hard links and symbolic links?
- c) (6 points) Consider a file system with 4KB blocks and 64 bit block indexes, Each inode has 10 direct blocks, 1 indirect block, and 1 double indirect block. What is the largest file possible that can be stored?

