

CMSC 412 Midterm #2 (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	20	
5	20	
Total	100	

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

a) Inverted Page Table

b) Sticky-bit

c) ACL

d) Working Set

2.) (20 points) Memory Systems

a) (7 points) The x86 processor uses a two-level page table (page directory and table) when operating in 32-bit mode. Why does AMD-64 (x86-64) in 64-bit mode use a 4-level page table when using 4KB pages?

b) (5 points) In 64-bit mode on an AMD-64 (with 4KB pages) there are 512 entries per level in the page table, but in 32-bit mode there are 1024. Why?

c) (8 points) Explain what TLB reach is and how do super pages improve the TLB reach?

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.

Variables

```
getCoffee(bool usesDecaf) {
```

```
}
```

4.) (20 points) File Systems

a) (6 points) List three types of meta-data that are typically associated with a file

b) (14 points) Compare and contrast how windows and UNIX define which program should be invoked when a user requests to "execute" a file that contains a script (i.e. not a native binary).

5.) (20 points) Project

- a) (6 points) For a fully functional program #4, the kernel and its data are non-pageable. However, you can still have a page fault (for a correct program) when running in kernel mode. How is this possible?
- b) (7 points) Why did you need to copy the identity mapped physical region from the kernel page directory into each user process's page directory given that user-mode process can't touch kernel memory?
- c) (7 points) What changes would you need to make to your project to make page tables pageable?