NAME: ____ (FIRST NAME FIRST) **SCORE**: _____

COSC 6360 FIRST MIDTERM SEPTEMBER 27, 2007

THIS EXAM IS CLOSED BOOK. YOU CAN HAVE ONE SHEET (I.E., TWO PAGES) OF NOTES. UH EXPELS CHEATERS.

1. Unlike the older UNIX file system, the Fast File System specifies a minimum block size.

a) What was that ***minimum block size***? (5 points)

Four kilobytes.

b) What is the ***main advantage*** of selecting that ***specific value*** instead of any other one? (5 points)

It is the smallest block size that eliminates the third level of indirection.

c) What was the ***major disadvantage*** of selecting that value? (5 points)

It increased internal fragmentation. (This was a very important issue as disks tended to have very little free space and most UNIX file systems had many files whose sizes were well below 4 KB.)

d) Which feature of the FFS was introduced to ***eliminate*** this disadvantage? (5 points)

File blocks could be partitioned into 2, 4, or 8 fragments and these fragments could be used to store small files or the tails of larger files.

2. Which safety issue is raised by the UNIX ***set user ID bit***? (5 points) What can be done to avoid that problem? (5 points)

Any user that can modify a file that has its set user ID bit turned on can have access to the account of the owner of that file.

Files that have their set user ID bit turned on should be modifiable by their owner only.

3. Comparing ***partial subblocking*** and ***complete subblocking***,

a) Which technique uses the TLB space in a more efficient manner than the other and why? (5 points)

Partial subblocking uses the TLB space in a more efficient manner because the page table entry mapping an entire subblock is only 24 bit long.

b) Which technique uses the main memory space in a more efficient manner than the other and why? (5 points)

Complete subblocking uses the main memory space in a more efficient manner because it does not require the pages of a subblock to occupy contiguous locations in main memory.

T:______

4. In conventional shared memory systems, critical sections that consist of a ***single machine language instruction*** do not have to be surrounded by lock/unlock—or request/release—pairs. Is this still true with Munin? (5 points) Why? (5 points)

In Munin, a critical section that consist of a ***single machine language instruction*** must be surrounded by a request/release pair in order to ensure that (a) it gets an up-to-date version of the data it accesses and (b) other processes are made aware of any potential data update.

5. What is ***false sharing*** and what is its main side effect in a distributed shared memory system? (5 points) How does Munin address that issue? (5 points for ***naming*** the technique)

False sharing happens whenever two distinct processors simultaneously access two or more distinct variables that are located in the same page. As a result, the page will go back and forth between the two processors The Munin write-shared consistency protocol eliminates this issue.

6. How many lines will be printed by the following program? (5 points)

```
main() { fork(); fork(); printf("Done!\n") }
```

_ **4** ____**lines**

7. What characterizes a ***self-tuning*** cache replacement policy? (5 points) Which feature(s) of the ARC cache replacement make that policy self-tuning? (10 points)

The ARC cache replacement policy is self-tuning because it has no parameter than can be adjusted by the user.

8. Mach mapped files

a) What is the main advantage of mapped files compared to more traditional file access techniques? (5 points)

Read and writes to a mapped files will not require context switches unless the data being accessed are not in main memory.

b) Which memory object is associated with each mapped file? (5 points)

The file system.

c) How does Mach enforce the traditional UNIX ***file access restriction***s (read-only, write-only and read-write) in its implementation of mapped files? (5 points)

It sets the appropriate protection bits for the range of virtual addresses that correspond to the mapped file.

d) What is the ***inheritance attribute*** of a mapped file? (5 points)

Shared.