CS 6210 Fall 2008 Midterm

Name:_____GT Number:

<u>**Thursday October 30, 2008 (2:00 to 3:30 PM)**</u>

Note:

1. **Write your name and GT number on each page.**
2. The test is **CLOSED BOOK** and **NOTES**.
3. Please provide the answers in the space provided. You can use scratch paper (provided by us) to figure things out (if needed) but you get credit **only** for what you put down in the space provided for each answer.
4. For conceptual questions, concise bullets (**not wordy sentences**) are preferred.
5. Where appropriate use figures to convey your points (a figure is worth a thousand words!)
6. Illegible answers are wrong answers.
7. Please look through the whole test before starting so that you can manage your time better.

Good luck!

Question number	Points earned	Running total
1 (1 min) (Max: 1 pts)		
2 (10 min) (Max: 10 pts)		
3 (5 min) (Max: 10 pts)		
4 (5 min) (Max: 9 pts)		
5 (10 min) (Max: 10 pts)		
6 (15 min) (Max: 10 pts)		
7 (5 min) (Max: 9 pts)		
8 (15 min) (Max: 13 pts)		
9 (5 min) (Max: 9 pts)		
10 (10 min) (Max: 10 pts)		
11 (5 min) (Max: 9 pts)		
Total (86 min) (Max: 100 pts)		

1. (1 min, 1 point)
Oxymoron means
(Don't worry you get a point irrespective of your answer!)

   a. A moron who breathes oxygen
   b. Oxygenated moron
   c. More information on Oxygen
   d. A combination of contradictory words or phrases
   e. Nickname for George Bush
   f. What does this have to do with CS 6210?
   g. Write in _____

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2. (10 min, 10 points) (L3 kernel - conceptual)
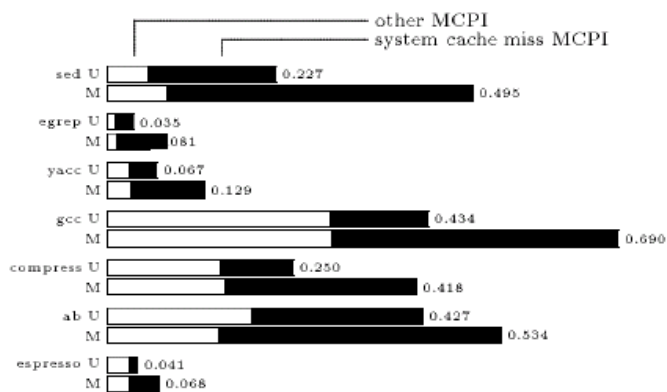Study these figures from Liedtke's paper. MCPI stands for Memory Cycle overhead Per Instruction.

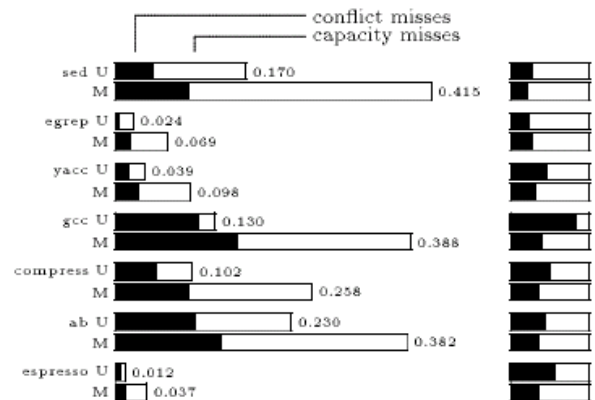Figure 3: *Baseline MCPI for Ultrix and Mach.*

Figure 4: *MCPI Caused by Cache Misses.*

The figures show the memory performance of Ultrix and Mach.

(a) Explain MCPI

(b) Explain capacity miss

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(c) Explain conflict miss

(d) From Figures 3 and 4 what can you conclude about the Mach Microkernel? Why?

3. (5 min, 10 points) (OS structures - conceptual)
Place the letters S (for Spin), E (for Exokernel), or L (for L3) in the space provided to identify to which microkernel the particular attribute best applies to.

Secure bindings in the Kernel   _____

Language enforced co-location of
kernel and extensions   _____

Logical protection domains   _____

Exploit hardware to the maximum in
Kernel abstractions   _____

Runtime extension of the kernel by
Downloading code   _____

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4. (5 mins, 9 points) (Ensemble – conceptual)
Mention at least three advantages of component based design of large
software systems.
(Bullet points preferred than long essay)

5. (10 min, 10 points) (Parallel system synchronization – conceptual)
Answer True or False (circle one or the other)

(a) In Anderson's array-based lock algorithm, all processors spin on the
same shared memory location.
        True   False

(b) MCS lock algorithm respects FIFO ordering of lock requesters.
        True   False

(c) In the ticket lock algorithm, all processor spin on distinct memory
locations.
        True   False

(d) MCS lock algorithm is more optimal with respect to space requirements
than Anderson's lock algorithm.
        True   False

(e) Ticket lock algorithm does not respect FIFO ordering of lock requesters.
        True   False

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6. (15 min, 10 points) (Xen - problem)
Each user process in XenoLinux represents a protection domain and occupies the same virtual address space 0 through VMMAX, where VMMAX is some system defined limit of virtual memory per process. XenoLinux itself is a protection domain on top of Xen and contains all the user processes within it. In other words, conceptually, XenoLinux is a protection domain which in turn contains the distinct protection domains corresponding to all the user processes. Explain how this two level protection domain structure is implemented with para-virtualization of Xen. Use illustrative figures to explain how user processes, guest OS (XenoLinux), and Xen all co-exist.

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7. (5 min, 9 points) (Active Networks – conceptual)
Give at least three security concerns with using active networks.
(Bullet points preferred than long essay)

8. (15 min, 13 points) (LRPC – conceptual and problem)
a) What are the arguments given by the authors for the need for optimizing
   cross domain RPC within a single machine?

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b) Assume a server exports a function:

int foo(int a[30]; float b[20]);

Assume that the client has already imported the function and bound to it.

Sketch the details of an actual call from the client to the procedure **foo** clearly detailing what interaction goes through the kernel and what interactions directly happen between the client and the server. Use figures to explain how arguments are passed and results are received.

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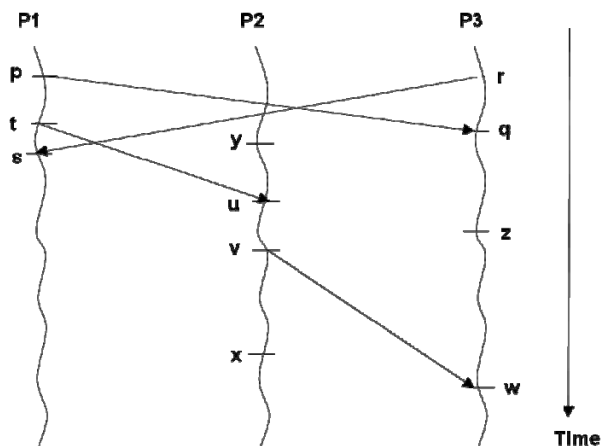
9. (5 min, 9 points) (Tornado – conceptual)
Present at least three advantages of clustered object as a system
structuring tool for building multiprocessor OS.
(Bullet points preferred than long essay)

10. (10 min, 10 points) (Lamport clock - problem)

Given the following events in a distributed system answer the questions
below indicating if the events are concurrent (||) or satisfy the
Lamport's "happened before" (⟶) partial order.

(i) s   v   (ii) q   x   (iii) s   q (iv) p   w

(v) t   w

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11.(5 min, 9 points) (Thekkath-Levy, Limits to communication - conceptual)
Give at least three sources of overhead that lead to a disparity between the
performance of communication software and pure hardware speeds of networks.
(Bullet points preferred than long essay)