

CS 2200 Spring 2010 Final Exam

Name: _____ GT Number: _____

Problem	Points	Lost	Gained	Running Total	TA
1	1				
2	9				
3	8				
4	12				
5	10				
6	12				
7	8				
8	8				
9	12				
10	14				
11	6				
Total	100				

You may ask for clarification but you are ultimately responsible for the answer you write on the paper.

Please look through the entire test before starting. WE MEAN IT!!!

Illegible answers are wrong answers.

Show your work in the space provided to get any credit for problem-oriented questions.

Good luck!

1. (1 point, 1 min)

The term "booting up a computer" comes from

- (a) the urge to kick it when it malfunctions
- (b) the fact that a computer fits in the boot of a car
- (c) the availability of many bootleg software for a computer
- (d) picking up oneself by the bootstrap
- (e) who cares?
- (f) _____ (your interpretation)

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Memory management

2. (9 points, 10 mins)

(a) (4 points) Distinguish between static and dynamic relocation.

(b) (5 points)

For the sentences below that pertain to demand-paged virtual memory found in modern processors, fill in the blanks with **True** or **False**.

Page table is implemented in hardware inside the CPU _____

Page table is a data structure in memory _____

Address translation is done in software _____

Address translation is done in hardware _____

There is one page table per process _____

There is one common page table for all processes _____

There is one page table base register in the CPU _____

There is one page table base register in the CPU for each process _____

Page table entries are set up dynamically at runtime _____

Page table entries are set up at boot time _____

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Memory hierarchy

3. (8 points, 10 min)

(a) (4 points) Distinguish between write-through and write-back cache policies.

(b) (4 points) (Fill in the blanks)

In a Virtually Indexed Physically Tagged cache, the _____
is generated from the page-offset portion of the virtual address, and the
_____ is generated from the VPN portion of the virtual address.

4. (12 points, 15 min)

Consider a pipelined processor that has an average CPI of 1.8 without accounting for memory stalls. I-Cache has a hit rate of 95% and the D-Cache has a hit rate of 98%. Assume that memory reference instructions account for 30% of all the instructions executed. Out of these 80% are loads and 20% are stores. On average, the read-miss penalty is 20 cycles and the write-miss penalty is 5 cycles.

(a) (3 points)

What is the average memory stall (in CPU cycles) incurred per instruction due to instruction misses in the cache?

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(b) (3 points)

What is the average memory stall (in CPU cycles) incurred per instruction due to data read misses in the cache?

(c) (3 points)

What is the average memory stall (in CPU cycles) incurred per instruction due to data write misses in the cache?

(d) (3 points)

What is the effective CPI of the processor?

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I/O and disk scheduling

5. (10 points, 10 min)

(a) (5 points) For each sentence below, fill in the blank with **True** or **False**.

An input device that uses programmed I/O, usually requires a large buffer in the controller to hold the data received from the device. _____

Use of DMA for data transfer assures no data loss. _____

DMA is used for devices that are much faster than the CPU. _____

Programmed I/O is usually used for slow speed devices. _____

A CD-ROM drive is an example of a device that would use DMA. _____

(b) (5 points)

Given the following:

Total number of cylinders in the disk = 200 (numbered 0 to 199)

Current head position = cylinder 23

(Note: **The head assembly has been moving from cylinder 0 towards cylinder 199**)

Current requests in order of arrival = 20, 17, 55, 35, 25, 78, 99

Show the schedule for LOOK disk scheduling algorithms for the above set of requests. Use a figure to make your answer clearer.

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File systems

6. (12 points, 15 min)

(a) (3 points)

Fixed contiguous allocation of disk space results in (choose one of the following)

- 1) Good sequential access
- 2) Good random access
- 3) Ability to grow the file easily
- 4) Poor disk utilization
- 5) Good disk utilization
- 6) {1 and 2}
- 7) {3 and 5}
- 8) {1, 2, and 4}

(b) (9 points)

Notes:

- Unix "**touch file1**" command creates a zero byte new file
- Unix "**ln file1 file2**" command creates a hard link
- Unix "**ln -s file1 file2**" command creates a sym link

Fill in the table below. The reference count in the table pertains to the i-node that is affected by the command in that row. If a new i-node is created, show the old reference count for that i-node as 0.

Command	New i-node created (yes/no)	Reference count	
		old	new
touch f1			
ln f1 f6			
ln f6 f7			
ln -s f1 f2			
ln -s f2 f3			
ln f3 f8			

Use this area for rough work for this question.

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7. (8 points, 15 min)

Consider an indexed allocation scheme for a disk:

Size of a cylinder	= 4000 Kbytes
Size of i-node	= 512 bytes
Size of pointer in an i-node to a data block	= 8 bytes
Size of a data block	= 2 cylinders

(Note: **K** = **1024**; The i-node contains only pointers to data blocks)

(a) What is the minimum amount of space used for a (non-zero length) file on this system?

(b) What is the maximum file size possible with this allocation scheme?

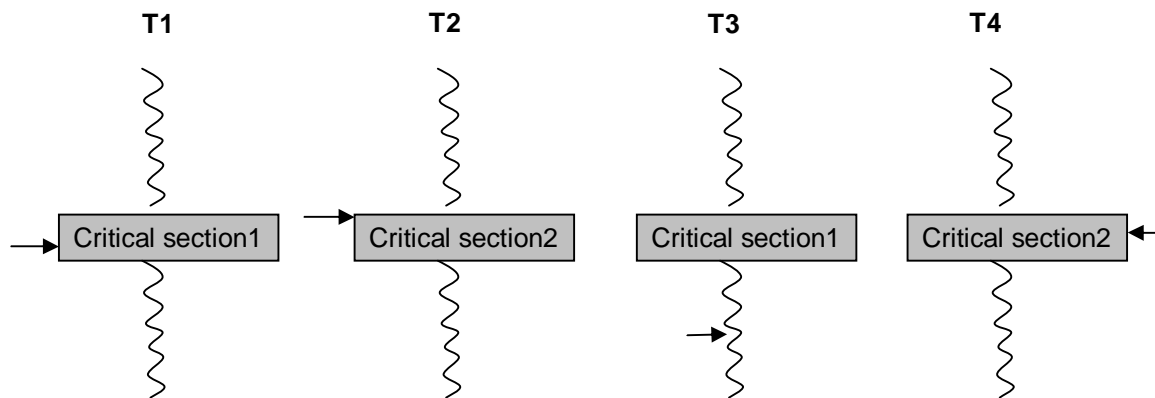
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Parallel systems

8. (8 points, 10 min)

Given the points of execution of the threads (indicated by the arrows) in the figure below, state which ones are active and which ones are blocked and why. Note that distinct locks govern each of critical sections 1 and 2, respectively. T1-T4 are threads of the same process.



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9. (12 points, 15 min)

(a) (6 points)

Use the following phrases to fill in the blanks. Note, **not all phrases are needed**, and **no phrase may be used more than once**:

TLB	page table	memory hierarchy
mutual exclusion	virtual address	disk map
physical memory location	atomicity	frame table
synchronization operations	address space	

To support multithreading in a shared memory multiprocessor system, the hardware and the operating system together have to ensure that (1) Threads of the same process share the _____ for _____ translation; (2) Threads of the same process have identical views of the _____ despite being on different processors when they access the same _____; and (3) Threads are guaranteed _____ for _____ while executing concurrently.

(b) (3 points)

Keeping the TLBs consistent in an SMP

- (1) Is the responsibility of the user program
- (2) Is the responsibility of the hardware
- (3) Is the responsibility of the operating system
- (4) Is impossible

(c) (3 points)

Deadlock

- (1) Is a condition where threads are not using mutex locks
- (2) Is a condition where all the locks variables are in use
- (3) A lock variable that is dead
- (4) Is a condition where one or more threads are waiting for an event that will never happen
- (5) None of the above

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Networking

10. (14 points, 15 min)

(a) (4 points)

Assume that the network loses 1 in 5 packets on an average. For a message that consists of 100 packets, determine the total number of packets sent by the sender to successfully complete the message transmission. Ignore fractional packet loss.

(b) (10 points)

Given the following:

Packet size	=	20 Kbits
Bandwidth on the wire	=	400,000 bits/sec
Time of flight	=	48 milliseconds
Sender overhead	=	1
Receiver overhead	=	1

(Note: $K = 10^3$)

Considering only a single packet, what is the observed throughput of the network?

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11. (6 points, 10 min)

Consider the following figure. How many IP networks are in this Figure? Assume that the top 24 bits of the 32-bit address name an IP network. Explain your answer to get full credit.

