CS 2200 Spring 2009 Sec A Final Exam

Name:_____GT Number: _____

Problem	Points	Lost	Gained	Running Total	TA
1	1				
2	10				
3	9				
4	5				
5	10				
6	5				
7	5				
8	5				
9	5				
10	15				
11	5				
12	10				
13	5				
14	10				
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)
How many chapters does the required textbook for CS 2200 have?
(a) 10
(b) 12
(c) 14
(d) 16
(e) There is a textbook for the course?

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Memory hierarchy
2. (10 points, 10 mins)
(a) Explain spatial locality. How is it used in cache design?

(b) Explain temporal locality. How is it used in cache design?

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3. (9 points, 10 min)
Memory address = 32 bits (little-endian) byte-addressed
Total cache size = 512 Kbytes
Organization:
- 4-way set associative
- 16 byte block size

(a) (6 points) Show the bit positions in the following figure for the way the memory address is interpreted by the cache subsystem

___ ___ ___ ___ ___ ___

Show your work for partial credit.

(b) (3 points) Explain why write-back policy may be preferred over write-through for the cache

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I/O and Disk scheduling

4. (5 points, 5 minutes)
Explain the difference between programmed I/O and DMA.

5. (10 points, 10 min)
Given the following specifications for a disk drive:

- 256 bytes per sector
- 12 sectors per track
- 20 tracks per surface
- 3 platters
- Average seek time of 8 ms
- Rotational speed 15000 RPM
- Normal recording

On an average, how much time would it take to read 6 contiguous sectors from the same track?

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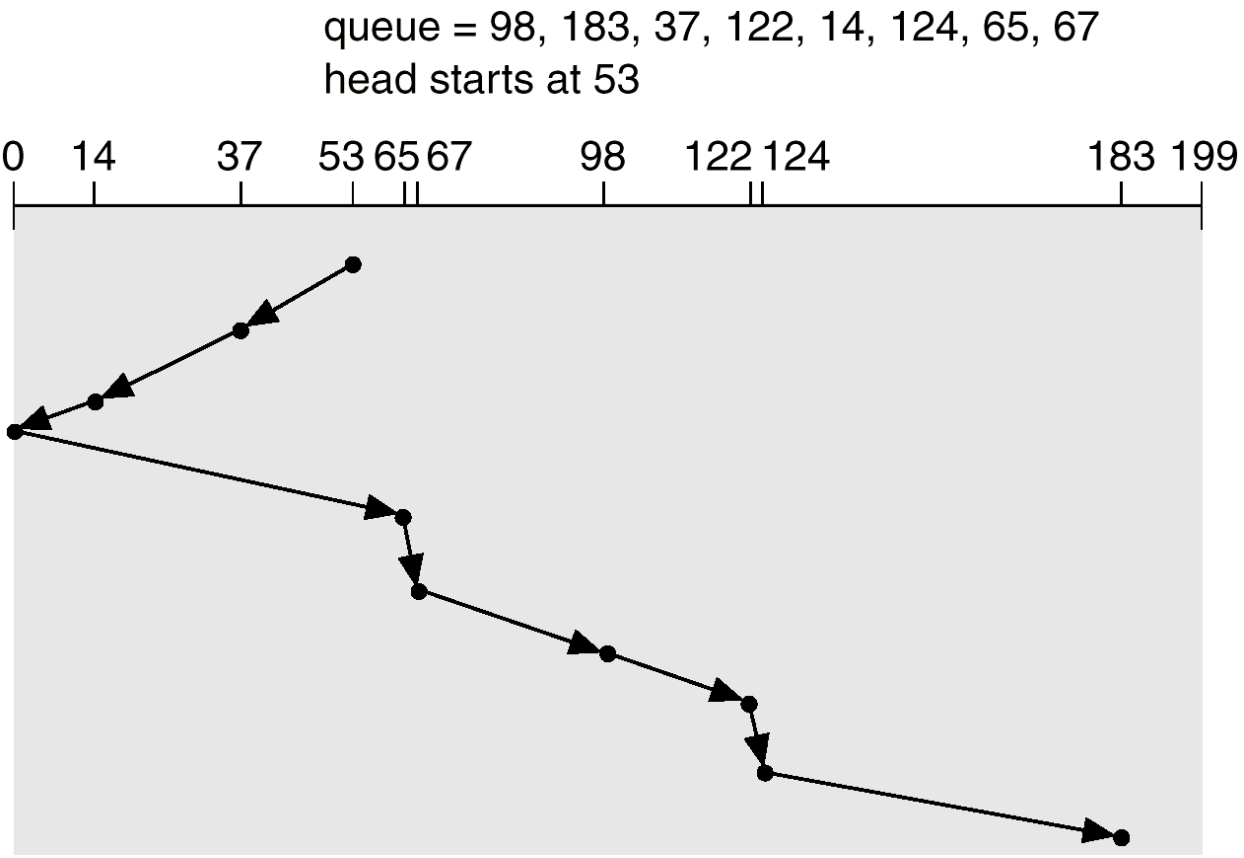
6. (5 points, 5 min)
Consider the head movement as shown in the figure below to satisfy a set of disk requests currently in the queue as shown below:



The disk schedule as pictured above corresponds to (choose one of the following)

1) FCFS
2) Shortest seek time first
3) SCAN
4) C-SCAN
5) LOOK
6) C-LOOK

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File System

7. (5 points, 5 min)
Linked allocation of disk space results in (choose one of the following)
   1) Bad 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. (5 points, 5 min)
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}

9. (5 points, 5 min)
Consider:

```
touch f1          /* create a file f1 */
ln –s f1 f2       /* sym link */
ln –s f2 f3
ln f1 f4          /* hard link */
ln f4 f5
```

(a) How many i-nodes will be created by the above set of commands?

(b) What is the reference count on each node thus created?

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Symmetric Multiprocessor
10. (15 points, 10 min)
Given the following details about an SMP (symmetric multiprocessor):
Cache coherence protocol: **write-invalidate**
Cache to memory policy: **write-back**

Initially:
The caches are empty
Memory locations:
C contains 31
D contains 42

Consider the following timeline of memory accesses from processors P1, P2, and P3.

Time (in increasing order)	Processor P1	Processor P2	Processor P3
T1		Load C	Store #50, D
T2	Load D	Load D	Load C
T3			
T4		Store #40, C	
T5	Store #55, D		

Fill the table below, showing the contents of the cached after each timestep. We have started it off for you by showing the contents after time T1.
(**I indicates the cache location is invalid. NP indicates not present**)

Time	Variables	Cache of P1	Cache of P2	Cache of P3	Memory
T1	C D	NP NP	31 NP	NP 50	31 42
T2	C D				
T3	C D				
T4	C D				
T5	C D				

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11. (5 points, 10 min)
Given the following threads and their execution history, what is the final value in memory location x? Assume that the execution of each instruction is atomic. Assume that Mem[x] = 0 initially.

Thread 1 (T1)	**Thread 2 (T2)**
Time 0: R1 <- Mem[x]	
	Time 1: R2 <- Mem[x]
Time 2: R1 <- R1+2	
	Time 3: R2 <- R2+1
Time 4: Mem[x] <- R1	
	Time 5: Mem[x] <- R2

Network
12. (10 points, 10 min)
Given the following:
Message size = 100,000 bytes
Header size per packet = 100 bytes
Packet size = 1100 bytes
How many packets are needed to transmit the message assuming a 10% packet loss? Ignore fractional packet loss. Ignore ACKs. Show your work for partial credit.

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13. (5 points, 10 min)
The following are the sizes of the fields of a packet header:

Destination address	8 bytes
Source address	8 bytes
Number of packets in message	4 bytes
Sequence number	4 bytes
Actual packet size	4 bytes
Checksum	4 bytes

Assuming that the maximum packet size is 1100 bytes, what is the maximum payload in each packet?

14. (10 points, 10 mins)
Given the following:

Sender overhead	= 1 ms
Message size	= 200,000 bits
Wire bandwidth	= 100,000,000 bits/sec
Time of flight	= 2 ms
Receiver overhead	= 1 ms

Compute the observed bandwidth. Recall that the message transmission time consists of sender overhead, time on the wire, time of flight, and receiver overhead. Ignore ACKs.