Name_____SAMPLE_____
Last 4 digits of Student ID_____

CSE 3320 GRADE:_____/100
Operating Systems
Exam 3, Fall 2012 (Last)

Please read this:
This is a closed book, closed notes exam. You may, however, use one sheet of notes. Use a dark ink (or pencil) and print answers on the test paper following the question or on separate paper. Please **do not write on the back of sheets** of paper **or** on the **back of the exam**. Please **keep answers to questions together** and try to avoid continuing answers off the page. Please answer the questions in a **few keywords**, complete sentences are not necessary, **be brief**! Please put your name on each page. Turn in all pages of the test. **Write** your answers **legibly**. Unreadable answers will be counted wrong. Make sure you have all pages of the test.
Read each question **carefully** (twice) and be sure your answer addresses the question. Overly general (non-specific) answers will be counted wrong. If any part of an answer is incorrect (even if other parts are correct) points will be deducted.
Point values are given for each question. The exam has a total of 100 points.
Please turn in the exam promptly when called for. **Late exams will have points deducted**.

"Explain" - means briefly describe why - just a few words.

You do not need to calculate the final result - just show the calculation, and your reasoning.

1. [25 pts] Short Answer:
   (a) In both Windows and Linux when you are installing the OS you have a choice where the swap (for virtual memory) goes: (1) on a separate disk (swap disk) or (2) a file on the Windows disk (swap file).
   (a.1) Which would be faster?

   (a.2) Other than speed, give one advantage of picking swap disk ***OR*** swap file.

   (b) Many systems with multiple disks (for example 8 disks) use simple striping for the file system (this is RAID 0).
   (b.1) For a very large file, ***how much*** slower or faster would you expect striping across 8 disks to be, compared to putting the file on one disk?

   (b.2) Other than speed, what is one disadvantage to using simple striping?

   (c) For one disk, the read/write head is currently on track 100, and the following Disk track requests are already in the queue: 98, 110, 30, 110, 96, 99, 120, 40. Please give the order these requests are serviced for:
   (c.1) FCFS (FIFO):

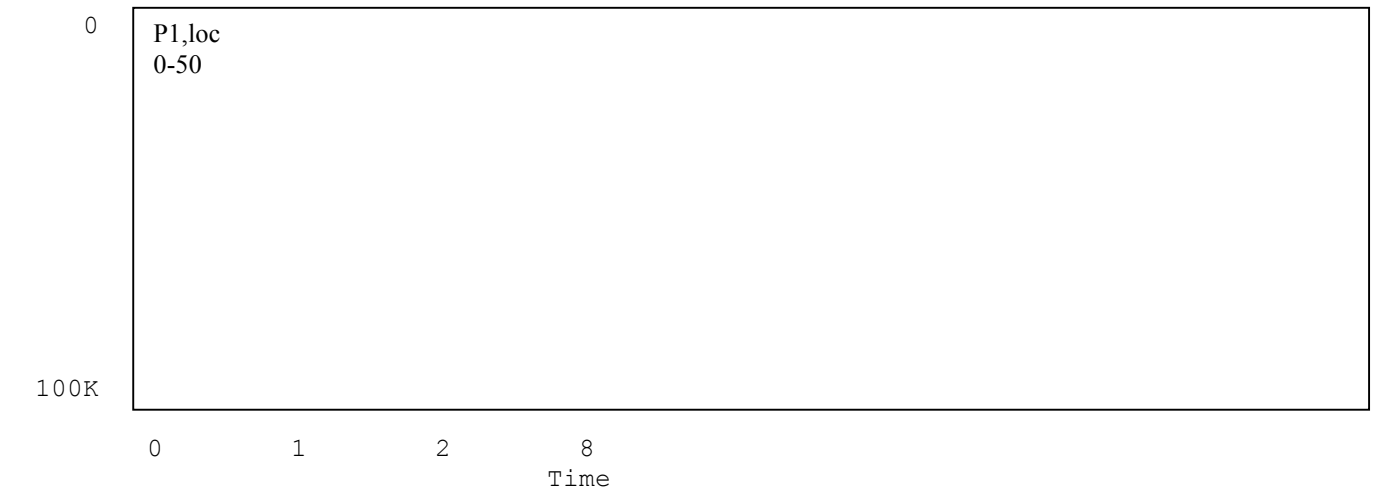
   (c.2) LOOK (Elevator):

   (c.3) Which method minimizes disk arm movement? Which is most "fair"? Why?

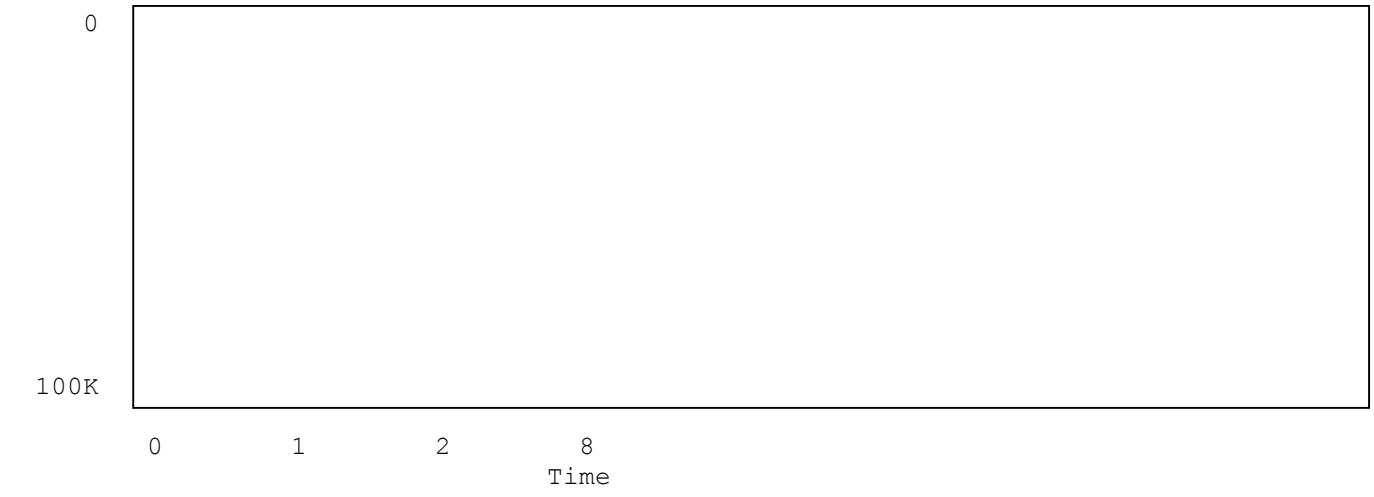
2. [20 pts]
The following is a list of processes:

Process #	Arrival Time	Memory Size	Running Time
1	0	50K	5
2	1	10K	20
3	2	30K	10
4	8	10K	20
5	14	10K	12
6	15	50K	5
7	16	50K	1

The total memory available for processes is 100 KB, (for a and b)processes remain in memory until they terminate (arrival time+wait time+running time), they can not be relocated. Assuming memory starts at location 0, for
(a) First fit, and (b)best fit; describe which memory locations are occupied, in order.
(a) First fit



(b) Best fit



(c) In a Virtual Memory OS for the same 100K real memory, where pages are 256 bytes in size and memory addresses are 20 bits:
(1) How much virtual memory (addressable) space is available?

(2) How many entries are in the page table (maximum)?

(3) How would 20-bit addresses be used (how many page bits, how many offset bits)?

(4) If it takes 5 ms (5×10^{-3} sec) to read or write a page to disk and it takes 10 ns (10×10^{-9}) to read or write memory, and the hit rate of memory is 98%, what is the ***average*** memory access time (with VM)?

3. [15 pts]
In your file system programming assignment, if a sector (block) size was 1 KB, and there are 256 entries in the directory (everything else remains the same):
(a) What is the largest size a single file may be? (show calculations)

(b) What are the maximum number of files that may be stored in your file system?

(c) If possible, please give an example of a file where inserting one character would not increase the space of the file stored in your file system.

(d) A very common security vulnerability (attack) against a file system like yours is to try to change a file name to a very, very long name string. If you didn't check for this case, what type of attack is this called?
What would be the result if successful? (Briefly explain.)

4. [25 pts] Short Answer:
(a) On most OSs the recommendation for login passwords is at least 8 characters with a mixture of letters, numbers and punctuation.
(1) Why?

(2) Is an 10 character password composed of only letters worse than the mixture (described above)? Why?

(3) In Unix (and most OS) where are passwords stored, and how are they used to authenticate someone?

(b) There are two disks available for a computer system: D1 - a disk with 100 sectors/track, 200 tracks, and one platter; and
D2 - a disk with 200 sectors/track, 100 tracks, and one platter
both disks spins at 7200 RPM and have a .005 sec average seek time and sectors are 1KB in size.

(1) For a big file (5 MB, best case) which disk is fastest (to read), and which is slowest? Why?
(2) For a small file (100 bytes) which disk is fastest, and which is slowest? Why?
(3) In total (raw) capacity, which disk is largest, and which is smallest? Why?
(4) For D1, how long would it take, on average, to read a one byte file?
(5) To use (all) disk D2, would you need to modify your file system program? If so, how?
(6) If you created a 4 disk (total) mirrored RAID of disks D1,
(6.a) What is the total **file** storage capacity (size)?
(6.b) How many disks can fail, if any, (worst case) and we can still recover data?

(c) On a 200 GB capacity disk you have the option of formatting sector size to be either 512 bytes per sector or 8K bytes per sector. Please give one advantage for each choice: 512 bytes and 8 KB.

(d) Alice wants to send an encrypted message to Bob. She may choose a (1)symmetric key (shared) or (2) asymmetric key (public) algorithm. For each case: (1) how many keys, in total are used and

(2) how do Alice and Bob use those keys to encrypt and then read the message?

5. [15 pts] Networking:

(a) Since every device (computer,phone,etc.) has a (MAC) addresses built into the hardware why not use (only) that address (not the IP address) in a large network?

(b) Briefly, what does the “Network Layer” in a network do? Please give an example of a Network Layer protocol.

(c) In TCP/IP do (all) the packets in a message from computer A to computer B use the same path (route)? Why?