CoEn 177 Fall 2012 Final Examination - Section 01

Tuesday 4th December 2012

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<u>Engineering Honor Code:</u> "All students taking courses in the School of Engineering agree, individually and collectively, that they will not give or receive unpermitted aid in examinations or other coursework that is to be used by the instructor as the basis of grading"

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Student Signature

- This exam is closed-everything (this includes notes, PDAs, and phones), please note and acknowledge the honor code above.

- You may use calculators, but you do not need to simplify numerical answers, so please do not use the calculator apps on phones.

- Attempt all questions, and show partial work.

- If you are unsure of the meaning of a question, feel free to ask the instructor for clarification, or if you are still uncertain … please be sure to state any assumptions you need to make.

- Explicitly state any assumptions you make when answering a question.

- Good Luck!

Login Name:

Question 1 (5 pts): What is the benefit of employing C-SCAN instead of SCAN for disk head scheduling?

Question 2 (10 pts): Assume that you have a disk with 16 tracks, and the head is parked on track 4. It takes 1 time unit to move the head from a track to an adjacent track. At time *t=0* we have a queue of requests for blocks on tracks 2, 6, 6, 9, 7, 11, 5, 3, 4. All these tracks need to be visited, and no new requests arrive. How much time will it take to visit all the tracks requested above using each of the following algorithms (when you need to, assume activity is only performed as the arm moves towards higher-numbered tracks):

a) SSTF

b) SCAN

c) C-LOOK

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Question 3 (12 pts): Given the following page access sequence, count the page faults for each of the following memory capacities and replacement algorithms. Access sequence: `0, 1, 2, 3, 4, 0, 2, 3, 0, 0, 1, 1, 1, 2, 3, 3, 1, 7, 8, 8, 7, 7, 6, 5, 6`

a) using LRU Page Replacement, and a 3-page memory
b) using LRU Page Replacement, and a 24-page memory
c) using Second Chance Page Replacement, and a 3-page memory

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Question 4 (12 pts): The block size of a file system is 8K bytes (a character occupies one byte). Each disk can have no more than 16 Exa (16 x 2^{60}) blocks (not bytes … that's the total number of **blocks**). Assume that the file system described above uses *i-nodes*, and that each is a single block, and has 2-K bytes of attribute/header information (the remaining space in the block is used for index pointers). What is the maximum file size you can represent ***on a single disk*** (you need to calculate the size of a block pointer for such disks) if these pointers are:

a) all direct pointers?

b) all single-indirect pointers?

c) all triple-indirect pointers?

d) Finally, what is the maximum file size if an allocation table is used instead of index nodes? (Hint: the pointers in the allocation table, i.e., its entries, are each the same size as pointers that you would use with an index node).

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Question 5 (4 pts): A disk head is at track 10, and an lseek() system call is made. The file system uses a RAM-resident allocation table, and has a single directory that is always cached in RAM. The new current position of the file can be located on a sector on track 1010. If a disk arm can move 100 tracks per millisecond, how long is the **minimum** delay for returning from this lseek() system call? from a subsequent read() system call?

Question 6 (5 pts): LRU is impractical for virtual memory page replacement, but practical for storage caches. Why is this true?

Question 7 (6 pts): PGP uses public key encryption, secret key encryption, and one way secure hash algorithms. Why does it need the secret key algorithm (i.e., the symmetric key algorithm)?

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Question 8 (8 pts): ***TRUE/FALSE***

a) **[2pts]** We can store file attributes in an index node, but not in a typical allocation table.

b) **[2pts]** DMA-driven I/O results in less load on the main CPU than programmed I/O.

c) **[2pts]** An operating systems designer claims that his operating system has an authentication mechanism that cannot be thwarted or bypassed in any way. It turns out that his claim is true, and so we should believe that this operating system is therefore secure.

d) **[2pts]** You can create a secure operating system using encryption. And by "secure" we mean an operating system guaranteed to be free of security vulnerabilities.

Question	Possible	Grade
1	5	
2	10	
3	10	
4	12	
5	4	
6	5	
7	6	
8	8	
	60	

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