考 試 科 目 計算機概論　所 別 資訊科學系碩士在職專班　考 試 時 間 3月14日 星期六 第四節

1. (20%) Let $f(n)$ and $g(n)$ be asymptotically positive functions. Prove or disprove each of the following conjectures.

   (a) $f(n) = O(g(n))$ implies $g(n) = O(f(n))$.

   (b) $f(n) + g(n) = \Theta(min(f(n), g(n)))$.

   (c) $f(n) = O(g(n))$ implies $\lg(f(n)) = O(\lg(g(n)))$, where $\lg(g(n)) \geq 1$ and $f(n) \geq 1$ for all sufficiently large n.

   (d) $f(n) = O(g(n))$ implies $2^{f(n)} = O(2^{g(n)})$.

2. (20%) Use a recursion tree to determine a good asymptotic upper bound on the recurrence $T(n) = 3T(\lfloor n/2 \rfloor) + n$. Use the substitution method to verify your answer.

3. (20%) Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)? Which algorithm makes the most efficient use of memory?

4. (10%) Consider a demand-paging system with a paging disk that has an average access and transfer time of 20 milliseconds. Addresses are translated through a page table in main memory, with an access time of 1 microsecond per memory access. Thus, each memory reference through the page table takes two accesses. To improve this time, we have added an associative memory that reduces access time to one memory reference, if the page-table entry is in the associative memory. Assume that 80 percent of the accesses are in the associative memory and that, of the remaining, 10 percent (or 2 percent of the total) cause page faults. What is the effective memory access time?

5. (20%) For the following, assume that no data compression is done; this would in practice almost never be the case. For (a)-(c), calculate the bandwidth necessary for transmitting in real time:

   (a) Video at a resolution of 640 × 480, 3 bytes/pixel, 30 frames/second.
   (b) 160 × 120 video, 1 byte/pixel, 5 frames/second.
   (c) CD-ROM music, assuming one CD holds 75 minutes' worth and takes 650 MB.
   (d) Assume a fax transmits an 8 × 10-inch black-and-white image at a resolution of 72 pixels per inch. How long would this take over a 14.4-Kbps modem?

備 考　試 題 隨 卷 繳 交

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6. (10%) Suppose we have the forwarding tables for nodes A and F, in a network where all links have cost 1. Give a diagram of the smallest network consistent with these tables.

A		
Node	Cost	NextHop
B	1	B
C	2	B
D	1	D
E	2	B
F	3	D

F		
Node	Cost	NextHop
A	3	E
B	2	C
C	1	C
D	2	E
E	1	E

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