

國立中山大學 107 學年度碩士暨碩士專班招生考試試題

科目名稱：作業系統與資料結構【資工系碩士班甲組】

題號：434003

※本科目依簡章規定「不可以」使用計算機(問答申論題)

共 2 頁第 1 頁

1. [Process Management: 15%]
 - (1) Explain the two basic models of inter-process communication. (4%)
 - (2) When will a race condition occur? (2%)
 - (3) What are the three requirements that a critical-section solution should meet? (3%)
 - (4) What is the difference between deadlock prevention and deadlock avoidance? (4%)
 - (5) When will priority inversion occur in process synchronization? (2%)
2. [Memory Management: 15%]
 - (1) What device deals with address translation? In which case we will not use this device? (3%)
 - (2) Please give two benefits of using paging. (4%)
 - (3) Does any system use the optimal page replacement method? Why or why not? (2%)
 - (4) Let average page-fault time and memory-access time be $70\mu s$ and $250ns$, respectively. What is the expected page-fault rate if we want to get effective access time smaller than $285ns$? List your calculation. (4%)
 - (5) What is reentrant code? (2%)
3. [Storage and I/O Management: 15%]
 - (1) When a file is opened, what are the four items of file information kept in UNIX? (4%)
 - (2) Consider a disk queue with requests for I/O to blocks on cylinders 100, 185, 40, 120, 2, 138, 75 and 87. Let the disk head currently stay at cylinder 60, and the maximum cylinder be 200. Please give the results of SSTF and C-LOOK scheduling methods. (6%)
 - (3) How does the parity bit work in RAID? (2%)
 - (4) Give three methods for CPU to know whether data are ready in an I/O device. (3%)
4. [Protection and Security: 15%]
 - (1) What is the principle of least privilege? How does Sun Microsystems OS implement it? (4%)
 - (2) Why language-based protection may not be secure? (3%)
 - (3) How do polymorphic and tunneling viruses bypass the detection of antivirus software? (4%)
 - (4) How does the digital-signature algorithm work? (2%)
 - (5) How does DDoS work? (2%)
5. [Basic Data Structures: 15%]
 - (1) Consider a binary tree. Suppose that its DFS result is "c, b, e, f, d, h, i, g, k, a, j" while BFS result is "c, b, g, e, d, k, j, f, h, i, a". Please draw the tree. (3%)
 - (2) Given the postfix of an equation " $2\ 4\ +\ 6\ \times\ 9\ 8\ -\ 3\ 5\ +\ \times\ -$ ", please compute its result. List your calculation. (3%)
 - (3) What is a binary search tree? Explain its property. (2%)
 - (4) Except that every node is either red or black, how can you make a binary search tree become a red-black tree? (4%)
 - (5) Show that the worst-case complexity of quicksort is $O(n^2)$. (3%)
6. [Advanced Data Structures: 15%]
 - (1) Given an n -key B-tree with minimum degree t , what is the upper bound of tree height? Prove the correctness of your answer. (8%)
 - (2) What is a B*-tree? (2%)
 - (3) Given a binomial tree B_k , show that there are exactly $C(k, i)$ nodes at depth i , where $C(k, i)$ denotes a combination function. (5%)

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7. [True/False Question: 10%] Please mark 'O' or 'X' to answer each question.

- (1) The average-case time complexity of selection sort is $O(n \lg n)$. (1%)
- (2) LIFO and FIFO policies can be implemented by queues and stacks, respectively. (1%)
- (3) A hash has no inverse functions. (1%)
- (4) A red-black tree with k internal nodes has height no more than $2\lg(k-1)$. (1%)
- (5) A tree contains no cycles. (1%)
- (6) Threads in the same process can directly share memory and common variables. (1%)
- (7) In any case, a user process is prohibited to use kernel data structures. (1%)
- (8) A hard real-time OS can be implemented by preemptive, priority-based scheduling. (1%)
- (9) The wait-die scheme is a preemptive-based solution for deadlock prevention. (1%)
- (10) Write-through policy is more reliable than write-back policy for caches. (1%)