

國立中山大學 105 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)

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1. [Process and Synchronization: 10%]

- (1) What is the priority inversion problem? How can we solve this problem? (4%)
- (2) Please explain how a deadlock avoidance scheme works? (3%)
- (3) Please give three necessary conditions for any solution to the critical-section problem. (3%)

2. [File System and I/O: 10%]

- (1) What is a mount point? (2%)
- (2) What is the advantage of multilevel naming? (2%)
- (3) What are the two parts of the random-access time for a magnetic disk? (2%)
- (4) Please explain the two interrupt request lines for a CPU? (4%)

3. [Memory Management: 15%]

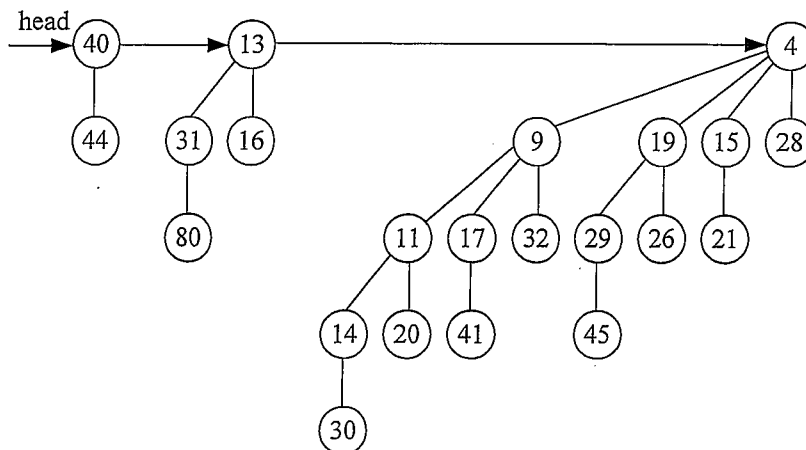
- (1) Please explain the three common solutions to the dynamic storage allocation problem in memory. (6%)
- (2) What are the purposes of MMU and TLB? (2%)
- (3) Show that a stack algorithm will never encounter the Belady's anomaly. (4%)
- (4) How does the Buddy system work to allocate kernel memory? (3%)

4. [Protection and Security: 15%]

- (1) Please give three methods to implement a protection domain and explain when domain switching will occur in each method. (3%)
- (2) Please list the advantages of using language-based protection. (4%)
- (3) What is the difference between a computer virus and a computer worm? (4%)
- (4) In asymmetric encryption, how do you realize key distribution? (2%)
- (5) What is the difference between signature-based and anomaly detection? (2%)

5. [Hash and Heap: 10%]

- (1) Supposing that we store n keys in a hash table with size of n^2 by a universal hash function, prove that the collision probability is less than 0.5. (5%)
- (2) Given a binomial heap below, please show the result of extracting the node with minimum key. (5%)



6. [Search and Sort: 10%]

- (1) What is the major property of a binary search tree? (2%)
- (2) Given a set of numbers 8, 2, 7, 9, 14, 16, 3, 1, 4, and 10, draw the heap used by the heapsort method. (5%)
- (3) Prove that the best-case complexity of the quicksort method is $O(n \lg n)$. (3%)

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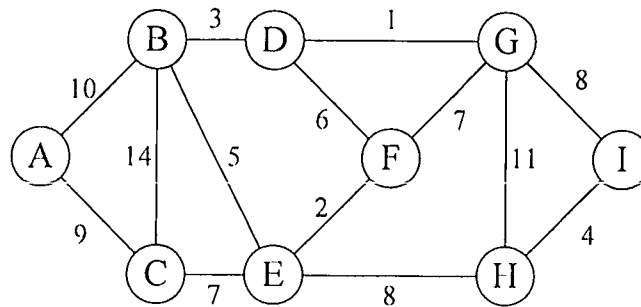
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7. [Trees: 15%]

- (1) What are the two major properties of a tree? (2%)
- (2) Prove that any red-black tree with k internal nodes can have a height no more than $2\lg(k+1)$. (10%)
- (3) Explain three variants of a B-tree: B⁺-tree, B*-tree, and 2-3-4 tree. (3%)

8. [Graphs: 15%]

Given a graph below, please answer the following questions, where you should denote an edge between two vertices i and j by (i, j) .



- (1) Starting from node E, give the sequence by bread-first-search. If you have multiple choices, just follow the alphabetical order. (3%)
- (2) Starting from node D, give the sequence by depth-first-search. If you have multiple choices, just follow the alphabetical order. (3%)
- (3) Show the result by the Kruskal's algorithm. (3%)
- (4) Starting from node I, show the result by the Prim's algorithm. (3%)
- (5) Show the minimum connected dominating set. (3%)