

國立台灣科技大學九十五學年度碩士班招生試題

系所組別：資訊管理系碩士班甲組

科目：資料結構

(本試卷共七大題，滿分共計100分)

1. (a) The topological sort algorithm can determine the processing sequence of a directed acyclic graph like Fig.1. Design an efficient data structure representing the DAG graph for facilitating the implementation of the topological sort algorithm. Use Fig.1 to illustrate your data structure. (5%)
(b) State the topological sort algorithm incorporating your data structure and using the queue data structure to store the "ready" node. (10%)
(c) Analyze the complexity of the topological sort algorithm. (5%)

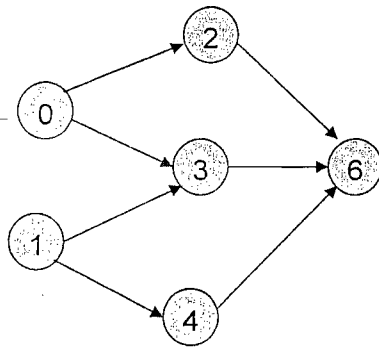


Fig. 1

2. An unsorted sequence 26, 05, 77, 01, 61, 11, 59, 15, 48, 19 is stored in an array and to be sorted in increasing order.
 - (a) Write the contents of the array in the first two passes of heap sort. (10%)
 - (b) Write the contents of the array in the first pass of radix sort. (5%)
 - (c) Prove that any algorithm that sorts by comparisons only must have a worst case computing time $\Omega(n \log_2 n)$. (5%)
3. Show the final AVL tree after successively inserting the keys 2, 7, 8, 1, 3, 6, 4, 5, 9, 10 into an initially empty AVL tree. (10%)



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4. (a) Given a binary tree as shown in the following, write a *recursive* function *count_node* that counts the number of nodes in the tree. (10%)

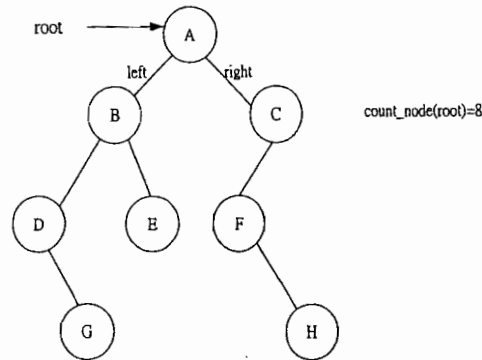


Fig. 2

- (b) With Fig. 2 as the input, write down, respectively, the outputs of *postorder traversal* and *level order traversal of the tree*. (10%)

5. Assume that $A = 3$, $B = 5$, $C = 6$, $D = 48$. Compute the value of the following expressions:

- (a) $ABC + *CBA - +*$ (5%)
 (b) $/* + ABCD$ (5%)

6. Given a 2-3 tree in the following, draw the tree after deleting 70, 90, 60, 95, 20 in the given order. (Hint: a 2-3 tree is a B-tree of order 3.) (10%)

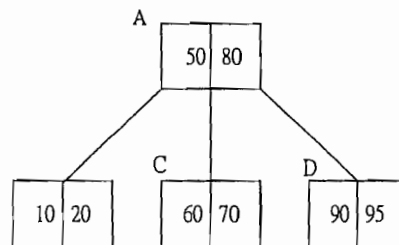


Fig. 3

7. Solve the following recurrence equation of $T(n)$ and find the Big-Oh of $T(n)$.

$$T(n) = T(n-1) + 1/n, \text{ and } T(1) = 1 \quad (10\%)$$

