淡江大學 97 學年度碩士班招生考試試題

88-1

系別：資訊工程學系資訊網路與通訊碩士班　　科目：資　料　結　構

B組

本試題共 2 頁，九 大題 1/2

1. [10%] For each of the following statements, answer TRUE or FALSE.
(1). Merge-Sort is based on an algorithmic technique called divide and conquer.
(2). The worst-case running time of Quick-Sort for n items is $O(n\log_2 n)$.
(3). Insertion-Sort for n items has a worst-case running time of $O(n\log_2 n)$.
(4). big-Oh is the asymptotic notation for lower-bounds on functions.
(5). big-Omega is the asymptotic notation for upper-bounds on functions.

2. [8%]
(1). Select data structure(s) that support constant access to any of its elements.
A. stack　B. AVL-tree　C. heap　D. array
(2). Select data structure(s) that follow the LIFO(Last-in-first-out) principle
A. stack　B. queue　C. heap　D. AVL-tree

3. [10%] Let $t(n)$ be the time taken by an algorithm to solve an instance of size n.

$$t(n)=\begin{cases}5 & \text{for } n=1\\ 2*t(\frac{n}{2})+3n & \text{for } n\geq 2\end{cases}$$

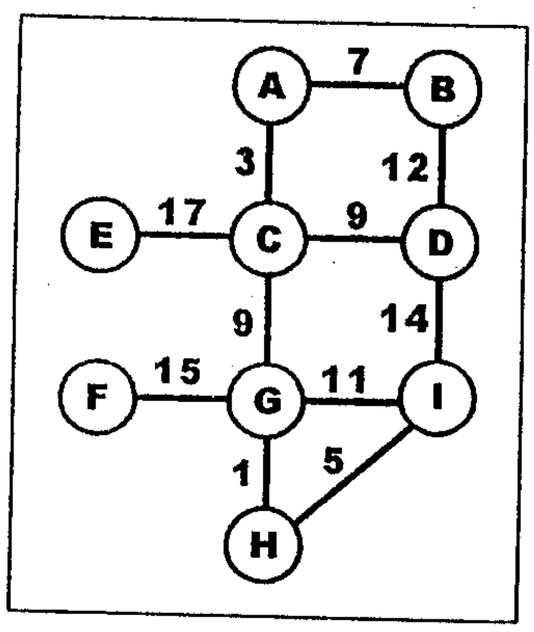
Determine $O(t(n))$.

4. [10%] Order the following functions by their growth rates starting with the slowest.
(a) $2n$　(b) $n\log_2 8+\log_2 n$　(c) 16^{n-10}　(d) 64　(e) $(\log_2 n)^2$
(f) n^3　(g) $4^{\log_2 n}$　(h) $n!\log_2 n$　(i) 2^{n-3}　(j) n^5

5. [10%] Suppose you have a binary tree whose data fields are single characters. When the data fields of the nodes are output in *inorder*, the out put is COMPUTER, and when they are output in *postorder*, the output is CPMOERTU. Draw the binary tree showing the data in each node and the pointers between nodes.

6. [10%] Given a sequence {4, 15, 6, 3, 21, 2} and insert these elements in the given order into an initially empty data structure. Draw the results when the data structure is (1). Max-Heap (2). Binary search tree.

7. [16%] Consider the graph in the right hand side.
(1). In what order are the vertices visited using DFS (depth first search) starting from vertex A? Where a choice exists, use alphabetical order. What if you use BFS (breadth first search)?
(2). A vertex x is 'finished' when the recursive call DFS(x) terminates. In what order are the vertices finished? (This is different from the order in which they are visited, when DFS(x) is called.)
(3). In what order are edges added to the minimum spanning tree by Kruskal's algorithm? List the edges by giving their endpoints.



淡江大學97學年度碩士班招生考試試題

88-2

系別：資訊工程學系資訊網路與通訊碩士班　　科目：資　料　結　構

本試題共 2 頁，九 大題 2/2

8. [6%] Deleting a node in a binary search tree when the node to be deleted has two children can be handled by the method of *deleting by merging*. The method is to make one tree out of the two subtrees and attach the merged tree to the node's parent. By the nature of binary search trees, every value of the right subtree is greater than every value of the left subtree, so the best thing to do is to find in the left subtree the node with the greatest value and make it a parent of the right subtree. Thus the two subtrees are merged into one tree. This tree is then attached to the deleting node's parent. For the binary search tree listed in Figure 8, show the resulting tree after deleting node **P**.

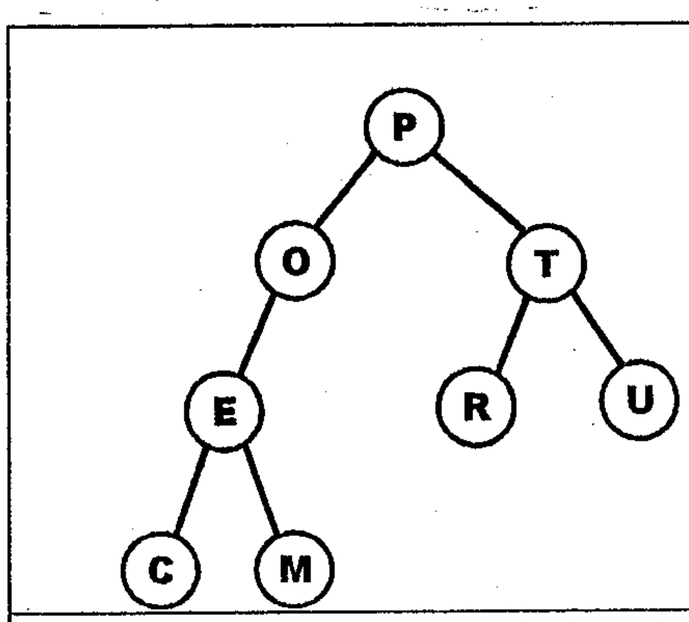


Figure 8. Binary search tree for Problem 8.

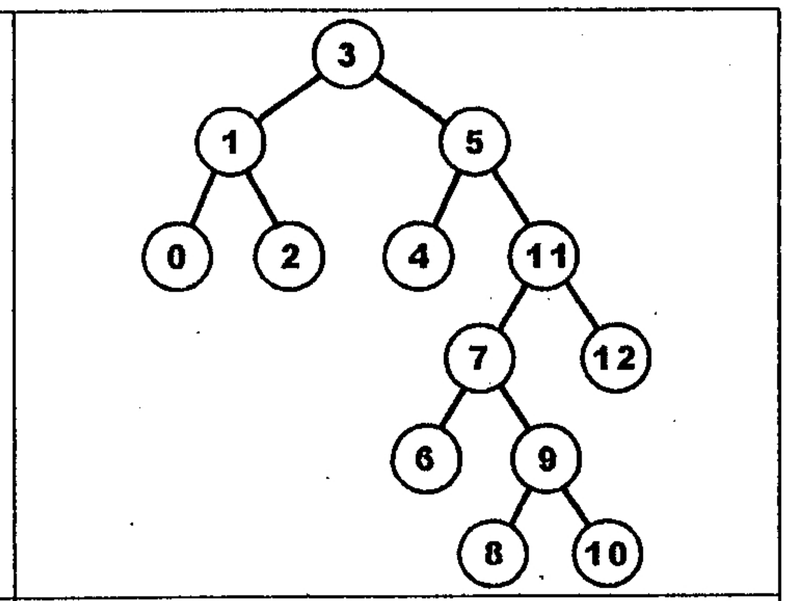


Figure 9. Splay tree for Problem 9.

9. [20%] A *splay* tree is a self-restructuring binary search tree with the property that recently accessed element is moved to the root through a series of *splay* operations. Three types of splay steps are defined depending on the relative positions of node X, its parent node P and the grandparent of X, which is denoted by G. When P is the root node, a *zig* step brings node X to the root by performing a rotation on the edge between X and P. When P is not the root and X and P are either both right children or are both left children, a *zig-zig* step is performed. The tree is rotated on the edge joining P with its parent G, then rotate the edge joining X with P. The zig-zig step brings node X two levels closer to the root when X is the left child of the left child of its grandparent, or the right child of the right child of its grandparent. A *zig-zag* step is used when P is not the root and X is a left child and P is a right child or vice versa. The tree is rotated on the edge between X and P, then rotated on the edge between X and its new parent G. The zig-zag step brings X two levels closer to the root when X is the left child of the right child of its grandparent, or the right child of the left child of its grandparent.

(1). Starting from the splay tree in Figure 9, what is the resulting splay tree after the operation `first()` that finds the maximum item?

(2). Starting from the splay tree in Figure 9, what is the resulting splay tree after the operation `insert(4.5)`?

(3). Starting from the splay tree in Figure 9, what is the resulting splay tree after the operation `find(10)`?

(4). Starting from the splay tree in Figure 9, what is the resulting splay tree after the operation `remove(9)`?