國立中央大學111學年度碩士班考試入學試題

所別： 資訊管理暨大數據分析類

科目： 資料結構

【題型說明：皆依題意為問答題或程式設計題】

1. Please describe the operations of "single linked list" and "doubly linked list." (4%)
   Please explain the pros and cons of the two data structures. (4%)

2. Assume that the root of a tree structure is in Level 1. The level of a binary tree is 11.
   a) How many nodes in total can be stored in the binary tree? (3%)
   b) How many nodes can be stored in level 8? (3%)

3. Given the following traversal of a binary search tree:
   Preorder: 15, 7, 2, 4, 9, 8, 30, 22, 17, 28, 45, 40, 37, 44
   Inorder: 2, 4, 7, 8, 9, 15, 17, 22, 28, 30, 37, 40, 44, 45
   a) Please give the results of postorder traversal. (8%)
   b) Please illustrate the corresponding binary tree. (5%)

4. Give the data as: 15, 7, 22, 9, 63, 45, 17, 12
   After the first pass (round) of quicksort, please give the order of the data. (6%)

5. $A[5,2]\ address = 57, A[8,3]\ address = 93,$ element size = 1 byte, what is the address of $A[7,7]$? (10%)

6. Please use **Prefix** (8%) and **Postfix** (8%) to express following mathematical expression:
   $$12 \times 37 - 51 \div 17 + 21 \div 3$$

7. We try to use an adjacency matrix M to describe the needed cost units of international trade between seven countries. Each country is represented by a vertex, which are V_1, V_2, V_3, V_4, V_5, V_6, V_7. Please use Kruskal's algorithm to draw the minimum cost spanning tree. (7%)

$$M = \begin{bmatrix} 0 & \infty & 11 & 1 & 3 & 4 & \infty \\ \infty & 0 & 3 & 11 & 7 & 20 & \infty \\ 11 & 3 & 0 & \infty & 15 & 7 & \infty \\ 1 & 11 & \infty & 0 & 3 & 2 & 9 \\ 3 & 7 & 15 & 3 & 0 & 8 & 6 \\ 4 & 20 & 7 & 2 & 8 & 0 & 1 \\ \infty & \infty & \infty & 9 & 6 & 1 & 0 \end{bmatrix}$$

注意:背面有試題

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8. Please use the data {40, 28, 56, 15, 63, 74, 98, 80} to describe sorting process (in ascending order) with round results by using insertion sort (4%). Please also use C code (ANSI C) to implement an insertion sort function (8%) with binary search (8%).

9. Please draw a figure to explain key(s), hash function, bucket(s) when using hash table and illustrate the relationship (6%). Furthermore, please explain the difference between MD5 and SHA-1 hash function outputs (4%).

10. Please briefly explain the average (2%) and worst case (2%) time complexity (in big O notation) of hash table data structure when processing search action.

注意:背面有試題