銘傳大學八十九學年度轉學生招生考試

八月一日　第三節

資管　轉三

資料結構　試題

(一)True or False (20 points)

For each question, answer true (T) or false (F) in the answer sheet, and then briefly justify your answer.

(1) At most one (single or double) rotation is needed after any insertion in an AVL tree.

(2) The best-case running time of quicksort on a sequence of size n is O (n log n).

(3) DFS method runs in O (n^2) if the graph is represented with an adjacency matrix.

(4) A red-black tree is a binary search tree.

(5) It is not possible to thread a tree for a postorder traversal.

(6) An AVL tree storing a set of items will always have the same structure, regardless of the order in which the items are inserted.

(7) Although a binary tree with n nodes has n-1 edges, this is sometimes not true for high degree trees such as B-trees.

(8) The time complexity of inserting or deleting an element in an AVL tree of n nodes is O (log n) on average, but Ω(n) in the worst case.

(9) Minimum spanning tree is unique.

(10) A subtree of red-black tree is itself a red-black tree.

(二)Multiple choice: only one answer for each question (24 points)

(1) Which situation represents the best case for the quicksort?

(A) the elements are in ascending order

(B) the pivot in the smallest element all of the time

(C) the elements are in random order

(D) the elements are in alternating small/large order

(2) What is the computational complexity of the double sort when handling the best case?

(A) O(n log n)　(B) O(n)　(C) O(n^2)　(D) O(1)

(3) Hashing is an _____ algorithm.
(A) O(log n) (B) O(n) (C) O(1) (D) $O(n^2)$

(4) What is the complexity of deleting an item from an n-element priority queue that is implemented as a heap?
(A) $O(n^2)$ (B) O(n) (C) O(1) (D) O(log n)

(5) What is the time complexity of inserting n item from an n-element priority queue that is implemented as a heap?
(A) O(log n) (B) O(1) (C) O(n) (D) $O(n^2)$

(6) A six-digit key is hashed by using folding. The key is mapped into the sum of its digits. The hash table for this hash function must be able to store at least _____ items.
(A) 46 (B) 55 (C)81 (D) 120

(7) What is the action of the following function when t is the root of a binary search tree?

```
Template <class T>
T    Func (TreeNode<T> *t);
{ while (t->left()!=NULL)
t = t->left();
   return t->data;
}
```

(A) Returns the value for the node of greatest depth in the tree
(B) Returns the maximum value in the tree.
(C) Returns the minimum value in the tree.
(D) Returns the minimum non-leaf node in the tree.

(8) Which of the following lists represent a possible inorder scan of a binary search tree.
(A) 73829411 (B) 11293847 (C) 23478911 (D) all of the above

(三)Heap (15 points)

(a) show the resulting heap after 33,22 and 8 are added to the following heap:
50 30 40 20 10 25 35 10 5

(b) show which item would be deleted from the following heap after calling the delete algorithm 3 times: 50 30 40 20 10 25 35 10 5

(c) What is the largest number of nodes that can exist in a tree that is both a minimum heap tree and a binary search tree?

(d) What is the largest number of nodes that can exist in a tree that is both a maximum heap tree and a binary search tree?

(e) If one element from the following sequence is deleted, the remaining values

form an ascending heap, which one?

2 5 11 6 12 9 15 14 8 10 20 32

(四)Binary tree (8 points)

A complete binary tree B, containing 50 nodes, represents an array.

(a) What is the level of the tree?

(b) How many nodes are leaf nodes? Nonleaf nodes?

(c) What is the index of the parent of B[35]?

(d) What is the index of the children of node B[20]?

(e) What is the index of the first node with no children? With one child?

(f) What are the indices for all nodes at level 4 in the tree?

(五)Huffman code (6 points)

Given letters A, B, C, D, E, F, G with probabilities 0.001(A), 0.002(B), 0.03(C), 0.04(D), 0.1(E), 0.3(F), 0.527(G). Construct the Huffman code for these letters using Huffman's algorithm. (Draw the tree)

(六)Trace program (10 points)

What is the output produced by the function call func(5), for each of the following three definitions:

1. (3pt.)

```
void func(int n)
{
        cout<<n<<" ";
        if(n>1)
                func(n-1);
 }
```

2. (3pt.)

```
void func(int n)
{
        if(n>1)
                func(n-1);
        cout<<n<<" ";
 }
```

3. (4pt.)

```
void func(int n)
{
        cout<<n<<" ";
```

```
        if(n>1)
            func(n-1);
        cout<<n<<" ";
    }
```

(七)(9 points)

(a) The following integer sequence is obtained by traversing a binary search tree in preorder. Construct a tree that has such an ordering

20 15 10 17 16 18 25 22 21 24 35

(b) Find the root of each of the following binary trees?

(1) Tree with poster order traversal: FCBDG

(2) Tree with preorder traversal: IBCDFEN

(3) Tree with inorder traversal: CBIDFGE

(c) A tree is a directed graph. Depth-first-search traversal of a graph that is a tree corresponds to what tree traversal order?

(八)(8 points)

Which of the two do you think is more important for constructing the information super-highway: data compression or data encryption? Justify your answer.

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