

# 銘傳大學八十七學年度資訊管理研究所碩士班招生考試

## 第三節

### 資料結構 試題

- (1) (5%) Each of the following series of records consists of a four-digit primary key and a four-character secondary key. Show the inverted list for this collection of records.

3456	DEER
2396	DEER
2926	DUCK
9737	DEER
7739	GOAT
9279	DUCK
1111	FROG
8133	DEER
7183	DUCK
7186	FROG

- (2) (5%) Show the Trie for the following collections of ten words:  
deer, duck, horse, goat, ant, antelope, chicken, goldfish, goose, anteater.

- (3) a) (5%) Here is a simple recursive function to compute the Fibonacci sequence:

```
int Fibr (int n) {  
    if ((n==1)||(n==2)) return 1;  
    return Fibr (n-1) + Fibr (n-2);  
}
```

This algorithm turns out to be very slow. Contrast this with the following iterative algorithm:

```
long Fibi (int n){  
    long curr, prev;  
    if(n==1)||(n==2)) return 1;  
    curr = prev = 1;  
    for (int i = 3; i<=n; i++){  
        curr = prev + curr;  
        prev = curr - prev;  
    }  
}
```

```
    return curr;
}
```

Explain why **Fibr** is so much slower than **Fibi**.

- b) (5%) Fibr (100) might not run to completion on a real computer. Why?
- (4) (5%) Which of the following operations are best implemented by first sorting the list of numbers?
- find the minimum value.
  - find the maximum value.
  - compute the arithmetic mean
  - find the median (i.e. the middle value)
  - find the mode (i.e. the value that appears the most )
- (5) (10%) Given the sequence 1,2,3,4,5,6,7,8
- construct an AVL tree
  - construct a B-tree of order 3
- (6) a) (5%) insert the values 29, 44, 28, 9, 25, 51, 11, 56, 8 into a hash table using the hash function
- $$h(k) = k \text{ modulo } 7$$
- Handle collisions by setting up a linked list into an overflow area. Show the resulting table and describe your data structure.
- b) (5%) Which table positions will be examined in a search of the value 45.
- (7) a) (4%) Construct a binary tree with nodes a, b, c, d, e, f such that b is second in inorder and fifth in postorder.
- b) (4%) Show a tree for which the preorder and inorder traversals generate the same sequence.
- c) (4%) If a graph has a form of a binary tree, do depth-first or breadth-first traversals correspond in any way to preorder, inorder, or postorder traversals?
- (8) (4%) There is no Huffman code on four letters with code lengths 3, 2, 2, 2. Why?
- (9) (4%) How can a singly linked list be implemented so that insertion requires no test for whether **head** is null?

(10) (4%) When is a bubble sort better than a quicksort? Please briefly explain your answer.

(11) (6%) Suppose we have an algorithm that requires precisely

$$6 * \log n + 34 n^2 + 12$$

operations for an input of  $n$  data items. Indicate which of the following are valid big-O classification of the algorithm.

- a.  $O(n^2)$       b.  $O(n^3)$       c.  $O(n)$       d.  $O(n^2 \times \log n)$       e.  $O(n \times \log n)$   
f.  $O(\log n)$       g.  $O(1)$

Of those that you have indicated are valid, which is the best big-O classification? Why?

(12) (5%) The integers from 1 to 9 are used to build a 9-node binary search tree.

Give the possible root node values if the depth of the tree is 6. (Assume the root of a binary tree is defined to be at level 0. The level of a direct descendant of a node of level  $i$  is  $i+1$ . The maximum level of any element of a binary tree is said to be its depth.)

(13) (5%) A queue is an applicable data structure for

- (a) expression evaluation
- (b) operating system job scheduler
- (c) simulation of waiting lines
- (d) printing a list in reverse order
- (e) radix sort
- (f) depth-first traversal of a graph

(14) (5%) B-tree can not grow deeper unless it is 100% full. Discuss this.

(15) (10%) Write a program in any programming language that check whether one word is an anagram of another word, e.g., plum and lump, silent and listen. (Note: Anagram is a word or phrase that is made by changing the order of the letters in another word or phrase. You should describe in details the data structure you need.)

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