大同大學 九十四 學年度 轉學考試 試題

考試科目：資料結構　　系別：資訊工程學系　　第一頁，共一頁

註：本次考試<u>不可以</u>參考書籍及筆記，<u>不可以</u>使用字典，以及<u>不可以</u>使用計算器。

Part I. ○× (10, points, 2 points each)

1. *Heapsort* and *Quicksort* are both based on the **divide-and-conquer** paradigm.

2. Any comparison sort algorithm requires $O(n \lg n)$ comparisons in the worst case.

3. The *n* in the statement "The running time of an algorithm is $O(n^2)$." means the number of execution steps.

4. A minimum spanning tree for a connected graph may not be unique.

5. A binary tree can be an empty set, i.e., it may contains no elements.

Part II. Answer the following questions. (90 points)

6. (10 points) (a) Draw a **circularly linked list** with three nodes. (b) Explain why only one pointer is needed to access both ends (head and tail) of the list.

7. (15 points) Use **prefix** expression, **postfix** expression and **binary expression tree** to represent the following expression.

$$A = B - C * D / (E + F)$$

8. (20 points) (a) What operations can be applied to access the elements of a **stack**? (b) What operations can be applied to access the elements of a **queue**? (d) What operations can be applied to access the elements of a **priority queue**? (c) What are the differences in the behavior between them?

9. (5 points) What are the differences between a **binary search tree** and an *AVL* (high balanced) *tree*?

10. (5 points) What are the differences between **sequential search** and **binary search**?

11. (5 points) When does the worst-case behavior for **quicksort** occur? Explain.

12. (15 points) Consider inserting the keys 18, 41, 22, 44, 59, 32, 31, 73 into a **hash table** of length $m = 13$ with the hash function

$$h(k) = k \bmod m.$$

Illustrate the result of inserting these keys using

(a) chaining,

(b) linear probing,

(c) double hashing with the secondary hash function $h'(k) = 7 - k \bmod 7$.

13. (5 points) Algorithm *A* solves a problem in $O(n \log n)$ time, while Algorithm *B* solves the same problem in $O(n^2)$ time. Why is the statement, "Algorithm *A* always performs better than Algorithm *B*," **NOT** always true?

14. (10 points) Transform the iterative procedure *iter* into a recursive procedure *recur*. *f(i)* is a function returning a logical value based on the value of *i*, and *g(i)* is a function that returns a integer value.

```c
void iter(int n)
{
    int i;

    i = n;
    while(f(i) == TRUE) {
        /* any group of C statements that */
        /* does not change the value of i */
        i = g(i);
    } /* end while */
} /* end iter */
```

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