國立政治大學　105　學年度碩士班招生考試試題

考試科目	資料結構及演算法 81411	所別	資訊科學系	考試時間	2月 28 日(日) 第一節

僅書寫答案而缺乏必要的解題過程，亦無法獲得該題分數。

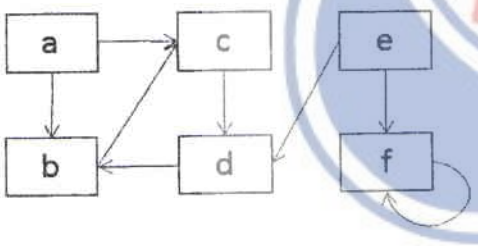
1. (10 points) Draw a diagram to precisely describe the definition of "$f(n) = \Theta(g(n))$", explain the detail.

2. (10 points) What are the **minimum** and **maximum** numbers of elements for a **min-heap** of height **h**? explain detail.

3. Time complexity
   (a) (5 points) Formulate the **time complexity** for the following procedure.
   (b) (5 points) Show a worst case example, and why?

```
Q3(A)
for i = 1 to A.length - 1
    for j = A.length downto i+1
        if A[j] <A[j-1]
            swap (A[j], A[j-1])
```

4. (10 points) Design a data structure with as small as possible storage to represent the following graph, explain detail of the data structure and compare to alternate data structure.



5. Binary search tree
   (a) (5 points) What is binary search tree property?
   (b) (5 points) Propose an $O(n \log n)$ algorithm to output a sorted array from a binary search tree.

6. Use master theorem to solve following equatioin:
   (a) (5 points)　$T(n) = 6T(n/3) + n^2$
   (b) (5 points)　$T(n) = 4T(n/4) + n \lg n$

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7. (10 points) Answer following questions after executes the code fragment.

(a) k =

```
int n = 4096;
int k = 0;
for (int i = 1; i < n; i = i*4)
    k = k + 10;
```

(b) f(5) =

```
int f(int x) {
    if (x==1 || x==0 ) return 2;
    else return f(x-1) + f(x-2);
}
```

8. Give the precise definition of problem class in following categories.
   (a) (2 points) class of P,
   (b) (2 points) class of NP
   (c) (2 points) polynomial-time reduction
   (d) (4 points) What will happen if P = NP? Draw a diagram and explain.

9. (10 points) Show how to implement a queue using two stacks. Analyze the running time of the queue operations.

10. (10 points) Write pseudo code for a recursive version of Binary Search. Analyze the worst-case time complexity.

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。