

# 國立臺北大學九十七學年度碩士班招生考試試題

系(所)別：電機工程研究所  
科目：資料結構與演算法

組別：乙組(電腦工程組)

第1頁共2頁

可 不可使用計算機

1. (10 points) What kinds of outputs are printed out on the screen by the following code?(2 points each)

```
int *p1;
int *p2;
p1 = new int;
p2 = new int;
*p1 = 100;
*p2 = 200;
cout << *p1 << " and " << *p2 << endl;
delete p1;
p1 = p2;
cout << *p1 << " and " << *p2 << endl;
*p1 = 300;
cout << *p1 << " and " << *p2 << endl;
*p2 = 400;
cout << *p1 << " and " << *p2 << endl;
delete p1;
cout << *p1 << " and " << *p2 << endl;
```

2. (15 points) Given the problem of  $n$  towers of Hanoi? with six rings. Please compute the number of steps required to move these six rings from one end to the other end. (5 points) Please implement a recursive function for the problem of  $n$  towers of Hanoi? (10 points)
3. (10 points) What type of data structure is used to store the return address of a function call?(5 points)  
Please explain why.(5 points)
4. (10 points) Given a hash table of size 10 (assuming that the hash table starts with index 0), show how the following data (in the given order) would be stored in the table using  
(a) linear probing (4 points)  
(b) double hashing:  $h_1(x) = x \% 10$  and  $h_2(x) = 2 + (x \% 7)$  (6 points)  
Data: 99, 15, 75, 36, 20, 25, 89, 0, 47, 42
5. (7 points) Given a circular queue with its maximum size equal to **MAXQUEUE**. This queue only uses two pointers, i.e. **front** and **rear**, to maintain its elements. The **front** pointer is point to one position counterclockwise from the first element, whereas the **rear** pointer is point to the current end of the queue. Assume that the function name to add an element to the queue is called **AddQueue(int front, int \*rear, element item)**. Please use C language to implement this function.
6. (12 points) Prove that any sorting algorithm that sorts only by comparisons must have a worst case computing time of  $\Omega(n \log n)$ .

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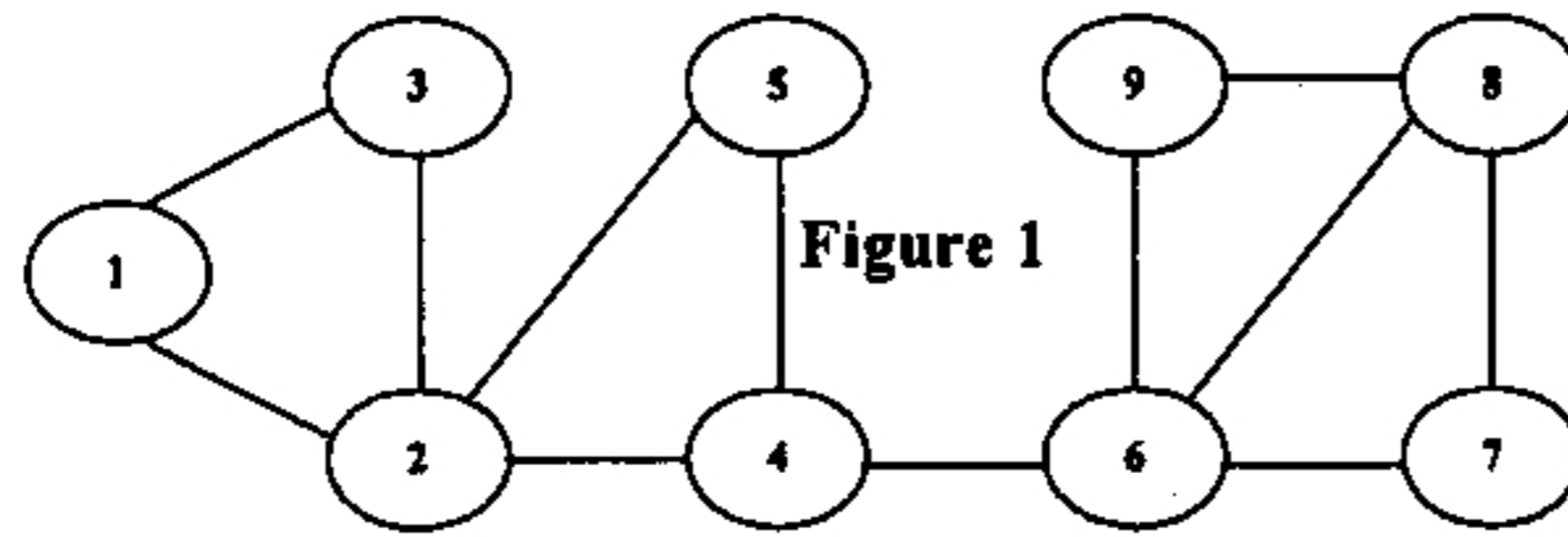
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第2頁 共2頁

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7. (12 points) Find all articulation points in Figure 1. (You have to use the *dfn* and *low* values to find it.) The node's order of Depth First Search is 1-2-3-4-5-6-8-9-7.



8. (12 points) Insert 15,14,13,12,11,8,9,10,1,2,3,4,5,6 and 7 as a AVL tree step by step.
9. (12 points). Figure 2 is a binomial heap on 10 keys. Note that it consists of two trees. If we apply the following sequence of 3 operations: delete-minimum, insert 15, decrease key 72 to 13. What will be the resulting binomial heap for each operation?

