

國立臺北大學九十六學年度碩士班招生考試試題

系(所)別：資訊管理研究所
科目：資料結構與演算法

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可 不可使用計算機

1. (9 points) Manually provide the inorder, preorder and postorder traversals of the binary search tree of Fig.1

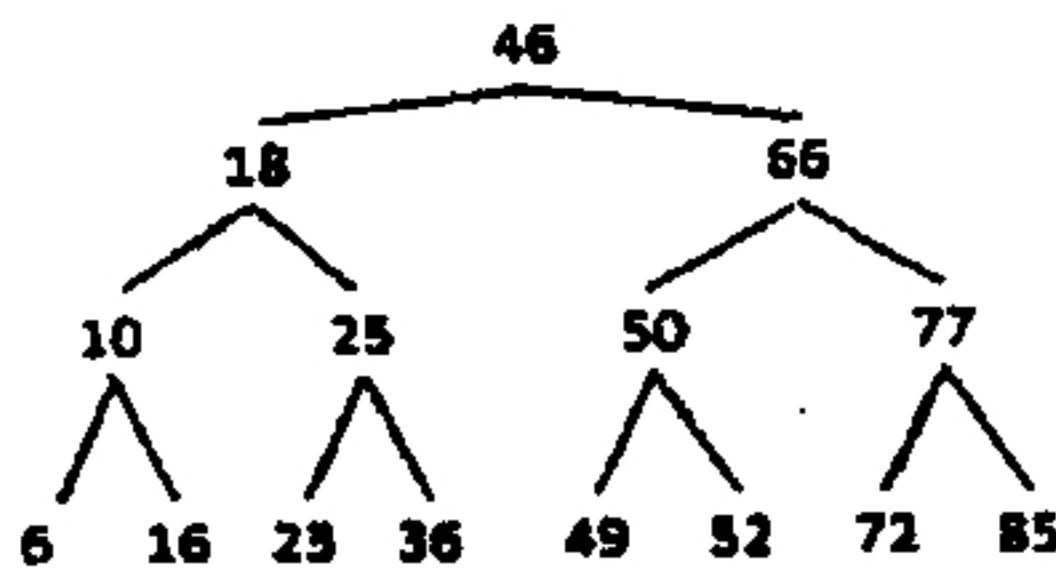


Fig. 1: Binary search tree with 15 nodes

2. (7 points) Please show the recursion version of Greatest Common Divisor routine using Euclid's algorithm in C language.
int GCD(const int & a, const int & b)

3. (10 points) If you have a Node structure shown as follow:

```
struct Node
{
    int item;
    Node *next;
}
```

Please use the structure to implement a linked Queue in which have two functions- insert(int item) and int delete() respectively.

4. (10 points) Use the master method (theorem) to give tight asymptotic bounds for the following recurrences.

- a. $T(n) = 9T(n/3) + n$
b. $T(n) = T(2n/3) + 1$

5. The binary heap data structure is an array object that can be viewed as a complete binary tree. Each node of the tree corresponds to an element of the array that stores the value in the node.

- a. (4 points) Is an array $\langle 24, 15, 12, 14, 10, 13, 9, 8, 7 \rangle$ a heap that satisfy the heap property? Why?
b. (6 points) If you have a heapify procedure for adjusting a max heap as following (in C++):

```
template <class T>
void heapify (T *a, const int root, const int n) // a is the array, n is the number //of heap.
{
    T e = a[root];
    for (int j=2*root; j<=n; j*=2) {
        if (j < n && a[j] < a[j+1]) j++;
        if (e >= a[j]) break;
        a[j/2] = a[j];
    }
    a[j/2] = e;
}
```

Please implement a heap sort based on the heapify procedure in C++.

- c. (4 points) What is the time complexity of your heap sort procedure?

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接背面

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6. (22 points)(a) 請針對單一來源/所有目的地(single source/all destinations)之圖形設計一最短路徑演算法。其中此圖形之長度可為負數但是不允許有負長度之迴圈(cycle)。(b) 請利用 (a) 設計出來之演算法一步一步算出 Figure 2 結果。

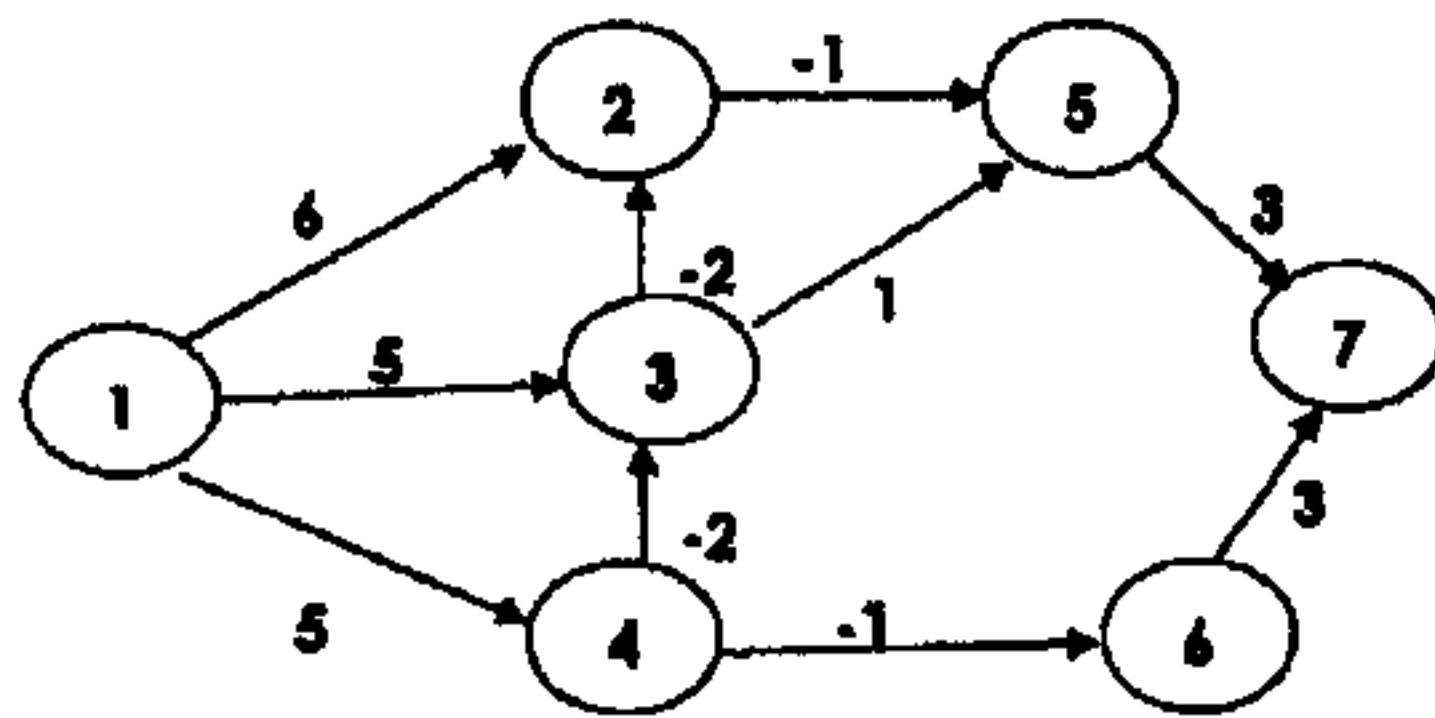


Figure 2

7. (16 points) (a) 請依序將串列(19, 39, 11, 30, 15, 35, 7, 25, 18, 24, 7, 42, 13, 46, 27, 8)輸入形成 2-3 樹並顯示其每一步之結果。(b) 請將(a)之結果依序將串列(7, 15, 24, 25)刪除掉並顯示其每一步之結果。
8. (12 points) 請設計一演算法將一二元樹(binary tree)每一節點之左子樹和右子樹交換(swap) 如 Figure 3 所示

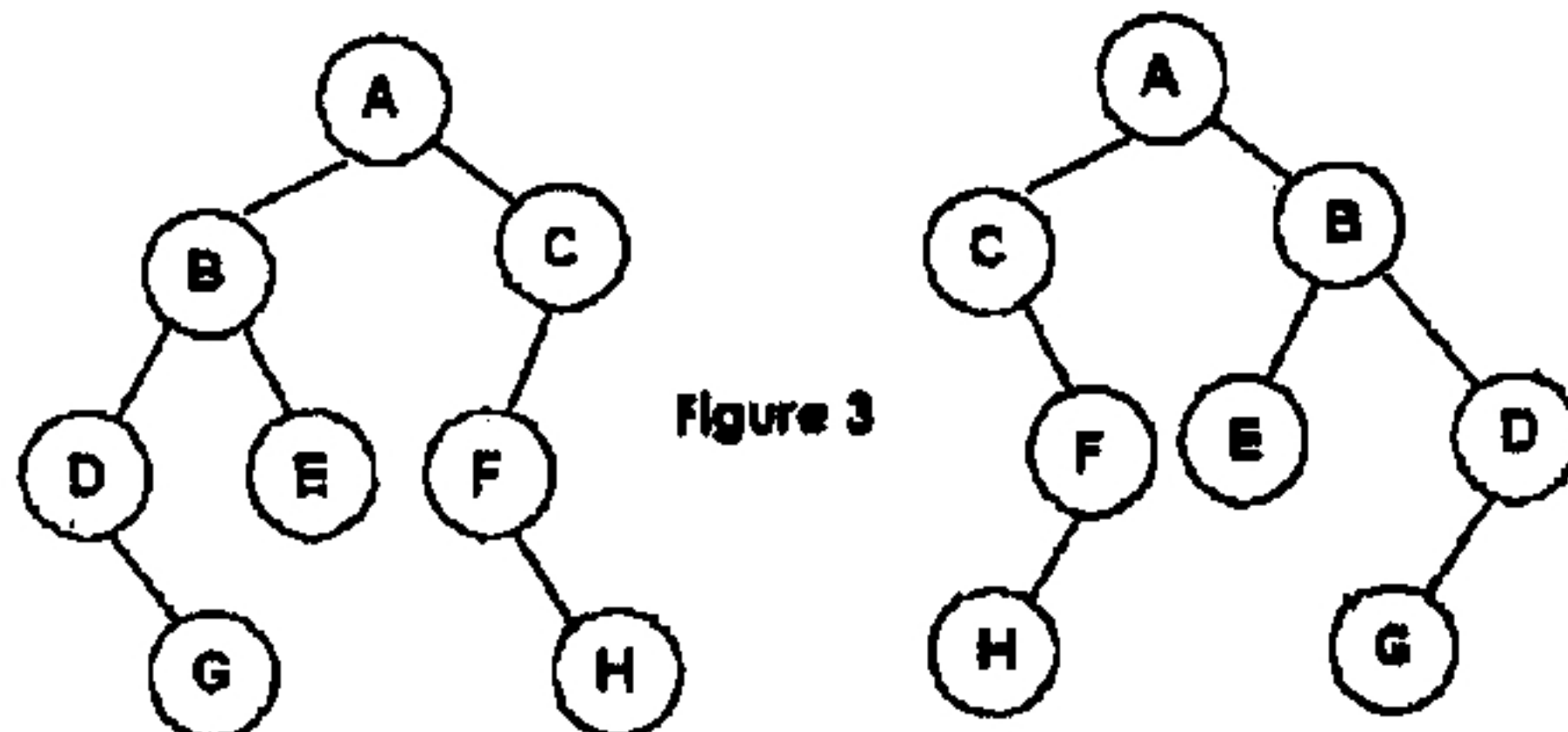


Figure 3

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