

國立嘉義大學九十七學年度
資訊管理學系碩士班（乙組）招生考試試題

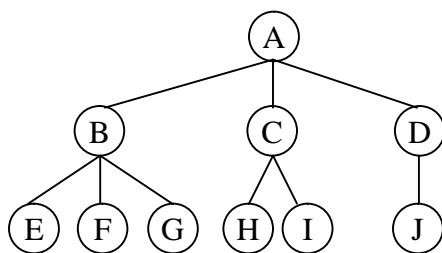
科目：資料結構

1. The following is a program coded by C language, please write down the output of this program. (8 points)

```
#include <stdio.h>
int main()
{
    int a = 1;
    int b = 1;
    printf("%d, %d, %d, %d\n", a, ++a, b++, b);
}
```

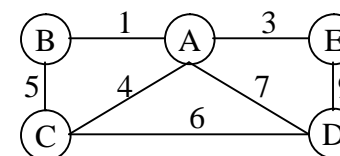
2. Given a sequence of data [13, 5, 10, 9, 8, 12, 4, 15, 7, 2]. Please answer the following questions:
- Please construct a binary search tree from the sequence of data. (5 points)
 - Please adjust the binary search tree after removing 13 from it. Please briefly describe your approach. (5 points)
 - Please construct a max-heap tree from the sequence of data. (5 points)
 - Please adjust the max-heap tree after removing 13 from it. Please briefly describe your approach. (5 points)

3. Given a general tree as follows. Please answer the following questions:

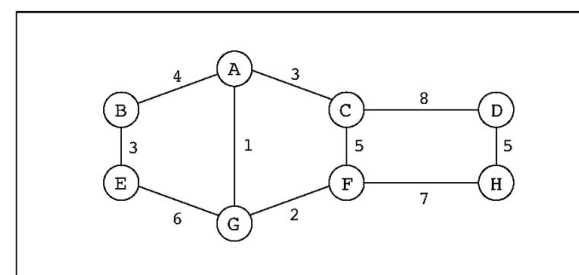


- Please convert the general tree to a binary tree. (5 points)
- Is the corresponding binary tree a complete binary tree? Why? (6 points)

4. Given a graph as follows. Please answer the following questions:



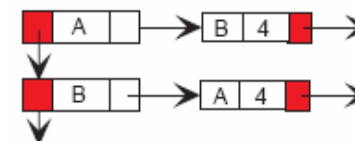
- Please apply the Kruskal's algorithm to find the minimum spanning tree. (5 points)
 - Please use depth-first search and breadth-first search to traverse the graph with the node A as the starting node and write down both of the traversal sequences (If more than one node can be visited next, always choice the one with the smallest weight to visit first). (6 points)
5. From the following graph:



- Give (a) adjacency matrix to represent the graph such as (3 points)

	A	B	...
A	0	4	...
B	4	0	...
...

- (b) adjacency linked list to represent the graph such as (3 points)



6. What are the respective values in the data structure (implemented with an array) after the following operations performed in sequence : INSERT(A) · INSERT(E) · DELETE · INSERT(B) · INSERT(C) · DELETE · DELETE · INSERT(D) · INSERT(H) · DELETE · INSERT(E) · INSERT(F) · DELETE · INSERT(G) · INSERT(D) · and DELETE. (1) If the structure is a stack (3 points). (2) If the structure is a queue (3 points). (3) If the structure is a circular queue (3 points). (Please also identify the values of front and rear if the array size is 6.)

7. (1) Illustrate the operation of PARTITION three times on the array $A=\{5, 3, 2, 6, 4, 1, 3, 7\}$, that is one for $A=\{5, 3, 2, 6, 4, 1, 3, 7\}$, one for $A'=\{3, 3, 2, 1, 4\}$, and the other for $A''=\{6, 5, 7\}$. (10 points)

Hint: PARTITION(A, p, r)

```

1. x←A[p]
2. i←p-1
3. j←r+1
4. while TRUE
5.   do repeat j←j-1
6.     until A[j]≤ x
7.   repeat i←i+1
8.     until A[i]≥x
9.   if i<j
10.    then exchange A[i]←>A[j]
11.    else return j

```

- (2) How would you modify QUICKSORT and PARTITION to sort in nonincreasing order? Write down the pseudocode. (5 points)

Hint: QUICKSORT(A, p, r)

```

1. if p < r
2.   then q←PARTITION(A, p, r)
3.     QUICKSORT(A, p, q)
4.     QUICKSORT(A, q+1, r)

```

8. (10 points) Determine the satisfiability of the following Boolean formulas:

(a) $\neg X_1 \vee \neg X_2 \vee X_3$
 $X_1 \vee \neg X_2$
 X_2
 $\neg X_3$

(b) $\neg X_1 \vee \neg X_2 \vee X_3$
 X_1
 X_2

Hint: Satisfiability problem: Given a Boolean formula, determine whether this formula is satisfiable or not. For example, the logical formula:

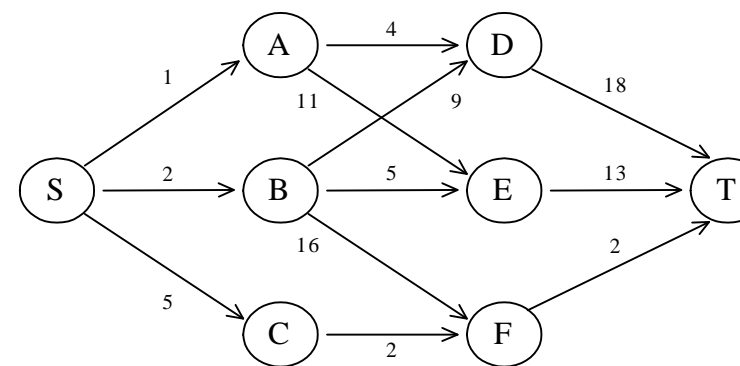
$$X_1 \vee X_2 \vee X_3$$

$$\neg X_1$$

$$\neg X_2$$

The assignment : $X_1 \leftarrow F, X_2 \leftarrow F, X_3 \leftarrow T$, will make the above formula true. If there is at least one assignment which satisfies a formula, then we say that this formula is satisfiable; otherwise, it is unsatisfiable.

9. (10 points) Consider the following graph. Find the shortest route from S to T by the dynamic programming approach (Using forward reasoning).



Hint: Forward Reasoning

$$D(S, T) = \min\{ d(S, D) + 18, d(S, E) + 13, d(S, F) + 2\}$$