國立臺灣師範大學100學年度碩士班招生考試試題

科目：**程式設計與資料結構**　　適用系所：**資訊教育研究所**

注意：1.本試題共 3 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

1. (5 分) What is the output of the following C++ program segment if we call f1(15, 123)?

```
f1(int v1, int v2)
{
    if (v2 == 0)   return v1;
    return f1( v2, v1%v2);
}
```

2. (5 分) What is the return value of the following C++ program segment if we call f2(5)?

```
int f2(int n)
{
    if (n <= 2)   return n;
    return f2(n-1)+f2(n-2);
}
```

3. (5 分) What is the output of the following C++ program segment?

```
bool f3(float x, int y)
{
    float z = 0.0;
    for (int i = 0 ; i < 10 ; i++)    z += x;
    return (z == y);
}
int main(void)
{
    std::cout << 5 * f3 (0.1, 1);
    return (1);
}
```

4. (5 分) What is the output of the following C++ program segment if we call f4(5)?

```
void f4(int v)
{
     int i, j, x;   x = 0;
     for (i = 1; i <= v; i++)
         for (j = i, j <= v + 4; j++)
             x = x + 1;
    cout << x << '\n';
}
```

5. (5 分) Show the output of the following C++ program segment.

```
int a = 1;
void f5()
{
        int b = 1;
        static int c = a;
        cout << " a = " << a++ << " b = " << b++
             <<" c = " << c << '\n';
        c = c + 2;
}
int main()
{
    while (a<4)    f5();
}
```

6. (5 分) Can you explain the meaning of function f6?

```
int f6(const char* p)
{
    const char* q = p;
    while (*q++);
    return q-p-1;
}
```

7. What are the meanings of the following statements?
   (1) (3 分) d = ((a > b) ? ((a > c)? a : c) : (b > c)? b : c);
   (2) (3 分) Is "a = b+++c" equal to "a = (b++) + c" or "a = b + (++c)" ?

8. Given an algorithm as follows:

```
void f7(int a*, const int n)
{
    for (int i = 0; i <=n; i++){
        int j = i;
        for (int k = i, k < n ; k++)
            if (a[k] < a[j] )  j = k;
    int temp = a[i];   a[i] = a[j];    a[j] = temp; }
}
```

   (1) (3 分) If the input array a = [3, 6, 2, 4, 8] and n = 5, please show its corresponding output.
   (2) (3 分) Show its time complexity using big oh notation.

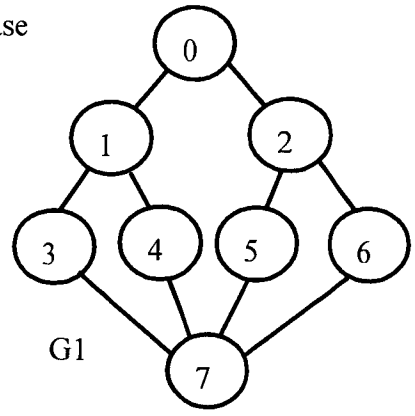
9. (6 分) What are sparse matrices? How to represent a sparse matrix?

10. (1)(3 分) If we have the declaration A[4..6][2..4][1..2][3..4] then how many elements do we have?
    (2)(5 分) Which kind of data structures is suitable to be used by a program at run time to process function calls? Why?
    (3)(5 分) Which kind of data structures is suitable to be used to implement job scheduling in the operating system? Why?

11. (1) (3 分) What are the circular linked lists?
    (2) (5 分) Compared with the arrays, could you show some advantages of the linked lists?

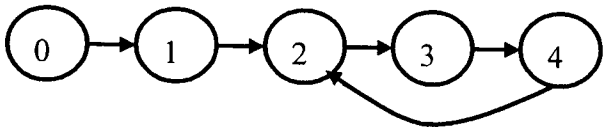
12. (1) (5 分) Which kind of data structures is suitable to implement a full binary tree? Why?
    (2) (5 分) If a full binary search tree has stored the following keys:
    2, 7, 11, 13, 15, 24, 66
    Please draw the binary search tree.
    (3) (5 分) A max heap is a complete binary tree that is also a max tree. If the following data input into the max heap in order,
    2, 7, 11, 13, 15, 24, 66
    Please draw the max heap.

13. (5 分)Given a graph G1 with 8 nodes and 10 edges, please draw the depth-first search result if the start vertex is 0.



G1

14. Given a digraph G2 with 5 nodes as follows:



    (1) (3 分) Please show its adjacency matrix A.
    (2) (3 分) Please show its transitive closure matrix A^+.

15. (5 分) A decision tree is a binary tree and can be used to describe the sorting process. Each vertex of the tree represents a key comparison, and the branches indicate the result. A path through a decision tree represents a sequence of computations that an algorithm could produce. Thus, any decision tree that sorts n distinct elements has height of at least _____.