國立臺灣師範大學 101 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，否則依規定扣分。

1. (8 分) What are the return values of the following C++ functions if we call fun1(15) and fun2(15)?

```
int fun1(int n){
    if (n <= 2)   return n;
    return fun1(n-1);
}

int fun2(int n){
    if (n <= 2)   return n;
    return fun2(n%3);
}
```

2. (8 分) Here shows a function which can be used to count the length of a string. Is it correct? If not, please correct it.

```
Line 1      int stringLength(char *st)
Line 2      {
Line 3          int len = 0,
Line 4          while ( *st ) ++len;
Line 5          return len;
Line 6      }
```

3. (8 分) Here shows a function which can output the address of array[i]. Is it correct? If not, please correct it.

```
Line 1      void main( )
Line 2      {
Line 3          int array[5] = { 1, 1, 2, 3, 5};
Line 4          for (i = 0; i < 5; i++){
Line 5              cout << array[i] << "\n";}
Line 6      }
```

4. (8 分) Can you explain the meaning of the following function?

```
void main( ){
    int x = 0, y = 0, temp = 0;
    cin >> x >> y;
    while (y !=0) {
        temp = x % y;      x = y;      y = temp;}
    cout << x << endl;
}
```

5. (8 分) Can you explain the meaning of the following function?

```
void main( ){
    int i ,j ;
    for (i = 2 ; i <= 9; i++){
        for (j = 1 ; j <= 9; j++){
            cout << i << "x" << j << "=" << i*j << "\t";}
    cout << endl;
}
```

6. (8 分) Can you explain the meaning of lines 5 and 6-8 in the following function?

```
Line 1    void main( )
Line 2    {
Line 3        int n;
Line 4        cin >> a;
Line 5        char **ptr = new char *[a];
Line 6        for (i = 0 ; i < n; i++){
Line 7            cin >> b;
Line 8            char *ptr[i] = new char[b];}
Line 9    }
```

7. (1) (4 分) What are sparse polynomials? Please show an example.

(2) (4 分) What kind of representations (data structures) in computers can be used if the polynomials are sparse?

8. (1) (4 分) What is a stack? And please show an application to use the stack data type.

(2) (4 分) What is a queue? And please show an application to use the queue data type.

9.(1) (4 分) Show the prefix and postfix notations of the following infix expression: (Note that the priorities of the arithmetic operators "／" and "×" are higher than "＋" and "－")

A／B－C＋D × E－A × C

(2) (4 分) What are the advantages of the postfix expressions using in a compiler?

10. (1) (4 分) Please define a binary tree.

(2) (4 分) If the output of the inorder traversal of a binary tree T is AGBDCFE and the output of the preorder traversal of T is GAFDBCE. Please show the output of the postorder traversal of T.

(3) (2 分) If the keys A, B, C, D, E, F, G are presented by their ASCII codes, is tree T a binary search tree? Why or Why not?
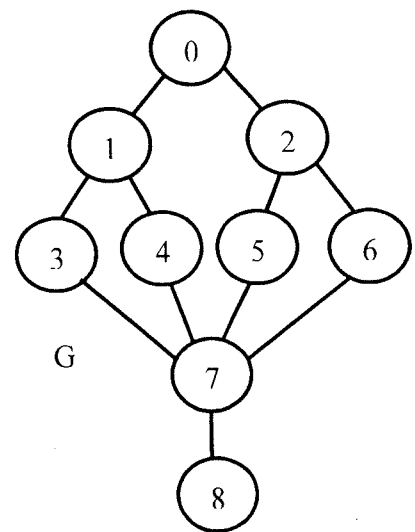
11. Given a connected graph G with 9 nodes and 11 edges.

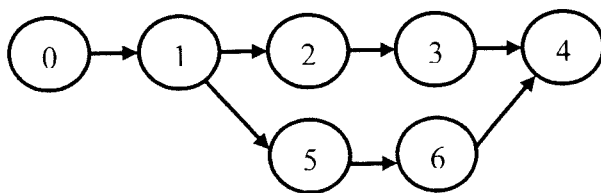(1) (3 分) Please show its biconnected components.

(2) (3 分) Please show its articulation points.

(3) (4 分) Please write an algorithm to find the articulation points. (You can define the representation of the graph by yourself.)

12. (1) (4 分) What is a topological order? Please show two topological orders of the following graph.

(2) (4 分) Given a directed graph, please write an algorithm to find at least one topological order. (You can define the representation of the graph by yourself.)