國立中正大學105學年度碩士班招生考試試題

系所別：資訊工程學系-甲組　　　　科目：軟體設計

第2節

1. (5%) Write down the output of the following C program

```
int main(void)
{
   int a=7, b=6, c=5;
   if(a < b < c)
      printf(“Yes\n");
   else
      printf(“No\n");
   return 0;
}
```

2. (5%) Write down the output of the following C program

```
int main()
{
      int i, count=0;
      for(i=0; i<35; i++){
            if(i%5==0) continue;
            count++;
      }
      printf("%d\n", count);
      return 0;
}
```

3. (5%) Write down the output of the following C program

```
int main()
{
      for(int i; i<=9; i++)
      {
            if(i%2)
                  if(i%3)
                        printf("A");
            else
                  printf("B");
      }
      return 0;
}
```

4. (5%) Write down the output of the following C program

```
void main()
{
  int s[5]={1, 3, 9, 6, 4};
  int *p=s , *ptr=s+2 ;
  printf("A:%d\n", *p+1);
  printf("B:%d\n", *ptr);
  printf("C:%d\n", s[0]);
  printf("D:%d\n", *p++);
  printf("E:%d\n", *p);
}
```

5. (5%) Write down the output of the following C program

```
int func (int a, int b)
{
    if (a < b)
        return func(b, a);
    if (b == 0)
        return a;
    else
        return func(b, a%b);
}
int main(void){
    int a, b;
    printf("%d", func(30, 75));
    return 0;
}
```

6. (4%) Choose the correct answer (as far as the syntax of C++ language is concerned).

甲. Member functions always have to be **public**.
(a) True (b) False

乙. If s1 and s2 are **structs**, s1 == s2 checks if all their data members are identical.
(a) True (b) False

丙. It is possible for a class to have several different constructors.
(a) True (b) False

丁. It is possible for a class to have several different destructors.
(a) True (b) False

7. (5%) Choose the correct answer (as far as the syntax of C++ language is concerned).
Consider the following code:

```
int a[2];
int* x = new int[3];
int* y = new int[5];
int* t = y;
y = x;
x = a;
delete t;
delete y;
delete x;
```

This code compiles. However, what bug(s) does it have?

甲. This code has the following bug. (a) True (b) False
cannot **delete** t, since it was not initialized using **new**

乙. This code has the following bug. (a) True (b) False
has memory leak

丙. This code has the following bug. (a) True (b) False
mixes arrays of different lengths

丁. This code has the following bug. (a) True (b) False
tries to deallocate a statically-allocated array

戊. This code has the following bug. (a) True (b) False
wrong deallocation syntax

8. (8%) Choose the correct answer (as far as the syntax of C++ language is concerned).
The **getline** function

甲. skips all whitespace. (a) True (b) False

乙. can write data directly to an **int**. (a) True (b) False

丙. can cause stream to fail if there is no more data to read. (a) True (b) False

丁. can be used with an **ofstream**. (a) True (b) False

The >> operator

戊. skips all whitespace. (a) True (b) False

己. can write data directly to an **int**. (a) True (b) False

庚. can cause stream to fail if there is no more data to read. (a) True (b) False

辛. can be used with an **ofstream**. (a) True (b) False

9. (8%) Choose the best answer (as far as the syntax of C++ language is concerned).

甲. When an object X of a derived class is assigned, using the default assignment operator, to a variable Y of its corresponding base type:
(a) Y has all the data and function members of the derived class.
(b) Y has only the data and function members of the base class.
(c) an error occurs because this is not an allowed operation.
(d) none of the above

乙. If a class C is derived from class B, which is derived from class A, all through public inheritance, then a class C member function can access
(a) protected and public data only in C and B.
(b) protected and public data only in C.
(c) private data in A and B.
(d) protected data in A and B.

丙. Usually a pure virtual function
(a) has complete function body.
(b) will never be called.
(c) will be called only to delete an object.
(d) is defined only in derived class.

丁. In which case is it mandatory to provide a destructor in a class?
(a) Almost in every class.
(b) Class for which two or more than two objects will be created.
(c) Class for which copy constructor is defined.
(d) Class whose objects will be created dynamically.

10. (10%)
(a) What is the average case time complexity to search in a binary tree of N nodes?
(b) What is the average case time complexity to search in a sorted linked list of N nodes?
(c) What is the worst case time complexity to search in an AVL tree of N nodes?
(d) What is the worst case time complexity of Breadth-First-Search algorithm for a graph with V nodes

and E edges?

(e) What is the worst case time complexity of Dijkstra's Shortest Path Algorithm for a graph with V nodes and E edges?

11. (15%)

a). (8%) Please write a C function to search in a Binary Search Tree. Assume that each node contains a key that s a string. Return the node containing the matched key. You have to write the data structure of the tree node.

b). (7%) Please write a C function to insert a new node to the tail of a linked list. Suppose that each node contains a key that is of integer type. You have to write the data structure of the linked list node.

12. (9%) True or False (每答錯一小題倒扣該小題分數直至本題零分為止。)

(a) (3%) Quicksort is asymptotically optimal

(b) (3%) When a given set of numbers makes the partitioning of Quicksort maximally unbalanced at every recursive level, the corresponding decision tree is a full binary tree.

(c) (2%) Insertion sort is not stable

(d) (1%) Hamiltonian cycle is an NP-complete problem

13. (5% total; 1% each) Determine which of Floyd-Warshall algorithm, Depth first search, greedy algorithm, or dynamic programming could be the best fit to solve the following problems: (a) Minimum Spanning Tree; (b) 0-1 Knapsack problem; (c) construct Huffman coding; (d) topological sort; (e) construct an optimal binary search tree.

14. (6%) Use substitution method to prove a tight asymptotic lower bound for the recurrence:

$$T(n) = 4T(n/2) + n^2 \lg n$$

15. (5%) Given a chain of n matrices, $A_1, A_2, \ldots, A_n$ where the dimension of A_i is $d_{i-1} \times d_i$, if we want to exhaustively check all possible parenthesizations of the n-matrices multiplication, (a) derive a recurrence for the number of alternative parenthesizations, P(n) (2%); and (b) prove that it is exponential to n (3%).