科目名稱	計算機概論	類組代碼	A06
		科目碼	A0602

※本項考試依簡章規定所有考科均「不可」使用計算機。　　本科試題共計 **6** 頁

1. Multiple Choice (56 points; 4 points for each)

(1) What is the binary representation of 79?

　　A. 1001111
　　B. 1001101
　　C. 1010000
　　D. 1001100

(2) Which of the following is a process that tells the compiler the name and type of the variable being used in your program?

　　A. Assignment
　　B. Declaration
　　C. Initialization
　　D. Execution

(3) Which statement(s) about read-only memory (ROM) is/are false?

　　A. ROM is volatile memory.
　　B. ROM usually stores the boot loader programs.
　　C. ROM is non-volatile memory.
　　D. ROM's contents can be read and altered.

(4) There are seven network layers defined in the Open Systems Interconnection (OSI) model. Which layer includes the sublayer, the medium access control (MAC) layer?

　　A. Transport Layer
　　B. Network Layer
　　C. Data Link Layer
　　D. Physical Layer

(5) What statement(s) about Recursion is/are true?

　　A. A function is recursive if it invokes itself.
　　B. Recursion can let us use the same function to solve subproblems.
　　C. Recursion breaks a problem into smaller identical problems.
　　D. Recursion can be applied to the problems which can be solved by dividing the original problem into one or several smaller and similar pieces of subproblems

(6) Which of the following statement(s) is/are correct?

A. Breadth-first search (BFS) uses a stack to keep track of the sequence of visited vertices

B. For a binary tree, if both the left subtree and the right subtree of the root are binary search trees, then this binary tree is a binary search tree.

C. An AVL tree is a balanced binary search tree and maintains a height close to the minimum.

D. If a binary tree and a heap both contain the same set of keys, on average, searching a key in a binary search tree is faster than a heap.

(7) What is the result if we apply XOR between the binary representation of 8 and 12?

A. 1100

B. 0100

C. 1000

D. 0010

(8) How many function calls does a(15) produce if we used this recursive function written in C?

```c
int a(int n){
    if(n == 0)
        return 1;
    else
        return n * a(n-1);
}
```

A. 14

B. 15

C. 16

D. 17

(9) Which sorting methods have the time complexity $O(n^2)$ in average case?

A. Insertion Sort

B. Selection Sort

C. Merge Sort

D. Quick Sort

(10) There is a large enough array A with indices p and q which are initialized by 0. Array A and indices p and q can only be accessed in the functions $f(x)$ and $g()$. If functions $f(x)$ and $g()$ are defined as follows. Which data structure is operated by those functions?

$f(x)$
- $p \leftarrow p + 1$
- $A[p] \leftarrow x$

$g()$
- $x \leftarrow A[p]$
- $p \leftarrow p - 1$
- return x

    A. Hash

    B. Heap

    C. Stack

    D. Queue

(11) What is the correct printed message of the following program fragment written in C?

```c
    int score = 1, all_num_test = 6;
  for(int num_test = 0, final_score = 0;
    num_test < all_num_test;
    num_test++, final_score += score){
      printf("%d ", final_score);
  }
```

    A. 1 2 3 4 5

    B. 1 2 3 4 5 6

    C. 0 1 2 3 4 5

    D. 0 1 2 3 4 5 6

(12) Which logic operator should we apply between 0xa and 0x5 to get 0xf? 0x indicates the follow-up number is a hexadecimal number.

    A. NOT

    B. AND

    C. XOR

    D. OR

(13) Which comparison(s) between different storage capacities is/are incorrect?

    A. 1 byte = 8 bits

    B. GB > 2^{40} bytes

    C. TB > 1000MB

    D. $(\frac{GB}{1024})$ = KB

(14) Which of the following statement(s) is/are correct for C++?

    A. A while loop can always be replaced by a for a loop

    B. We can get the memory address of a variable by using the * operator

    C. A local variable may hide another local variable. When this happens, one cannot access that hidden local variable.

    D. We can only define the method for a class inside the class definition

2. (10 points; 5 points for each) Trace the following sorting methods as it sorts the array 2 8 4 1 6 7 3 into ascending order. You need to write the current state of the array after each pass. For example:

Selection Sort

pass 0: 2 8 4 1 6 7 3

pass 1: ....

pass 2: ...

...

pass N: 1 2 3 4 6 7 8

(1) Selection Sort

(2) Bubble Sort

3. (4 points) Please read the following program fragment written in C. If a user inputs the sequence of numbers -1, -2, -3, 1, 2, 3. What are the values stored in s, g, z, and i at the end of the execution of the loop?

```c
int z = 0, g = 0, s = 0, i = 0, t;
while (i < 6) {
  scanf("%d", &t);
  s = s + t;
  if (t >= 0){
    ++g;
  }
  else{
    z++;
  }
  i += 1;
}
```

4. (15 points) Consider the following sequence of operations on an initially empty search tree:
- Insert 10
- Insert 100
- Insert 30
- Insert 80
- Insert 50
- Remove 10
- Insert 60
- Insert 70
- Insert 40
- Remove 80

What is the height of the tree after these operations execute if the tree is a red-black tree?

5. (15 points) Please write the vertices of the following graph in the order using the breadth-first search (BFS) traversal beginning with vertex 0.