10%(I) Define/explain each of the following computer terminologies:
   - Name server
   - Router
   - Hypertext
   - Virtual memory
   - URL

10%(II) Explain the booting procedure in a general-purpose machine.

10%(III) For storing or transferring data, it is often helpful to reduce the data involved,
the data compression techniques are used. Explain what are run-length
encoding, Huffman codes, and the relative encoding?

10%(IV) What are the worst cases when the methods of insertion sort, selection sort,
merge sort, quick sort and heap sort are used to sort a list of integer data?
Discuss their time complexities.

10%(V) An increasing subsequence of a sequence of distinct integers \(x_1, x_2, \ldots, x_n\) is a
subsequence \(x_{i_1}, x_{i_2}, \ldots, x_{i_k}\), with \(i_1 < i_2 < \ldots < i_k\), such that, for all \(1 \leq j < k\),
we have \(x_{i_j} < x_{i_{j+1}}\). Design an algorithm to find the longest increasing
subsequence.

10%(VI) Briefly answer the following questions:

(a) Draw a flow chart representing the structure expressed by the C/C++ “for”
statement: (3%)
   ```
   for ( stmt_1; stmt_2; stmt_3) stmt_4;
   ```

(b) The following C program usually cause a runtime error, explain the reason
and try to fix it by adding one or two statements. (3%)
   ```
   #include<stdio.h>
   int main(){
   int* pp;  /*修正時這 statement 不准改，不然按分數:-)*/
   *pp = 38;  /* 這列也不准改 */
   }
   ```

(c) What is a binary tree representation of tree? What can it be used for?
   Explain it with an example. (4%)

10%(VII) Briefly answer the following questions:

(a) What is the difference between a homogeneous array and a heterogeneous
array? (3%)

(b) What is the difference between “call by value” and “call by reference”? (3%)

(c) Explain Object Oriented Programming paradigm in 300 to 400 中字, 不可以超過半頁的答案紙。 (4%)
10% (VIII) (a) Describe how a STACK can be implemented as a linked list. Diagram (圖解) the PUSH and POP operation for the linked-list implementation.

(b) Give the output of the following C program: (5%)  
```
#include<stdio.h>
int ggg(int n) { int tmp;
    int m=0;
    if (n == 0) return m;
    tmp = ++m; return ggg(n-1) + tmp;
}
int fun(int);
int main(){
    printf("ans=%d, %d\n", ggg(5), fun(5)); return 0;
}
int fun(int n) { int tmp;
    static int m=0;
    if (n == 0) return m;
    tmp = ++m; return fun(n-1) + tmp;
}
```

10% (IX) Write the following functions without any C library functions:

(a) Write a C function int toupper(int x); (就是 C library 的 toupper) which will return the upper case character of x. Return x if x is not a lower case char (5%)  
(b) Write a C function int strlen(char x[]); (就是 C library 裡的 strlen) which will return the length of the string x. (5%)  

10% (X) Suppose that IEEE floating standard (IEEE 754/854) is used to represent single precision floating number. (Note that Exponent is excess 127)

(a) What does "IEEE" stand for? Write the English and 中文 (2%)  
(Hint: the last "E" stands for Engineers 工程師)

(b) Convert the decimal number 1234567.8 into binary (3%)  
(c) Give the output of the following program: (5%)  
```
#include<stdio.h>
double y=1234567.8, d=0.0001;
const long NLOOP = 2000;
void dump(){
    int main() { long i; float y;
        /* float number uses IEEE 754 standard */
        printf("%13.4f, %13.4f\n", x, y);
        for(i=1; i<= NLOOP; ++i) x += d;
        printf("After Loop: x=%13.4f\n", x);
        printf("x="); dump(&x); printf("n"); return 0;
    }
    void dump(long*p){
        long x = "p, i;
        printf("%0%8X == binary ", x);
        for(i=1; i<=32; ++i){
            if(x<0) printf("1"); else printf("0");
            if(x%4 == 0) printf(" ");
            x = x << 1;
        }
    }

    Hint: IEEE 754/854 format:
    s eeeeee efffffff ggggggg hhhhhhh (注意有 hidden bit 1. 在 fraction 之左)
    EXP Fractional mantissa (23 bits)
    Sign (1 for negative, 0 for positive)
    以上 32 bits 代表 +/- 1.fffffffff gggggggg hhhhhhhhhhh * 2 的 (eeeee - 127) 次方