## I. Matching: choose the correct meaning. (20%)

| | |
|---|---|
| ____ 1. & | ____ 2. Dereferencing operator |
| ____ 3. Local variable | ____ 4. Scaling |
| ____ 5. static | ____ 6. Subscript |
| ____ 7. Scope | ____ 8. Off-by-one error |
| ____ 9. Function call | ____ 10. sizeof operator |
| ____ 11. srand | ____ 12. Divide-and-conquer |
| ____ 13. Null character | ____ 14. Pass-by-value |
| ____ 15. Rand | ____ 16. Pointer-offset notation |
| ____ 17. Search key | ____ 18. Pass-by-reference |
| ____ 19. Zeroth element | ____ 20. Header file |

a) String termination character.
b) Unary operator that returns the address of its operand.
c) Signifies that a local variable retains its value after the function in which it was defined is exited.
d) Contains function prototypes and definitions of various data types.
e) Generates and returns a pseudo-random number.
f) Value that the program attempts to find by searching.
g) Technique for reducing the range of values produced by function rand.
h) Invokes a function.
i) Provides a called function with the ability to access the caller's data directly.
j) ptr + 3 (ptr is a pointer).
k) First element in an array.
l) Technique for constructing a program from smaller, more manageable pieces.
m) Can be used to determine the size of an array in bytes.
n) The portion of a program in which an identifier may be referenced.
o) *.
p) Seeds the random-number generator.
q) Refers to a particular location or element in an array.
r) Passes a copy of an argument's value to a function.
s) Discrepancy between "ith element of the array" and "array element i."
t) Known only in the function in which it is defined.

## II. Close the sentences. (15%)

a) The _____ operator can be used to determine the size of an array in bytes.
b) A function that calls itself either directly or indirectly (i.e., through another function) is a(n) _____ function.
c) For a recursion to terminate, it must reduce the original problem to the simplest form, called the _____.
d) A pointer is a variable that stores the _____ of another variable.
e) The process of placing the elements of an array in order is called the _____ array.

## III. The following function is a **pointer-based** array version of the substring function **substr**.

(a:10%, b:5%, total:15%)

```
void substr(char dest[], const char src[], int n, int length)
{
for ( int i = 0; (dest[i] = src[i+n])!='\0' && i < length ; i++)
   std::cout << i << "" << n << dest[i];.
dest[length]='\0';
 }
```

a) Please modify the **substr** function by using just pointer notations, including the declarations of arguments and operations in the statements.
b) Please overload the **substr** with a function:
**void substr(char dest[], const char src[], int n)**
that takes the substring of **src[]** from position **n** to the end of **src[]** (use pointer notations too).

## IV. In a small company, there are three salesmen, Bob, John, and Joe, who are responsible for selling 5 products, P1~P5, with commission rates as in Table 1. Table 2 shows one month's sale figures of the three salesmen.

(a:5%, b:10%, c:10%, d:10%. total: 35%)

Table 1.

| Product Names | P1. | P2. | P3. | P4 | P5. |
|---|---|---|---|---|---|
| Rates | 0.02 | 0.03 | 0.01 | 0.02 | 0.04 |

Table 2.

| Name/Products | P1. | P2. | P3. | P4 | P5. |
|---|---|---|---|---|---|
| Bob | 5600 | 6700 | 8300 | 8100 | 7000 |
| John | 7600 | 8900 | 8100 | 4200 | 6600 |
| Joe | 6500 | 6900 | 9100 | 8900 | 8200 |

a) Declare a two-dimensional array **sales** and a one-dimensional array **rates** to store the sales figures and the commission rates of the products, using at least *two ways* to initialize the arrays.
b) Declare an array of pointers **name** and initialize it with the names, "*Bob*", "*John*", and "*Joe*" of the salesmen.
c) Define a function **commission** that takes a *one-dimensional array* and its *size* as arguments and returns the total monthly earned commission of a salesman. Please use the **pointer-based notation** (i.e. using pointers in the declaration of array argument and the access of array elements)
d) Please use a nested loop to print out the *names*, the *sales figures*, and the *total earned commissions* of the three salesmen.

## V. Write a recursive function **gcd** that returns the greatest common divisor of x and y, defined recursively as follows: If y is equal to 0, then gcd(x, y) is x; otherwise, gcd(x, y) is gcd(y, x % y), where % is the modulus operator. [HINT: This is the 輾轉相除法。NOTE: Check in the function that x must be larger than y.]

(15%)

今天最好笑的.....

小明正在客廳看棒球新聞。
爸爸從外面進來：「鈴木一朗呢？」
小明：「退休了！」
爸爸：「退什麼休！我是問"恁母伊郎"勒？