中原大學 104 學年度碩士班考試入學

104/3/4 8:00 AM~9:30 AM

誠實是我們珍視的美德，
我們喜愛「拒絕作弊，堅守正直」的你！

資訊工程學系資訊組

科目：資訊工程概論(含電腦基本概念與資料結構)　　(共 4 頁，第 1 頁)

□可使用計算機(僅限於四則運算、三角函數及對數等基本功能，可程式之功能不可使用)

■**不可使用計算機**

---------- **(不可直接作答於試題，請作答於答案卷)** ----------

1. (4%) Historians divide the era of computer into generations. The following are some major changes in them. The correct ordering of these generations by time is _____.

(A) The appearance of **laptop computers**.	**(B)** The emergence of **World Wide Web**.
(C) The invention of **integrated circuits**.	**(D)** The emergence of **computer networks**.

2. (10%) The **base** of a positional number system means the number of distinct symbols to be used. For example, the **base** of binary numbers is 2. A set of **bit-wise operators** is provided for problems **2.3~2.5**. Please answer the following questions about binary numbers.

2.1 $(35.625)_{10} = (\_\_\_\_\_)_2$ *// Convert a **decimal** number into a **binary** number.*

2.2 $(101011.101)_2 = (\_\_\_\_\_)_{16}$ *// Convert a **binary** number into a **hexadecimal** number.*

2.3 We can use the _____ operator to set the rightmost bit of a binary number (as bit 1).

2.4 We can use the _____ operator to flip (from 0/1 to 1/0) every bit of a binary number.

2.5 We can use the **logical right shift** operator and _____ _____ operator to count the number of 1's in a binary number.

bit-wise NOT (~), bit-wise AND (&), bit-wise OR (|), bit-wise XOR (^), logical right shift (>>)

3. (15%) A **computer network** is a combination of hardware and software that sends data from one computer to another. Rule sets called **protocols** are created to perform tasks on the internetworks. Please answer five questions about the **TCP/IP** protocol suite of **Internet**, which has five layers.

3.1 World Wide Web is a service on the **application** layer. The web browser uses the _____ to find one particular web page on a website.

3.2 The server computer may be running several processes at the same time, e.g., an FTP process and an HTTP process. The **transport** layer uses the ____ to identify one particular process.

3.3 Internet Protocol (IP) on the _____ layer is responsible for the delivery of a packet from the source network to the destination network.

3.4 What is the use of **Domain Name System** (DNS)? *// Clearly describe it in Chinese.*

3.5 What is the use of **router**? *// Clearly describe it in Chinese.*

4. (8%) **Figure 1** shows the basic units of a computer, i.e., **CPU**, **memory** and **I/O devices**. Please fill in the blanks for each of the following questions about them.

4.1 A program is loaded in _____ when it is ready to run.

4.2 Each instruction for execution is put into the **instruction register** in the _____ unit of **CPU**.

4.3 A small storage unit called _____ memory is placed between **CPU** and **main memory**.

4.4 **CPU** and **memory** are connected by three kinds of connections, including the **data bus**, **control bus** and _____ **bus**.

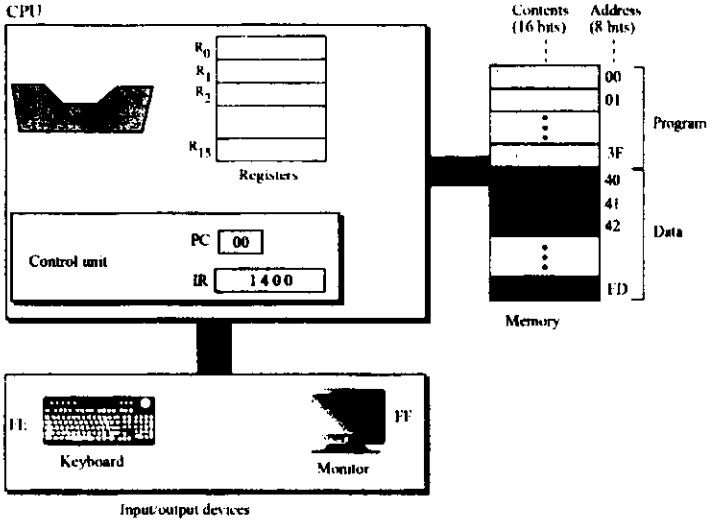

Figure 1. The basic units of a computer[1]

Relation A

A1	A2	A3
1	12	100
2	16	102
3	16	103
4	19	104

Relation B

B1	B2
22	214
24	216
27	284
29	216

Relation C

C1	C2	C3
31	401	1006
32	401	1025
33	405	1065

Figure 2. Three relations

5. (10%) **Structured Query Language** (SQL) is the language standardized for use on **databases**. Given three relations in **Figure 2**, complete the following **SQL** queries to get correct results.

5.1

A1	A2	A3
3	16	103
4	19	104

←

Select *
From A
Where _____

5.2

A1	A2	A3
1	12	100
4	19	104

←

Select *
From A
Where _____

5.3

B1
24
29

←

Select B1
From B
Where _____

5.4

A3	C2
102	401
103	401

←

Select _____
From A, C
Where A2*2 = C1

5.5

A1	B2
1	214

←

Select A1, B2
From _____
Where B1 < 25 **and**
B2 > (A3 * 2 + A2)

[1] **Figure 1** was taken from the textbook: **Foundations of Computer Science** written by Forouzan & Mosharraf.

6. (15%) An **operating system** facilitates the execution of other programs and the access to hardware and software resources. It has at least four duties: memory manager, process manager, device manager and file manager. Please answer five questions about them.

6.1 Memory manager enables **virtual memory** by **demand** _____ and **demand segmentation**.

6.2 Process manager uses two schedulers: _____ **scheduler** and process **scheduler**.

6.3 If a process needs to print out a message, it moves from **running state** to _____ **state**.

6.4 In process management, when does **deadlock** occur? *// Clearly describe it in Chinese.*

6.5 In process management, when does **starvation** occur? *// Clearly describe it in Chinese.*

7. (12%) **Recursion** is a useful programming concept and problem-solving technique. Please fill in the blanks to complete the following algorithms.

7.1 Use correct parameters in the **recursive call** that reverses the order of all items in an array.

```
Algorithm ReverseArray(anArray, low, high)
   if low < high then
   {  Swap anArray[low] and anArray[high];
      ReverseArray(anArray,_____);    }    // end of if statement
```

7.2 Use correct parameters in the **recursive call** that solves the **Tower of Hanoi** problem.

```
Algorithm SolveToH(n, A, B, C)    // Move n disks from A to C and B is the auxiliary peg.
  if (n == 1) then
      Move a disk directly from A to C;
  else {
      SolveToH(n - 1, _____);
      SolveToH(1, A, B, C);
      SolveToH(n - 1, B, A, C);    }    // end of else statement
```

7.3 Use correct parameters in the **tail recursion** that compute **factorial n** (n!).

```
Algorithm SolveF(n, p)        // Call SolveF(n, 1) and use p to keep the partial product.
  if (n == 1) then
      return p;               // base case: at this moment, p = n!
  else return SolveF(n - 1, _____);
```

8. (10%) **Array** and **Linked List** are two data structures commonly used in programming. Assume that the array **A**[1....n] and the linked list **L** both keep n integers and sorted in **ascending order**. Please fill in the blanks to complete the following **C** functions.

8.1 Find the position of x in **A**.

```
int SearchArray(int A[], int x)
{   int i = 0, j = n - 1;
    while (i <= j)
    {   int mid = (i + j) / 2;
        if (A[mid] == x)
            return mid;    // x is found
        else if (A[mid] > x)
            j = mid - 1;
        else _____;
    }   // end of while statement
    return -1;             // x does not exist
}   // end of SearchArray
```

8.2 Find the first node with value x in **L**.

```
NODE *SearchList(NODE *cur, int x)
                    // Call: ans =SearchList(L, x);
{   NODE *pre = NULL;

    while (cur != NULL)
        if (cur->value < x)
        {   _____;
            cur = cur->next;
        }   // end of if statement
        else break;
    return cur;
}   // end of SearchList
```

8.3 Make **A** in **descending order**.

```
void ReverseArray(int A[], int n)
{   int i = 0, j = n - 1;

    while (i < j)
    {   int temp = A[i];

        _____ ____;
        A[j] = temp;
        i = i + 1;
        j = j - 1;
    }   // end of while statement
}   // end of ReverseArray
```

8.4 Make **L** in **descending order**.

```
NODE *ReverseList(NODE *cur)
                    // Call: L = ReverseList(L);
{   NODE *pre = NULL;

    while (cur != NULL)
    {   NODE *temp = cur->next;

        ____ _ _ _____;
        pre = cur;
        cur = temp;
    }   // end of while statement
    return pre;     // the new head of L
}   // end of ReverseList
```

9. (10%) 中原大學資訊工程系研究重點涵蓋**網路與資訊安全、系統與 IC 設計自動化、資訊系統與資訊科技應用**。請選擇其中一個自己最感興趣且熟悉的領域，提出一項自己可能投入的研究主題，以 **150 字以內的中文**清楚描述該主題的發展背景、現況及未來方向，並且指出相關課程或關鍵技術。