臺灣綜合大學系統 108 學年度學士班轉學生聯合招生考試試題

科目名稱	計算機概論	類組代碼	D24
		科目碼	D2491

※本項考試依簡章規定各考科均「不可以」使用計算機　　本科試題共計 5 頁

1. Multiple Choice (32 pts, 2 pts for each)　請於答案卷上作答，否則不予計分

(1). Suppose the 8-bits floating-point notation is adopted, where the high-order of the byte as the sign bit, the three bits following the sign bit as the exponent field and the remaining four bits as the mantissa field. Which of the following values cannot be represented accurately in the floating-point format?

A. $4\frac{1}{2}$

B. 9

C. $\frac{15}{16}$

D. $\frac{13}{16}$

(2). Which of the following memories does not belong to the type of non-volatile memory?

A. Dynamic random-access memory (DRAM)

B. Phase change memory (PCM)

C. NAND flash memory

D. Hard disk drive (HDD)

(3). Imagine that a host with IP address 150.55.66.77 wishes to download a file from the web server at IP address 202.28.15.123. Select a valid socket pair for a connection between this pair of hosts.

A. 150.55.66.77:80 and 202.28.15.123:80

B. 150.55.66.77:150 and 202.28.15.123:80

C. 150.55.66.77:2000 and 202.28.15.123:80

D. 150.55.66.77:80 and 202.28.15.123:3500

(4). What statement concerning privileged instructions is considered false?

A. They may cause harm to the system.

B. They can only be executed in kernel mode.

C. They cannot be attempted from user mode.

D. They are used to manage interrupts.

(5). Which of the following statements is false?

A. Mobile devices must be concerned with power consumption.

B. Mobile devices can provide features that are unavailable on desktop or laptop computers.

C. Mobile devices usually have fewer processing cores than a standard desktop computer.

D. The difference in storage capacity between a mobile device and laptop is shrinking.

(6). Which RAID level is best for storing large volumes of data?

A. RAID levels 0 + 1 and 1 + 0

B. RAID level 3

C. RAID level 4

D. RAID level 5

(7). Absolute code can be generated for ____.

A. compile-time binding

B. load-time binding

C. execution-time binding

D. interrupt binding

(8). Which of the following describes the action of storing a bit of data in a mask ROM?

A. A1 is stored in a bipolar cell by opening the base connection to the address line.

B. A1 is stored by connecting the gate of a MOS cell to the address line.

C. A0 is stored in a bipolar cell by shorting the base connection to the address line.

D. A0 is stored by connecting the gate of a MOS cell to the address line.

(9). What is the binary representation of 123?
A. 1010111
B. 1101011
C. 1111011
D. 1110110

(10). Which of the following statement is wrong regarding KB, MB, and GB?
A. 1KB < 1GB
B. 1MB = 1024KB
C. 1GB = 1024KB
D. 1KB = 1024B

(11). Consider the following program code written in C.

```
for( int i = 20; i >= 1; i -= 3 )
    printf("*");
```

How many '*' will be printed after its execution?
A. 0
B. 6
C. 7
D. 8

(12). What is the result of the following program code written in C?

```
int i = 3, j = 4, k = 5;

printf("%d", i++ + j++ + --k );
```

A. 11
B. 13
C. 14
D. 12

(13). Assume the following declaration:

```
int i, j, k, *ptr;
```

Which of the following expressions is equivalent to `i+j**ptr++-k*2`?
A. ((i + j) * ((*ptr) ++) - k) * 2
B. i + j * (*(ptr++)) - (k * 2)
C. i + j * ((*ptr) ++) - (k * 2)
D. ((i + j) * (*(ptr++)) - k) * 2

(14). Priority queue is a data structure that supports the following two operations in $O(\log n)$ time: (i) insertion of (mutually comparable) data and (ii) extract the current maximum element. Which of the following data structures can fulfill this requirement?
A. Stack
B. Binary Search Tree
C. Linked List
D. Heap

(15). Let G be an undirected graph with n vertices, m edges, and no negative cycles. What is the time complexity of Dijkstra's single source shortest path algorithm?

A. $O(nm + n\log n)$
B. $O(nm)$
C. $O(n\log n)$
D. $O(n^2m)$

(16). Which of the following algorithms can be used to detect negative cycles in a weighted directed graph which may possibly contain edges with negative weight?
A. Dijkstra's single-source shortest path algorithm
B. Floyd-Warshall all-pair shortest path algorithm
C. Bellman-Ford algorithm
D. Breadth-First Search

2. (12 pts) Suppose the machine language described in Table I has been extended as suggested at the end of this section. Moreover, suppose register 8 containsthe pattern DB, the memory cell at address DB contains the pattern CA, andthe cell at address CA contains the pattern A5. What bit pattern will be inregister 5 immediately after executing each of the following instructions?
(1) 25A5 (4pts)
(2) 15CA (4 pts)
(3) D508 (4 pts)

Table 1

Op-code	Operand	Description
1	RXY	LOAD the register R with the bit pattern found in the memory cell whose address is XY.
2	RXY	LOAD the register R with the bit pattern XY.
D	RXY	Load register R with the contents of the memory cell whose address is found at address XY

3. (8 pts) Suppose a queue implemented in a circular fashion is in the state shown in Figure 1 below.
(1) Draw a diagram showing the structure after the letters G and R are inserted, three letters are removed, and the letters D and P are inserted. (4 pts)

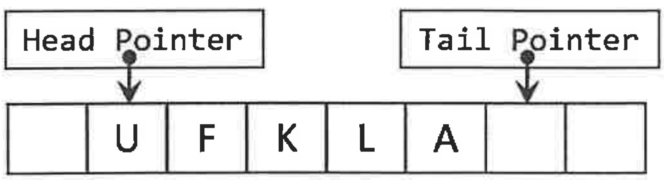

Figure 1

(2) What error occurs in part (a) if the letters G, R, D, and P are inserted before any letters are removed? (4 pts)

4. (6 pts) A semaphore S is an integer variable that is accessed only through two standardatomic operations: Wait and Signal

- Wait(S): while (S <= 0)
```
{
    do_nothing();
}
S = S - 1;
```

- `Signal(S): S = S + 1;`

Observe a railroad crossing, where a semaphore S is used to indicate whether or not cars can pass the crossing (the critical region in this question). When trains or cars arrive at the crossing, the code segments in Figure. a and Figure. b will be executed respectively (that is, Figure. a for each train arrival and Figure. b for each car arrival) to ensure that trains and cars can pass the crossing safely. Please complete the code segments by filling in blank_1, blank_2 and blank_3 with correct answers.

```
Semaphore S = [blank_1];
```

```
if (A train is coming)
{
  [blank_2];

  // critical region
  train_passing();

  [blank_3];
}
```

(a)

```
while (S <= 0)
{
  // wait until S > 0
  wait_for_train();
}
car_passing();
```

(b)

Figure 2

5. (8 pts) The following table represents a portion of a linked list in a computer's mainmemory. Each entry in the list consists of two cells: The first contains a letter ofthe alphabet; the second contains a pointer to the next list entry.
   (1) Please alter the pointers so that the letter N is no longer in the list. (4 pts)
   (2) Please replace the letter N with the letter G and alter the pointers so that thenew letter appears in the list in its proper place in alphabetical order. (4 pts)

Table 2

Address	Contents
30	J
31	38
32	B
33	30
34	X
35	46
36	N
37	40
38	K
39	36
40	P
41	34

6. (12 pts) The conditional probability that event E occurs given that event F occur is defined as

$$\Pr(E|F) = \frac{Pr(E \cap F)}{Pr(F)}$$

   (1) (3 pts) Show that, if E andF are independent and $Pr(F) \neq 0$, then $\Pr(E|F) = \Pr(E)$

(2) (5 pts) (Law of Total Probability) Let $E_1, E_2, \ldots, E_n$ be mutually disjoint events in the sample space Ω, and let $\bigcup_{1 \le i \le n} E_i = \Omega$. Prove that

$$\Pr(B) = \sum_{1 \le i \le n} Pr(B|E_i) \cdot \Pr(E_i)$$

(3) (4 pts) Let Ω denote the sample space of throwing two fair 6-sided dices. Let A denote the event that the sum of two throws is even and B denote the event that the at least one throw results in 3. Calculate $\Pr(B|A)$ and $\Pr(A|B)$.

7. (12 pts) Consider the following pseudo-code for the MergeSort algorithm.

```
   function merge_sort( list M of length n )
1      if n ≤ 1 then
2          return M
3
4      var Left := empty list, Right := empty list, Result := empty list
5
6      Split the list M into two halves.
       Add the first half into Left and the second half into Right
7
8      Left := merge_sort(Left)
9      Right := merge_sort(Right)
10
11       Merge Left and Right into Result in sorted order in O(n) time
12
13       return Result
```

(1) (5 pts)Describe a method to achieve the requirement of Line 11 in the above pseudo-code,i.e., to merge Left and Right into Result in sorted order in $O(n)$ time.

(2) (3 pts) Let T(n)denote the time complexity of the merge_sort algorithm. Write down the recurrence relation of T(n).

(3) (4 pts) Let T(n) denote the time complexity of the merge_sort algorithm.Solve the recurrence of T(n) for the asymptotic solution. Express the solution using the Big-O notation.

8. (10 pts) Let $G = (V, E)$ be an undirected graph and $v \in V$ be an arbitrary vertex in G. Consider the following pseudo-code for the Depth-First Search algorithm：

```
procedure DFS(G,v):
    label v as discovered
    for each neighboring vertex w of v do
        if vertex w is not labeled as discovered then
            recursively call DFS(G,w)
```

(1) (4 pts) What is the time complexity of this method?

(2) (6 pts) Prove or disprove that: If G is connected, then a call to DFS(G,v) discovers every vertexof G.