



1. (6 points) A data with binary representation is 1101011011. Please derive its hamming code.
2. (7 points) In the computer networks, what is the OSI 7-layer?
3. (10 points) Please transfer the infix expression “6+4\*7-8/3\*2” into prefix and postfix expressions.
4. (5 points) The representation of a single precision floating-point numbers in IEEE 754 standard contains one sign bit  $s$ , 23 significand bits, and 8 exponent bits  $E$ , and takes the value of

$$(-1)^s * (1 + \text{significand}) * 2^{(E-127)}$$

s	exponent	significand
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What is the decimal value of the following representation

11000000111100000000000000000000?

5. (12 points) A computer system has 32 address lines and 32-Kbyte cache. Each cache block size is 32-byte. For the following cases, how many tag-bit is required for each cache block?
  - (a) A direct mapped cache
  - (b) A fully associative cache
  - (c) A 8-way set associative cache
6. (5 points) Suppose two jobs are being multi-programmed together. Job A uses a great deal of CPU time and performs relatively little I/O. Job B performs many I/O operations, but requires very little CPU time. Which of these two jobs should be given higher dispatching priority to improve the overall system performance? Why?
7. (5 points) The performance of a 200 MHz microprocessor P is measured by execution 10,000,000 instructions of benchmark code, which is found to take 0.125 s. What is the value of CPI?
8. (10 points) Write a step by step execution of operations that happen after a user presses a key on the keyboard. (You should describe the flow as much detail as possible.)
9. (10 points) Please write a C program to find whether a machine is big endian.



10. (10 points) The following program is used to find the largest integer in the array. Please find the time complexity of this program in the worst case.

```
int FindMax(int array[], int n){
    int curMax, i;
    if (n <= 0)
        return -1;
    curMax = array[0];
    for (i = 1; i < n; i++) {
        if (array[i] > curMax) {
            curMax = array[i];
        }
    }
    return curMax;
}
```

11. (10 points) Given the C code segment below,

```
int *q, s, *t=&s;
s=1;
++(*t);
q=t;
++(*q);
```

After the above code segment, what value does \*q contain?

12. (10 points) What is the output of the following code fragment?

```
int f1(int n, int m){
    if(n < m)
        return 0;.
    else if(n==m)
        return m + f1(n-1, m);
    else
        return n + f1(n-2, m-1);
}
int main(){
    cout << f1(5,4);
    return 0;
}
```



A. 題目1至題目10為單選題，每題5分。(50%)

1. According to the storage-device hierarchy, what device has the fastest access time?
  - (A) magnetic disk
  - (B) electronic disk
  - (C) magnetic tape
  - (D) optical disk
  
2. What category does the system call "wait event" belong to?
  - (A) information maintenance
  - (B) file manipulation
  - (C) process control
  - (D) communications
  
3. What is the structure of the original UNIX?
  - (A) simple structure
  - (B) layered approach
  - (C) microkernel
  - (D) modules
  
4. When an external interrupt occurs, what state will the running process be changed into?
  - (A) terminated
  - (B) waiting
  - (C) ready
  - (D) running
  
5. What thread library is generally implemented using a thread library available on the host system?
  - (A) POSIX Pthreads
  - (B) Win32
  - (C) Win64
  - (D) Java
  
6. What measure is not considered as a CPU-scheduling criterion?
  - (A) I/O time
  - (B) CPU utilization
  - (C) turnaround time
  - (D) response time



7. What is a hardware-based solution to the critical-section problem?
- (A) Peterson's solution
  - (B) TestAndSet( ) instruction
  - (C) semaphore
  - (D) monitor
8. What deadlock solution was proposed, based on the statement "a safe state is not a deadlocked state"?
- (A) deadlock prevention
  - (B) deadlock avoidance
  - (C) deadlock detection
  - (D) recovery from deadlock
9. What is not the common technique for structuring the page table?
- (A) hierarchical paging
  - (B) hashed page tables
  - (C) inverted page tables
  - (D) translation look-aside buffer
10. For the IBM 370 MVC instruction, how many frames should be required in the worst case when executing it?
- (A) 2
  - (B) 4
  - (C) 6
  - (D) 8

B. 題目11至題目13為詳答題。(50%)

11. (a) Why we need the synchronization mechanism in the operating system? (5%)  
(b) Define the Dining Philosopher (DP) problem in the operating system. (3%)  
(c) Solve the DP problem by using the "Monitor" method and give some detail descriptions of the codes. (12%)
12. (a) What are the 4 necessary conditions of exhibiting a deadlock in OS? [List each and give a detail description] (8%)  
(b) The Resource Allocation Graph (RAG) algorithm can be used for solve the deadlock problem for \_\_\_\_\_ Instance(s) case. (2%) Detail the RAG algorithm. (5%)
13. Terminology. (15%) //Specify the functions of each in detail, rather than translation.  
(a) Cloud Computing: (10%)  
//Describe at least three main parts for Cloud Computing & the CC features  
(b) System calls: (5%)



1. (6% ; 複選全對才給分) Check whether B is the inverse of A, for each of the following 2x2 matrices A and B .

(a)  $A = \begin{bmatrix} 7 & -3 \\ 5 & -2 \end{bmatrix}, B = \begin{bmatrix} -2 & 3 \\ -5 & 7 \end{bmatrix}$  (b)  $A = \begin{bmatrix} 3 & 4 \\ 5 & 7 \end{bmatrix}, B = \begin{bmatrix} -4 & 7 \\ 3 & -5 \end{bmatrix}$

(c)  $A = \begin{bmatrix} 2 & -9 \\ -1 & 5 \end{bmatrix}, B = \begin{bmatrix} 9 & 5 \\ 2 & 1 \end{bmatrix}$  (d)  $A = \begin{bmatrix} 7 & 6 \\ 8 & 7 \end{bmatrix}, B = \begin{bmatrix} 7 & -6 \\ -8 & 7 \end{bmatrix}$

2. (6%) Prove the Cauchy-Schwartz inequality  $|u \cdot v| \leq \|u\| \times \|v\|$ , if  $u$  and  $v$  are vectors in  $\mathbb{R}^n$ .

3. (6%) Find the norms and the unit vectors of the following column vectors.

(a)  $(1, 2, 3)^T$

(b)  $(5, 12)^T$

4. (6%) Find a basis for the row space of the following matrix A, and determine its rank.

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 4 \\ 1 & 1 & 5 \end{bmatrix}$$

5. (6%) Show that the set  $\left\{ (1, 0, 0), \left(0, \frac{3}{5}, \frac{4}{5}\right), \left(0, \frac{4}{5}, -\frac{3}{5}\right) \right\}$  is an orthonormal set.

6. (a) (5%) Diagonalize the matrix  $A = \begin{bmatrix} 0 & 0 & 3 \\ 1 & 0 & 1 \\ 0 & 1 & 3 \end{bmatrix} = P\Lambda P^{-1}$ . Show the invertible matrix P and the

diagonal matrix  $\Lambda$ . (b) (5%) Find  $A^{100}$ .

7. (10%) Determine the least-squares parabola for the data points. (1, 2), (2, 5), (3, 7), (4, 1)

8. (6%) Convert the binary number 10110.1101 to base 10 and also convert 18.2 to binary.

9. (4%) Given  $A = \{1, 2, 3, 4\}$  and  $B = \{u, v, w\}$ , how many different functions are there from A to B? From B to A?

10. (10%) For  $n \in \mathbb{Z}^+$ , prove that  $10^{2n} + 5 \times 12^n - 6$  can be divided by 11.

11. (5 %) In how many ways can a particle move in the  $xy$ -plane from the origin to the point (9,5) if the moves that are allowed are of the form:

(R):  $(x, y) \rightarrow (x+1, y)$ ; (U):  $(x, y) \rightarrow (x, y+1)$



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碩士班招生考試試題

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科目：線性代數與離散數學

12. (5%) Let  $P = a_1^{e_1} a_2^{e_2} a_3^{e_3} a_4^{e_4}$  and  $Q = a_1^{f_1} a_2^{f_2} a_3^{f_3} a_5^{f_5}$ , where  $a_1, a_2, a_3, a_4, a_5$  are distinct primes, and  $e_1, e_2, e_3, e_4, f_1, f_2, f_3, f_5 \in \mathbb{Z}^+$ . How many common divisors are there for  $P, Q$ ?

13. (10%) Which of the following are statements?

- (a) The moon is made of green cheese.
- (b) He is certainly a tall man
- (c) Two is a prime number.
- (d) Will the game be over soon?
- (e) Next year interest rates will rise.

14. (10%) If  $n \in \mathbb{Z}^+$  and  $n \geq 2$ , prove that  $2^n < \binom{2n}{n} < 4^n$ .