本科目不得使用計算機　　　　　　　　本科目試題共 **4** 頁

PART 1. Introduction to Computer Science

A. Multiple Choice (24 %)

1. Assume there is no compilation error. If a=7.00, b=7.00, c= 6.00, then what is printed by the following C statement: printf ("%.3f", sqrt(a+b*c));
   (a) 7.0 (b) 7.00 (c) 7 (d) 7.000

2. In the ___ hashing method, selected digits are extracted from the key and used as the address.
   (a) direct (b) division remainder (c) modulo division (d) digit extraction

3. A Turing machine has these components: ___.
   (a) tape, memory, and read/write head (b) disk, controller, and read/write head
   (c) tape, controller, and read/write head (d) disk, memory, and controller

4. In ___ sort, the smallest item from the unsorted list is swapped with the item at the beginning of the unsorted list.
   (a) bubble (b) selection (c) insertion (d) shell

5. If we are adding two numbers, one of which has an exponent value of 7 and the other an exponent value of 9, we need to shift the decimal point of the smaller number ___.
   (a) one place to the left (b) one place to the right (c) two places to the left (d) two places to the right

6. The ___ method of integer representation is the most common method for storing integers in computer memory.
   (a) sign-and-magnitude (b) one's complement (c) two's complement (d) unsigned integers

7. A computer's hard disk, memory, and CPU can divide into multiple virtual machines, and each virtual machine will have its own hard disk, memory and CPU. What kind of technology does be used in the following?
   (a) Parallel computing (b) Multitasking (c) Multicore (d) Virtualization

8. Hamming distance is greater than or equal to a group of seven numbers, how many bits can be self-correcting errors at the most?
   (a) 4 (b) 3 (c) 2 (d) 1

B. Short Answer Questions (26%)

1. According to the following code segment of C language, please show the print results? (6 %)

```c
#include <stdio.h>
#include <stdlib.h>

void bf(int *i, int *j)
{
    *i=*j+4;
    *j=*j-2;
    printf("%d %d \n", *i,*j);
```

```
}
void af(int *a, int b)
{
    *a+=4;
    b*=3;
    printf("%d %d \n", *a,b);
    bf(a, &b);
}
int main(int argc, char *argv[])
{
    int x=6,y=9;
    af(&x,y);
    printf("%d %d \n", x,y);
        return 0;
}
```

2. A binary tree has 10 nodes. The inorder and preorder traversal of the tree are shown below. Preorder: JCBADEFIGH; Inorder: ABCEDFJGIH
    Draw the tree. (6 %)

3. Convert the following numbers in 32-bit IEEE format. (8 %)
    (a) -12.640625 (b) -0.375

4. Write down the pseudo code for the quick sort. (6 %)

PART 2. Operating Systems

1. The processes typically will be assigned to the CPU based on the given scheduling algorithm. Suppose there are four processes and their arrival time, burst time, and priority are as shown in the following table. (8%)

Process	Arrival Time	Burst time	Priority
P_1	0	10	1
P_2	1	8	1
P_3	2	3	2
P_4	3	6	3

(a) What is the execution order and average time of these processes when using first-come, first-served (FCFS) scheduling algorithm?

(b) What is the execution order and average time of these processes when using shortest-job-first (SJF) scheduling algorithm?

(c) What is the execution order and average time of these processes when using priority-scheduling algorithm?

(d) What is the execution order and average time for these processes when using round-robin (RR) scheduling algorithm? Note that each process will have a fixed time to execute in RR called a quantum which is set equal to 5 here.

2. Given the following snapshot of the system: (9%)

	Allocation ABCD	Max ABCD	Available ABCD
P_0	0 1 1 2	0 1 1 3	1 4 2 3
P_1	1 0 0 1	1 5 5 5	
P_2	1 5 4 3	2 7 4 3	
P_3	0 5 5 2	0 5 5 3	

(a) Please show the content of the matrix **Need**? (4%)

(b) Is this system in a safe state? If yes, please show the details; otherwise, please explain why. (5%)

3. Given a two-dimensional array A declared as follows: (8%)

```
int A[100][100];
```

where each integer occupies four bytes and A[0][0] is at location 1,600 in a paged memory system with pages of size 1,600. A small process for manipulating the matrix resides in page 0 (locations 0 to 1,599); thus, every instruction fetch will be from page 0. For three page frames, how many page faults are generated by the following array initialization loops, using LRU replacement and assuming that page frame 1 has the process in it, the other two are initially empty, and the array is stored in memory row by row?

(a)
```
for (int i = 0; i < 100; i++)
    for (int j = 0; j < 100; j++)
        A[i][j] = 0;
```

(b)
```
for (int j = 0; j < 100; j++)
    for (int i = 0; i < 100; i++)
        A[i][j] = 0;
```

PART 3. Computer Organizations

1. True or False (10%)

   (a) The cost of carry lookahead adder (CLA) is always higher than that of ripple carry adder (RCA).

   (b) The pipelining is a key factor that makes the memory hierarchy work well.

   (c) The potential amount of instruction-level parallelism (ILP) can be increased by the use of static multiple issue.

   (d) For a disk, the mean time to failure (MTTF) is a reliability measure. We can use the fault forecasting to improve MTTF.

   (e) The use of branch target buffer (BTB) would increase the accuracy of branch prediction.

2. Answer the following questions briefly. (15%)

   (a) What's the *immediate* addressing mode?

   (b) Show the state diagram of 2-bit branch prediction scheme.

   (c) For a program *P*, the instruction number is N and the frequency of all loads and stores is 35%. Assume an instruction cache miss rate is 2% and a data cache miss rate is 5%. If the miss penalty are 80 and 100 cycles for instruction cache miss and data cache miss, respectively, please determine the total number of memory-stall cycles for program *P*.