國立交通大學 104 學年度碩士班考試入學試題

科目：計算機概論（5091）　　考試日期：104 年 2 月 6 日 第 2 節

系所班別：資訊管理與財務金融學系　組別：資管碩甲組　　第 1 頁，共 2 頁

【不可使用計算機】＊作答前請先核對試題、答案卷（試卷）與准考證之所組別與考科是否相符!!

1. Briefly explain each following component of an OS kernel:
(a) **(3%)** File manager.
(b) **(3%)** Device drivers.
(c) **(3%)** Memory manager.
(d) **(3%)** Scheduler.
(e) **(3%)** Dispatcher.

2. Suppose the function *Modify* is defined by

```
def Modify(Y):
    Y = 9
    print(X)
    print(Y)
```

Also suppose that X is a global variable.
(a) (4%) If parameters are passed by value, what will be printed when the following program segment is executed?

```
X = 5
Modify(X)
print(X)
```

(b) (4%) What if parameters are passed by reference?

3. (12%) Write the C++ codes to implement a recursive algorithm that lists all possible rearrangements of the symbols in a string of *n* distinct characters.

4. (10%) Suppose you are given 16 processors, each capable of finding the sum of two multidigit numbers in a millionth of a second. Describe how parallel processing techniques can be applied to find the sum of 128 numbers. What is the minimum time required for this parallel processing? How much time does a single processor require to find this same sum?

5. (10%) Please design a flip-flop using the minimum number of NOR gates and also explain how it works in detail.

6. (7%) What is the largest value that can be represented in a floating-point system in which each value is encoded by two bytes whose most significant bit is the sign bit, the next six bits represent the exponent field in excess notation, and the last nine bits represent the mantissa? Please demonstrate your calculation in detail.

7.

(a) (4%) Explain why adding only a few characters to a text file may increase the file's size by several hundred bytes and at other times may not increase the file's size at all.

(b) (4%) Please propose two methods to increase the computer's throughput.

8. (12%) Below is a subset of relations from COMPANY schema. The keys have been underlined.

EMPLOYEE(EMPNAME, EmpID, ADDRESS, SALARY, SupervisorEmpID, DNUMBER)
DEPARTMENT(DNAME, DNUMBER, MANAGERID)
WORKS_ON(EmpID, PNUMBER, HOURS)
PROJECT(PROJNAME, PNUMBER, DNUMBER)

In a company, each employee works for a department and may work on several projects. The EMPLOYEE table also keeps track of the direct supervisor of each employee. Supervisors are also employees. An employee (supervisor) may be the direct supervisor of several employees.

Query: Retrieve the name and salary of each supervisor who works for the "MIS" department and is the direct supervisor of at least five employees.

Express the Query in SQL statement by using a correlated nested query.

9. (12%) Consider the universal relation R = {A, B, C, D, E, F, G, H, I, J, K, L} and the set of functional dependencies F = {{A, B}→{C},{A}→{D, E},{B}→{F},{F}→{G,H}, {D}→{I,J}}. Decompose R into 2NF, then 3NF relations. You need to clearly show the results (tables) and the keys of the tables after the decompositions.

10. (6%) Briefly explain three main ideas of distributed file systems (e.g. Hadoop DFS) for distributed processing of large datasets.