國立交通大學 103 學年度碩士班考試入學試題

科目：計算機概論(5091)

考試日期：103 年 2 月 14 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

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1. 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.

   (a) (12%) Query: For each employee who works on the "Mobile 4G" project and whose salary is greater than the salary of his supervisor, list the name of employee and the name of his supervisor.

   Express the Query in SQL statements.

   (b) (10%) Explain the referential integrity constraint. Describe three possible options to handle the **DELETE** operation when a referential integrity constraint is violated. Please draw diagram and use the EMPLOYEE and DEPARTMENT table as examples to aid your explanations.

2. Answer the following.

   (a) (5%) If both a compute-bound (CPU computations) process and an I/O-bound (I/O operations) process are waiting for a time slice, which should be given priority? Why?

   (b) (6%) Explain the following terms.　(b-1) Thread　(b-2) Multi-Threading

3. Solve the following recurrence relations.

   (a) (5%) $a_{n+2} - 3a_{n+1} - 15a_n = 0, n \geq 0, a_0 = 3, a_1 = 7$.

   (b) (8%) Let a_n, for $n > 0$, be the number of moves required in the Towers of Hanoi with n disks. Formulate a recurrence relation of a_n. Solve the recurrence relation.

4. (6%) Describe the problems of finding Hamiltonian cycles and Eulerian circuits, respectively. Are the two problems NP-hard?

5. (7%) Let $G=(V, E)$ be an undirected, connected graph in which the weights on edges are all different. Show that the minimum spanning tree is unique.

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6. (8%) For n distinct elements $a_1, a_2, \ldots, a_n$, with weights $w_1, w_2, \ldots, w_n$, such that $\sum_{i=1}^{n} w_i = 1$, the weighted median is the element x_k satisfying $\sum_{x_i < x_k} w_i < 1/2$ and $\sum_{x_i > x_k} w_i \geq 1/2$. Give an algorithm for locating the weighted median. Analyze the time complexity of your algorithm.

7. (3%) Which of the following items of information would not be contained in an operating system's process table?

   A. The location of the memory area assigned to the process

   B. The priority of each process

   C. Whether the process is ready or waiting

   D. The machine language instructions being executed by the process

8. (3%) Which of the following is a protocol for controlling the right to transmit a message in a network?

   A. UDP　　　B. CSMA/CD　　　C. TCP　　　D. FTP

9. (3%) Which of the following instructions (as described in the language description table) changes the contents of a memory cell?

   A.　10AB　　B.　20AB　　C.　30AB　　D.　40AB

Language Description Table

Op-code	Operand	Description
1	RXY	LOAD the register R with the bit pattern found in the memory cell whose address is XY. *Example:* 14A3 would cause the contents of the memory cell located at address A3 to be placed in register 4.
2	RXY	LOAD the register R with the bit pattern XY. *Example:* 20A3 would cause the value A3 to be placed in register 0.
3	RXY	STORE the bit pattern found in register R in the memory cell whose address is XY. *Example:* 35B1 would cause the contents of register 5 to be placed in the memory cell whose address is B1.
4	0RS	MOVE the bit pattern found in register R to register S. *Example:* 40A4 would cause the contents of register A to be copied into register 4.
5	RST	ADD the bit patterns in registers S and T as though they were two's complement representations and leave the result in register R. *Example:* 5726 would cause the binary values in registers 2 and 6 to be added and the sum placed in register 7.
6	RST	ADD the bit patterns in registers S and T as though they represented values in floating-point notation and leave the floating-point result in register R. *Example:* 634E would cause the values in registers 4 and E to be added as floating-point values and the result to be placed in register 3.

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7	RST	OR the bit patterns in registers S and T and place the result in register R. *Example:* 7CB4 would cause the result of ORing the contents of registers B and 4 to be placed in register C.
8	RST	AND the bit patterns in register S and T and place the result in register R. *Example:* 8045 would cause the result of ANDing the contents of registers 4 and 5 to be placed in register 0.
9	RST	EXCLUSIVE OR the bit patterns in registers S and T and place the result in register R. *Example:* 95F3 would cause the result of EXCLUSIVE ORing the contents of registers F and 3 to be placed in register 5.
A	R0X	ROTATE the bit pattern in register R one bit to the right X times. Each time place the bit that started at the low-order end at the high-order end. *Example:* A403 would cause the contents of register 4 to be rotated 3 bits to the right in a circular fashion.
B	RXY	JUMP to the instruction located in the memory cell at address XY if the bit pattern in register R is equal to the bit pattern in register number 0. Otherwise, continue with the normal sequence of execution. (The jump is implemented by copying XY into the program counter during the execute phase.) *Example:* B43C would first compare the contents of register 4 with the contents of register 0. If the two were equal, the pattern 3C would be placed in the program counter so that the next instruction executed would be the one located at that memory address. Otherwise, nothing would be done and program execution would continue in its normal sequence.
C	000	HALT execution. *Example:* C000 would cause program execution to stop.

10. (3%) What sequence of numbers would be printed if the procedure named xxx as described below were executed with the value of N being 2?

```
procedure xxx (N)
print the value of N;
if (N < 3)
    then (apply procedure yyy
          to the value 4);
print the value of N
```

```
procedure yyy (N)
print the value of N;
apply the procedure xxx to the value 5;
print the value of N
```

11. (3%) Given the three relations X, Y, and Z below,

X:

A	B
7	s
3	z
1	u

Y:

C	D
t	4
r	2

Z:

E	F
2	w
3	q

what values would be retrieved by executing the following statement?

```
select X.B, Y.C, Z.F
from X, Y, Z
where X.A > Y.D and X.A = Z.E
```

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12. Write a function to generate the *nth* Fibonacci number in two ways:

   (a) (4%) Recursive solution

   (b) (4%) Iterative solution

13. You are given an array of integers (both positive and negative). Find the continuous sequence with the largest sum. Return the sum.

   (a) (6%) A brute force summing of the sequences will give a straightforward solution. Write the codes and analyze the running time in big-O notation.

   (b) (4%) "A simple linear algorithm will work by keep track of the current subsequence sum: If that sum ever drops below zero, that subsequence will not contribute to the subsequent maximal subsequence since it would reduce it by adding the negative sum." Argue whether this is true or false.