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（5101）　　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系　組別：資管碩乙組　

【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. (12%) A friend network is usually used to model the friend relationships among users. Assume that the friend network of a source (root) user *Us* has been preprocessed and simplified to be organized in a *k*-ary tree *T*, which is a rooted tree in which each node has no more than *k* children.

(i) Each user is represented as a node in *T*. Given a user *Ux*, the node of *Ux* contains no more than *k* friend-links to *Ux*'s friends. Each friend-link *FL*(*Ux*, *Ui*) is associated with a recommendation cost *RC*(*Ux*, *Ui*) for user *Ux* to recommend a product to user *Ui*. (ii) All users in *T*, except the source user *Us*, are linked by only one friend-link. The leaf node represents a user that does not have any friend-links to other users. (iii) Source user *Us*'s recommendation on a product may be propagated to any user in *T*. However, the propagation of recommendation may not be effective for users who are far away from source user *Us*. Thus, a distance threshold *D* is set to control the propagation of recommendation from *Us* to users whose link distances from *Us* to them are ≤ *D*. A propagation of recommendation to a user *Ui* traverses from source user *Us* to *Ui* according to the friend-links. The propagation cost of *Us*'s recommendation to a user *Ui* is the summation of the recommendation costs of those friend-links traversed from *Us* to *Ui*. (iv) Assume that there are *N* users in *T*.

Write a recursive algorithm to find the user who is within the distance threshold *D* and has maximum propagation cost of recommendation from source user *Us*. Analyze and explain the time complexity of your algorithm.

2. 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)

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%)** Write SQL for the 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.

(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.

3. (15 %) Explain the following terms:

(a) Method Inheritance (b) Data Integrity (c) Heuristic method (d) Confidence vs Support (e) Autonomic computing.

4. (10%) (a) Write DFS (depth first search) and BFS (breadth first search) algorithms for a social graph search. (b) Explain and compare their respective advantages/disadvantages when applied in various types of social networking applications (e.g. knowledge discovery and viral marketing).

5. (8%) Describe and compare the benefits and drawbacks of the following two intelligent techniques (a) Fuzzy logic (b) Neural networks.

6. **(10%)** Draw a entity-relationship (ER) diagram for a database with companies, people, and professionals (people who work for companies):
- People who work for companies are Professionals. So there is an ISA (is a) relationship between People and Professionals (or we could say that a Professional is derived from People).
- Each Professional has additional information: degree and work experiences, in addition to the properties derived from People: unique person ID, person name, sex, date of birth, phone numbers, and address.
- Each Company has the properties: unique company ID, comapany name, and address.
- A Professional works for one company at a time, but Companies can hire many Professionals, so there is a Many to One relationship between Professionals and Companies. This "Works For" relationship can store attributes: date of joining the company and salary. These attributes are only defined when we relate a Professional with a Company.
- A Person can have multiple phone numbers so Phone is a multi-valued attribute.

7. **(1) (3%)** Which of the following does not print the same sequence of numbers as the others?

A.
```
X ← 5
while (X < 6) do
(print the value of X;
 X ← X + 1)
```

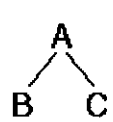
B.
```
X ← 4
while (X < 5) do
 (X ← X + 1;
  print the value of X)
```

C.
```
X ← 5
 repeat
  (print the value of X;
    X ← X + 1)
 until (X > 6)
```

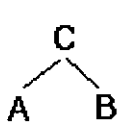
(2) (3%) The nodes in which of the trees below will be printed in alphabetical order by the following recursive procedure?

```
procedure printTree (Tree)
if (Tree is not empty)
    then (apply the procedure printTree to the left subtree of Tree;
          apply the procedure printTree to the right subtree of Tree;
          print the root node)
```

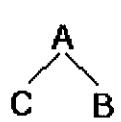
A.



B.



C.



(3) (3%) Which of the following is not a means of performing multiple activities at the same time?

A. Pipeling　B. Multiprogramming　C. Virtual memory　D. Multiple processors

(4) (3%) Which of the following is not a means of implementing server-side activities?

A. CGI　B. JSP　C. ASP　D. Applets

8. **(1) (3%)** What mask in register F would cause the instruction 7AAF (refer to the language description table) to put a 1 in the most significant bit of register A without disturbing the other bits?

A. 11111110　B. 00000001　C. 10000000　D. 01111111

(2) (8%) The following table shows a portion of a machine's memory containing a program (instructions) written in the language described in the language description table. Each instruction consists of 16 bits in memory. Answer the questions below assuming that the machine is started with its program counter containing 00.

address	content	address	content	address	content	address	content
00	25	04	53	08	C0	0C	C0
01	03	05	05	09	00	0D	00
02	20	06	33	0A	C0		
03	F9	07	00	0B	00		

(a) What bit pattern will be in register 5 when the machine halts?
(b) What bit pattern will be in register 0 when the machine halts?
(c) What bit pattern will be in register 3 when the machine halts?
(d) What bit pattern will be at memory location 00 when the machine halts?

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.
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.