CSE 444 Midterm --- Winter 2006

Name_____ **Student ID**_____

#	1	2	3	4	Total (100)
Score					

Time: 50 minutes. Total points: 100.

1. [35points] A human resource department maintains information about employees in the following table:

Empolyee(<u>eid</u>, name, dept, manager, gender)
-- **manager** is a foreign key to **Employee**, may be null

a. [7 points] A *co-worker* of an employee is another employee who has the same manager. Write a SQL query that computes for each employee in the 'Sales' dept(department) the number of his/her coworkers (in all departments). Your query should order the answer in decreasing order of the number of coworkers.

Select x.eid, count(*)
From Empolyee x **left outer join** Empolyee y **on** x.manager = y.manager
and x.dept='Sales'
Group by x.eid

b. [7 points] Write a SQL query that returns all managers that manage only employees that are in a different department from their own. For example, if 'Joe' is in the 'Sales' department and manages three employees in 'IT', 'HR', and 'HR' departments, then you should return 'Joe'; but if 'Joe' also managed a fourth employee who is in the 'Sales' department then you should not return 'Joe'.

```
Select  x.eid
From  Employee x  left outer join  Employee y  on  y.manager = x.eid and
        x.dept=y.dept
having  count(*) = 0
```

or

```
Select  x.eid
From  Employee x
Where  x.eid not in ( select y.manager
                      From  Employee y
                      Where  x.dept=y.dept )
```

c. [14 points] Consider the following sets of SQL queries Q1, Q2, and Q3. For each set, indicate which queries are equivalent and which not. You have to turn in an answer of the form Q1=Q2≠ Q3, Q1=Q2=Q3, or, say, Q1 ≠ Q2 ≠ Q3 ≠ Q1

(1)

Q1:
```
select   dept
from     Employee
where    gender = 'F'
group by dept
having   count(*) < 5
```

Q2:
```
select   distinct x.dept
from     Employee x
where    (select  count(*)
          from    Employee y
          where   x.dept = y.dept    AND
                  y.gender='F') < 5
```

Q3:
```
select   distinct x.dept
from     Employee x
where    x.gender = 'F'  AND
         (select  count(*)
         from     Employee y
         where    x.dept = y.dept    AND
                  y.gender='F') < 5
```

Solution:____Q1=Q3 != Q2_____

(2)

Q1:
```
select   distinct x.dept
from     Employee x, Employee y, Employee z
where    x.manager = y.eid    AND
         z.manager = y.eid    AND
         x.gender = 'F'       AND
         y.gender = 'F'       AND
         z.dept = 'Sales'
```

Q2:
```
select   distinct x.dept
from     Employee x, Employee y, Employee z
where    x.manager = y.eid    AND
         z.manager = y.eid    AND
         z.gender = 'F'       AND
         y.gender = 'F'       AND
         z.dept = 'Sales'
```

Q3:
```
select   distinct x.dept
from     Employee x, Employee y, Employee z, Employee u
where    x.manager = y.eid    AND
         z.manager = y.eid    AND
         u.gender = z.gender  AND
         x.gender = 'F'       AND
         y.gender = 'F'       AND
         z.dept = 'Sales'     AND
         u.dept = 'Sales'
```

Solution:_____Q1 = Q3 != Q2_____

d. [7 points] The human-resource department decides to store separately for each employee the number of employees they manage. The new table has the following schema:

Supervise(eid, name, num)

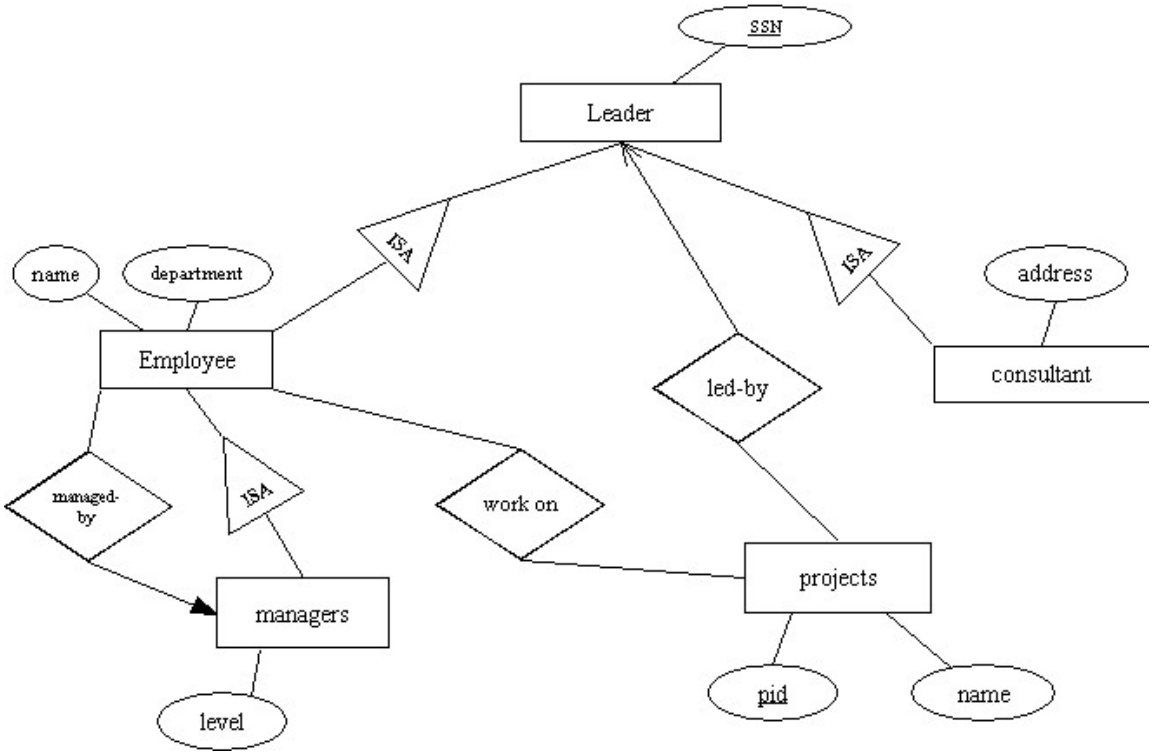
In each entry **num** represents the number of employees supervised by the employee in that entry: note that **num** may be 0. Write a SQL statement that populates the table **Supervise** using the data in **Employee.** You should turn in one (or several) SQL **insert** statements.

Insert into Supervise(eid, name, num)
Select x.eid, x.name, count(*) as num
From Employee x **left outer join** Employee y **on y**.manager=x.eid
Group by x.eid, x.name

2. [15 points] Draw an E/R diagram describing the following domain:

- **Employees**. Attributes: **ssn** (key), **name**, **department**
- **Managers** are **Empolyees**. Attributes: **level**
- **Consultants**. Attributes: **ssn** (key), **address**
- **Projects**. Attributes: **pid** (key), **name**
- Every **Employee** is **managed-by** (at most one) **Manager**
- **Employees** work on **Projects**: an employee may work on an arbitrary number of projects, and an arbitrary number of employees many work for a project.
- Every **project** has exactly one **leader**, who is either an **employee** or a **consultant**

Your answer should consist of an E/R diagram, which includes entity sets, attributes, relationships, ISA relations. Indicate the type of each relationship with appropriate arrows (one-one, one-many, or many-many).



3. [32 points]

a. [20 points] Consider the table R(A, B, C, D, E) satisfying the following functional dependencies:

AB → C
BE → A
D → E

Decompose the table in BCNF. Your answer should consist of
(1) a list of table names and attributes;
(2) an indication of the keys in each table. [like R1(A,B), R2(B,C), R3(B,D,E) -- but note that this is NOT the correct answer.]

R1(B,E,A)
R2(D,E)
R3(D,B,C)

Or
R1(A,B,C)
R2(D,E)
R3(D,B,A)

Or
R1(A,B,C)
R2(B,E,A)
R3(D,E)
R4(D,B)

b. [9 points] Let FD be a set of functional dependencies on a table, and let X+ denote the closure of a set of attributes X. For each of the statements below, indicate whether they are true or false. You do not need to justify your answer.

i. For any two sets X, Y: $(X \cup Y)+ = X+ \cup Y+$

F

ii. For any two sets X, Y: if $X \subseteq Y$ then $X+ \subseteq Y+$

T

iii. For any two sets X, Y: if X+ = X and Y+ = Y then $(X \cap Y)+ = X \cap Y$

T

c. [3 Points] Now suppose that all functional dependencies in FD are of the form:

$A \rightarrow B$

where A and B are attributes. That is, the left hand side of each functional dependency consists of a single attribute. Which of the answers in (b) change?

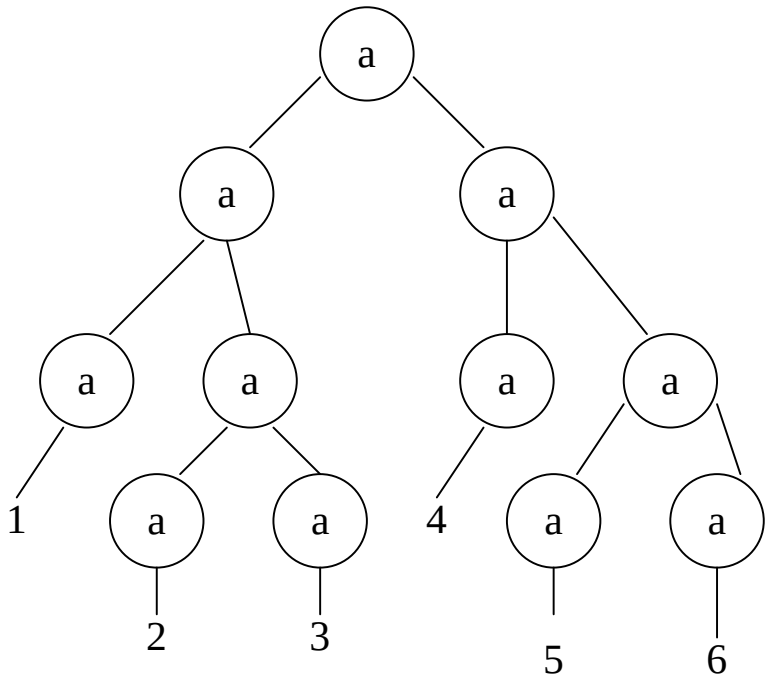
T

T

T

4. [18 points] Consider the following XML document:

```
<a>
  <a>
    <a> 1 </a>
    <a> <a> 2 </a>
        <a> 3 </a>
    </a>
  </a>
  <a>
    <a> 4 </a>
    <a> <a> 5 </a>
        <a> 6 </a>
    </a>
  </a>
</a>
```



For each of the XPath expressions below indicate what they return.
For example, if the expression is:

```
/a/a/a/a/text()
```

then you will answer:

```
2
3
5
6
```

and if the expression is:

```
//a[a/text() = 8]/a/text()
```

you will answer EMPTY, since the value 8 is not in the document.

a. //a/text()

1 2 3 4 5 6

b. /a/a/a/a/text()

2 3 5 6

c. /a[.//a/text()=”2”]/a/a/text()

1 4

d. //a[a/text()=”2”][a/text()=”3”]/a/text()

2 3

e //a[.//a/text()=”3”][.//a/text()=”4”]/a/a/text()

1 4

f. /a/a[2]/a[2]/a[1]

5
or
<a> 5