北京邮电大学 2013 学年《数据库系统原理》期中考试

姓名： _____ **班级：** _____ **学号：** _____ **成绩：** _____

1. (10 points) Give a brief answer to each of the following questions

What is the three levels of data abstraction in DBS ? (6 points)

What is the physical data independency? (4 points)

Answers:

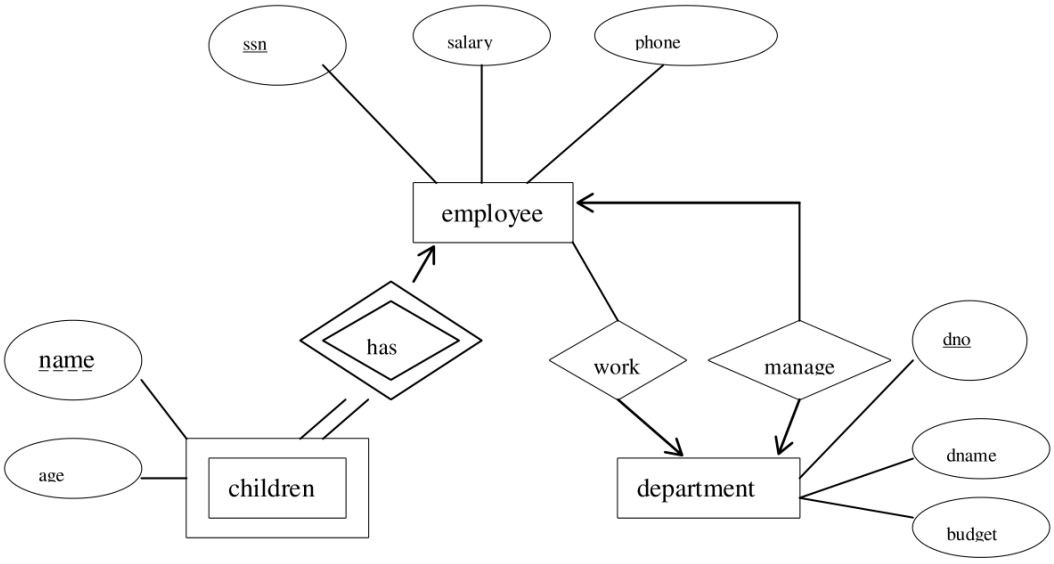
1) view level, logical view, physical level

2) application programs do not depend on the physical schemas, and thus need not to be rewritten if the physical schemas change

2. (15 points) A Company database needs to store information about employees (identified by ssn, with salary and phone as attributes), department ((identified by dno, with dname and budget as attributes), and children of employees (with name and age as attributes).

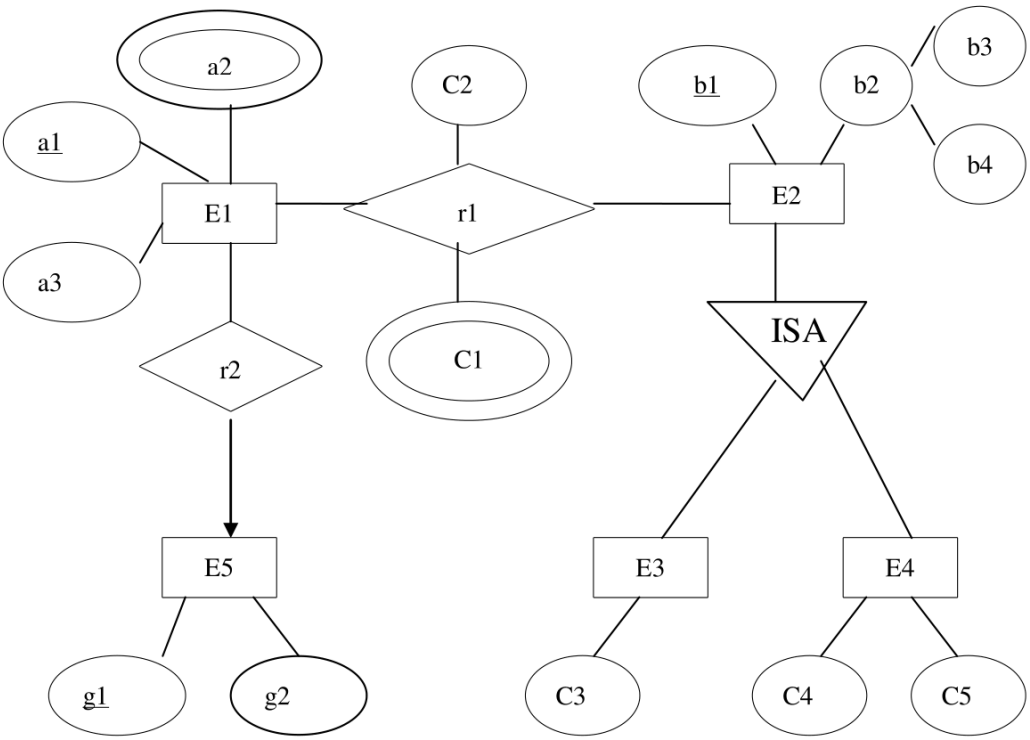
Each employee can only work in one department; each department is managed by an employee; a child must be identified uniquely by name when the parent (who is an employee; assume that only one parent works for the company) is known; We are not interested in information about a child once the parent leaves the company.

Design the E-R Diagram on basis of the information above.



phone 可以使多值属性，两椭圆；
children 这是双线，其他联系双线单线都可。
每处 1 分。

3. (10 points) Convert the following E-R diagram to the proper relation schemas and identify the primary key of each relation.



E1（a1, a3,g1）
E12(a1,a2)
E2(b1,b3,b4)
E3（b1,c3）
E4(b1,c4,c5)
E5(g1,g2)
R1(a1,b1,c2)
R2(a1,b1,c1)

4. (30 points）Consider the following relations in banking enterprise database, where the primary keys are underlined.

branch (branch-name, branch-district, assets),
employee(employee-ID, employee-name, branch-name, job-title)
loan (loan-number, branch-name, amount)
borrower(customer-name, loan-number, borrow-date)
customer (customer-name, customer-street, customer-city)
customerpoints(customer-name, scored-points) (注：客户积分表)
account (account-number, branch-name, balance)
depositor (customer-name, account-number , deposit-date)

(1) (9 points) Use a SQL statement to define the relational table *employee*, in which {employee-ID} is the primary key, {employee-name} is the candidate key and not permitted to be null, and there exists referential integrity between the table *employee* and *branch*. It is also required that an employee's job-tile must be one of manager, teller, officer, or secretary.

Answer:

```
create table employee
 ( employee-ID    integer,
  employee-name varch(50),   /*也可以采用其它长度的 varch、char 类型
  branch-name     varch(50),
  job-title          varch(50)，
  primary key (employee-ID),
  unique (employee-name),
  foreign key (branch-name) references branch,
  check (job-title in ('manager', 'teller', 'officer', 'secretary'))
 )
```

4 个完整性约束，每个 1 分。

(2) (5 points) Give a SQL statement to find the customer' name who has one or more *accounts* at the *branches* located in Brooklyn district, and the total sum of the balances of his these *accounts* in Brooklyn is more than $10,000. It is required to list in alphabetic descending order the customer's name, and his total balances in the branches in Brooklyn.

Answer:

```
Select    customer-name, sum(balance)
From      branch Natual Join account Natual Join depositor
Where     branch-district=Brooklyn
Group by    customer-name
   Having sum(balance)>10,000
Order by customer-name desc
```

group by 和 having 子句占 2 分，其余部分 3 分。

(3) (3 points) User1 needs to be able to read and update existing rows in *employee*. Define a SQL statement to give User1 only the privileges needed.

Answer:

grant select, update **on** *employee* **to** User1

(4) (3 points). Use a ***relational algbra expression*** to display the customer name, customer city, and points for **all** customers that have scored points.

It is assumed that,

a) initially, each customer appearing in *customerpoints* has a positive points.

b) not all customers in the table *customer* have scored points, also not all customers with scored points appear in *customer*.

Answer:

$\Pi_{\text{customer-name, customer-city, points}}$ (*customerpoints* **lef-touter-join 符号** *customer*)

如果没有写出左外连接符号、只写出自然连接符号，扣 1 分。

(5)(10 points) For the customers who appear in the table *customer* but have no scored points (i.e. not appear in the table *customerpoints*), use one or more SQL statements to add their *names* into *customerpoints* and set their scored points as 0.

Answer:

```
Select customer-name into Temp
From customer
Where customer-name not in ( select customer-name
                             from customerpoints
                           )

Insert into customerpoints
    Select customer-name, 0
    From Temp
```

2 个句子各 5 分。

5. (12 points) Consider the following relations and answer the Questions:

(1) (6 points) The relation schema R(U,F),U=(A,B,C,D,E), The functional dependencies set F ={A→BC, CD→E,B→D,E→A}

A. Compute $(B)^+$. List all the candidate keys of R. (2 points)

BD

B. List all the candidate keys of R. (4 points)

A, BC, CD, E

(2) (6 points) The relation schema R(U,F),U=(A,B,C,D,E), The functional dependencies set F ={A→D, E→D,D→B,BC→D, CD→A },The Candidate key of R is {C,E}:

A. What is the highest normal form of R? Why? (2 points)

1NF

B. Give a lossless-join, dependency-preserving decomposition into 3NF of R. (4 points).
本身就是最小函数依赖集。R1(ED), R2(BCD),R3(CDA),R4(CE)

6. (6 points) Consider the schema R=(X,Y,W,Z,P,Q), and F, where F = { XY→WP, XW→P, PQ→Z,XY →QZ} that holds on R.

(1) Give the canonical cover of F. (3 points)

(2) Give a lossless-join, dependency-preserving decomposition into 3NF of R. (3 points)

{ XY→WQ, XW→P, PQ→Z }

7. (6 points) Answer the following questions about the schema R.

(1) R={A, B, C, D, E, F},F={A→B, C→D, D→E, E→F, F→C} that holds on R. List all the candidate keys of R. (2 points)

AC, AD, AE, AF

(2) R={X, Y, Z, W, P },F={X→YZ, ZW→P, Y→W, P→X } that holds on R. What is the highest normal form of R? Why? (4 points)

3NF

8. (11 points) Here are six schemas in the database *"Company"* .

EMPLOYEE(Esn, Ename, BirthDate, LivingAddress, Sex, Salary, Mgr_sn, DeptID)

DEPARTMENT(DeptID, DeptName, Mgr_sn)

DEPT_LOCATIONS(DeptID, DeptLocation)

WORKS_ON(Esn, PrjNo, Hours)

PROJECT(PrjNo, PrjName, PLocation, DeptID)

DEPENDENT(Esn, DependentName, Sex, BirthDate, Relationship)

Use SQL statements to implement the following operations:

(1) It is required that, *the salary of an employee in a department should be lower than that of his manager in this department*. Define this requirement as a constraint in the database. (5 points)

(2) Find out the department identity (i.e. DeptID) of each department, in which there are at least five employees, and calculate the number of the employees that have the salaries of more than $5000 in this department (6 points)

Answers:

1) create assertion Salary_constraint
check (not exists

```
                ( select *
                  from EMPLOYEE as E, EMPLOYEE as M, DEPARTMENT as D
                  where E.salary > M.salary
                        AND E.DeptID=D.DeptID
                        AND D.Mgr_sn=M.Esn
                )
2)  select   DeptID, count(*)
    from     DEPARTMENT as D, EMPLOYEE as E
    where    E.DeptID= D.DeptID    AND Salary>5000 AND
             D.DeptID    in ( select    E.DeptID
                              from    EMPLOYEE
                              group by    E.DeptID
                              having      count(*) >5
                             )
```

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