作 业

1. Consider the following relational schema. An employee can work in more than one department; the pct_time field of the Works relation shows the percentage of time that a given employee works in a given department.

    Emp(eno, ename, age, salary)

    Works (eno, deptid, pct_time)

    Dept (deptid, deptname, budget, manageid)

(1) Give a SQL statement to find the employees with salaries over 50,000, ages under 40 and working hours in software development departments over 50% ，list their NOs and *names*.

(2) For the SQL statement in (1), give an optimized query tree.

2. Consider the following tables mentioned above in Question 2

    factory(factoryID, name, manager, account)

    employee(employeeID, name, age, factoryID)

    airconditioner(serialID, date, model, price, factoryID)

    storehouse(houseID, size, address)

    stored(serialID, houseID)

    order(orderID, customerID, model, num_ordered, factoryID)

    customer(customerID, name, address)

(1) Give a SQL statement to find the air conditioner model. It is required that the number of the ordered products of this model is not below 200, the model's price is higher than 2000, and all ordered products of this model are stored in the storehouse with *houseID* BJ101. List the model, the number of the ordered product. (4 points)

(2) For the SQL statement in (1), give an optimized query tree.

作业答案及例题

1. Consider the following relational schema. An employee can work in more than one department; the pct_time field of the Works relation shows the percentage of time that a given employee works in a given department.
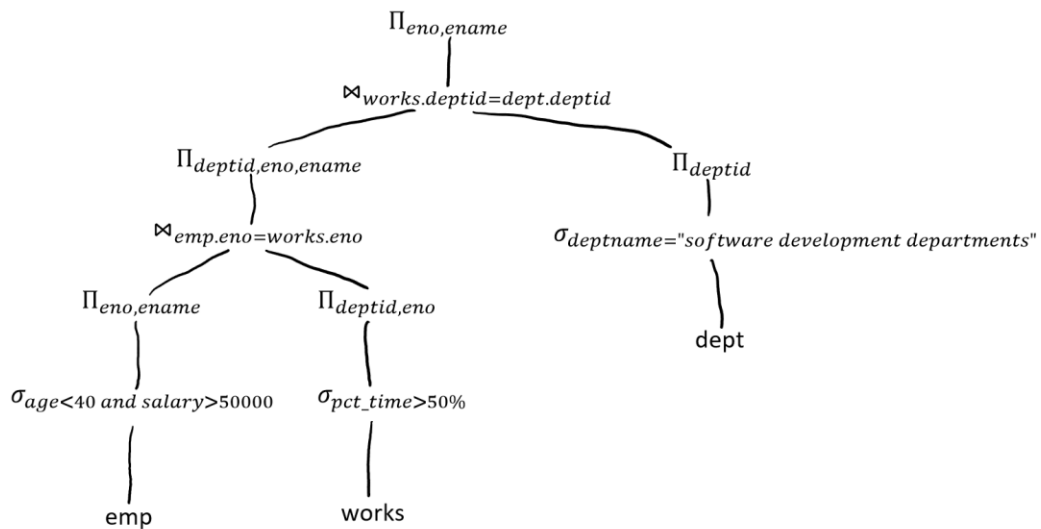
    Emp(<u>eno,</u> ename, age, salary)

    Works (<u>eno</u>, deptid, pct_time)

    Dept (deptid, deptname, budget, manageid)

(1) Give a SQL statement to find the employees with salaries over 50,000, ages under 40 and working hours in software development departments over 50% ，list their NOs and *names*.   (3 points)

    select Emp.eno, ename

    from emp, works, Dept

    where emp.eno=works.eno and works.deptid=dept.deptid

        and   salary>50000 and age<40 and pct_time>50

         and   deptname= "software development"

(2) For the SQL statement in (1), give an optimized query tree.

$$\Pi_{eno,ename}$$
$$\bowtie_{works.deptid=dept.deptid}$$
$$\Pi_{deptid,eno,ename} \qquad \Pi_{deptid}$$
$$\bowtie_{emp.eno=works.eno} \qquad \sigma_{deptname="software\ development\ departments"}$$
$$\Pi_{eno,ename} \qquad \Pi_{deptid,eno} \qquad dept$$
$$\sigma_{age<40\ and\ salary>50000} \qquad \sigma_{pct\_time>50\%}$$
$$emp \qquad works$$

2. (10 points) Consider the following tables mentioned above in Question 2

factory(<u>factoryID</u>, name, manager, account)

employee(<u>employeeID</u>, name, age, factoryID)

airconditioner(<u>serialID</u>, date, model, price, factoryID)

storehouse(<u>houseID</u>, size, address)

stored(<u>serialID</u>, <u>houseID</u>)

order(<u>orderID</u>, customerID, model, num_ordered, factoryID)
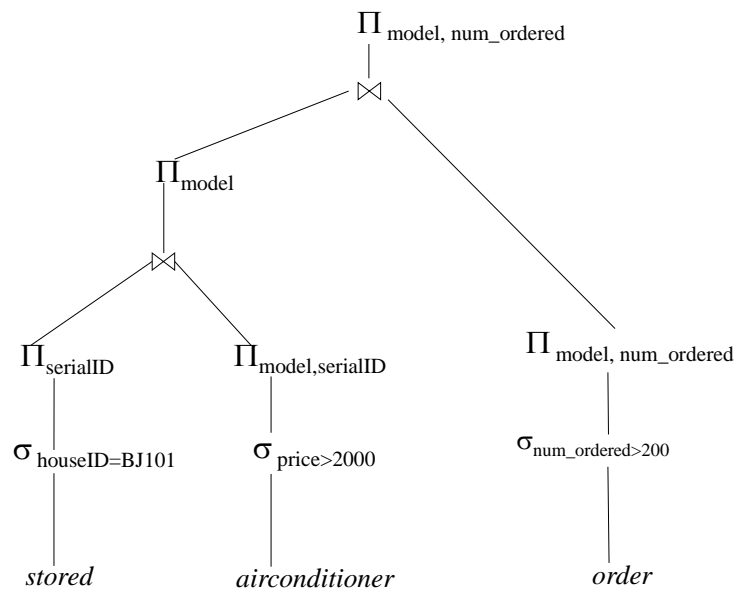
customer(customerID, name, address)

(1) Give a SQL statement to find the air conditioner model. It is required that the number of the ordered products of this model is not below 200, the model's price is higher than 2000, and all ordered products of this model are stored in the storehouse with *houseID* BJ101. List the model, the number of the ordered product. (4 points)

select   *model, num_ordered*

from   *stored* natural join *airconditioner* natural join *order*

where   *houseID*=BJ101 and *price*>2000 and *num_ordered*>200

说明：**3 张表、2 个连接条件/自然连接、3 个选择条件；**
以在 from 子句中不使用自然连接，改为在 where 子句中写出连接条件.

(2) For the SQL statement in (1), give an optimized query tree.

$$\Pi_{model, num\_ordered}$$

$\bowtie$

Π_{model}

$\bowtie$

$\Pi_{serialID}$ $\Pi_{model,serialID}$ $\Pi_{model, num\_ordered}$

$\sigma_{houseID=BJ101}$ $\sigma_{price>2000}$ $\sigma_{num\_ordered>200}$

stored   *airconditioner*   *order*

3. Consider the following relations in a Library database, where the primary keys are underlined.

Books (<u>BookIndexNo</u>, BookTitle, author, bookno, PublishUnit, price, year-published),

Readers (<u>CardID</u>, student-name, student-school, sex),

Loans(<u>CardID, BookIndexNo</u>, borrowing-date, priority).

For the query "Find out the names of those students in School of Computer Science, who borrow the book "Database System Concepts" between 2015/03/01 and 2015/06/20, and these borrowed books were published in the year of 2012"

(1) Give an SQL statement for this query.

(2) For the query in (1), convert it into an optimized query tree by means of heuristic optimization.

Answers：

（1）

    Select   studentname

    From   Books, Readers, Loans

    Where   Books.BookIndexNo= Loans.BookIndexNo   and

               Loans.CardID= Readers.CarID   and

               student-school= School of Computer Science   and

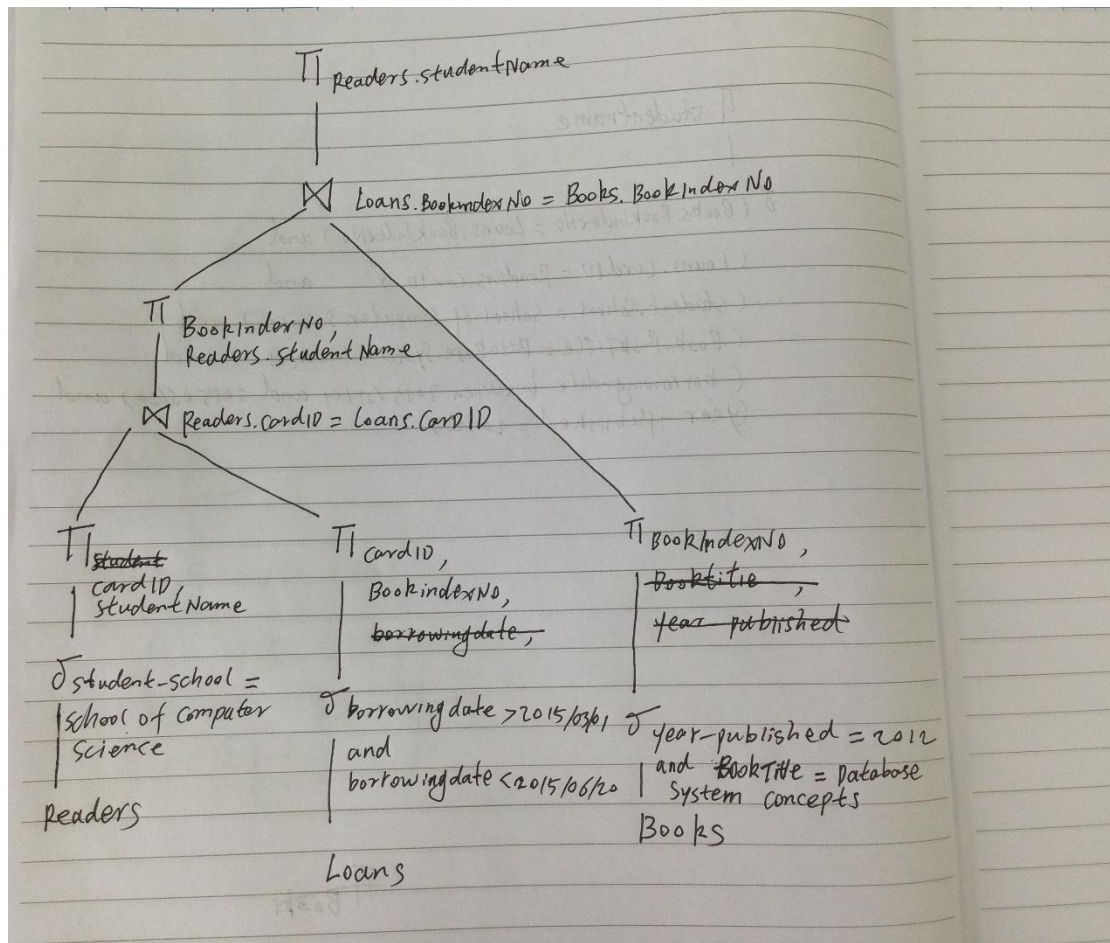   Book.BookTitle= Database System Concepts   and

            borrowing-date between 2015/03/01 and 2015/06/20 and

            year-published=2012

说明：where 子句中的 2 个连接条件，也可以用 from 子句中的 natural join 实现

（2）

$\Pi_{\text{Readers.studentName}}$

$\bowtie_{\text{Loans.BookindexNo = Books.BookIndexNo}}$

$\Pi_{\text{BookIndexNo, Readers.studentName}}$

$\bowtie_{\text{Readers.cardID = Loans.cardID}}$

$\Pi_{\text{student, cardID, studentName}}$

$\sigma_{\text{student-school = School of Computer Science}}$

Readers

$\Pi_{\text{cardID, BookindexNo, borrowingdate,}}$

$\sigma_{\text{borrowing date > 2015/03/01 and borrowingdate < 2015/06/20}}$

Loans

$\Pi_{\text{BookIndexNo, Booktitle, year published,}}$

$\sigma_{\text{year-published = 2012 and BookTitle = Database System concepts}}$

Books

3 个选择操作、4 个投影操作、2 个连接操作

4. Consider the **Student-Project** management database given below.

　　Student (<u>Sno</u>, Sname, class, major, dept_name)
　　Project (<u>Pno</u>, Pname, requirement, start_time, end_time)
　　Teacher (<u>Tno</u>, Tname, phone, email, dept_name)
　　Department (<u>dept_name</u>, building, budget)
　　Participation (<u>Sno, Pno, Tno</u>, grade)

(1) Give a SQL statement to find some students and list their names and departments that they belong to and list the names of the teachers who guide their projects. It is required that the students' major is 'Big data major', they participate in the projects named as 'Big data analysis and mining', their teachers who guide them are in Computer Science Department, and their grades of projects are more than 85.

select   Sname, dept_name, Tname

from   Student, Participation, Project, Teacher

where Student.Sno=Participation.Sno

　　and Teacher.Tno=Participation.Tno

　　and Project.Pno=Participation.Pno

　　and major=' Big data major'

　　and Project.Pname=' Big data analysis and mining'

　　and Teacher. dept_name=' Computer Science Department'

　　and grade>85

或者：

select   Sname, major, Tname

from   Student **natural join** Participation **natural join** Project **natural join** Teacher

where major=' Big data major' and Project.Pname=' Big data analysis and mining'

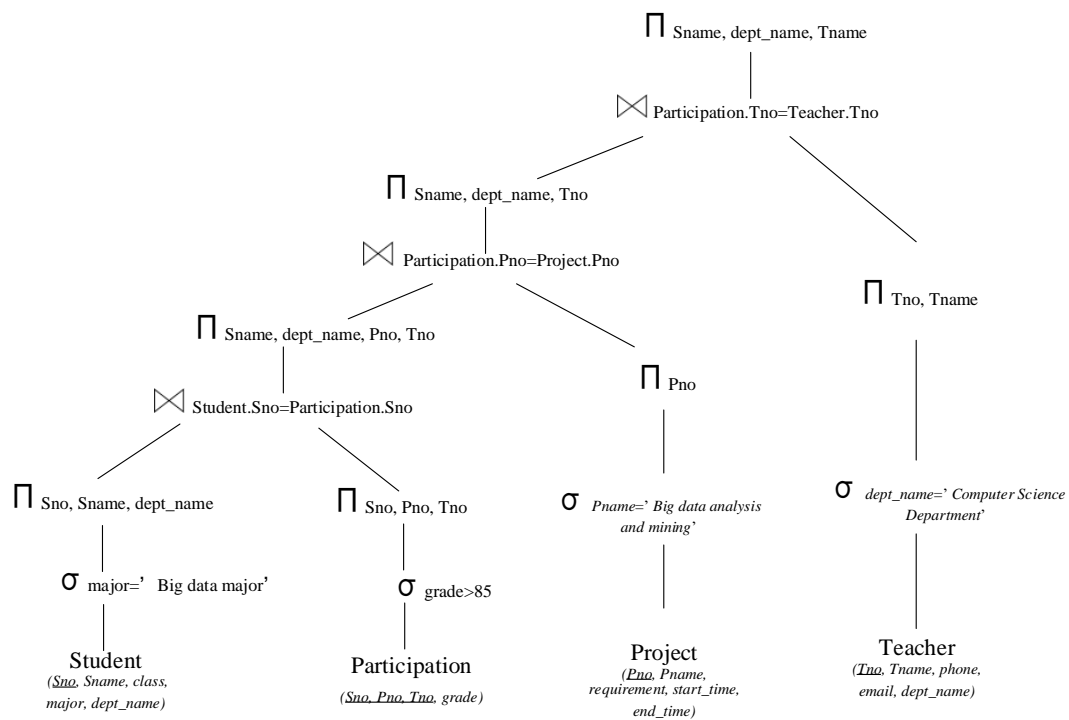　　and Teacher. dept_name=' Computer Science Department' and grade>85

说明：4 张表，3 个连接条件，4 个选择条件

(2) For the SQL statement in (1), give an optimized query tree.　　(7 points)

∏ Sname, dept_name, Tname

⋈ Participation.Tno=Teacher.Tno

∏ Sname, dept_name, Tno

⋈ Participation.Pno=Project.Pno

∏ Sname, dept_name, Pno, Tno

⋈ Student.Sno=Participation.Sno

∏ Sno, Sname, dept_name

σ major=' Big data major'

Student
(Sno, Sname, class, major, dept_name)

∏ Sno, Pno, Tno

σ grade>85

Participation
(Sno, Pno, Tno, grade)

∏ Pno

σ Pname=' Big data analysis and mining'

Project
(Pno, Pname, requirement, start_time, end_time)

∏ Tno, Tname

σ dept_name=' Computer Science Department'

Teacher
(Tno, Tname, phone, email, dept_name)

4 个选择操作，7 个投影操作，3 个连接操作。