

Classroom Exercise

1. The schema of a database containing university-type data is given below.

Primary key is bold for each relation.

STUDENT(**Sid**, Sname, Sex, Age, Year, GPA)

DEPT(**Dname**, Numphds)

PROF(**Pname**, Dname)

COURSE(**Cno**, Cname, Dname)

MAJOR(**Dname**, **Sid**)

SECTION(**Dname**, **Cno**, **Sectno**, Pname)

ENROLL(**Sid**, Grade, **Dname**, **Cno**, **Sectno**)

Write the following query in SQL. Find the name(s) of student(s) with the lowest GPA.

Solution:

```
SELECT      Sname
FROM        STUDENT
WHERE       GPA IN
(SELECT MIN(GPA)
FROM STUDENT);
```

2. Consider the following relational schema:

Reader(RDNR, Surname, Firstname, City, Birthdate)

Book(ISBN, Title, Author, NoPages, PubYear, PublisherName)

Publisher(PublisherName, PublisherCity)

Category(CategoryName, BelongsTo)

Copy(ISBN, CopyNumber, Shelf, Position)

Loan(ReaderNr, ISBN, Copy, ReturnDate)

BookCategory(ISBN, CategoryName)

BelongsTo refers to which parent categories the current category belongs to. Each book has a specific ISBN, and many copies of a book might be available under the same ISBN. A reader may borrow the same copy for multiple times, and each instance is recorded by its ReturnDate. All the parent categories that a book belongs to are stored in the table BookCategory.

Formulate the following queries in SQL.

(a) Which categories do not have any subcategories?

Solution:

```
SELECT C1.CategoryName
FROM Category C1
WHERE NOT EXISTS
(SELECT CategoryName
FROM Category C2
WHERE C2.BelongsTo = C1.CategoryName);
```

(b) For which of the books there is at least one copy available?

Solution:

```
SELECT Title
FROM Book
WHERE ISBN IN
(SELECT ISBN FROM
(SELECT CopyNumber, ISBN FROM Copy)
EXCEPT
(SELECT Copy, ISBN FROM Loan));
```

(c) Which books have more pages than twice the average of the number of pages of all books?

Solution:

```
SELECT ISBN
FROM Book
WHERE NumberOfPages >= 2 * (SELECT AVG(NumberOfPages)
FROM Book);
```

(d) What are the surnames of the readers from the city "New York"?

Solution:

```
SELECT DISTINCT Surname
FROM Reader
WHERE City = 'New York'
```

3. For the following relational schema:

employee (employee-name, street, city)

works (employee-name, company-name, salary)

company (company-name, city)

manages (employee-name, manager-name)

Give an expression in SQL for each of the following queries:

(a) Find the names of all employees who earn more than the average salary of all employees of their company. Assume that all people work for at most one company.

Solution:

```
SELECT employee-name
FROM works t
WHERE salary > (SELECT AVG(salary)
                FROM works s
                WHERE t.company-name = s.company-name);
```

(b) Find the names of all employees in the database who live in the same cities and on the same streets as do their managers. Assume that all people work for at most one company. Each company has at most one manager, who is also an employee of the same company.

Solution:

```
SELECT p.employee-name
FROM employee p, employee r, manages m
WHERE p.employee-name = m.employee-name
AND m.manager-name = r.employee-name
AND p.street = r.street AND p.city = r.city;
```

Critical Thinking Exercise

4. Consider the following schema containing airport flight information. Primary Keys are in bold.

FLIGHTS(**flno:integer**, from:string, to:string, distance:integer, departs:time, arrives:time)

AIRCRAFT(**aid:integer**, aname:string, cruisingrange:integer)

CERTIFIED(**eid:integer**, **aid:integer**)

EMPLOYEES(**eid:integer**, ename:string, salary:integer)

Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft (otherwise, he or she would not qualify as a pilot), and only pilots are certified to fly.

Give an SQL expression for the following query. Your solution should be only one SQL statement.

Find the eids of employees who make the second highest salary