

Query Examples in Relational Algebra and SQL

Consider the relation schemas as follows.

works(person_name, company_name, salary);
lives(person_name, street, city);
located_in(company_name, city);
managers(person_name, manager_name);
where manager_name refers to person_name.

- a Find the names of the persons who work for company 'FBC' (company_name='FBC').

Relational algebra:

$$\text{result} = \pi_{\text{person_name}}(\sigma_{\text{company_name}='FBC'}(\text{works}))$$

SQL:

```
Select person_name
From   works
Where  company_name = 'FBC'
```

- b List the names of the persons who work for company 'FBC' along with the cities they live in.

Relational algebra:

$$\begin{aligned} \text{NamesForFBC} &= \pi_{\text{person_name}}\sigma_{\text{company_name}='FBC'}(\text{works}) \\ \text{TheyLiveIn} &= \text{NamesForFBC} \bowtie \text{lives} \\ \text{result} &= \pi_{\text{person_name}, \text{city}}(\text{TheyLiveIn}) \end{aligned}$$

SQL:

```
Select lives.person_name, city
From   works, lives
Where  company_name = 'FBC' and
       works.person_name = lives.person_name
```

- c Find the persons who work for company 'FBC' with a salary of more than 10000. List the names of these persons along with the streets and cities where they live.

Relational algebra:

$$\begin{aligned} \text{PersonsOffFBC} &= \sigma_{\text{company_name}='FBC'}(\text{works}) \\ \text{NameWithBigSal} &= \pi_{\text{person_name}}\sigma_{\text{salary}>10000}(\text{PersonsOffFBC}) \\ \text{result} &= \text{NameWithBigSal} \bowtie \text{lives} \end{aligned}$$

SQL:

```
Select lives.person_name, stree, city
From   lives, works
Where  lives.person_name = works.person_name and salary > 10000
       and works.company_name = 'FBC'
```

d Find the names of the persons who live and work in the same city.

Relational algebra:

$$\begin{aligned} \text{WorkLocation} &= \pi_{\text{person_name, city}}(\text{works} \bowtie \text{located_in}) \\ \text{result} &= \pi_{\text{person_name}} \sigma_{\text{city=L.city}}(\text{WorkLocation} \times \rho_L(\text{lives})) \end{aligned}$$

SQL:

```
Select person_name
From   works, lives, locates_in
Where  works.person_name = lives.person_name and
       works.company_name = located_in.company_name and
       located_in.city = lives.city
```

e Find the names of the persons who live in the same city and on the same street as their managers.

Relational algebra:

$$\begin{aligned} \text{EAddMAdd} &= \sigma_{\text{manager_name=M.person_name}}(\rho_E(\text{lives}) \bowtie \text{manager}) \times \rho_M(\text{lives}) \\ \text{SameStreetCity} &= \sigma_{\text{E.street=M.Street} \wedge \text{E.city=M.city}}(\text{EAddMAdd}) \\ \text{result} &= \pi_{\text{E.person_name}}(\text{SameStreetCity}) \end{aligned}$$

SQL:

```
Select e.person_name
From   lives e, lives m, managers
Where  e.person_name = managers.person_name and
       m.person_name = managers.manager_name and
       e.street = m.street and e.city = m.city
```

f Find the names of the persons who do not work for company 'FBC'.

Relational algebra:

$$\begin{aligned} \text{PersonForFBC} &= \pi_{\text{person_name}} \sigma_{\text{company_name='FBC'}}(\text{works}) \\ \text{WorkPersons} &= \pi_{\text{person_name}}(\text{works}) \\ \text{result} &= \text{WorkPersons} - \text{PersonForFBC} \end{aligned}$$

SQL:

```
Select person_name
From   works
Where  person_name not in (Select person_name
                          From   works
                          Where  company_name = 'FBC')
```

g Find the persons whose salaries are more than the salary of everybody who work for company 'SBC'.

Relational algebra:

$$\begin{aligned} \text{SalariesOfSBC} &= \pi_{\text{salary}} \sigma_{\text{company_name='SBC'}}(\text{works}) \\ \text{WorksWithSalaryOfSBC} &= \text{works} \times \rho_S(\text{SalariesOfSBC}) \\ \text{EarnsLessThanSomeSBC} &= \pi_{\text{person_name}} \sigma_{\text{salary} \leq \text{S.salary}}(\text{WorksWithSalaryOfSBC}) \\ \text{result} &= \pi_{\text{person_name}}(\text{works}) - \text{EarnsLessThanSomeSBC} \end{aligned}$$

SQL:

```
Select person_name
From works
Where salary > all (Select salary
                    From works
                    Where company_name = 'SBC')
```

h Find the names of the companies that is located in every city where company 'SBC' is located in.

Relational algebra:

```
AllSBCCities =  $\pi_{city} \sigma_{company\_name='SBC'}(located\_in)$ 
ImaginAllCompanyAtAllSBCLocations =  $\pi_{company\_name}(located\_in) \times AllSBCCities$ 
NotReallyTrue =  $ImaginAllCompanyAtAllSBCLocations - located\_in$ 
result =  $\pi_{company\_name}(located\_in) - \pi_{company\_name}(NotReallyTrue)$ 
```

Relational algebra (another solution):

```
AllSBCCities =  $\pi_{city} \sigma_{company\_name='SBC'}(located\_in)$ 
result =  $located\_in / AllSBCCities$ 
```

SQL:

```
Select company_name
From located_in t
Where (Select city
       From located_in s
       Where t.company_name = s.company_name)
       contains (Select city
                From located_in s1
                Where s1.company_name = 'SBC')
```

SQL (another solution):

```
Select company_name
From located_in t
Where not exists
      (Select *
       From located_in s

       Where s.company_name = 'SBC' and
            s.city not in
            (Select city
             From located_in l
             Where l.company_name = t.company_name))
```