



Relational Algebra Examples

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Exercise 4.3

Exercise 4.3 Consider the following schema:

Suppliers(sid: integer, sname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)

The key fields are underlined, and the domain of each field is listed after the field name. Therefore *sid* is the key for Suppliers, *pid* is the key for Parts, and *sid* and *pid* together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in relational algebra, tuple relational calculus, and domain relational calculus:

$$\rho(C, Catalog) \quad \rho(S, Suppliers)$$
$$\rho(P, Parts)$$



Exercise 4.3.1

- **Suppliers**(*sid*: integer, *sname*: string, *address*: string)
- **Parts**(*pid*: integer, *pname*: string, *color*: string)
- **Catalog**(*sid*: integer, *pid*: integer, *cost*: real)
- **Find** the names of *suppliers* who supply some *red* part.

$$\pi_{sname} \left(\pi_{sid} \left(\pi_{pid} \left(\sigma_{color=red} (P) \right) \bowtie C \right) \bowtie S \right)$$

✓
color = green



Exercise 4.3.2

- **Suppliers**(*sid*: integer, *sname*: string, *address*: string)
- **Parts**(*pid*: integer, *pname*: string, *color*: string)
- **Catalog**(*sid*: integer, *pid*: integer, *cost*: real)
- **Find** the *sids* of suppliers who supply some red or green part.

$$\pi_{sid} \left(\pi_{pid} \left(\sigma_{color=red \vee color=green} (P) \right) \bowtie C \right)$$



Exercise 4.3.3

- **Suppliers**(*sid*: integer, *sname*: string, *address*: string)
- **Parts**(*pid*: integer, *pname*: string, *color*: string)
- **Catalog**(*sid*: integer, *pid*: integer, *cost*: real)
- **Find** the *sids* of suppliers who supply some red part or are at 221 Packer Street.

$$\rho(R1, \pi_{sid}(\pi_{pid}(\sigma_{color=red}(P)) \bowtie C))$$

$$\rho(R2, \pi_{sid}(\sigma_{address=221 \text{ Packer St.}}(S)))$$

$$R1 \cup R2$$



Exercise 4.3.4

- Suppliers(**sid**: integer, **sname**: string, **address**: string)
- Parts(**pid**: integer, **pname**: string, **color**: string)
- Catalog(**sid**: integer, **pid**: integer, **cost**:real)
- Find the *sids* of suppliers who supply some red part and some green part.

$$\rho(R1, \pi_{sid}(\pi_{pid}(\sigma_{color=red}(P)) \bowtie C))$$
$$\rho(R2, \pi_{sid}(\pi_{pid}(\sigma_{color=green}(P)) \bowtie C))$$

$$R1 \cap R2$$



Exercise 4.3.5

- **Suppliers**(*sid*: integer, *sname*: string, *address*: string)
- **Parts**(*pid*: integer, *pname*: string, *color*: string)
- **Catalog**(*sid*: integer, *pid*: integer, *cost*: real)
- **Find** the *sids* of suppliers who supply every part.

$$\pi_{sid, pid}(C) / \pi_{pid}(P)$$



Exercise 4.3.6

- **Suppliers**(*sid*: integer, *sname*: string, *address*: string)
- **Parts**(*pid*: integer, *pname*: string, *color*: string)
- **Catalog**(*sid*: integer, *pid*: integer, *cost*: real)
- Find the *sids* of suppliers who supply every red part.

$$\pi_{sid, pid}(C) / \pi_{pid}(\sigma_{color=red}(P))$$

✓
color = 'green'



Exercise 4.3.7

- Suppliers(**sid**: integer, **sname**: string, **address**: string)
- Parts(**pid**: integer, **pname**: string, **color**: string)
- Catalog(**sid**: integer, **pid**: integer, **cost**:real)
- Find the *sids* of suppliers who supply every red or green part.

$$\pi_{sid,pid} (C) / \pi_{pid} (\sigma_{color=red \vee color=green} (P))$$



Exercise 4.3.8

- **Suppliers**(*sid*: integer, *sname*: string, *address*: string)
- **Parts**(*pid*: integer, *pname*: string, *color*: string)
- **Catalog**(*sid*: integer, *pid*: integer, *cost*: real)
- **Find** the *sids* of suppliers who supply every red part or supply every green part.

$$\rho(R1, \pi_{sid, pid}(C) / \pi_{pid}(\sigma_{color=red}(P)))$$

$$\rho(R2, \pi_{sid, pid}(C) / \pi_{pid}(\sigma_{color=green}(P)))$$

$$R2 \cup R1$$



Exercise 4.3.9

- Suppliers(**sid**: integer, **sname**: string, **address**: string)
- Parts(**pid**: integer, **pname**: string, **color**: string)
- Catalog(**sid**: integer, **pid**: integer, **cost**: real)
- Find pairs of *sids* such that the supplier with the first *sid* charges more for some part than the supplier with the second *sid*.

$$\rho(R1, C) \quad \rho(R2, C)$$

$$\rho(R3, \sigma_{R1.pid=R2.pid \wedge R1.sid \neq R2.sid \wedge R1.cost > R2.cost} (R1 \times R2))$$
$$\pi_{R1.sid, R2.sid} (R3)$$



Exercise 4.3.10

- Suppliers(**sid**: integer, **sname**: string, **address**: string)
- Parts(**pid**: integer, **pname**: string, **color**: string)
- Catalog(**sid**: integer, **pid**: integer, **cost**:real)
- Find the *pids* of parts supplied by at least two different suppliers.

$$\rho(R1, C) \quad \rho(R2, C)$$

$$\rho(R3, \sigma_{R1.pid=R2.pid \wedge R1.sid \neq R2.sid} (R1 \times R2))$$
$$\pi_{R1.pid} (R3)$$



Exercise 4.3.11

- **Suppliers**(*sid*: integer, *sname*: string, *address*: string)
- **Parts**(*pid*: integer, *pname*: string, *color*: string)
- **Catalog**(*sid*: integer, *pid*: integer, *cost*:real)
- **Find** the *pids* of the most expensive parts supplied by suppliers named Yosemite Sham.



Exercise 4.3.11

$$\rho(R1, \pi_{sid}(\sigma_{name=YosemiteSham} S))$$

$$\rho(R2, R1 \bowtie C) \quad \rho(R3, R2)$$

$$\rho(R4, \sigma_{R3.cost < R2.cost} (R3 \times R2))$$

$$\rho(R4(1 \mapsto sid, 2 \mapsto pid, 3 \mapsto cost), R4)$$

$$\pi_{pid} (R2 \text{ -- } \pi_{sid, pid, cost} (R4))$$