

In-class Exercise Relational Algebra
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.

1. Find the *names* of suppliers who supply some red part.

$$\pi_{sname} \left(Suppliers \bowtie_{sid=sid} Catalog \bowtie_{pid=pid, color="red"} \sigma_{color="red"} (Parts) \right)$$

2. Find the *sids* of suppliers who supply some red or green part.

$$\pi_{sid} \left(Catalog \bowtie_{pid=pid} \left(\sigma_{color="red"} \cup \sigma_{color="green"} (Parts) \right) \right)$$

3. Find the *sids* of suppliers who supply some red part or are at 221 Packer Street.

$$\pi_{sid} \left(Catalog \bowtie_{color="red"} \sigma_{color="red"} (Parts) \right) \cup \pi_{sid} \left(\sigma_{address="221 Packer Street"} (Suppliers) \right)$$

4. Find the *sids* of suppliers who supply some red part and some green part.

$$\pi_{sid} \left(Catalog \bowtie_{pid=pid} \left(\sigma_{color="red"} \cap \sigma_{color="green"} (Parts) \right) \right)$$

5. Find the *sids* of suppliers who supply every part.

$$\pi_{sid, pid} (Catalog) \supseteq \pi_{pid} (Parts)$$

6. Find the *sids* of suppliers who supply every red part.

$$\pi_{sid, pid} (catalog) \div \pi_{pid} (\sigma_{color="red"} (parts))$$

7. Find the *sids* of suppliers who supply every red or green part.

$$\pi_{sid, pid} (catalog) \div \left(\pi_{pid} (\sigma_{color="red" \vee color="green"} (parts)) \right)$$

8. Find the *sids* of suppliers who supply every red part or supply every green part.

$$\pi_{sid, pid} \div \pi_{pid} (\sigma_{color="red"} (parts))$$

$$\cup$$

$$\pi_{sid, pid} \div \pi_{pid} (\sigma_{color="green"} (parts))$$

9. Find pairs of *sids* such that the supplier with the first *sid* charges more for some part than the supplier with the second *sid*.

$$\sigma_{c1.cost > c2.cost} \left(\left(\pi_{sid, cost} (p_{c1}(catalog)) \right) \times \left(\pi_{sid, cost} (p_{c2}(catalog)) \right) \right)$$

10. Find the *pids* of parts supplied by at least two different suppliers.

$$pid \ \rho_{count(*) > 1} \left(\pi_{sid, pid} (catalog) \right)$$

11. Find the *pids* of the most expensive parts supplied by suppliers named Yosemite Sham.

$$\pi_{pid} (catalog) - \pi_{c1.pid} \left(\sigma_{c1.cost < c2.cost} \left(\pi_{pid, cost} (p_{c1}(catalog)) \times \pi_{pid, cost} (p_{c2}(catalog)) \right) \right)$$