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 *name*s of suppliers who supply some red part.

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

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

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

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

$$\pi_{sid} \left(Catlog \bowtie \sigma_{color="red"}(Parts) \right)$$
$$\cup$$
$$\pi_{sid} \left(\sigma_{address="221\ Parker\ Street"}(Suppliers) \right)$$

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

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

5. Find the *sid*s of suppliers who supply every part.

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

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

$$\pi_{\substack{sid, \\ pid}} (catalog) \;\; \overset{\circ}{\underset{\circ}{}} \;\; \pi_{pid} \left(\sigma_{color = "red"} (Parts) \right)$$

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

$$\pi_{\substack{sid, \\ pid}} (catalog) \;\; \overset{\circ}{\underset{\circ}{}} \left(\pi_{pid} \left(\sigma_{\substack{color = "red" \vee \\ color = "green"}} (Parts) \right) \right)$$

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

$$\pi_{\substack{sid, \\ pid}} \;\; \overset{\circ}{\underset{\circ}{}} \;\; \pi_{pid} \left(\sigma_{color = "red"} (Parts) \right)$$

$$\cup$$

$$\pi_{\substack{sid, \\ pid}} \;\; \overset{\circ}{\underset{\circ}{}} \;\; \pi_{pid} \left(\sigma_{color = "green"} (Parts) \right)$$

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

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

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

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

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

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