Exercises: Relational Algebra

Exercise 2.1 Explain the statement: relational algebra operators can be composed. Why is the ability to compose operators important?

Exercise 2.2 Given two relations R1 and R2, where R1 contains N1 tuples, R2 contains N2 tuples, and N2 > N1 > 0, give the minimum and maximum possible sizes (in tuples) for the resulting relation produced by each of the following relational algebra expressions. In each case, state any assumptions about the schemas for R1 and R2 needed to make the expression meaningful:

(Assume set semantics)

1. R1 U R2
2. R1 ∩ R2
3. R1 – R2
4. R1 x R2
5. $\sigma_{a=5}(R1)$
6. $\pi_{a}(R1)$
7. $R1/R2$

Exercise 2.3 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:

1. Find the names of suppliers who supply red parts.
2. Find the sids of suppliers who supply red or green parts.
3. Find the sids of suppliers who supply red parts or are at 221 Packer Ave.
4. Find the sids of suppliers who supply both red and green parts.
5. Find the sids of suppliers who supply every part.
6. Find the sids of suppliers who supply every red part.
7. Find the sids of suppliers who supply every red or green part.
8. Find the sids of suppliers who supply every red part or supply every green part.
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.
10. Find the pids of parts supplied by at least two different suppliers.