

CS44, Fall 2016, Lab 4: Relational Algebra

1. Assume you have two relations R and S , where R contains N tuples and S contains M tuples, and $N > M$ (i.e., R has more rows). For each expression below, give the (1) *minimum* and (2) *maximum* number of tuples possible for the resulting relation. Additionally, describe if there are any (3) requirements for the schemas to ensure the expression is legal:

- (a) $R \cup S$
- (b) $R \cap S$
- (c) $R - S$
- (d) R/S
- (e) $\sigma_{x=10}R$
- (f) $R \times S$

2. You are given the following schema:

Suppliers(sid:integer, sname: string, address: string)

Parts(pid:integer, pname: string, color: string)

Catalog(sid:integer, pid: integer, cost: real)

Underlined fields form the primary key for the relation. Write each of the following queries as a relational algebra expression:

- (a) Find the names of suppliers who supply some red part.
- (b) Find the sids of suppliers who supply some red part or are at 500 College Avenue.
- (c) Find the sids of suppliers who supply some red part and some green part.
- (d) Find the sids of suppliers who supply every part.
- (e) Find the sids of suppliers who supply every red part.
- (f) Finds sids of suppliers who supply every red part or supply every green part.
- (g) Find the pids of parts supplied by at least two different suppliers.

Note: one benefit to the renaming operator is that it makes a copy of a relation. So, you could use it to store an intermediate result if you want to break up an expression into pieces. For example, to simplify $\pi_{a,b,c}((R \bowtie S) \cup (X \bowtie Y))$ we could produce:

$\rho(Temp, R \bowtie S)$

$\rho(Temp2, X \bowtie Y)$

$\pi_{a,b,c}(Temp \cup Temp2)$

3. Using the same schema as above, state the query that the following expressions compute. If the query is illegal, please state why:

- (a) $\pi_{sname}((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)$
- (b) $\pi_{sname}(\pi_{sid}((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers))$
- (c) $(\pi_{sname}((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)) \cap (\pi_{sname}((\sigma_{color='green'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)))$