Relational Calculus

Find the names of pizzas that come in a 10 inch size

$\{T \mid \exists T1$
$(T1 \in pizza \wedge T1.size = 10 \wedge T1.name = T.name)\}$

$\{<N> \mid \exists C\ \exists S\ (pizza(C, N, S) \wedge S = 10)\}$

Find the names of pizzas that come in a 10 inch or a 12 inch size

$\{T \mid \exists T1$
$(T1 \in pizza \wedge (T1.size = 10 \vee T1.size = 12) \wedge T1.name = T.name)\}$

$\{<N> \mid \exists C\ \exists S\ (pizza(C, N, S) \wedge (S = 10 \vee S = 12))\}$

Find the names of pizzas that come in both a 10 inch and a 12 inch size

$\{T \mid \exists T1\ \exists T2$
$(T1 \in pizza \wedge T2 \in pizza \wedge T1.name = T2.name \wedge T1.size = 10 \wedge T2.size = 12 \wedge T1.name = T.name)\}$

$\{<N1> \mid \exists C1\ \exists S1\ \exists C2\ \exists N2\ \exists S2$
$(pizza(C1, N1, S1) \wedge pizza(C2, N2, S2) \wedge N1 = N2 \wedge S1 = 10 \wedge S2 = 12)\}$

Find the pairs of different codes of pizzas with the same name and the same size (is there any?)

$\{T \mid \exists T1\ \exists T2$
$(T1 \in pizza \wedge T2 \in pizza \wedge T1.code <> T2.code \wedge T1.name = T2.name \wedge T1.size = T2.size \wedge T.code1 = T1.code \wedge T.code2 = T2.code)\}$

$\{<C1, C2> \mid \exists N1\ \exists S1\ \exists N2\ \exists S2$
$(pizza(C1, N1, S1) \wedge pizza(N2, C2, S2) \wedge C1 <> C2 \wedge N1 = N2 \wedge S1 = S2)\}$

Find the names and phone numbers of the stores in "College Park" or "Greenbelt" that sell a 10 inch pizza named "pepperoni" for less than $8

$\{T \mid \exists T1\ \exists T2\ \exists T3$
$(T1 \in pizza \wedge T2 \in store \wedge T3 \in sells \wedge T1.code= T3.code \wedge T2.name = T3.store\_name \wedge (T2.area = \text{‘College Park’} \vee T2.area = \text{‘Greenbelt ‘}) \wedge T1.name = \text{‘pepperoni’} \wedge T1.size = 10 \wedge T3.price < 8 \wedge T2.name = T.name \wedge T2.phone = T.phone)\}$

$\{<SN, P> \mid \exists C\ \exists N\ \exists S\ \exists A\ \exists Pr$
$(pizza(C,N, S) \wedge store(SN, A, P) \wedge sells(SN, C, Pr) \wedge (A = \text{‘College Park’} \vee A = \text{‘Greenbelt ‘}) \wedge N = \text{‘pepperoni’} \wedge S = 10 \wedge Pr<8)\}$

Find the codes of the most expensive pizzas – assume the scheme of the database is reduced to a relation pizza(code, price) to simplify

$\{T \mid \exists T1\ \forall T2$
$(T1 \in pizza \wedge (T2 \in pizza \Rightarrow T1.price \geq T2.price) \wedge T1.code = T.code)\}$

$\{\langle C1 \rangle \mid \exists P1\ \forall C2\ \forall P2$
$(pizza(C1, P1) \wedge (pizza(C2, P2) \Rightarrow P1 \geq P2))\}$

Find the names of the stores that sell all the pizzas

$\{T \mid \exists T1\ \forall T2\ \exists T3$
$(T1 \in store \wedge (T2 \in pizza \Rightarrow (T3 \in sells \wedge T2.code = T3.code \wedge T1.name = T3.store\_name))$
$\wedge T1.name = T.name)\}$

$\{\langle SN \rangle \mid \exists A\ \ \exists P\ \ \forall C\ \ \forall N\ \ \forall S\ \ \exists Pr$
$(store(SN, A, P) \wedge (pizza(C, N, S) \Rightarrow sells(SN, C, Pr)))\}$

Relational Algebra

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

$\pi_{sname}\ (\pi_{sid}\ ((\pi_{pid}\ (\sigma_{color='red'}\ Parts) \otimes Catalog) \otimes Supplier)$

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

$\pi_{sid}\ (\sigma_{color='red' \vee color='green'}(Parts \otimes Catalog))$

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

$\rho(R1, \pi_{sid}\ (\sigma_{color='red'}(Parts) \otimes Catalog))$

$\rho(R2, \pi_{sid}\ (\sigma_{address='221\ Packer\ Ave'}(Suppliers)))$

$R1 \cup R2$

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

$\rho(R1, \pi_{sid}\ (\sigma_{color='red'}(Parts) \otimes Catalog))$

$\rho(R2, \pi_{sid}\ (\sigma_{color='green'}(Parts) \otimes Catalog))$

$R1 \cap R2$

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

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

6. Find the names of suppliers who supply every red part.

$\pi_{sname}\ (Suppliers \otimes\ (\pi_{sid,pid}(Catalog)\ /\ \pi_{pid}(\sigma_{color='red'}(Parts))))$

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

$\pi_{sid,pid}(Catalog) / \pi_{pid}(\sigma_{color='red' \vee color='green'} (Parts))$

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

$\rho(R1, \pi_{sid,pid}(Catalog) / \pi_{pid}(\sigma_{color='red'}(Parts)))$

$\rho(R2, \pi_{sid,pid}(Catalog) / \pi_{pid}(\sigma_{color='green'}(Parts)))$

$R1 \cup R2$

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.

$\rho(R1, Catalog)$

$\rho(R2, Catalog)$

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

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

$\rho(R1, Catalog)$

$\rho(R2, Catalog)$

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