CS2102/S and IT2002 Tutorial Solution

- Relational Algebra

$P \rightarrow$ Pizza(*code, pname, size*)
$S \rightarrow$ Store(*sname, area, phone*)
$L \rightarrow$ Sells(*sname, code, price*)

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

$$\pi_{pname}(\sigma_{size=10}(P))$$

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

$$\pi_{pname}(\sigma_{size=10 \vee size=12}(P))$$

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

$$\pi_{pname}(\sigma_{size=10}(P)) \cap \pi_{pname}(\sigma_{size=12}(P))$$

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

$$\pi_{P1.code,P2.code}(\sigma_{P1.code \neq P2.code \wedge P1.name = P2.name \wedge P1.size = P2.size}(\rho(P1,P) \times \rho(P2,P)))$$

5. 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.

$$\pi_{S.sname,phone}($$

$$\sigma_{size=10 \wedge pname='pepperoni' \wedge price<8 \wedge (area='CollegePark' \vee area='Greenbelt')}(P \bowtie n\ S \bowtie n\ L))$$

please note that the attribute names are changed, as given at the beginning of this answer sheet. Otherwise, we cannot use nature join here.

6. Find the codes of the most expensive pizzas assume the scheme of the database is reduced to a relation P → Pizza(<u>code</u>, price) to simplify.

$$\pi_{P1.code,P2.code}(\sigma_{P1.price \geq P2.price}(\rho(P1,P) \times \rho(P2,P)))/\pi_{code}(\rho(P1,P))$$

The intuition is: (i) Find all pairs (code1, code2) of pizza codes where the price of code1 is more or

equal to the price of code2. (ii) For a specific c ∈ code1, if c is paired with all possible codes, it means

that its price is more or equal to all prices. Therefore c is the most expensive pizza. Note that many such pizzas may exist (if all have the same high price).

Recall that, for two tables A(x, y), B(y), division is defined as:

$$A/B = \pi_x(A) - \pi_x((\pi_x(A) \times B) - A)$$

7. Find the names of the stores that sell all the pizzas.

$$\pi_{sname,code}(L)/\pi_{code}(P)=$$

$$\pi_{sname}(L) - \pi_{sname}((\pi_{sname}(L) \times \pi_{code}(P)) - \pi_{sname,code}(L))$$

Observe. This is division. In this case:

$$A \equiv \pi_{sname,code}(L)$$

$$B \equiv \pi_{code}(P)$$