**Lecture Notes** 

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Topic : Relational Algebra :Practice Problems (The problems were taken from Raghu Ramakrishnan) Exercise 4.3. 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)

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

Soln:

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

Division operator A/B is defined as the set of all x values (in the form of unary tuples ) such that for every y value in (a tuple of) B ,there is a tuple (x,y) in A.

In this problem, to get the list of all sids that supply all parts, we project the column pertaining to pid in Parts(R1) and the columns sid, pid in Catalog(R2) and perform division on them (R2/R1). On doing so, we get those sids which correspond to every pid in Parts hence those suppliers who supply all parts.

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

Soln:

Ans:  $\pi_{sid,pid}(Catalog) / \pi_{pid}(\sigma_{color=red}(Parts))$ 

We again perform division operation as above but with one extra condition – ie. We select only those parts' pids who are of red colour.

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

Soln:

Ans:

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

OR

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\pi_{sid,pid}(Catalog)/\pi_{pid}(\sigma_{color=red or green}(Parts))
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There are two approaches to this problem.

1<sup>st</sup> Approach: We get sids of suppliers who supply every red part(as in previous question) and sids of those suppliers who supply every green part. Then, take their Union to get sids of suppliers who supply

every red or green part.

 $2^{nd}$  Approach: We again perform division operation as above question but with one extra condition – ie. We select only those parts' pids who are of red or green colour.

Extra ques: Find the pids of the most expensive parts supplied by supplier with sid x.

Soln:

 $C = \sigma_{sid=x}(Catalog)$   $R1 = C_{s1,p1,t1} X C_{s2,p2,t2} \qquad (s1,p1,t1 = first instance of the relation C)$   $R2 = \pi_{t1,p1}(\sigma_{t1 < t2}(R1))$   $R3 = \pi_{p1,t1}(C)$ 

Ans: $\pi_p(R3 - R2)$ 

In this, firstly we selected the rows in Catalog with sid=x. Then we did cross product of two instances of C. After doing so, we compare the rates in the same row(t1<t2) and project them- hence we get the pids and rates of all the parts except the parts with the highest rate. Then we take the set difference with the original C(with pid and rate projected) ie R3 and get the parts with the highest rate.

(Multiple rows can be present in the final output as there can be more than one part with highest rate.)