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Relational Algebra

Case study 1

1. Find names of suppliers who supply 'yellow' part.

$$\Pi_{sname}(\Pi_{sid}(\Pi_{pid}(\sigma_{color="yellow"}Parts) \bowtie Catalog) \bowtie Suppliers$$

~~Duty~~

2. Find 'sid' of suppliers who supply 'blue' or 'yellow' part.

$$\Pi_{sid}(\Pi_{pid}(\sigma_{color="blue" \vee color="yellow"}Parts) \bowtie catalog)$$

3. Find 'sid' of suppliers who supply 'yellow' part or are at 'SVNIT'

$$\rho(R_1, \Pi_{sid}((\Pi_{sid}\sigma_{color="yellow"}Parts) \bowtie Catalog))$$

$$\rho(R_2, \Pi_{sid}\sigma_{address="SVNIT"}Suppliers)$$

$$R_1 \cup R_2$$

4. Find sid of suppliers who supply 'yellow' part and 'green' part.

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$\rho(R_1, \Pi_{sid}((\Pi_{pid}\sigma_{color="yellow"} Parts) \bowtie Catalog))$

$\rho(R_2, \Pi_{sid}((\Pi_{pid}\sigma_{color="green"} Parts) \bowtie Catalog))$

$R_1 \cap R_2$

(5). Find 'sid' of suppliers who supply every part.

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

(6). Find 'sid' of suppliers who supply every 'red' part.

$(\Pi_{sid,pid} Catalog) / (\Pi_{pid}\sigma_{color="red"} Parts)$

(7). Find 'sid' of suppliers who supply every ~~or~~ blue OR yellow part.

~~$(\Pi_{sid,pid} Category) / \Pi_{pid}\sigma_{color="blue" \vee color="yellow"}$~~

$(\Pi_{sid,pid} Catalog) / \Pi_{pid}\sigma_{color="blue" \vee color="yellow"} Parts)$

(8). Find 'sid' of suppliers who supply every red part or supply every green part

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$\rho(R_1, ((\Pi_{sid,pid}\ Catalog) / (\Pi_{pid}\ \sigma_{color="red"}\ Parts)))$

$\rho(R_2, ((\Pi_{sid,pid}\ Catalog) / (\Pi_{pid}\ \sigma_{color="green"}\ Parts)))$

$R_1 \cup R_2$

(9). Find pairs of 'sid' such that supplier with the first 'sid' charges more for some part than the supplier with second 'sid'.

$\rho(R_1, catalog)$
$\rho(R_2, Catalog)$

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

(10). Find 'pid' of parts supplied by at least two different suppliers.

$\rho(R_1, Catalog)$
$\rho(R_2, Catalog)$

$\Pi_{R1.pid}\ \sigma_{R1.pid = R2.pid \wedge R1.pid != R2.sid}(R1 \times R2)$

(11) Find the 'pid' of most expensive parts supplied by suppliers named 'Raj Patel'.

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$\rho(R1, \Pi_{sid}\, \sigma_{sname = \text{"Raj. Patel"}}\, Suppliers)$

$\rho(R2, R1 \bowtie Catalog)$

$\rho(R3, R2)$

$\rho(R4(1 \to sid, 2 \to pid, 3 \to cost), \sigma_{R3.cost < R2.cost}(R3 \times R2))$

$\Pi_{pid}(R2 - \Pi_{sid,pid,cost} R4)$

(12). Find the supplier names of suppliers who supply a red part that costs less than Rs100.

$\Pi_{sname}(\Pi_{sid}((\sigma_{color = \text{"red"}} Parts) \bowtie (\sigma_{cost<100} Catalog)) \bowtie Suppliers)$

(13). This relational Algebra statement does not returns anything because of its sequence of projection. Projecting on sname will not return anything.

$\Pi_{sname}(\Pi_{sid}((\sigma_{color = \text{"red"}} Parts) \bowtie (\sigma_{cost<100} Catalog) \bowtie Supplie$

(14). Find the supplier names of suppliers who supply a red part that costs less than Rs 100 and a green part that costs less than Rs 100

$(\Pi_{sname}((\sigma_{color = 'red'} Parts) \bowtie (\sigma_{cost<100} Catalog) \bowtie Suppliers)) \cap (\Pi_{sname}((\sigma_{color = 'green'} Parts) \bowtie (\sigma_{cost<100} Catalog) \bowtie Suppliers))$

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(15) ~~To~~

(15) Find the supplier ids of suppliers who supply a red part that costs less than INR 100 and a green part that costs less than INR 100.

$$\left[\Pi_{sid}\left(\left(\sigma_{color='red'}\,Parts\right)\bowtie\left(\sigma_{cost<100}\,Catalog\right)\bowtie Suppliers\right)\right]\cap\left(\Pi_{sid}\left(\left(\sigma_{color='green'}\,Parts\right)\bowtie\left(\sigma_{cost<100}\,Catalog\right)\bowtie Suppliers\right)\right)$$

(16). Find the supplier names of suppliers who supply a red part that costs less than INR 100 and a green part that costs less than INR 100.

$$\Pi_{sname}\left(\left[\Pi_{sid,sname}\left(\left(\sigma_{color="red"}\,Parts\right)\bowtie\left(\sigma_{cost<100}\,Catalog\right)\bowtie Suppliers\right)\right]\cap\left[\Pi_{sid,sname}\left(\left(\sigma_{color="green"}\,Parts\right)\bowtie\left(\sigma_{cost<100}\,Catalog\right)\bowtie Suppliers\right)\right]\right)$$

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Case Study II

(1). Find the 'e_id' of pilots certified for some Boeing aircraft.

$$\Pi_{e\_id}(\Pi_{aname="Boeing"}(Aircraft \bowtie Certified))$$

(2). Find the names of pilots certified for some Boeing aircraft

$$\Pi_{ename}(\Pi_{aname="Boeing"}(Aircraft \bowtie Certified \bowtie Employees))$$

(3). Find the a_id of all aircraft that can be used on non-stop flights from Surat to Delhi.

$$\rho(R1, \sigma_{from="Surat" \wedge to="Delhi"}(Flights))$$

$$\Pi_{a\_id}(\sigma_{cruising\_range > distance}(Aircraft \times R1))$$

(4). Identify the ~~names~~ flights that can be piloted by every pilot whose salary is more than INR 100000.

$$\Pi_{f\_no}(\sigma_{distance<cruising\_range \wedge salary>100000}(Flights \bowtie Aircraft \bowtie Certified \bowtie Employees)))$$

(5). Find the names of pilot who can operate planes with a range greater than 3000 km but are not certified on any Boeing aircraft.

ρ (RLT, Π_{e_id} ($\sigma_{cruising\_range > 3000}$ (Aircraft ⋈ Certified)))

Π_{ename} (Employees ⋈ (RLT − Π_{eid} ($\sigma_{aname = 'Boeing'}$ (Aircraft ⋈ Certified))))

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(6). Find the e-id of employees who make highest salary.

ρ (R1, Employees)
ρ (R2, Employees)

→ Finds all employees not having highest salary

ρ (R3, $\Pi_{R2.e\_id}$ (R1 $\bowtie_{R1.salary > R2.salary}$ R2))

(Π_{e_id} R1) − R3 → Subtracts all employees not having highest salary from total set of empl.

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(7). Find the ~~e_id~~ e_id of employees who make second highest salary.

→ Finding highest salary employee and removing it from total set of employee.

ρ (R1, Employees)
ρ (R2, Employees)

→ set of all employee not having highest salary

ρ (R3, $\Pi_{R2.e\_id}$ (R1 $\bowtie_{R1.salary > R2.salary}$ R2))

ρ (R4, R2 ⋈ R3)

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$\rho(R5, R2 \bowtie R3)$ → Set of all empl not having second highest salary

$\rho(R6, \Pi_{R5.e\_id}(R4 \bowtie_{R1.salary > R5.salary} R5))$

$\therefore (\Pi_{e\_id} R3) - R6$ → Employee id with second highest salary

(8) - Find e_id of employees who are certified for exactly three aircraft.

$\rho(C1, Certified)$
$\rho(C2, Certified)$
$\rho(C3, Certified)$
$\rho(C4, Certified)$

→ To get empl with at least 3 aircraft certified (C1 x C2 x C3)

$\rho(C5, \Pi_{e\_id}(\sigma_{(C1.e\_id = C2.e\_id = C3.e\_id) \wedge (C1.a\_id \neq C2.a\_id \neq C3.a\_id)}$

$\rho(C6, \Pi_{e\_id}(\sigma_{(C1.e\_id = C2.e\_id = C3.e\_id = C4.e\_id) \wedge (C1.a\_id \neq C2.a\_id \neq C3.a\_id \neq C4.a\_id)}$ (C1 x C2 x C3 x C4)))

→ To get empl with at least 4 aircraft certified

C5 - C6