(a) Find the names of suppliers who supply some red part.

Ans:→

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

(b) Find the sids of suppliers who supply some red or green part.

Ans:→

$\pi_{sid}((\pi_{pid}\sigma_{color="red" \lor color="green"}\ Parts) \bowtie Catalog)$

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

$\pi_{sid}((\pi_{pid}\sigma_{color="red"}\ Parts) \bowtie Catalog) \cup \pi_{sid}(\sigma_{address="221\ Packer\ Ave"}\ Suppliers)$

(d) Find the sids of suppliers who supply some red part and some green part.

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

(e) Find the sids of suppliers who supply every part.

Ans:→

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

(f) Find the sids of suppliers who supply every red part.

Ans:→

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

(g) Find the sids of suppliers who supply every red or green part.

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

(h) Find the sids of suppliers who supply every red part or supply every green part.

$(\pi_{sid,pid}(Catalog) / \pi_{pid}\sigma_{color="red"}\ Parts) \cup (\pi_{sid,pid}(Catalog) / \pi_{pid}\sigma_{color="green"}\ Parts)$
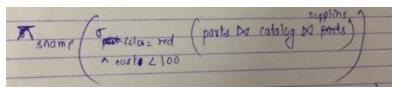
(i) Find the pairs of sids such that the supplier with the first sid charges more for some part than the supplier with the second sid.

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

(j) Find the pids of parts that are supplied by at least two different suppliers.

$$\pi_{R1.pid} \left(\sigma_{R1.pid = R2.pid \, \wedge \, R1.sid \neq R2.sid} \left(\rho_{S_{R1}}Catalog \times \rho_{S_{R2}}Catalog \right) \right)$$

(k) Find the pids of the most expensive parts supplied by suppliers names Yosemite Sham.

$$t1 \leftarrow \pi \left(\sigma_{sid} \, \sigma_{sname = "Yosemite Sham"} \left(Suppliers \bowtie Catalog \right) \right)$$

$$t4 \leftarrow \pi_{t2.sid, t2.pid, t2.cost} \, \sigma_{t3.cost \, < \, t3.cost} \left(\rho_{S_{t2}}(t1) \times \rho_{t3}(t1) \right)$$

$$\pi_{pid} \left(\sigma_{t5.cost}(sid, pid, cost) \, t1 - (S_{t6}(sid, pid, cost) \neq 4) \right)$$

(l) Find the pids of parts supplied by every supplier at less than $200. (If any supplier either does not supply the part or charges more than $200 for it, the part is not selected.)

$$\pi_{pid, sid} \left(\sigma_{cost \, < \, 200} \left(Catalog \right) \right) / \left(\pi_{sid} \, Suppliers \right)$$

(m) Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars.

$$\pi_{sname} \left(\sigma_{part.color = red \, \wedge \, cost \, < \, 100} \left(parts \bowtie catalog \bowtie \overset{suppliers}{parts} \right) \right)$$

(n) Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.

$$\pi_{sname} \left(\sigma_{color = red \, \vee \, color = green \, \wedge \, cost < 100} \left(parts \bowtie catalog \bowtie supplier \right) \right)$$

(o) Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.

$$\pi_{sname} \left(\sigma_{color = red \, \vee \, color = green \, \wedge \, cost < 100} \left(parts \bowtie catalog \bowtie supplier \right) \right)$$