EXERCISES

Consider the following schema:

SUPPLIERS(Sid, Name,City)
PARTS(Pid, Pname, Colour)
CATALOG(Sid, Pid, Cost)

where key attributes have been underlined; and relation CATALOG lists prices charged by Suppliers for Parts. Express in RA,TRC, and SQL the queries that find:

1. the Names of suppliers who supply red parts
2. the Sids of suppliers who supply red OR green parts
3. the Sids of suppliers who supply red parts AND live in Dublin

3*) the Sids of suppliers who supply red parts OR live in Dublin

4. the Sids of suppliers who supply red AND green parts
5. Pairs of Sids such that the supplier with the first Sid charges more than the supplier with the second Sid for the same part.
6. Pids of parts that are supplied by at least two different suppliers.

POSSIBLE SOLUTIONS
NOTE:

- some solutions can be expressed also in alternative ways
- the symbol ⋈ without any predicate specified indicates NATURAL JOIN (see definition)

1. RA:
   $\pi_{Name}(\pi_{Sid}(\pi_{Pid}(\sigma_{Colour='red'}(PARTS)) \bowtie CATALOG) \bowtie SUPPLIERS)$

   TRC:
   $\{T:\{Name\} \mid (\exists T')(T' \in SUPPLIERS \wedge (\exists X)(X \in PARTS \wedge X[Colour]='red' \wedge (\exists Y)(Y \in CATALOG \wedge Y[Pid]=X[Pid] \wedge Y[Sid]=T'[Sid])) \wedge T[Name]=T'[Name])\}$

   SQL:
   ```
   SELECT S.Name
   FROM SUPPLIERS S, PARTS P, CATALOG C
   WHERE P.Colour='red' AND C.Pid=P.Pid AND C.Sid=S.Sid
   ```

2. RA:
   $\pi_{Sid}(\pi_{Pid}(\sigma_{Colour='red' \vee Colour='green'}(PARTS)) \bowtie CATALOG)$

   TRC:
   $\{T:\{Sid\} \mid (\exists T')(T' \in CATALOG \wedge (\exists X)((X \in PARTS \wedge (X[Colour]='red' \vee X[Colour]='green') \wedge X[Pid]=T'[Pid]) \wedge T[Sid]=T'[Sid])\}$

   SQL:
   ```
   SELECT C.Sid
   FROM CATALOG C, PARTS P
   WHERE (P.Colour='red' OR P.Colour='green') AND C.Pid=P.Pid
   ```

3. RA:

   Let R and R' be:
   $R=\pi_{Sid}(\pi_{Pid}(\sigma_{Colour='red'}(PARTS)) \bowtie CATALOG)$; $R'=\pi_{Sid}(\sigma_{City='Dublin'}(SUPPLIERS))$

   The solution is: $R \cap R'$

   TRC:
   $\{T:\{Sid\} \mid (\exists T')(T' \in CATALOG \wedge (\exists X)(X \in PARTS \wedge X[Colour]='red' \wedge X[Pid]=T'[Pid]) \wedge T[Sid]=T'[Sid]) \wedge (\exists Y)(Y \in SUPPLIERS \wedge Y[City]='Dublin' \wedge T[Sid]=Y[Sid])\}$

SQL:

```
SELECT S.Sid
FROM SUPPLIERS S
WHERE S.City='Dublin AND S.Sid IN (SELECT C.Sid
                                   FROM PARTS P, CATALOG C
                                   WHERE P.Colour='red' AND C.Pid=P.Pid )
```

***NOTE: "**IN" is the same as "=ANY" in nested queries**

3*. RA:

Let R and R' be:

$R=\pi_{Sid}(\pi_{Pid}(\sigma_{Colour='red'}(PARTS))\bowtie CATALOG)$; $R'=\pi_{Sid}(\sigma_{City='Dublin'}(SUPPLIERS))$

The solution is: $R \cup R'$

TRC:

$\{T:\{Sid\} \mid (\exists T')(T' \in CATALOG \wedge (\exists X)(X \in PARTS \wedge X[Colour]='red' \wedge X[Pid]=T'[Pid]) \wedge T[Sid]=T'[Sid]) \vee (\exists Y)(Y \in SUPPLIERS \wedge Y[City]='Dublin' \wedge T[Sid]=Y[Sid])\}$

SQL:

```
SELECT S.Sid
FROM SUPPLIERS S
WHERE S.City='Dublin OR S.Sid IN (SELECT C.Sid
                                  FROM PARTS P, CATALOG C
                                  WHERE P.Colour='red' AND C.Pid=P.Pid )
```

4. Similar

5. RA:

Let R' be:

$R'=\rho_{Sid'<-Sid,Pid'<-Pid,Cost'<-Cost}(CATALOG)$

The solution is: $\pi_{Sid,Sid'}(\sigma_{Pid=Pid' \wedge Sid <> Sid' \wedge Cost>Cost'}(CATALOG \times R')$

TRC:

$\{T:\{Sid,Sid'\} \mid (\exists T')(T' \in CATALOG \wedge (\exists X)(X \in CATALOG \wedge X[Pid]=T'[Pid] \wedge X[Sid] <> T'[Sid] \wedge X[Cost]<T'[Cost] \wedge T[Sid']=X[Sid]) \wedge T[Sid]=T'[Sid])\}$

SQL:

```
SELECT C.Sid, C'.Sid
FROM CATALOG C, CATALOG C'
WHERE C.Pid=C'.Pid AND C.Sid < > C'.Sid AND C.Cost>C'.Cost
```

6. RA:

Let R' be:

$R'=\rho_{Sid'<-Sid,Pid'<-Pid}(CATALOG)$

The solution is: $\pi_{Pid}(\sigma_{Pid=Pid' \wedge Sid <> Sid'}(\pi_{Sid,Pid}(CATALOG) \times R')$

TRC:

$\{T:\{Pid\} \mid (\exists T')(T' \in CATALOG \wedge (\exists X)(X \in CATALOG \wedge X[Pid]=T'[Pid] \wedge X[Sid] <> T'[Sid]) \wedge T[Pid]=T'[Pid])\}$

SQL:

```
SELECT distinct C.Pid
FROM CATALOG C, CATALOG C'
WHERE C.Pid=C'.Pid AND C.Sid < > C'.Sid
```