## 1: Relational Model and Languages

Consider the following relational schema:
*Suppliers(sid, sname, address)*
*Parts(pid, pname, color)*
*Catalog(sid, pid, cost)*
The underlined attributes are keys for their relations. The *Catalog* relation lists the prices charged for *Parts* by *Suppliers*. Write the following queries in SQL:

**(a)** Find the *pname*s of parts for which there is some supplier.

**(solution)**
SELECT DISTINCT P.pname
FROM Parts P, Catalog C
WHERE P.pid = C.pid

**(b)** Find the *sid*s of suppliers who supply only red parts.

**(solution)**
SELECT C.sid
FROM Catalog C
WHERE NOT EXISTS ( SELECT *
FROM Parts P
WHERE P.pid = C.pid AND P.color <> 'Red' )

**(c)** Find the *sname*s of suppliers who supply every part.

**(solution)**
SELECT S.sname
FROM Suppliers S
WHERE NOT EXISTS (( SELECT P.pid
FROM Parts P)
EXCEPTS
(SELECT C.pid
FROM Catalog C
WHERE C.sid = S.sid))

**(d)** Find the *sid*s of suppliers who charge more for some part than the average cost of that part (averaged over all the suppliers who supply that part).

**(solution)**
SELECT C.sid
FROM Catalog C
WHERE C.cost > ( SELECT AVG (C1.cost)
FROM Catalog C1
WHERE C1.pid = C.pid )

**(e)** For each part, find the *sname* of the supplier who charges the most for that part.

**(solution)**
SELECT P.pid, S.sname
FROM Parts P, Suppliers S, Catalog C
WHERE C.pid = P.pid
AND C.sid = S.sid
AND C.cost = (SELECT MAX (C1.cost)
FROM Catalog C1
WHERE C1.pid = P.pid) )

**(f)** Find the *sname*s of suppliers that provide some parts.

**(solution)**
SELECT DISTINCT S.sname
FROM Suppliers S, Catalog C
WHERE S.sid = C.sid

**(g)** Find the *sid*s of suppliers who supply a red part and a green part.

**(solution)**
SELECT DISTINCT C.sid
FROM Catalog C, Parts P
WHERE C.pid = P.pid AND P.color = 'Red'
INTERSECT
SELECT DISTINCT C1.sid
FROM Catalog C1, Parts P1
WHERE C1.pid = P1.pid AND P1.color = 'Green'

**(h)** Find the pnames of parts supplied by Acme Widget Suppliers and no one else.

**(solution)**
SELECT P.pnam
FROM Parts P, Catalog C, Suppliers S
WHERE P.pid = C.pid AND C.sid = S.sid AND S.sname = 'Acme Widget Suppliers'
AND NOT EXISTS ( SELECT *
FROM Catalog C1, Suppliers S1
WHERE P.pid = C1.pid AND C1.sid = S1.sid AND S1.sname <> 'Acme Widget Suppliers' )

**(i)** Find the *pid*s and minimum costs of parts whose maximum costs are less than $100 and their color is red.

**(solution)**
SELECT P.pid, MIN(C.cost)
FROM Catalog C, Parts P
WHERE C.pid = P.pid AND P.color = 'Red'
Group by P.pid
Having MAX(C.cost) < 100