CSC 370 — Database Systems
Summer 2004
Solutions for Exercise No. 1
Version 1.0 June 14, 2004

Problem 4.2

Expression	Assumption	Min	Max
$R1 \cup R2$	R1 and R2 are union compatible	N2	N1 + N2
$R1 \cap R2$	R1 and R2 are union compatible	0	N1
$R1 - R2$	R1 and R2 are union compatible	0	N1
$R1 \times R2$		N1 * N2	N1 * N2
$sigma_{a=5}R1$	R1 has an attribute name a	0	N1
$pi_a R1$	R1 has an attribute name a	1	N1
$R1/R2$	The set of attributes of R2 is a subset of the set of attributes of R1	0	N1
$R2/R1$	The set of attributes of R1 is a subset of the set of attributes of R2	0	$\lfloor N2/N1 \rfloor$

Problem 4.3

See Web site for answers.

Problem 4.4

1. Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars.
2. This relational algebra does not seem to return anything because of the sequence of projection operations. Once the sid is projected, it is the only field in the set. Therefore, projecting $sname$ will not return anything.
3. Find the Supplier names of the supppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.
4. Find the Supplier ids of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.
5. 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.

Problem 5.2

1. Query:

```
SELECT DISTINCT P.pname
   FROM Parts P, Catalog C
   WHERE P.pid = C.pid
```

   Result:

pname
7 Segment Display
Acme Widget Washer
Anti-Gravity Turbine Generator
Fire Hydrant Cap
I Brake for Crop Circles Sticker
Left Handed Bacon Stretcher Cover
Smoke Shifter End
SQL queries

2. Query:

```
SELECT S.sname
   FROM Suppliers S
   WHERE NOT EXISTS (
             ( SELECT P.Pid FROM Parts P)
             EXCEPT
             ( SELECT C.pid FROM Catalog C
                  WHERE C.sid = S.sid))
```

   Result:

sname
Acme Widget Suppliers

3. Query:

```
SELECT S.sname
   FROM Suppliers S
   WHERE NOT EXISTS (
              ( SELECT P.pid   FROM Parts P
                   WHERE P.color = 'Red')
              EXCEPT
              ( SELECT C.pid
                   FROM Catalog C, Parts P
                   WHERE C.sid = S.sid AND
                   C.pid = P.pid AND P.color = 'Red'))
```

Result:

sname
Acme Widget Suppliers
Big Red Tool and Die

4. Query:

```
SELECT P.pname
   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')
```

Result:

pname
Acme Widget Washer
Smoke Shifter End

5. Query:

```
SELECT DISTINCT C.sid
   FROM Catalog C
   WHERE C.cost > ( SELECT AVG (C1.cost)
                     FROM Catalog C1
                     WHERE C1.pid = C.pid )
```

Result:

sid
1
2
3
4

6. Query:

```
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)
```

Result:

pid	*sname*
1	Acme Widget Suppliers
2	Acme Widget Suppliers
3	Big Red Tool and Die
4	Acme Widget Suppliers
5	Alien Aircaft Inc.
5	Acme Widget Suppliers
6	Alien Aircaft Inc.
7	Alien Aircaft Inc.
7	Acme Widget Suppliers
8	Perfunctory Parts
9	Acme Widget Suppliers
10	DB Dudes Inc.
10	Acme Widget Suppliers

7. Query:

```
SELECT DISTINCT C.sid
   FROM Catalog C
   WHERE NOT EXISTS ( SELECT *
                      FROM Parts P  NATURAL JOIN Catalog C2
                      WHERE C.sid = C2.sid AND
                            P.color <> 'Red')
```

Result:

sid
2

8. Query:

```
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'
```

Result:

sid
1
3

9. Query:

```
SELECT DISTINCT C.sid
   FROM Catalog C, Parts P
   WHERE C.pid = P.pid AND P.color = 'Red'
UNION
SELECT DISTINCT C1.sid
   FROM Catalog C1, Parts P1
   WHERE C1.pid = P1.pid AND P1.color = 'Green'
```

Result:

sid
1
2
3
5

10. Query:

```
SELECT DISTINCT S.Sname, count(*) AS PartCount
   FROM Suppliers S NATURAL JOIN Parts NATURAL JOIN Catalog
   WHERE NOT EXISTS
              (SELECT Color FROM
                  Parts P2 NATURAL JOIN Catalog C2
               WHERE S.Sid = C2.Sid AND Color <> 'Green')
GROUP BY S.sname, S.sid
```

Result:

sname	*partcount*
DB Dudes Inc.	2

11. Query:

```
select GPS.sid, P2.Pname, C.cost from
  Parts P2 , (SELECT C2.sid FROM
 Catalog C2 NATURAL JOIN Parts P
 WHERE P.color = 'Green'
INTERSECT
 SELECT C2.sid FROM
 Catalog C2 NATURAL JOIN Parts P
 WHERE P.color = 'Red'
  ) as GPS, Catalog C
   where GPS.sid = C.sid and P2.pid = C.pid and
 C.Cost = (
            select max(C3.Cost)
            FROM Catalog C3
            WHERE C3.sid = C.sid)
```

Result:

sid	*pname*	*cost*
1	Anti-Gravity Turbine Generator	1.24755e+06
3	Fire Hydrant Cap	12.5

Problem 5.4

1. Query:

```
SELECT E.ename, E.age
   FROM Emp E, Works W1, Works W2, Dept D1, Dept D2
   WHERE E.eid = W1.eid AND
         W1.did = D1.did AND
         D1.dname = 'Hardware' AND
         E.eid = W2.eid AND
         W2.did = D2.did AND
         D2.dname = 'Software'
```

Result:

ename	*age*
Mary Johnson	44
Stanley Browne	23

2. Query:

```
SELECT W.did, COUNT(W.eid)
   FROM Works W
GROUP BY W.did
HAVING 2000 < ( SELECT SUM (W1.pct_time)
                FROM Works W1
                WHERE W1.did = W.did)
```

Result:

did	*count*
2	26
6	22

3. Query:

```
SELECT E.ename
   FROM Emp E
   WHERE E.salary > ALL ( SELECT D.budget
                          FROM Dept D, Works W
                          WHERE E.eid = W.eid AND
                                D.did = W.did)
```

Result:

ename
Linda Davis

4. Query:

```
SELECT DISTINCT D.managerid
   FROM Dept D
   WHERE 1000000 < ALL ( SELECT D2.budget
                         FROM Dept D2
                         WHERE D2.managerid = D.managerid )
```

Result:

managerid
287321212
578875478

5. Query:

```
SELECT E.ename
   FROM Emp E
   WHERE E.eid IN (SELECT D.managerid
                   FROM Dept D
                   WHERE D.budget =
                        (SELECT MAX (D2.budget)
                         FROM Dept D2)
                   )
```

Result:

ename
Edward Baker

6. Query:

```
SELECT D.managerid
   FROM Dept    D
   WHERE 5000000 < ( SELECT SUM(D2.budget)
                        FROM Dept  D2
                        WHERE D2.managerid = D.managerid)
```

Result:

managerid
578875478

7. Query:

```
SELECT DISTINCT tempD.managerid
   FROM (
      SELECT DISTINCT D.managerid, SUM (D.budget) AS tempBudget
        FROM Dept D
        GROUP BY D.managerid ) AS tempD
   WHERE tempD.tempBudget = (select MAX (tempD2.tempBudget) from
            (SELECT DISTINCT D.managerid, SUM (D.budget) AS tempBudget
            FROM Dept D
            GROUP BY D.managerid ) as tempD2)
```

Result:

managerid
578875478

8. Query:

```
SELECT DISTINCT E.ename
   FROM Emp E, Dept D
   WHERE E.eid = D.managerid AND
        NOT EXISTS (select D2.managerid
                       FROM Dept D2
                       WHERE D2.managerid = E.eid AND
                             D2.budget < 1e6)
        AND
        EXISTS (select D2.managerid
                       FROM Dept D2
                       WHERE D2.managerid = E.eid AND
                             D2.budget < 5e6)
```

Result:

ename
Michael Miller