B561 Assignment 5: Query Optimization

Due: October 18, 2018 by 11:59pm

For this assignment we will be using the student, book, buys, and cites relational database schema.

This assignment is concerned with optimizing SQL and RA queries using the optimization rewrite rules for RA. The assignment will be done using the PostgreSQL system. As you are aware, SQL can be naturally represent RA expressions. Consequently, rewrite write rules for RA expressions can be applied and specified in SQL.

Submit the following for each problem:

1. in a .pdf file, the initial (non-optimized) RA expression and the final (optimized) RA expression should be specified in the notation for RA expressions (e.g, using the π, σ, $\times$, $\bowtie$, $\ltimes$, $\overline{\bowtie}$, $\cup$, $\cap$, and $-$ operations);

2. in a .sql file, initial SQL (non-optimized) SQL query and the final (optimized) SQL query, along with (a) the intermediate SQL queries that emerge during the optimization and (2) the rewrite rules that are used to derive these intermediate queries

Problems:

1.
```
select distinct s.sid,s.sname, b.bookno, b.title
from   student s
       cross join book b
       inner join buys t on ((s.sname = 'Eric' or s.sname = 'Anna') and
                             s.sid = t.sid and
                             b.price > 20 and
                             t.bookno = b.bookno);
```

2.
```
select distinct s.sid
from   student s
       cross join book b
       inner join buys t on ((s.sname = 'Eric' or s.sname = 'Anna') and
                             s.sid = t.sid and
                             b.price > 20 and
                             t.bookno = b.bookno);
```

3.
```
select distinct s.sid, b1.price as b1_price, b2.price as b2_price
from   (select s.sid from student s where s.sname <> 'Eric') s
        cross join book b2
        inner join book b1 on (b1.bookno <> b2.bookno and b1.price > 60 and b2.price >= 50)
        inner join buys t1 on (t1.bookno = b1.bookno and t1.sid = s.sid)
        inner join buys t2 on (t2.bookno = b2.bookno and t2.sid = s.sid);
```

4.
```
select q.sid
from   (select s.sid, s.sname
        from   student s
        except
        select s.sid, s.sname
        from   student s
               inner join buys t on (s.sid = t.sid)
               inner join book b on (t.bookno = b.bookno and b.price > 50)) q;
```

5.
```
select q.sid, q.sname
from   (select s.sid, s.sname, 2007 as bookno
        from   student s
               cross join book b
        intersect
        select s.sid, s.sname, b.bookno
        from   student s
               cross join book b
               inner join buys t on (s.sid = t.sid and t.bookno = b.bookno and b.price <25)) q;
```

6.
```
select distinct q.bookno
from   (select s.sid, s.sname, b.bookno, b.title
        from   student s
               cross join book b
        except
        select s.sid, s.sname, b.bookno, b.title
        from   student s
               cross join book b
               inner join buys t on (s.sid = t.sid and t.bookno = b.bookno and b.price <20)) q;
```

7.
```
select s.sid
from   student s
except
(select s1.sid
 from  student s1
       inner join student s2 on (s1.sid <> s2.sid)
       inner join buys t1 on (s1.sid = t1.sid)
 union
 select s1.sid
 from  student s1
       inner join student s2 on (s1.sid <> s2.sid)
       inner join buys t1 on (s1.sid = t1.sid)
       inner join buys t2 on (t1.bookno = t2.bookno and t2.sid = s2.sid)
       inner join book b  on (t2.bookno = b.bookno and b.price = 80));
```