Assignment 6: Translating and optimizing SQL queries

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

1. Translate the following SQL queries into equivalent RA expressions and show the various steps that were involved in the translations.

   (a)
   ```
   SELECT  s.sid, b1.bookno
   FROM    student s, buys b1, buys b2
   WHERE   s.sid = b1.sid AND s.sid= b2.sid AND
           b1.bookno <> b2.bookno AND
           s.sname = 'Eric' and b1.bookno <> '2010';
   ```

   (b)
   ```
   SELECT  DISTINCT b.bookno, b.title
   FROM    book b, student s
   WHERE   b.price = SOME(select b1.price
                          from   buys t, book b1
                          where  b1.price > 50 and
                                 s.sid = t.sid and
                                 t.bookno = b1.bookno);
   ```

   (c)
   ```
   SELECT b.bookno
   FROM   book b
   WHERE  b.bookno IN (SELECT b1.bookno FROM book b1 WHERE b1.price > 50)
                       UNION
                      (SELECT c.bookno FROM cites c);
   ```

   (d)
   ```
   SELECT b.bookno FROM book b
   WHERE b.price >= 80 and
         NOT EXISTS(SELECT b1.bookno
         FROM book b1
         WHERE b1.Price > b.Price);
   ```

(e)
```
SELECT s.sid
FROM   Student s
WHERE  EXISTS(SELECT 1
              FROM Book b
              WHERE b.price > 50 AND
                    b.bookno IN (SELECT  t.bookno
                                 FROM    Buys t
                                 WHERE   s.sid = t.sid AND
                                         s.sname = 'Eric'))
```

(f)
```
SELECT s1.sid, s2.sid
FROM student s1, student s2
WHERE s1.sid <> s2.sid AND
      NOT EXISTS(SELECT 1
                 FROM   Buys t1
                 WHERE  t1.sid = s1.sid AND
                        t1.bookno NOT IN (SELECT t2.bookno
                                          FROM   Buys t2
                                          WHERE  t2.sid = s2.sid));
```

2. Subsequently, optimize the RA expressions you obtained in question 1 as much as possible and show the various steps that were involved in the optimizations.

3. For Query 1a and Query 1e manifest the steps involved in the translation and optimization in the Postgres interpreter. In other words, the final result should be for each of these queries an optimized RA expression formulated using SQL RA operators such as INNER JOINs, CROSS JOINs etc. You can use the WITH clause to specify your answers.