CMSC 235
Midterm Solutions

Problem 1:

(a) The relational schema consists of the following 5 relations:

A(a,b,c)
B(c,d)
C(e,f)
S(c,e,f)
T(a,c,e,f)

(b) The following FDs hold:

For A: ac \rightarrow b;
For B: c \rightarrow d;
For C: none;
For S: c \rightarrow ef, ef \rightarrow c;
For T ac \rightarrow ef;

Problem 2:

(a) The only key for R is AE.
(b) CE \rightarrow D does not necessarily hold in R.
(c) BE \rightarrow C holds in S and does not violate the BCNF condition for S.

Problem 3:

(a) SELECT MAX(A)
    FROM R

(b) SELECT A, MAX(B)
    FROM R
    GROUP BY A
**Problem 4:**

(a) No. The schemas are different.
(b) Yes.
(c) No. The first query will select R.A as many times as there are tuples in S with attribute B that equals R.B, whereas the second query will select each such R.A only once.
(d) Yes. By definition DISTINCT will eliminate duplicates. Intersecting a relation with itself has the same effect because the result of INTERSECT is a set.
(e) Yes. Grouping by all attributes is equivalent to eliminating duplicates.

**Problem 5:**

The only two tuples that must be in R are: (0,1,4) and (0,3,2).

**Problem 6:**

The trigger will not allow the price of any book to be changed to a number greater than the number of pages in the book. If such change is attempted, the trigger sets the price to the number of pages.

**Problem 7:**

(a) No. The system will not check the attribute constraint on attribute d of S since the operation is a deletion form T.
(b) Yes. The referential integrity for attribute d of S will be violated; tuple (3,5) of S will not have a tuple from T to refer to via its attribute d.
(c) Yes. The primary key constraint is violated. There is already a tuple with attribute c = 1.
(d) No.
(e) Yes. The referential integrity for attribute d of S will be violated. Also the attribute check constraint on d will be violated.

**Extra credit:**

120 orders. There are two constraints on the order of deletions:

1. (1,0) of T must be deleted after (1,1) and (2,1) of S are deleted.
2. (5,3) of T must be deleted after (3,5) of S is deleted.

So, there are 20 ways in which we can order the 5 tuples mentioned above subject to the two constraints. Adding the six tuple increases the number of orders by a factor of 6. So, the total number is 120.