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)
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SELECT MAX(A)
FROM R
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(b)
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SELECT A, MAX(B)
FROM R
GROUP BY A
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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.