Fall 2016 Prof. P. Scheuermann

EECS 495--Introduction to Database Systems
Homework Assignment 2
Due: Monday, November 28, 2016

1 Prove, or disprove the following inference rules for a relation R with X, Y, Z, W subsets of R.

a. $X \rightarrow Y$ and $Y \rightarrow Z$ imply $X \rightarrow YZ$
b. $X \rightarrow Y$ and $Z \rightarrow W$ imply $XZ \rightarrow YW$
c. $XY \rightarrow Z$ and $Z \rightarrow X$ imply $Z \rightarrow Y$

Note: To prove an inference rule you need to use Armstrong's rules.
To disprove a rule it is sufficient to exhibit a relation (extension) which does violate it.

(15 pts)

2. Given the relational schema R(A,B,C,D,E,F,G,H) with F = (ABH $\rightarrow$ C ; A $\rightarrow$ DE ; BGH $\rightarrow$ F; F $\rightarrow$ ADH ; BH $\rightarrow$ GE).

Use the decomposition algorithm to obtain a lossless BCNF schema. Examine the functional dependencies in F for violation of BCF in the order in which they appear above (i.e., consider first ABH $\rightarrow$ C)

(20pts)

3. Consider a database schema R=(A,B) that has only two attributes. Is an instance *r* of the schema R always in BCNF ? If your answer is no explain briefly your reasoning., Otherwise, give a proof that the claim is true.

(15 pts)

4. Consider a relation R with the following set of dependencies F: = { $A \rightarrow BC$, $B \rightarrow AC$, $C \rightarrow AB$}. Obtain at least two canonical covers of F. Use the algorithm given in class.

(15 pts)

5. Consider the relation schema R =(A,B,C,D,E) with the following set of functional dependencies:

$$F= \{ A \rightarrow BC,\ CD \rightarrow E,\ B \rightarrow D,\ E \rightarrow A).$$

a. Find the candidate keys of R.

b. Show that the following decomposition of R is a lossless-join decomposition:

R_1=(A, B,C) and R_2=(A,D,E).

(20 pts)

6a. Consider the following interleaved schedule of three transactions (T_1, T_2, T_3)

S; $R_2(A)$ $R_1(B)$ $W_2(A)$ $R_2(B)$ R_3 (A) $W_1(B)$ $W_3(A)$ $W_2(B)$

Construct the precedence graph for this schedule. Is this schedule conflict serializable ?

6b. Consider a database with objects X and Y and assume that there are two transactions T_1 and T_2. T_1 first reads X and Y and then writes X and Y. T_2. reads and writes X and then reads and writes Y. Give an example schedule that is not serializable.

(15 pts)