Winter 2008 **CPE/CSC 366:** Database Modeling, Design and Implementation Alexander Dekhtyar

Homework 3

Due date: Thursday, Feb 14, in class.

Problem 1

Consider relation $R(A, B, C, D, E, F)$. For each set of FDs shown below, perform the following actions:

(a) Determine all keys and identify all prime and non-prime attributes.

(b) Determine if R is in 2NF, 3NF, BCNF. Explain all violations of these normal forms.

(c) If R is NOT in 3NF, decompose R into 3NF-compliant relations.

1. $B, C \rightarrow D, E$
   $A, E \rightarrow C$
   $F, B \rightarrow A$

2. $A \rightarrow B$
   $A \rightarrow C$
   $A, D \rightarrow F, E$

3. $A, B, C \rightarrow D, E, F$
   $D, F \rightarrow C, A$
   $D, C \rightarrow B$

4. $F, A \rightarrow C$
   $C \rightarrow B, D$
   $A, B \rightarrow E$

5. $A, B \rightarrow C$
   $A, C \rightarrow D$
   $B, C \rightarrow E$
   $C, D, E \rightarrow F$

6.
$A, B, E \to D, E$
$A, B, D \to D, C$
$A, B, C \to C, F$
$A, B, F \to E, F$

Problem 2

Consider the relation Stocks(B,O,I,S,Q,D) with attrbutes describing Broker, Office of the broker, Investor, Stock, Quantity owned by investor and Divident of the stock. The following FDs are asserted:

$S \to D$
$I \to B$
$I, S \to Q$
$B \to O$

1. Find all the keys for Stocks. List all prime and non-prime attrbitues.
2. Describe all violations of 3NF.
3. Decompose Stocks into a 3NF-compliant database schema.

Problem 3

Consider a relational table $R(A, B, C, D, E, F)$. For each collection of FDs, find the closure of the following sets of attrbutes:

(a) $\{A\}$ (b) $\{D\}$ (c) $\{B, C\}$ (d) $\{A, D, F\}$

1.
$A \to D, E$
$A, E \to C$
$B, C, D, E \to A$

2.
$F, D, C \to B, A$
$A, D, C \to C, E$
$B, D, F \to A, E$

3.
$A, B, C \to D, E, F$
$D, F \to C, A$
$D, C \to B$

4.
$A \to C$
$C \to B, D$
$B, D \to E$
$E, F \to A$
$E, B \to F$

Problem 4 ***[Extra Credit]*** *Exercise 3.2.4, page 84 (textbook, 3d Ed.; Ex. 3.5.4, p. 101 in 2nd Ed.).*