Homework 3

Due date: Wednesday, February 17, 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. $D, E \rightarrow B, C$
   $A, C \rightarrow E$
   $A \rightarrow F, B$

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

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

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

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

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

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:

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

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

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

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

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

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