Homework 3

Due date: Monday, February 13

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

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

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

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

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

6. $\begin{array}{l} A, B, E \rightarrow D, E \\ A, B, D \rightarrow D, C \\ A, B, C \rightarrow C, F \\ A, B, F \rightarrow E, F \end{array}$

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. $\begin{array}{l} A \rightarrow D, E \\ A, E \rightarrow C \\ B, C, D, E \rightarrow A \end{array}$

2. $\begin{array}{l} F, D, C \rightarrow B, A \\ A, D, C \rightarrow C, E \\ B, D, F \rightarrow A, E \end{array}$

3. $\begin{array}{l} A, B, C \rightarrow D, E, F \\ D, F \rightarrow C, A \\ D, C \rightarrow B \end{array}$

4. $\begin{array}{l} A \rightarrow C \\ C \rightarrow B, D \\ B, D \rightarrow E \\ E, F \rightarrow A \\ E, B \rightarrow F \end{array}$