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

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

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) $\{A, B, F\}$

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

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

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

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