

CSCI321 – Fall 2012
Homework Set 5

1. Consider the relation schema $R(A, B, C, D, E)$ with the following functional dependencies:

$$\begin{aligned}A &\rightarrow BC \\ CD &\rightarrow E \\ B &\rightarrow D \\ E &\rightarrow A\end{aligned}$$

Compute the canonical cover (minimal basis) for this schema and FD's.

2. Is schema $R(A, B, C, D, E)$ in problem 1 in BCNF? If yes, justify your answer. If not, justify your answer and produce a BCNF decomposition.
3. Produce a 3NF decomposition for the schema given in problem 1.
4. Consider the schema $R(A, B, C, D, E)$ with the following functional dependencies:

$$\begin{aligned}AB &\rightarrow C \\ CD &\rightarrow E \\ DE &\rightarrow B\end{aligned}$$

Is AB a candidate key for this relation? If not, is ABD ? Explain your answer.

5. Consider the schema $R = (A, B, C, D, E, F, G, H, I, J)$ and the set of functional dependencies

$$\begin{aligned}AB &\rightarrow C \\ A &\rightarrow DE \\ B &\rightarrow F \\ F &\rightarrow GH \\ D &\rightarrow IJ\end{aligned}$$

What is the key for R ? Decompose R into 3NF relations.

6. Problem 15.35 on p. 541 of the text.
7. For each of the following relation schemas and sets of FD's:
- Indicate all BCNF violations.
 - Decompose, as necessary, into a collection of relations that are in BCNF.
 - Indicate all 3NF violations.
 - Decompose, as necessary, into a collection of relations that are in 3NF.
- (a) $R(A, B, C, D)$ with FD's $AB \rightarrow C$, $C \rightarrow D$, and $D \rightarrow A$.
- (b) $R(A, B, C, D)$ with FD's $B \rightarrow C$ and $B \rightarrow D$.
- (c) $R(A, B, C, D, E)$ with FD's $AB \rightarrow C$, $C \rightarrow D$, $D \rightarrow B$ and $D \rightarrow E$.

8. For each of the following relation schemas and dependencies:
- Indicate all 4NF violations.
 - Decompose, as necessary, into a collection of relations that are in 4NF.
- (a) $R(A, B, C, D)$ with MVD's $A \twoheadrightarrow B$ and $A \twoheadrightarrow C$.
- (b) $R(A, B, C, D)$ with MVD $AB \twoheadrightarrow C$ and FD $B \rightarrow D$.