Functional Dependencies

Suppose we have a relation R with attributes $ABCD$

1. What an FD means.

Suppose the functional dependency $BC \rightarrow D$ holds in R. Create an instance of R that violates this FD.

2. Equivalent sets of FDs.

(a) Are the sets $A \rightarrow BC$ and $A \rightarrow B$, $A \rightarrow C$ equivalent? If yes, explain why. If no, construct an instance of R that satisfies one set of FDs but not the other.

(b) Are the sets $AB \rightarrow C$ and $A \rightarrow C$, $B \rightarrow C$ equivalent? If yes, explain why. If no, construct an instance of R that satisfies one set of FDs but not the other.

(c) Are the sets $AB \rightarrow C$ and $A \rightarrow B$, $A \rightarrow C$ equivalent? If yes, explain why. If no, construct an instance of R that satisfies one set of FDs but not the other.

3. Keys and FDs.

(a) We claimed that if a set of attributes K functionally determines all attributes, K must be a superkey (i.e., no two tuples can agree on all attributes in K). Do you believe this? Suppose these FDs hold in R: $A \rightarrow BC$, $C \rightarrow D$. Does A functionally determine all attributes of R? Can two tuples agree on A?

(b) We also said that if K is a superkey (i.e., no two tuples can agree on all attributes in K) K must functionally determine all attributes. Do you believe this? Suppose A is a superkey of R. Does A functionally determine all attributes of R?

4. Does an FD follow from a set of FDs?

Suppose we have a relation on attributes ABCDEF with these FDs: $AC \rightarrow F$, $CEF \rightarrow B$, $C \rightarrow D$, $DC \rightarrow A$.

(a) Does it follow that $C \rightarrow F$?

(b) Does it follow that $ACD \rightarrow B$?

5. Projecting a set of FDs onto a subset of the attributes.

Suppose we have a relation on attributes $ABCDE$ with these FDs:

$$A \rightarrow C,\ C \rightarrow E,\ E \rightarrow BD$$

(a) Project the FDs onto attributes ABC.

(b) Project the FDs onto attributes ADE.