

Tutorial #1

Functional Dependencies

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Problem 1

Consider a relation with schema $R(A, B, C, D)$ and FD's $AB \rightarrow C$, $C \rightarrow D$, and $D \rightarrow A$.

1. What are all the nontrivial FD's that follow from the given FD's? You should restrict yourself to FD's with single attributes on the right side.
2. What are all the keys of R ?
3. What are all the superkeys for R that are not keys?

Problem 2

1. Show that each of the following are not valid rules about FD's by giving example relations that satisfy the given FD's (following the "if") but not the FD that allegedly follows (after the "then"):
 - (a) If $A \rightarrow B$ then $B \rightarrow A$
 - (b) If $AB \rightarrow C$ and $A \rightarrow C$, then $B \rightarrow C$
2. By using the 3+3 Armstrong's Axioms only, show that

$$\{AB \rightarrow CD, C \rightarrow EH, D \rightarrow G\} \models AB \rightarrow EHG$$

Problem 3

Suppose we have relation $R(A, B, C, D, E)$, with some set of FD's, and we wish to project those FD's onto relation $S(A, B, C)$.

1. Give the FD's that hold in S if the FD's for R are
 - (a) $AB \rightarrow DE$, $C \rightarrow E$, $D \rightarrow C$, and $E \rightarrow A$
 - (b) $A \rightarrow D$, $BD \rightarrow E$, $AC \rightarrow E$, and $DE \rightarrow B$