

Problem 1

Suppose you are given a relation $R(A, B, C, D)$. For each of the following sets of FD's that hold over R , do the following:

- (i) Suggest a candidate key for R .
- (ii) Suggest a normalization to BCNF, and whether or not it is Dependency Preserving.
 1. $\{A \rightarrow B, B \rightarrow C, A \rightarrow D\}$.
 2. $\{BC \rightarrow A, D \rightarrow A\}$.
 3. $\{B \rightarrow C, D \rightarrow A, AC \rightarrow D\}$.

Problem 2

Suppose we have a relation $R(A, B, Y, V)$ and the set of FD's $F = \{B \rightarrow Y, VA \rightarrow Y, YA \rightarrow V, BY \rightarrow V\}$. Note that when calculating closures of in the problems that follow, you don't need to include trivial functional dependencies.

- (i) Calculate F^+ .
- (ii) Calculate B^+ .
- (iii) Calculate a canonical cover for R .

Problem 3

Given the following relation $R(A, B, C, D, E, F)$ and the set of FD's $\{A \rightarrow CD, CB \rightarrow E, F \rightarrow A\}$ state whether the following decompositions...

- (i) ... are Dependency Preserving
- (ii) ... allow Lossless Joins
 1. FAC and $CBDE$.
 2. $FACD$ and CBE .
 3. $FACB$ and $CDEF$.

Problem 4

Give informal arguments, using the definition of functional dependencies, that each of Armstrong's Axioms are true.

Problem 5

Consider the following proposed rule for functional dependencies: If $\alpha \rightarrow \beta$ and $\gamma \rightarrow \beta$, then $\alpha \rightarrow \gamma$. Prove that this rule is *not* true by showing a relation R that satisfies $\alpha \rightarrow \beta, \gamma \rightarrow \beta, \alpha$ does not imply γ .

Problem 6

Concisely (3 or 4 lines) give an example of when you may want to use a non-normalized database.