

Quiz 2 Answers, Fall 2019

CSCI 4380 DB Sys

Question 1 (points: a-8 b-8). For the following relations with given functional dependencies, list all keys and explain in detail whether they are in BCNF (Boyce-Codd Normal Form) or not.

- (a) $R1(A, B, C, D, E)$, $\mathcal{F} = \{AB \rightarrow CD, ABC \rightarrow E\}$

Answer.

List Keys: AB

In BCNF? Explain why or why not. Yes, both relations have a superkey on the left (AB is a superkey and ABC is a superkey).

- (b) $R2(A, B, C, D, E)$, $\mathcal{F} = \{AB \rightarrow CD, D \rightarrow E, BCDE \rightarrow A\}$

Answer.

List Keys: AB, BCD

In BCNF? Explain why or why not. No, $D \rightarrow E$ is not trivial and D is not a superkey. Note that other functional dependencies do not violate the BCNF as AB and BCDE are both superkeys.

Question 2 (points: 9). Are the following two sets of functional dependencies equivalent? Show yes or no by checking (1) if all functional dependencies in \mathcal{F}_1 are implied by \mathcal{F}_2 , and (2) if all functional dependencies in \mathcal{F}_2 are implied by \mathcal{F}_1 . You can skip any functional dependencies that are identical in both relations.

$$\mathcal{F}_1 = \{AB \rightarrow C, C \rightarrow D, CDE \rightarrow F\}$$

$$\mathcal{F}_2 = \{AB \rightarrow C, C \rightarrow D, A \rightarrow A, AB \rightarrow D, DE \rightarrow F\}$$

Answer.

From 1 to 2: $CDE \rightarrow F$ is implied by 2, because $CDE^+ = \{C, D, E, F\}$ and hence includes F .

From 2 to 1: No need to check $A \rightarrow A$, it is trivial. $AB \rightarrow D$ is implied because in 1: $AB^+ = \{A, B, C, D\}$ which includes D.

$DE \rightarrow F$ is not implied because in 1, $DE^+ = \{D, E\}$ and does not include F .

Therefore, \mathcal{F}_1 and \mathcal{F}_2 are not equivalent.