

FINAL EXAM

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Question 5

Q5.1.

By applying Decomposition on $AB \rightarrow DE$, we get $AB \rightarrow D$ and $AB \rightarrow E$

By applying Augmentation on $C \rightarrow A$ with B , we get $CB \rightarrow AB$

By applying Transitivity on $CB \rightarrow AB$ and $AB \rightarrow D$, we get $CB \rightarrow D$

Thus, $\mathcal{G} \models CB \rightarrow D$ holds.

Q5.2.

Minimal cover: $\{AB \rightarrow D, C \rightarrow E, D \rightarrow C, E \rightarrow A\}$

Key: ABF, (BCF, BEF, BDF)

Q5.3.

The relational schema is not in BCNF as $AB \rightarrow D$ is a violation. We apply the Decompose-BCNF algorithm with the following steps:

- First, we split R using $AB \rightarrow D$, resulting in $R_1 = (A, B, C, D, E)$ and $R_2 = (\underline{A}, \underline{B}, \underline{E})$.
- R_2 is in BCNF as no non-trivial functional dependency holds in R_2 .
- Next, we split R_1 using the violation $C \rightarrow E$, resulting in $R_{1,1} = (C, E, A)$ and $R_{1,2} = (C, B, D)$.
- Next, we split $R_{1,1}$ using the violation $E \rightarrow A$, resulting in $R_{1,1,1} = (\underline{E}, A)$ and $R_{1,1,2} = (E, \underline{C})$.
- $R_{1,1,1}$ and $R_{1,1,2}$ are in BCNF as they have two attributes each.
- Next, we split $R_{1,2}$ using the violation $D \rightarrow C$, resulting in $R_{1,2,1} = (\underline{D}, C)$ and $R_{1,2,2} = (\underline{D}, \underline{B})$.
- $R_{1,2,1}$ and $R_{1,2,2}$ are in BCNF as they have two attributes each.