

- a. Compute B^+ .
- b. Prove (using Armstrong's axioms) that AG is a superkey.
- c. Compute a canonical cover for this set of functional dependencies F ; give each step of your derivation with an explanation.
- d. Give a 3NF decomposition of the given schema based on a canonical cover.
- e. Give a BCNF decomposition of the given schema using the original set F of functional dependencies.

7.31 Consider the schema $R = (A, B, C, D, E, G)$ and the set F of functional dependencies:

$$\begin{aligned} AB &\rightarrow CD \\ B &\rightarrow D \\ DE &\rightarrow B \\ DEG &\rightarrow AB \\ AC &\rightarrow DE \end{aligned}$$

R is not in BCNF for many reasons, one of which arises from the functional dependency $AB \rightarrow CD$. Explain why $AB \rightarrow CD$ shows that R is not in BCNF and then use the BCNF decomposition algorithm starting with $AB \rightarrow CD$ to generate a BCNF decomposition of R . Once that is done, determine whether your result is or is not dependency preserving, and explain your reasoning.

7.32 Consider the schema $R = (A, B, C, D, E, G)$ and the set F of functional dependencies:

$$\begin{aligned} A &\rightarrow BC \\ BD &\rightarrow E \\ CD &\rightarrow AB \end{aligned}$$

- a. Find a nontrivial functional dependency containing no extraneous attributes that is logically implied by the above three dependencies and explain how you found it.
- b. Use the BCNF decomposition algorithm to find a BCNF decomposition of R . Start with $A \rightarrow BC$. Explain your steps.
- c. For your decomposition, state whether it is lossless and explain why.
- d. For your decomposition, state whether it is dependency preserving and explain why.