Homework 6: Relational Design
Due Thursday October 17, 2024 by 1 PM

CSE 241: Fall 2024

NOTE: When we are dealing with functional dependencies, decompositions, and losslessness, we treat relations as SETS and sets do not contain duplicates.

1. Let $R = (A, B, C, D, E, G)$ and let F be $\{A \rightarrow BDG,\ BG \rightarrow DE,\ B \rightarrow D,\ D \rightarrow A\}$. Find all candidate keys.

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

   $A \rightarrow B$
   $C \rightarrow D$
   $BD \rightarrow E$.

   Which of the following are candidate keys (one or more)? For each of the options, show the process to verify whether each set of attributes it is a candidate key or not.

   (a) AB
   (b) CD
   (c) BD
   (d) AC
   (e) E
   (f) AE

3. Let $R = (A, B, C, D, E, G)$ and let F be $\{A \rightarrow BDG,\ BG \rightarrow DE,\ B \rightarrow D,\ D \rightarrow A\}$. Argue that R is not in BCNF by finding one functional dependency in F that violates the definition of BCNF.

4. Let $R = (J, K, L, M, N, P)$ and $F = \{J \rightarrow KL,\ L \rightarrow J,\ MNP \rightarrow K,\ KP \rightarrow M,\ LJ \rightarrow N\}$, give a canonical cover F_c for F.

5. Let $R = (J, K, L, M, N, P)$ and $F = \{J \rightarrow KL,\ L \rightarrow J,\ MNP \rightarrow K,\ KP \rightarrow M,\ LJ \rightarrow N\}$, give a lossless, dependency-preserving 3NF decomposition of R. Explain how you applied each step of the algorithm.