1. **Problem**
Given the following set of functional dependencies on the attribute set $\{ABCDE\}$:

$$ACEB \rightarrow A \quad \text{(a)}$$
$$CA \rightarrow BED \quad \text{(b)}$$
$$EAC \rightarrow B \quad \text{(c)}$$
$$A \rightarrow ED \quad \text{(d)}$$

Which of the following are key candidates?

(a) DA
(b) DA
(c) CD
(d) EA
(e) CA

Solution

(a) False, because the closure does not contain all attributes: $\{DA\}^+ = \{DAE\}$.
(b) False, because the closure does not contain all attributes: $\{DA\}^+ = \{DAE\}$.
(c) False, because the closure does not contain all attributes: $\{CD\}^+ = \{CD\}$.
(d) False, because the closure does not contain all attributes: $\{EA\}^+ = \{EAD\}$.
(e) True, because the closure contains all attributes and no attribute can be removed from the key: $\{CA\}^+ = \{CABED\}$.

2. **Problem**
Given the following set of functional dependencies on the attribute set $\{ABCDE\}$:

$$AB \rightarrow CE \quad \text{(a)}$$
$$EDAB \rightarrow A \quad \text{(b)}$$
$$DC \rightarrow E \quad \text{(c)}$$
$$DE \rightarrow AC \quad \text{(d)}$$
$$DC \rightarrow EBA \quad \text{(e)}$$
$$ADEB \rightarrow A \quad \text{(f)}$$

For which functional dependency is a left reduction possible?

Solution

The following left sides can be reduced:

(a) No reduction possible
(b) Attribute E can be removed from the left side, because $\{DAB\}^+ = \{DABCE\}$ and E $\in \{DAB\}^+$.
(c) No reduction possible
(d) No reduction possible
(e) No reduction possible
(f) Attribute A can be removed from the left side, because $\{DEB\}^+ = \{DEBAC\}$ and A $\in \{DEB\}^+$.

3. **Problem**
Given the following set of functional dependencies on the attribute set $\{ABCDE\}$:

$$A \rightarrow E \quad \text{(a)}$$
$$DECB \rightarrow A \quad \text{(b)}$$
$$DBA \rightarrow C \quad \text{(c)}$$

For which functional dependency is a right reduction possible?

Solution

The following right sides can be reduced:

(a) No reduction possible

(b) No reduction possible

(c) No reduction possible