Technische Hochschule Rosenheim

Exercise 06: Relational database design and normal forms

Additional task 1: Normal forms

Given the following relations Y in the first normal form with functional dependencies F :

$$\begin{aligned} Y &= (A, P, H, R, O, D, I, T, E)\ with \\ R &\rightarrow O \\ O &\rightarrow A, H, P \\ O, P &\rightarrow D, R \\ H, P &\rightarrow P \\ H, P, R &\rightarrow D \end{aligned}$$

1. First, use the COVER algorithm to simplify the set of functional dependencies.
2. Determine the keys of the relations.
3. Do the relations correspond with the second normal form (2NF)?
4. Do the relations correspond with the third normal form (3NF)?
5. Do the relations correspond with the Boyce-Codd normal form (BCNF)?

Additional task 2: Normal forms

1. Given the following relations W' in the first normal form with functional dependencies W :

$$\begin{aligned} W' &= (A, B, C, D)\ with \\ A, B &\rightarrow C \\ B &\rightarrow D \end{aligned}$$

   Show that W' does not correspond with the second normal form.

2. Given the following relations X' in the first normal form with functional dependencies X :

$$\begin{aligned} X' &= (A, B, C, D)\ with \\ A, B, C &\rightarrow D \\ B, C &\rightarrow A \end{aligned}$$

   Show that X' corresponds with the third normal form.

3. Given the following relations V' in the first normal form with functional dependencies V :

$$\begin{aligned} V' &= (A, B, C, D, E)\ with \\ C, D, E &\rightarrow A, C \\ A, E &\rightarrow B, D \\ C, D &\rightarrow E \end{aligned}$$

   Show that V' does not corresponds with the third normal form.

4. Given the following relations Y' in the first normal form with functional dependencies Y :

$$\begin{aligned} Y' &= (A, B, C, D, E, F)\ with \\ A &\rightarrow B, C \\ C &\rightarrow D \\ E &\rightarrow F \end{aligned}$$

   Show that Y' does not correspond with the third normal form.

5. Given the following relations Z' in the first normal form with functional dependencies Z:

$$\begin{aligned} Z' &= (A, B, C, D)\ with \\ A, B, C &\rightarrow D \\ A, B &\rightarrow C, D \\ C &\rightarrow A \end{aligned}$$

   Show that Z' does not correspond with the Boyes-Codd normal form.