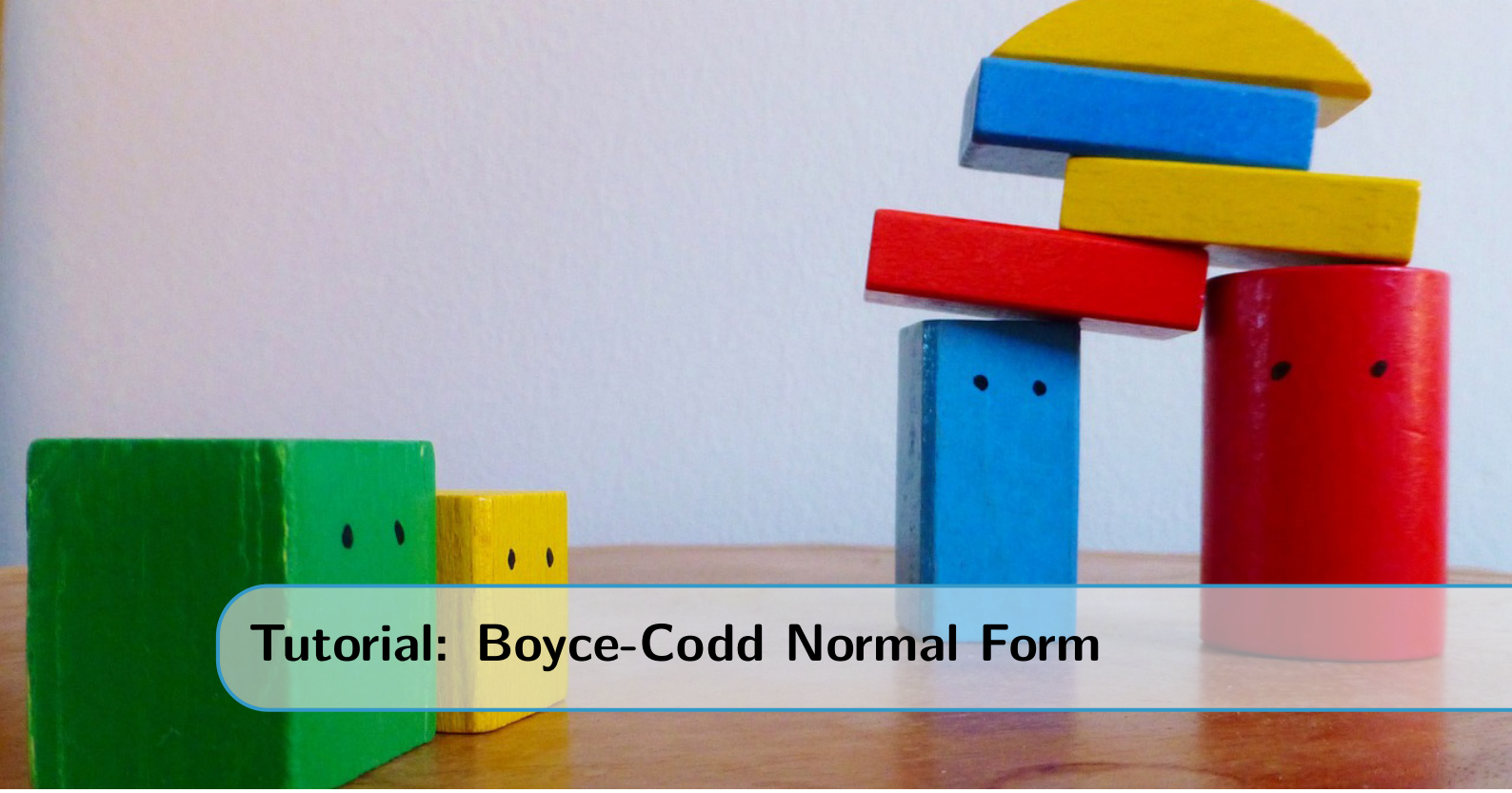

Tutorial: Boyce-Codd Normal Form

1. Consider the schema $R = \{A, B, C, D, E\}$ with the set of functional dependencies $\Sigma = \{\{A, B\} \rightarrow \{C\}, \{A, C\} \rightarrow \{D\}, \{E\} \rightarrow \{A, B, C, D\}\}$.

   Does the decomposition of R into $\delta = \{R_1(A, B, C), R_2(A, B, E), R_3(A, C, D)\}$ a lossless join decomposition? Justify your answer without using tableau method.

2. Consider the schema $R = \{A, B, C, D, E\}$ with a set of functional dependencies $\Sigma = \{\{A\} \rightarrow \{E\}, \{A, B\} \rightarrow \{D\}, \{C, D\} \rightarrow \{A, E\}, \{E\} \rightarrow \{B\}, \{E\} \rightarrow \{D\}\}$.

   (a) Is R in Boyce-Codd normal form with respect to Σ?

   (b) Consider the following decomposition $\delta = \{R_1(B, D, E), R_2(A, C, E)\}$. Is δ in Boyce-Codd normal form with respect to Σ.

   (c) If δ is not in Boyce-Codd normal form with respect to Σ, find a Boyce-Codd normal form decomposition of R with respect to Σ.