



## Tutorial: Boyce-Codd Normal Form

Your company, Apasaja Private Limited, is commissioned by an online company offering several services to design the relational schema the management of their users' profiles. A service is fully described and identified by its name. Each user can register to one or more services. A user is uniquely identified by her email as well as by her mobile number. Each user has both a postal address and a country of residence. The postal address, however, unambiguously identifies the country in which it is located. There can be several users with the same address.

We are only given an abstract schema for this application as follows.

$$R = \{A, B, C, D, E\}$$

$$\Sigma = \{ \{A\} \rightarrow \{A, B, C\}, \quad \{A, B\} \rightarrow \{A\}, \quad \{B, C\} \rightarrow \{A, D\}, \quad \{B\} \rightarrow \{A, B\}, \quad \{C\} \rightarrow \{D\} \}$$

This tutorial continues from the computation of candidate keys and minimal cover in “Tutorial: Functional Dependencies”. You are advised to compute them before continuing.

### Questions

*Not all questions will be discussed during tutorial. You are expected to attempt them before coming to the tutorial. You may be randomly called to present your answer during tutorial. You are encouraged to discuss them on Canvas Discussion.*

1. **Boyce-Codd Normal Form.**
  - (a) Is  $R$  with  $\Sigma$  in BCNF?
2. **Normalization.**
  - (a) Decompose  $R$  with  $\Sigma$  into a lossless-join BCNF decomposition using the algorithm from the lecture.
  - (b) Is the result dependency preserving?
  - (c) From the decomposition and the mapping of the attributes and the letters, can you figure out the mapping of fragments to the entity/relationship sets as mentioned in the text description?

## References

- [1] S. Bressan and B. Catania. *Introduction to Database Systems*. McGraw-Hill Education, 2006. ISBN: 9780071246507.
- [2] Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom. *Database Systems: The Complete Book*. 2nd ed. Prentice Hall Press, 2008. ISBN: 9780131873254.
- [3] Raghu Ramakrishnan and Johannes Gehrke. *Database Management Systems*. 2nd. USA: McGraw-Hill, Inc., 2000. ISBN: 0072440422.