

Exercise Sheet 1: Design

October 3, 2023

1. Use Armstrong's axioms (1-3) to prove the *pseudo transitivity* rule.
2. Given $r(A,B,C,D,E)$ with the following functional dependencies ($A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$, $E \rightarrow A$)

Calculate

- E^+
 - A^+
3. Given a set $F = \{ A \rightarrow B, ABCD \rightarrow E, EF \rightarrow GH, ACDF \rightarrow EG \}$ generate a minimal cover set.
 4. Given a relation R and a set of functional dependencies; outline pseudocode for an algorithm to decompose the relation R such that the resulting relations satisfy 3NF
 5. Consider the following schema:
 - USER (User_ID, Uname, Uaddress, UPhoneNo)
 - TRACK (Track_ID, TrackName, Duration, Album)
 - PLAYS (Play_id, User_ID, Track_ID, time)

which records information about users, tracks available on a streaming platform, and each time each user plays a given track.

The following are two expected queries with a high frequency.

- List the number of times a track "trackname" is played by user with user id "user_id".
- List the number of times any track from an album "albumname" is played.

Suggest an approach to modifying the design to allow efficient execution of the above queries. Specify any intentional redundancy you have introduced.

6. Prove that all 2 attribute relations are in BCNF