

Normalization of Relation Schemas

BOOKSTORE = {
 ISBN, BOOK_NAME, AUTHOR_ID, AUTHOR_NAME, AUTHOR_BIO, GENRE,
 NUM_OF_PAGES, PUBLISHER_ID, PUBLISHER_NAME, PUBLISHER_ADDRESS,
 ACCOUNT_NUMBER, EMAIL, PHONE_NUMBER, PRICES, AMOUNT, USER_ID,
 USER_NAME, USER_ADDRESS, CARD_NUMBER, CARD_PIN, TRACKER
}

F = {
 ISBN \rightarrow Book_Name, AUTHOR_ID, GENRE, NUM_OF_PAGES, PUBLISHER_ID, PRICES, Amount

 AUTHOR_ID \rightarrow AUTHOR_NAME, AUTHOR_BIO

 PUBLISHER_ID \rightarrow PUBLISHER_NAME, PUBLISHER_ADDRESS, ACCOUNT_NUMBER,
 EMAIL, PHONE_NUMBER

 USER_ID \rightarrow USER_NAME
 ORDER_NUMBER \rightarrow USER_ID, USER_NAME, TRACKER
 ORDER_NUMBER \rightarrow USER_ID, BOOK_NAME, BOOK_ISBN, PRICES
 USER_ID \rightarrow USER_NAME, USER_ADDRESS, CARD_NUMBER, CARD_PIN
}

A Candidate Key = {
 ISBN, AUTHOR_ID, PUBLISHER_ID, USER_ID, ORDER_NUMBER
}

BCNF Decomposition:

AUTHOR_ID is not a super key,
Author (AUTHOR_ID, AUTHOR_NAME, AUTHOR_BIO) is in BCNF

Book_Info (ISBN, BOOK_NAME, AUTHOR_ID, GENRE, NUM_OF_PAGES, PUBLISHER_ID,
PUBLISHER_NAME, PUBLISHER_ADDRESS, ACCOUNT_NUMBER, EMAIL, PHONE_NUMBER,
PRICES, AMOUNT, USER_ID, USER_NAME, USER_ADDRESS, CARD_NUMBER, CARD_PIN,
TRACKER)

PUBLISHER_ID is not a super key
Publisher (PUBLISHER_ID, PUBLISHER_NAME, PUBLISHER_ADDRESS, ACCOUNT_NUMBER,
EMAIL, PHONE_NUMBER) is not in BCNF

Book_Info1 (ISBN, BOOK_NAME, AUTHOR_ID, GENRE, NUM_OF_PAGES, PUBLISHER_ID,
PRICES, AMOUNT, USER_ID, USER_NAME, USER_ADDRESS, CARD_NUMBER, CARD_PIN,
TRACKER) is not in BCNF

ISBN is not a super key,
Book (ISBN, Book_Name, Author_ID, GENRE, NUM_OF_PAGES, PUBLISHER_ID, PRICES, Amount)
is in BCNF

StoreInfo (ISBN, USER_ID, USER_NAME, USER_ADDRESS, CARD_NUMBER, CARD_PIN,
TRACKER, ORDER_NUMBER) is not in BCNF

USER_ID \rightarrow USER_NAME, USER_ADDRESS, CARD_NUMBER, CARD_PIN holds but USER_ID is not a super key

USER(USER_NAME, USER_ADDRESS, CARD_NUMBER, CARD_PIN) is in BCNF

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THIRD NORMAL FORM Decomposition:

Detect and deleted the schemas that are subsets of other schemas.

The results are in 3NF:

ISBN \rightarrow Book_Name, AUTHOR_ID, GENRE, NUM_OF_PAGES, PUBLISHER_ID, PRICES, Amount

AUTHOR_ID \rightarrow AUTHOR_NAME, AUTHOR_BIO

PUBLISHER_ID \rightarrow PUBLISHER_NAME, PUBLISHER_ADDRESS, ACCOUNT_NUMBER, EMAIL, PHONE_NUMBER

ORDER_NUMBER \rightarrow USER_ID, USER_NAME, TRACKER

USER_ID \rightarrow USER_NAME, USER_ADDRESS, CARD_NUMBER, CARD_PIN