National University of Computer & Emerging Sciences

Department of Computer Science

Database Systems

Assignment # 04

Instructions:

1. Make a PDF document with the convention "**BSSE_5B_XXF-XXXX_A#2**".
2. Plagiarism is strictly prohibited; assignment will be marked **zero** if plagiarized.
3. Late submission is not allowed.
4. **Evaluated out of 160 Marks.**
5. **Due Date XX-XX-XXXX.**

FOR QUESTION 1-3, DO THE FOLLOWING PARTS:

a) Determine whether this set is in 2NF or not. Give reason(s). Without reasoning, no marks will be given.
b) Convert this to 2NF only if not already in 2NF.

1. Relation R(P, Q, R, S, T) having Functional Dependency set FD = { PQ → R, S → T }.
2. Relation R(P, Q, R, S, T, U, V, W, X, Y) having Functional Dependency set FD = { PQ → R, PS → VW, QS → TU, P → X, W → Y }.
3. Given a relation R(A, B, C, D, E) and Functional Dependency set FD = { A → B, B → E, C → D}.

FOR QUESTION 4-5, DO THE FOLLOWING PARTS:

a) Find all candidate keys.
b) The best normal form it satisfies {1NF, 2NF}
c) Convert it to 2NF if already not in 2NF. Write all the steps you perform.
d) Perform each step clearly in all the above mentioned parts.

4. Given a relation R(A, B, C, D, E) and Functional Dependency set FD = { BC → ADE, D → B}.
5. Given a relation R(A, B, C, D, E) and Functional Dependency set FD = { CE → D, D → B, C → A}.

FOR QUESTION 6-7, USE THE BELOW RELATIONAL SCHEMA:

Bookstore (BookID, Title, AuthorID, AuthorName, PublisherID, PublisherName, Price, Genre, Stock)

6. Based on the above schema, perform the following tasks:
   - Based on the Bookstore relation schema, identify and list all possible functional dependencies that exist within this schema.
   - Justify your reasoning for each identified functional dependency.

7. Perform the following tasks on the above given schema:

a. Normalize the schema upto 3NF. Document and write each step taken to convert it to 3NF. Your answer should include:
b. The relation schema and attributes for each normal form.
c. Explanations for transformations made during normalization.

FOR QUESTION 8-9, USE THE BELOW RELATIONAL SCHEMA:

Book (BookID, Title, AuthorID, PublisherID, Price, Genre, Stock)
Author (AuthorID, AuthorName, AuthorBio)
Publisher (PublisherID, PublisherName, PublisherAddress)
Sale (SaleID, BookID, SaleDate, QuantitySold, SalePrice)

8. Perform the following tasks on the above schema:
   - Based on the Bookstore relation schema, identify and list all possible functional dependencies that exist within this schema.
   - Justify your reasoning for each identified functional dependency.

9. Perform the following tasks on the above given schema:
   d. Normalize the schema upto 3NF. Document and write each step taken to convert it to 3NF. Your answer should include:
   e. The relation schema and attributes for each normal form.
   f. Explanations for transformations made during normalization.

USE THE BELOW RELATIONAL SCHEMA TO SOLVE ALL THE COMING QUESTIONS:

SCENARIO:

You are tasked with designing a database for a Multimedia Library System that manages not only books but also multimedia items (like DVDs, audiobooks, etc.), their creators, and the library's borrowing system. The initial relations are defined as follows:

Item (ItemID, Title, CreatorID, Type, Price, StockCount, Genre)

Creator (CreatorID, CreatorName, CreatorType, CreatorBio)

Loan (LoanID, ItemID, MemberID, LoanDate, ReturnDate, FineAmount)

Member (MemberID, MemberName, MemberType, JoinDate, MembershipExpiryDate)

Review (ReviewID, ItemID, MemberID, Rating, ReviewText, ReviewDate)

Functional Dependencies:

1. Identify all possible functional dependencies for each relation.
   - For the Item table, consider that StockCount is dependent on both ItemID and Type.
   - For the Creator table, the CreatorType (e.g., Author, Director, etc.) might change over time, affecting the relationship with Item.
   - For the Loan table, discuss how FineAmount could be a function of both LoanDate and ReturnDate.
   - For the Review table, analyze how Rating and ReviewText may depend on both ItemID and MemberID.

Normalization Process:

1. Normalize each of the relations into 1NF, 2NF, and 3NF.
2. Document the steps taken at each normalization stage for each relation.
3. Identify any transitive dependencies that affect multiple tables simultaneously.
4. Examine how changes in the Creator table (like a name change) can cascade through the Item and Review tables.

Using the final relation schemas obtained from 3NF, write SQL queries to:

1. Insert sample data into the normalized tables, ensuring all dependencies are respected.
2. Retrieve a complete list of items with associated creators, loans, and reviews while ensuring proper joins.
3. Calculate the total fines generated for overdue items over a specific time period.
4. Write a query to update the StockCount of an item based on the number of loans and returns tracked in the Loan table.
5. Write a query to delete a member and cascade delete their associated loans and reviews.

Identify Candidate Keys:

From the final 3NF schemas, identify all candidate keys for each table and justify their selection.

All the best! 🙂