CPSC 304: Introduction to Relational Databases
Tutorial #3: Functional Dependencies and Normalization – SuperRent

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For the tutorial's specifications and description of the vehicle rental business, refer to the **vehicle_rental_specifications.pdf** document that was uploaded to Canvas for Tutorial 1. We will be dealing with a subset of the entities and attributes described in that document.

Notes:

1. Be sure to complete these tutorials. Tutorials are not for marks, and will not be handed in, but a substantial part of the quizzes and course content are based on them.

2. Tutorials answers are generally released at the start of when the next tutorial is released.

Consider the following relational schema and functional dependencies (FDs):

SuperRentInfo(customerID, customerName, email, startDate, endDate, city, confirmationNumber, branchName, typeName, paymentCode)

… with the following FDs:

1) customerID → customerName, email
2) confirmationNumber → customerID
3) branchName → city
4) confirmationNumber, branchName → typeName
5) confirmationNumber, branchName, typeName → startDate, endDate
6) paymentCode → customerID, confirmationNumber

To save yourself some writing time in the questions that follow, let us abbreviate the above schema to:

SuperRentInfo(I, N, E, S, ED, C, CN, B, T, P)

… with the following FDs:

1) I → N, E
2) CN → I
3) B → C
4) CN, B → T
5) CN, B, T → S, ED
6) P → I, CN

Now, answer the following questions:

1. Give an instance of **SuperRentInfo** (i.e., a relation with a few rows in it) that illustrates these three anomalies: insertion, deletion, and update. Explain how your table shows the three anomalies.

2. Consider the decomposition of the relation **SuperRentInfo** into:

   SI1(I, N, E, S, C, B) and
   SI2(C, P, T, ED, CN, B)

   Is this a lossy, or lossless-join, decomposition? Justify your answer.

3. Repeat (2) for the decomposition:

   SI1(I, N, E, S, C, CN, B) and
   SI2(C, P, T, ED, CN, B)

4. Find all keys for **SuperRentInfo**.

5. Obtain a lossless-join, BCNF decomposition of **SuperRentInfo**.

6. Find a minimal cover for this set of FDs.

7. Obtain a lossless-join, dependency-preserving, 3NF decomposition of **SuperRentInfo** by using the decomposition method.

8. [OPTIONAL] Obtain a lossless-join, dependency-preserving, 3NF decomposition of S**uperRentInfo** by using the synthesis method.