Name

CWID

Homework Assignment 3

November 9th, 2022
Due on November 23th, 11:59pm (midnight)

CS425 - Database Organization

Instructions

- Try to answer all the questions using what you have learned in class

- Some questions are marked as bonus. You do not have to answer these questions to get full points for the assignment. However, you can get bonus points for these questions!

Part 3.1   Modelling (Total: 60 Points)

Question 3.1.1   (60 Points)

Build a conceptual model for a **car repair shop**. The solution should be presented as an **ER-diagram**. Base your design on the following requirements.

- The database should record information about Employees, Timeschedules, Customers, Cars (being repaired), Spare parts, Bills.

- An **Employee** is identified by their SSN. We also record their names and salary (monthly.

- A **Timeschedule entry** encodes a particular day and time interval during which an employee is at the shop. Each employee has at least one timeschedule entry, but may also have multiple entries.

- A **Customer** has a name which consists of *firstName*, *middleName* and *lastName* which are used together to identify a customer. A **Customer** has optionally an *Address*. All customers have *phoneNumber* and *email* addresses. We also record the outstanding balance per customer.

- The repairshop keeps track of the customer's cars which are currently at the shop. A **Vehicle** is identified by the combination of their *licenseplatenum*. For each **Vehicle** we store the *brand*, *model*, and *production year*. Furthermore, we record when the vehicle was dropped off at the shop (*drop off date*) and when it was picked up (*picked up*). We also record which customer does own the vehicle.

- The shop keeps **spare parts** for repairs. For a spare part we record the *car brand* and *model* it can be used on, a *product number* (which is unique) and a *price*.

- A **Bill** is send to a particular *customer* for a particular *vehicle*. For each bills we record which *spare parts* (and how many of each type) were used in the repair. Bills are identified by a unique *id*.

Part 3.2 Translation of ER into Relational Model (Total: 40 + 10 BONUS Points)

Question 3.2.1   (40 Points)

Take the following ER-model and translate it into a relational schema using the rules presented in class. Present the relational schema as an SQL script (assume that all attributes are of data type `INT`). Present the results of the following intermediate steps in this order:

1. Translate strong entities + unnest composite attributes

2. Translate weak entities

3. Translated multi-valued attributes

4. Translate relationships
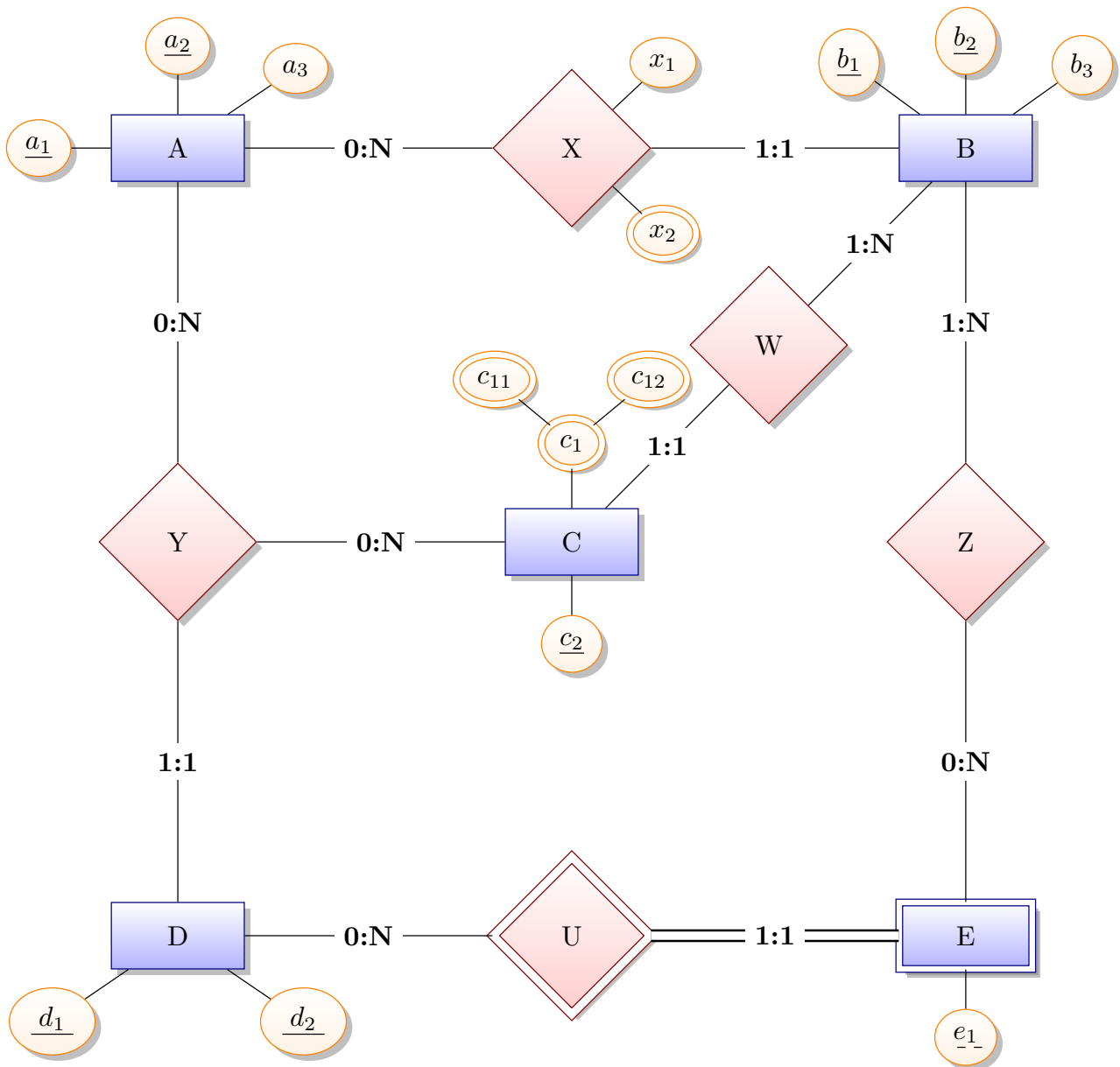
Question 3.2.2   (10 (BONUS) Points)

Consider the following relations and for each determine in which normal form the relation is (note that a relation can be in multiple normal forms). Please consider the following normal forms: 1NF, 2NF, 3NF and BCNF.

1. $R(A, B, C, D, E)$ and the Functional Dependencies are $B{\to}D, BD{\to}AE, BE{\to}AC, E{\to}D$
2. $R(A, B, C, D)$ and the Functional Dependencies are $B{\to}A, E{\to}AB, D{\to}B$
3. $R(A, B, C, D, E)$ and the Functional Dependencies are $A{\to}C, E{\to}BD, BE{\to}AD$
4. $R(A, B, C, D, E)$ and the Functional Dependencies are $E{\to}B, DE{\to}A, B{\to}D$