

Name

CWID

Homework Assignment 3

November 8th, 2019

Due on November 18th, 2019
11:59pm (CST)

CS425 - Database Organization

Please leave this empty!

3.1

3.2

3.3

Sum

Instructions

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

Part 3.1 Modeling (Total: 35 Points)

Question 3.1.1 (35 Points)

Build a conceptional model for an **Online Bus Booking System**. The solution should be presented as an **ER-diagram**. Design your ER diagram with the following requirements.

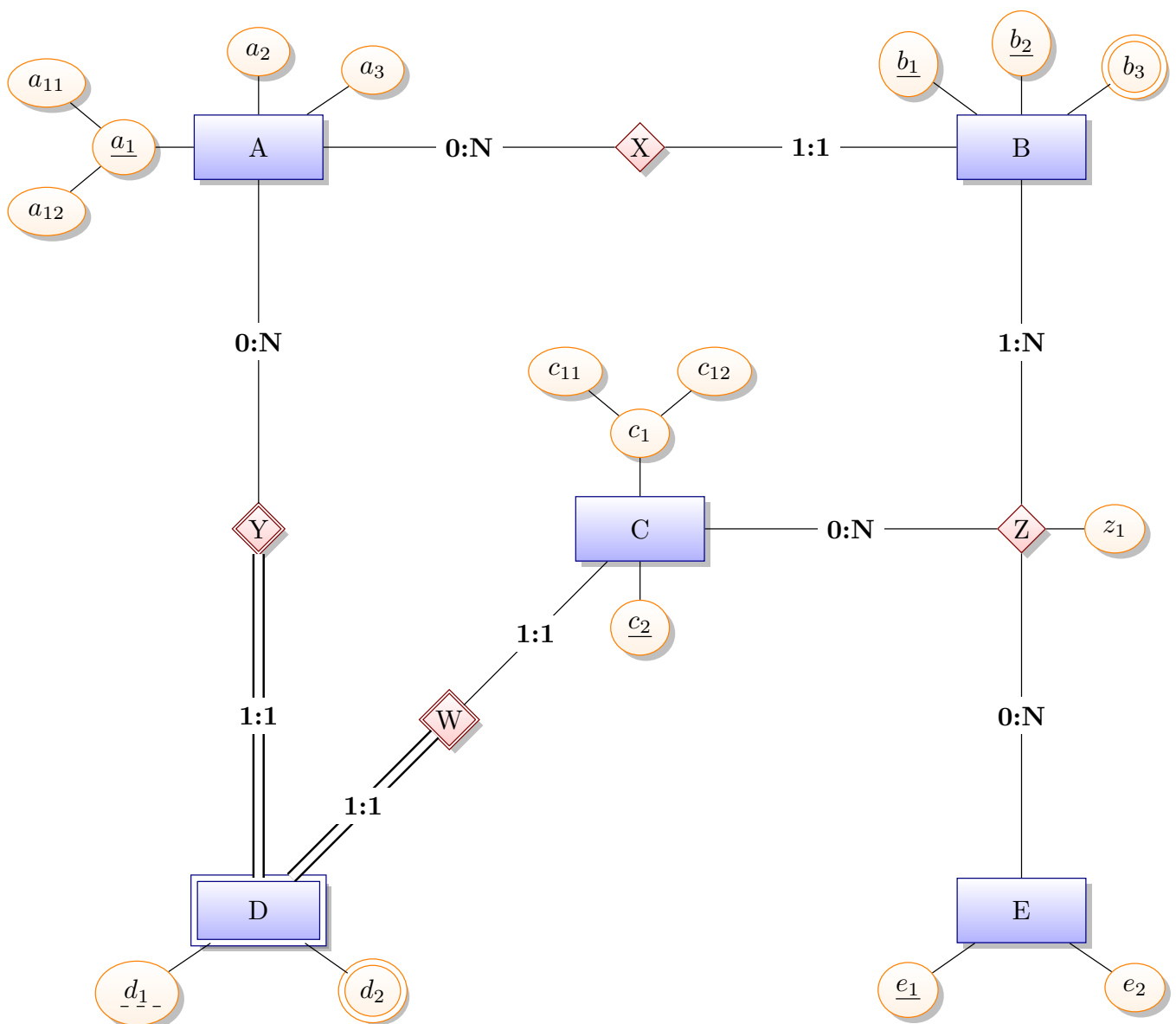
- The database should record information about Customers, Emails, Addresses, Tickets, Buses, Bus Schedules, Bus Stops, Purchase Feedback, and Payments.
- A **Customer** has a name which consists of *firstName*, *middleName* and *lastName*. **Customers** are identified by a unique *custID*. A **Customer** can have one or more *phoneNumbers*.
 - **Customers** can book any number of *Tickets* (including none). **Customers** may provide *Feedback* for each booking (optional). For every booking, a **Customer** has to make a *Payment*.
- An **Address** consists of a unique *addrID*, *street*, *streetNumber*, *city*, *state* and *zipcode*. The attributes *city* and *state* can be derived from the attribute *zipcode*.
 - A **Customer** can be associated with any number of **Addresses** and there may be multiple **Customers** living at the same **Address**. There may be some **Addresses** which are not be associated with any **Customer**.
- An **Email** consists of unique *emailID* and a *Password*.
 - A *Customer* may or may not have an **Email** and every **Email** belongs to a single owner (customer). We assume that a **Customer** can have only one **Email**.
- A **Bus** is identified using a *busNumber*. A **Bus** has a *capacity*, *model* and a *ticketPrice*.
 - A **Bus** may follow several **Schedules**.
- A **Bus Stop** is uniquely identified by the *Address* it is located at. A **Bus Stop** has a *type* (either *sheltered* or *simple*).
- A **Schedule** includes an *ArrivalTime*, **DepartureTime**, and a unique *scheduleID*.
 - A **Schedule** is associated with one or more **Bus Stops**. For each association, we record the *scheduled time* of the bus stopping at this **Bus Stop**.
- A **Ticket** has its unique *ticketId*. Tickets also have a *bookingDate* and *travelDate*. A **Ticket** may have one or more *seatNumbers*.
 - Each **Ticket** may be associated with a single **Feedback**.
 - Every **Ticket** has a **Bus** associated with it, while a **Bus** may have many different **Tickets** associated with itself.
- A **Payment** is identified by the *Ticket* for which the payment was made. It consists of the *amountPaid* and *paymentMethod* (Credit Card, E-Check, etc.)
- Every **Purchase Feedback** is uniquely identified by the **Ticket** for which the feedback is given. For each **Purchase Feedback** we store a *rating* and *comment*.

Part 3.2 Translation of ER into Relational Model (Total: 35 Points)

Question 3.2.1 (35 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



Part 3.3 Normalization (Total: 30 Points)

Question 3.3.1 (30 Points)

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

1. $R(A, B, C, D)$ and the Functional Dependencies are $C \rightarrow B, B \rightarrow D, A \rightarrow BD$
2. $R(A, B, C, D, E)$ and the Functional Dependencies are $A \rightarrow B, B \rightarrow C, AC \rightarrow D$
3. $R(A, B, C, D, E)$ and the Functional Dependencies are $A \rightarrow BC, D \rightarrow E, AB \rightarrow CD$
4. $R(A, B, C, D, E)$ and the Functional Dependencies are $A \rightarrow C, B \rightarrow C, AB \rightarrow DE, BC \rightarrow AD$
5. $R(A, B, C, D, E)$ and the Functional Dependencies are $AC \rightarrow BE, A \rightarrow D, B \rightarrow A, BC \rightarrow D$
6. $R(A, B, C, D)$ and the Functional Dependencies are $C \rightarrow B, B \rightarrow AC, A \rightarrow BD$

