Homework Assignment

3

November 2nd, 2016
Due on November 14th, 12:30pm (noon)

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

• 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 conceptional model for an Online Bus Ticket Booking System. The solution should be presented as an ER-diagram. Base your design on 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** has 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 such 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 has 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 a comment.
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 (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 \( A \rightarrow B, C \rightarrow BD, B \rightarrow C \)
2. \( R(A, B, C, D, E) \) and the Functional Dependencies are \( AC \rightarrow BE, A \rightarrow D, B \rightarrow A, BC \rightarrow D \)
3. \( R(A, B, C, D, E) \) and the Functional Dependencies are \( AC \rightarrow BE, A \rightarrow C, BC \rightarrow D, B \rightarrow A \)
4. \( R(A, B, C, D) \) and the Functional Dependencies are \( C \rightarrow B, B \rightarrow AC, A \rightarrow BD \)