Homework Assignment

3

November 9th, 2017
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 conceptional model for a Factory Management System. The solution should be presented as an ER-diagram. Base your design on the following requirements.

- The database should record information about Clients, Factories, Addresses, Products, Orders, Warehouses, Delivery Plans, and Payments.

- A Client has a name which consists of firstName, middleName and lastName. Clients are identified by a unique clientID. A Client has an Address, phoneNo and email address. A Client may be assigned to a Factory.
  - Clients can place any number of Orders (including none). Client may provide Feedback for each order they have played (optional). For every order, a Client has to make a Payment.

- A Factory is identified by the combination of name and type. A Factory may have one Address. A Factory has a type, phone number and a short description.

- 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.
  - There may be some Addresses which are not be associated with any Client or Factory.

- A Product is identified its name, A Product has a price and size, and a description.
  - Products are stored in warehouses. For each Product stored in a Warehouse we record the number of Products in stock produced by a certain Factory (e.g., 3 Macbooks in Warehouse 1 were produced by Factory 1).

- A Warehouse is identified by its warehouseId. A Warehouse has a capacity.
  - A Warehouse may service multiple Factories.
  - There may be one or more Warehouses for a Factory.

- An Order is uniquely identified by the orderId. An Order is created by a Client. For each order we store a Total Amount of ordered items and a Date.
  - An Order is associated with one or more Products. For each Product in an Order, we have to record how many items of this product are ordered (e.g., Order 1 contains 3 Spoons and 15 Forks). Note that the Total Amount can be computed as the sum of number of items for each ordered Product.

- A Delivery Plan is uniquely identified by the deliveryId. For a Delivery Plan we record a Shipment Date and Delivery Date.
  - Each Order is associated with one or more Delivery Plans. Each Delivery Plan is associated with exactly one Order.
  - A Delivery Plan consists of multiple lineitems. A lineitems encodes the shipment of a number of items of one Product which reside in one Warehouse. For example, consider an order of 10 Spoons. One possible way to service this order is to create 2 delivery plans: the first delivery plan ships 3 Spoons from Warehouse 1 and 2 Spoons from Warehouse 2 while the second delivery plan ships 5 Spoons from Warehouse 3.

- A Payment is identified by the Order for which the payment was made. It consists of the amountPaid and paymentMethod (Credit Card, E-Check, etc.)
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. $R(A, B, C, D)$ 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 $A \rightarrow C, B \rightarrow C, AB \rightarrow DE, BC \rightarrow AD$