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 conceptual 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, Ware-Houses, 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
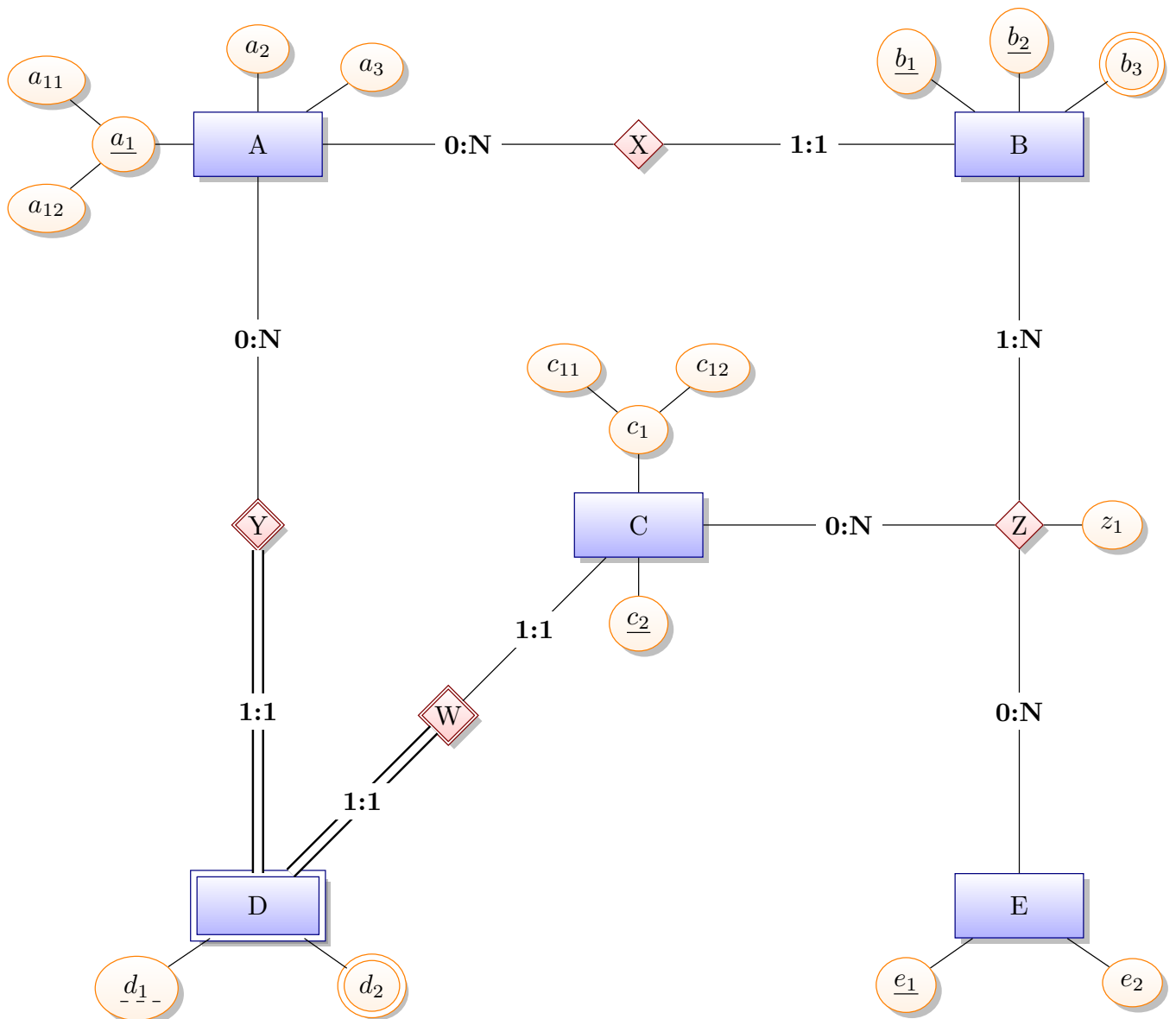
Question 3.2.2　(10 (BONUS) Points)

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