Project - 1

Report
On
Database Design

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Course: CSC-553

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Project Goal

Database Entity Relationship Diagram

Create a database for Marcia's Dry Cleaning which is able to keep track of customers, their orders, and a Frequent Cleaner's Club for offering 50% order discounts to members on every 10th order. Essential customer information to be collected includes email addresses, which will be used to notify customers when clothes are ready for pick-up.

## 1. DATABASE ENTITY RELATIONSHIP DIAGRAM:

From the requirements elicited from Marcia, the required entities are identified as
CUSTOMER
ORDER
SERVICE
SERVICEPERORDER
Also, we need separate entities like CLEANER'SCLUB and DISCOUNT to keep track of customers who are eligible for discounts. The attributes of these entities and the relationship among the entities are illustrated in the ER Diagram below.
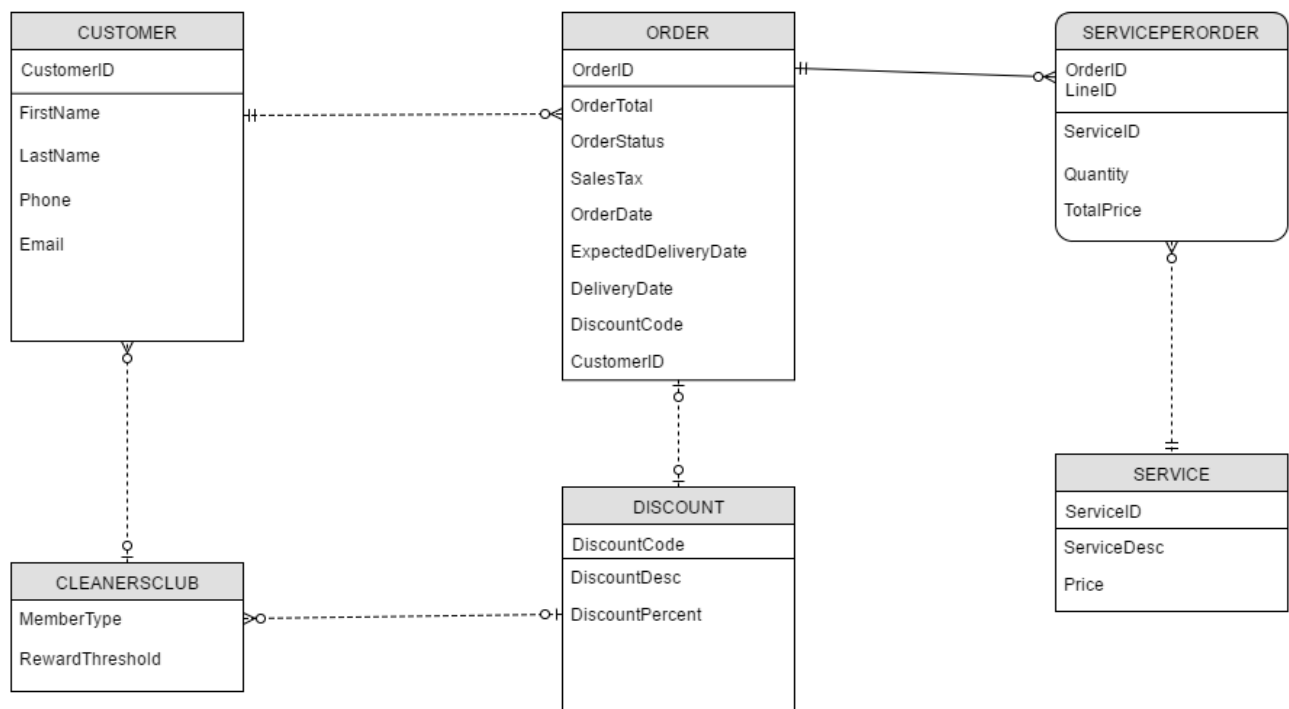
2. RELATIONSHIP TYPES AND CARDINALITIES SUMMARY:

RELATIONSHIP			CARDINALITY [Blue = Inferable]	
PARENT	CHILD	TYPE	MAX	MIN
CUSTOMER	ORDER	Strong	1:N	M-O
CUSTOMER	CLEANERSCLUB	Non-ID dependent weak entity	N:1	O-O
ORDER	SERVICEPERORDER	ID dependent weak entity	1:N	M-M
SERVICE	SERVICEPERORDER	strong	1:1	M-O
CLEANERSCLUB	DISCOUNT	strong	N:1	O-O

3. OTHER ESSENTIAL DETAILS FOR DATABASE IMPLEMENTATION:

The following questions and answers are necessary to be clarified with Marcia prior to final database design because they impact the design accordingly.

Question 1. How many clients do you deal with?
Answer: There are several hundred customers.

Question 2. What is the minimum number of times a customer uses your services?
Answer: Our customers use the services once or twice a month.

Question 3. What is the minimum number of orders a customer can place during a visit?
Answer: A customer can place one order per visit.

Question 4. What information is required by the customer to fill in the order form?

Answer: A customer is required to fill out his/her first name, last name, email, and phone number for dry cleaning.

Question 5. How is the service charged?

Answer: Internal billing processes the articles of clothes and pertinent charges are sent to their respective accounts.

Question 6. How do you come to know about the returning customers?

Answer: If a customer is on the database, a CustomerID assigned to him/her is displayed, else if a customer is new, a unique CustomerID is assigned.

Question 7. What indicates that it is the customer's tenth order?

Answer: Checking the order sequence number of the customer in past records.

Question 8. How do you recognize a returning customer?

Answer: Customers are recognized through their assigned CustomerID.

Question 9. What is the way to check whether a customer has been offered the 50% discount?

Answer: A customer with an offered 50% discount can be tracked by checking his/her previous number of orders. Once a customer places his/her tenth order, he/ she is automatically offered the 50% discount.

Question 10. Is it possible that an order can exist without a customer?

Answer: No. An order cannot exist without a customer.

Question 11. Is it possible that a customer can exist without an order?

Answer: Yes. It is feasible that a customer can exist without an order.

Question 12. Who has the right to offer discount?

Answer: It is a system generated discount i.e the discount is automatically provided by the system.

Question 13. Are the orders eligible for delivery?

Answer: Yes. Certainly, the orders are available for delivery.

Question 14. How can the customers be apprised once their order is ready?

Answer: The customers can be informed via their email.

Question 15. What is the way to check the reward won by a customer in the system?
Answer: By referring to the CLEANERSCLUB section.

Question 16. Can the order be delivered any day of the month?
Answer: No. The customer is informed about the date of delivery regarding the concerned order.

Question 17. How do you decide which order should be prepared first?
Answer: As every order is assigned an OrderID, therefore preparation of the orders is based on the OrderID.

Question 18. Is there a limit on the number of orders a customer can place?
Answer: No. There is no limit on the number of orders a customer can place.

Question 19. Do you plan to collect customer data if an order has not yet been placed?
Answer: Yes. The customer data is collected if an order has not yet been placed.

Question 20. Do you plan to have other types of discounts for Cleaners Club members?
Answer: Yes. The discounts can be changed, if necessary.

Question 21. Would you like to offer additional discounts to customers of the Cleaners Club?
Answer: Yes, it is possible that additional discounts might be offered in future.

Question 22. Will there be any service fees or additional taxes?
Answer: Yes, there will only be sales tax of (9%).

4. NORMALIZATION OF TABLES:

It is essential to ensure that the tables are normalized because it is a transactional database and there is going to be frequent updates. In order to avoid anomalies in future, we have normalized the tables to BCNF form by using straight-to-BCNF technique and 4NF by removing multivalued dependencies, if any.

4.1 FUNCTIONAL DEPENDENCY IDENTIFICATION:

CUSTOMER

        CustomerID → (FirstName, LastName, Phone, Email)

ORDER

        OrderID → (DateOfOrder, SalesTax, OrderTotal, ExpectedDeliveryDate, DeliveryDate, OrderStatus)

SERVICEPERORDER

        (OrderID, LineID) → (ServiceID, Quantity, TotalPrice)

        ServiceID → TotalPrice

SERVICE

        ServiceID → (ServiceDesc, Price)

        ServiceDesc → (ServiceID, Price)

CLEANERSCLUB

        MemberType → (RewardThreshold)

DISCOUNT

        DiscountID → (DiscountDesc, DiscountPercent)

4.2 TRANSFORMATION OF ENTITIES INTO BCNF TABLES:

As the design for this case, the CUSTOMER table would have been

CUSTOMER (CustomerID, FirstName, LastName, Email, Phone, TotalOrders, MemberType, RewardThreshold ,OrderID, DateOfOrder, SalesTax, OrderTotal, ExpectedDeliveryDate, DeliveryDate, OrderStatus, DiscountCode,ServiceID)

By following normalization rules, the following changes were made to design the final tables for the database. They are,

(1) The CustomerID, FirstName, LastName, Email, Phone, TotalPrice are dtermined by CustomerID and they are retained on CUSTOMER table

(2) The OrderID which is a non-key attribute determines DateOfOrder, SalesTax, OrderTotal, ExpectedDeliveryDate, DeliveryDate, OrderStatus and hence all these attributes should be moved to another table called ORDER table where CustomerID is a foreign key.

(3) The MemberType and RewardThreshold should be moved to another table called CLEANERSCLUB table which is a non-identifying weak entity of CUSTOMER

(4) The DiscountCode should be moved to another table called DISCOUNT where DiscountID is the primary key

Now, let us analyze the keys of each table

(1) Customer(CustomerID, FirstName, LastName, Email, Phone)
The CustomerID and Email are Candidate keys. The CustomerID can be primary key if only the number is unique value.

(2) Order(OrderID, DateOfOrder, SalesTax, OrderTotal, ExpectedDeliveryDate, DeliveryDate, CustomerID, OrderStatus)

The OrderID and DataOfOrder are Candidate keys. Because customers can use OrderID or DateOfOrder to check their order. ORDER.CustomerID must exist in CUSTOMER.CustomerId and hence Referential Integrity Constraint is ensured.

(3) CLEANERSCLUB(MemberType, RewardThreshold)
The MemberType is the primary key in this table.

(4)   DISCOUNT(DiscountCode,DiscountDesc)
The DiscountCode is the primary key in this table.

(5)   SERVICE(ServiceID,ServiceDesc,Price)
The ServiceID is the primary key and ServiceDescription is a candidate key in this table.

Thus, the tables are designed in a way such that every determinant is a candidate key or every dependant is determined by the entire candidate key and hence they are in BCNF

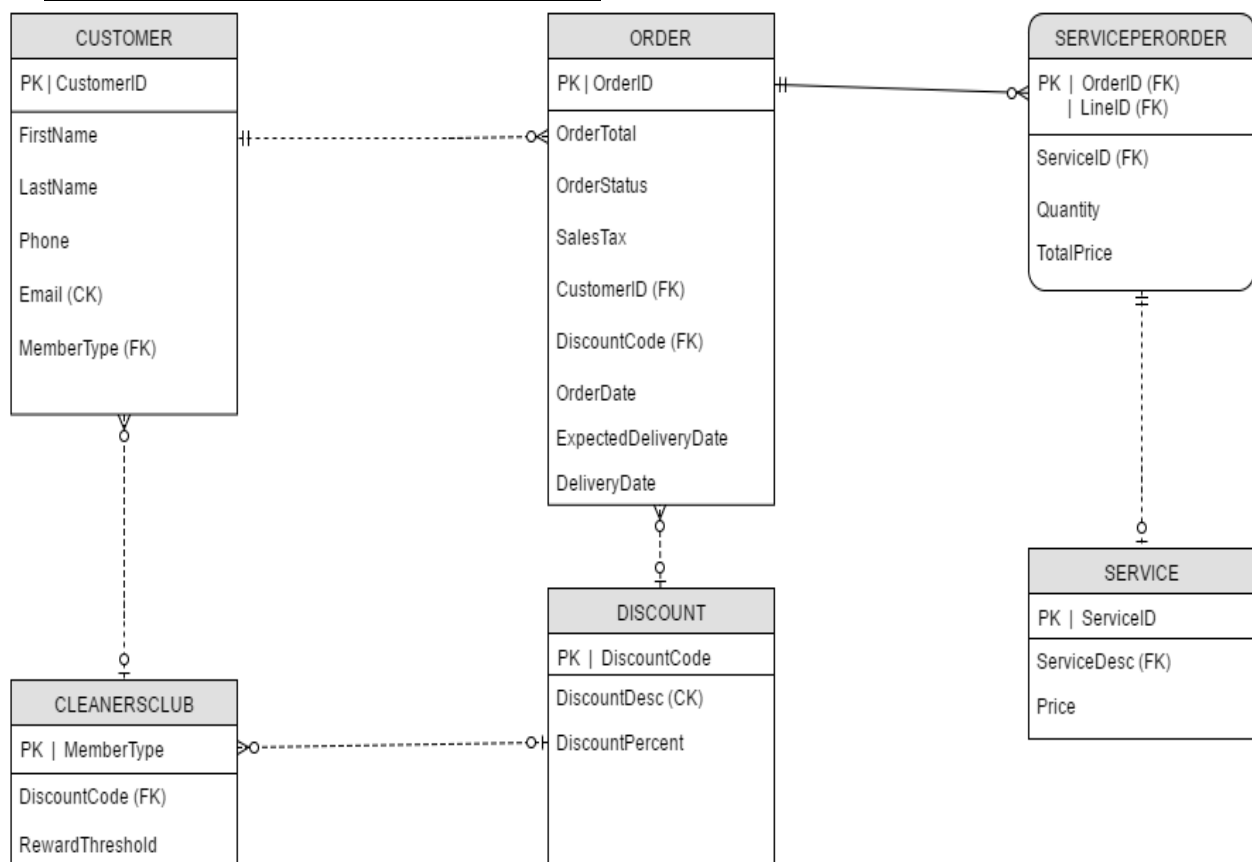## 4.3 4NF TRANSFORMATION: Move Multivalued Dependencies to new tables:

Multivalued Dependencies

If ServiceId is a part of ORDER entity, then there is a multivalued dependency
OrderID → → ServiceID
Hence, ServiceID is moved to a new entity SERVICEPERORDER and OrderID is made its composite identifier.

5. FINAL DATABASE DESIGN DIAGRAM:

6. TABLE DEFINITIONS:

(1) CUSTOMER(CustomerID, FirstName, LastName, Email, Phone)

The primary key for this table is CustomerID.
The candidate key for this table is Email.

(2) ORDER(<u>OrderID</u>, DateOfOrder, SalesTax, OrderTotal, ExpectedDeliveryDate, DeliveryDate, OrderStatus, *CustomerID*)

      The primary key is OrderID .
      The foreign key is CustomerID referencing CustomerID of CUSTOMER.

(3) DISCOUNT(<u>DiscountCode</u>, DiscountDesc, DiscountPercent, MemberType)

      The primary key is DiscountCode
      The Candidate key is DiscountDesc

(4) SERVICEPERORDER(<u>OrderID</u>, <u>LineID</u>, *ServiceID*, Quantity, TotalPrice)

      The primary key is a composite of OrderID, LineID
      The foreign key is ServiceID referencing ServiceID of SERVICE

(5) SERVICE(<u>ServiceID</u>,ServiceDesc,Price)

      The primary key is ServiceID for this table.
      The Candidate key is ServiceDesc for this table.

7. REFERENTIAL INTEGRITY REQUIREMENTS:

Referential Integrity Requirements

      In our design, Parent entities do not hold any child entities' attributes. Referential Integrity Constraints between PARENT AND CHILD are mentioned below.

Child Referential Integrity Requirements

      ORDER.CustomerID must exist in CUSTOMER.CustomerID
      SERVICEPERORDER.OrderID must exist in ORDER.OrderID
      SERVICEPERORDER.ServiceID must exist in SERVICE.ServiceID

8. ADDITIONAL NOTES:

CLEANER'S CLUB is a non-ID dependent weak entity of CUSTOMER.