

# **Database Management**

Restaurant Database

# Purpose

The purpose of this assignment is to gain experience designing, implementing, and using a relational database. This assignment is to be completed by your study groups.

# Background

Your team is tasked to develop a database for a client that is an online ordering startup, currently covering 30 restaurants in 6 cities. Consumers can order to-go meals from participating restaurants via the client’s online ordering platform. The client has a member management team and wants to capture data on its members and their orders. The database will support the member management team’s routine operations (identifying and signing up new members and providing data to the marketing team for analyzing member behaviors and preferences).

# Requirements

The member management team wants to keep the current member order management practices and conduct analyses to better understand the members’ behaviors and preferences. Customer preferences can vary depending upon the geographical location (e.g., salads might be more popular in warmer climates or potatoes in colder locations). Besides the member management, the client also needs to keep track of marketing activities, menu offerings, and staffing requirements.

1. (10 points) Describe the database you will need to create for your client. Your explanation should be written in terms that the client can understand. State the business rules that are important for the application.

Ans:

To meet the requirements of our client, an online ordering startup covering 30 restaurants across 6 cities, we propose a relational database system designed to efficiently manage member information, order details, restaurant data, marketing activities, and menu offerings. The database will consist of entities such as Members, Orders, Restaurants, Menu Items, Marketing Activities, Cities, Item Type, Meal, Meal Type, and Order Detail, each with specific attributes and relationships. Key business rules include ensuring data integrity through primary and foreign key constraints, tracking member orders for analysis of consumer behavior and preferences, organizing menu items and meals by type for efficient browsing, and capturing marketing activities to analyze their impact on member engagement.

Additionally, geographical data such as cities will enable location-based analysis, allowing the client to tailor marketing strategies and menu offerings according to regional preferences. Staffing requirements for restaurants will also be recorded to facilitate efficient staffing management. Overall, the proposed database will support the client's operations by providing comprehensive data management capabilities essential for member management, order processing, marketing analysis, and strategic decision-making.

Here are the important business rules for the application:

* Each member must have a unique identifier (Member ID).
* Orders placed by members should include details such as order date and time, total amount, and payment method.
* Restaurants participating in the online ordering platform must provide accurate information including name, address, cuisine type, and staffing requirements.
* Menu items offered by restaurants should be categorized by type for efficient browsing.
* Marketing activities conducted by the client should be recorded with details such as activity name, description, start date, end date, and target audience.
* Geographic data, including cities, should be captured to enable location-based analysis and customization of marketing strategies and menu offerings.
* Each order should be associated with specific members and restaurant IDs.
* The database should enforce referential integrity to ensure consistency and accuracy of data across tables.
* Staffing requirements for restaurants should be recorded to facilitate efficient staffing management.
* Analysis of member orders and preferences should be supported to understand consumer behavior and tailor services accordingly.

1. (20 points) Create the conceptual model needed to support your client’s database.
   1. List the entities, attributes, and relationships from the sample data.
   2. Draw an entity-relationship (E-R) diagram using the Crow’s feet or Chen notation. Make sure you are consistent in the notation you use, and it corresponds to the notation used in class.

Ans:

Entities:

a) Members: Individuals registered with the online ordering platform.

* Attributes:
  + Member ID (Primary Key)
  + Name
  + Email
  + Phone Number
  + Address
  + City
  + State
  + Zip Code
  + Registration Date

b) Orders: Details of orders placed by members.

* Attributes:
  + Order ID (Primary Key)
  + Member ID (Foreign Key)
  + Restaurant ID (Foreign Key)
  + Order Date and Time
  + Total Amount
  + Payment Method

c) Restaurants: Information about participating restaurants.

* Attributes:
  + Restaurant ID (Primary Key)
  + Name
  + Address
  + City
  + State
  + Zip Code
  + Cuisine Type
  + Staffing Requirements

d) Menu Items: Items offered by restaurants.

* Attributes:
  + Item ID (Primary Key)
  + Restaurant ID (Foreign Key)
  + Item Name
  + Description
  + Price

e) Marketing Activities: Records of marketing campaigns and promotions.

* Attributes:
  + Activity ID (Primary Key)
  + Activity Name
  + Description
  + Start Date
  + End Date
  + Target Audience

f) City: Geographic location of online ordering platform operations where they are operating.

* Attributes:
  + City ID (Primary Key)
  + City Name
  + State
  + Country

g) Item Type: Specific meals offered by restaurants (e.g., breakfast, lunch).

* Attributes:
  + Type ID (Primary Key)
  + Type Name
  + Description

h) Meal: Specific meals offered by restaurants (e.g., breakfast, lunch).

* Attributes:
  + Meal ID (Primary Key)
  + Meal Name
  + Description

i) Meal Type: Types of meals (e.g., appetizers, entrees, desserts).

* Attributes:
  + Meal Type ID (Primary Key)
  + Type Name
  + Description

j) Order Detail: Specifics of items within member orders.

* Attributes:
  + Order Detail ID (Primary Key)
  + Order ID (Foreign Key)
  + Item ID (Foreign Key)
  + Quantity
  + Price

**Relationships for ERD**

1. Members - Orders:
   * One member can place multiple orders.
   * One-to-Many relationship: One member can have multiple orders, but each order belongs to only one member. (Crow's foot notation: one-to-many)
2. Restaurants - Menu Items:
   * Each restaurant offers multiple menu items.
   * One-to-Many relationship: Each restaurant can have multiple menu items, but each menu item belongs to only one restaurant. (Crow's foot notation: one-to-many)
3. Restaurants - Orders:
   * Multiple orders can be placed at a restaurant.
   * One-to-Many relationship: One restaurant can have multiple orders, but each order belongs to only one restaurant. (Crow's foot notation: one-to-many)
4. Members - Marketing Activities:
   * Members can participate in various marketing activities.
   * Many-to-Many relationship: A member can be associated with multiple marketing activities, and a marketing activity can involve multiple members. (Crow's foot notation: many-to-many, represented with a junction table)
5. Cities - Restaurants:
   * Multiple restaurants operate in each city.
   * One-to-Many relationship: One city can have multiple restaurants, but each restaurant belongs to only one city. (Crow's foot notation: one-to-many)
6. Item Type - Menu Items:
   * Each menu item belongs to a specific item type.
   * One-to-Many relationship: One item type can have multiple menu items, but each menu item belongs to only one item type. (Crow's foot notation: one-to-many)
7. Meal Type - Meal:
   * Each meal belongs to a specific meal type.
   * One-to-Many relationship: One meal type can have multiple meals, but each meal belongs to only one meal type. (Crow's foot notation: one-to-many)
8. Orders - Order Detail:
   * Each order consists of multiple order details.
   * One-to-Many relationship: One order can have multiple order details, but each order detail belongs to only one order. (Crow's foot notation: one-to-many)
9. Restaurants - Staffing Requirements:
   * Each restaurant has specific staffing requirements.
   * One-to-One relationship: Each restaurant has one set of staffing requirements, and each set of staffing requirements is associated with only one restaurant. (Crow's foot notation: one-to-one)
10. Members - Orders:
    * One member can place multiple orders.
    * One-to-Many relationship: One member can have multiple orders, but each order belongs to only one member. (Crow's foot notation: one-to-many)
11. Restaurants - Menu Items:
    * Each restaurant offers multiple menu items.
    * One-to-Many relationship: Each restaurant can have multiple menu items, but each menu item belongs to only one restaurant. (Crow's foot notation: one-to-many)
12. Restaurants - Orders:
    * Multiple orders can be placed at a restaurant.
    * One-to-Many relationship: One restaurant can have multiple orders, but each order belongs to only one restaurant. (Crow's foot notation: one-to-many)
13. Members - Marketing Activities:
    * Members can participate in various marketing activities.
    * Many-to-Many relationship: A member can be associated with multiple marketing activities, and a marketing activity can involve multiple members. (Crow's foot notation: many-to-many, represented with a junction table)
14. Cities - Restaurants:
    * Multiple restaurants operate in each city.
    * One-to-Many relationship: One city can have multiple restaurants, but each restaurant belongs to only one city. (Crow's foot notation: one-to-many)
15. Item Type - Menu Items:
    * Each menu item belongs to a specific item type.
    * One-to-Many relationship: One item type can have multiple menu items, but each menu item belongs to only one item type. (Crow's foot notation: one-to-many)
16. Meal Type - Meal:
    * Each meal belongs to a specific meal type.
    * One-to-Many relationship: One meal type can have multiple meals, but each meal belongs to only one meal type. (Crow's foot notation: one-to-many)
17. Orders - Order Detail:
    * Each order consists of multiple order details.
    * One-to-Many relationship: One order can have multiple order details, but each order detail belongs to only one order. (Crow's foot notation: one-to-many)
18. Restaurants - Staffing Requirements:
    * Each restaurant has specific staffing requirements.
    * One-to-One relationship: Each restaurant has one set of staffing requirements, and each set of staffing requirements is associated with only one restaurant. (Crow's foot notation: one-to-one)
19. Members - Orders:
    * Members: One member can place multiple orders. (1 - Many)
    * Orders: Each order belongs to one member but can have multiple orders. (0 - Many)
20. Restaurants - Menu Items:
    * Restaurants: Each restaurant offers multiple menu items. (1 - Many)
    * Menu Items: Each menu item belongs to one restaurant but can have multiple menu items. (0 - Many)
21. Restaurants - Orders:
    * Restaurants: Multiple orders can be placed at a restaurant. (1 - Many)
    * Orders: Each order belongs to one restaurant but can have multiple orders. (0 - Many)
22. Members - Marketing Activities:
    * Members: Members can participate in various marketing activities. (0 - Many)
    * Marketing Activities: Each marketing activity can involve multiple members. (0 - Many)
23. Cities - Restaurants:
    * Cities: Multiple restaurants operate in each city. (1 - Many)
    * Restaurants: Each restaurant belongs to one city but can operate in multiple cities. (0 - Many)
24. Item Type - Menu Items:
    * Item Type: Each menu item belongs to a specific item type. (1 - Many)
    * Menu Items: Each item type can have multiple menu items. (0 - Many)
25. Meal Type - Meal:
    * Meal Type: Each meal belongs to a specific meal type. (1 - Many)
    * Meal: Each meal type can have multiple meals. (0 - Many)
26. Orders - Order Detail:
    * Orders: Each order consists of multiple order details. (1 - Many)
    * Order Detail: Each order detail belongs to one order but can have multiple order details. (0 - Many)
27. Restaurants - Staffing Requirements:
    * Restaurants: Each restaurant has specific staffing requirements. (1 - 1)
    * Staffing Requirements: Each set of staffing requirements is associated with only one restaurant. (1 - 1)
28. (15 points) Transform the E-R diagram into a relational database design that includes all the keys, data types, and constraints (e.g., null or not-null values). Show how the transformation rules are applied.
29. (10 points) Implement the database. Use Oracle, which is provided by GSU. You will need to create the (dummy) data for the database, e.g., 10-15 entries for each relation. Show the data that you input to your database by using the Select \*, command.

https://colab.research.google.com/drive/1o4VvJdaEPCcOvVi-lyOcQ9DvUJ9eKc6z?usp=sharing

1. (25 points) Identify 10 important, non-trivial queries for this database. Write the queries in English and state the importance of each query, within the context of the application domain. Write the queries in SQL and run them against the database. Show the SQL commands. Provide screen shots of the results obtained. Trivial queries are, for example, ‘retrieve the names of the customers,’ or ‘identify the customers who live in Atlanta and are over 21 years of age.’ At least 7 of the queries should require a join operation. One of the queries should use some form of a trigger or a way to capture integrity constraints.
2. **Query: Retrieve the total number of orders placed by each member.**

Importance: This query helps track the ordering behavior of each member, allowing the business to identify their most active customers. It can inform marketing strategies and loyalty programs targeted towards retaining high-volume customers.

1. Query: List all the restaurants along with the count of menu items they offer.

Importance: Understanding the variety of menu items offered by each restaurant is crucial for analyzing their menu diversity and potentially optimizing offerings to meet customer preferences.

1. Query: Retrieve the top 5 most ordered menu items.

Importance: Identifying the most popular menu items helps restaurants understand customer preferences and can influence menu planning and marketing efforts.

1. Query: Calculate the total revenue generated by each restaurant.

Importance: This query provides insights into the financial performance of each restaurant, aiding in assessing profitability and making informed business decisions.

1. Query: Find the average order value for each city.

Importance: Understanding the average order value per city helps in evaluating regional spending patterns and targeting marketing efforts effectively.

1. Query: Retrieve the members who have not placed any orders.

Importance: Identifying members who have not placed any orders can trigger targeted outreach efforts to encourage engagement and increase order frequency.

1. Query: List all marketing activities along with the count of members participating in each activity.

Importance: Monitoring member participation in marketing activities helps evaluate the effectiveness of promotional campaigns and refine future marketing strategies.

1. Query: Calculate the total number of orders placed in each city.

Importance: This query provides insights into order volume across different cities, aiding in resource allocation and expansion planning.

1. Query: Identify members who placed orders within a specific date range.

Importance: This query facilitates targeted analysis of member behavior during specific time periods, enabling businesses to assess seasonal trends and plan accordingly.

1. Query: Implement a trigger to ensure that the total amount of an order cannot be negative.

Importance: This trigger helps maintain data integrity by preventing the insertion or updating of orders with negative total amounts, ensuring accurate financial records and transactions.

To implement a trigger that ensures the total amount of an order cannot be negative, we can create a trigger named **check\_order\_total**. This trigger will be executed before inserting or updating a row in the **Orders** table. Here's the SQL command to create this trigger:

CREATE OR REPLACE TRIGGER check\_order\_total

BEFORE INSERT OR UPDATE ON Orders

FOR EACH ROW

BEGIN

IF :NEW.Total\_Amount < 0 THEN

RAISE\_APPLICATION\_ERROR(-20001, 'Order total cannot be negative');

END IF;

END;

/

Explanation:

* **BEFORE INSERT OR UPDATE ON Orders**: This specifies that the trigger should be fired before any new row is inserted into the **Orders** table or any existing row is updated.
* **FOR EACH ROW**: Indicates that the trigger should be executed for each row affected by the insert or update operation.
* **IF :NEW.Total\_Amount < 0 THEN**: Checks if the total amount of the new or updated order (**:NEW.Total\_Amount**) is less than zero.
* **RAISE\_APPLICATION\_ERROR(-20001, 'Order total cannot be negative');**: Raises an error with the specified error code and message if the condition is met, preventing the insertion or update operation.

1. (10 points) Discuss the real-world significance of this database. You will need to research and understand the purposes of customer relationship management systems. Do not simply write down the general purpose of a customer relationship management system. Identify what additional constructs should be included in the database and state how they would be useful. This question requires well-conceived and well-written arguments that reflect the role of data and its analysis.

In the context of this online ordering startup, the database must extend beyond basic customer relationship management (CRM) functionalities to effectively address the unique needs of the business and its customers. Here are additional constructs that should be included in the database, along with their significance:

1. **Customer Segmentation Data**: By incorporating customer segmentation data, the database can categorize customers based on factors such as demographics, order history, and preferences. This segmentation allows the platform to tailor marketing efforts and menu offerings to specific customer segments, enhancing engagement and driving sales. For example, customers who frequently order vegetarian dishes can receive targeted promotions for new plant-based menu items.
2. **Order Preferences and History**: Tracking individual customers' order preferences and history enables the platform to offer personalized recommendations and promotions. By analyzing past orders, the platform can identify patterns and trends, such as preferred cuisine types or favorite menu items, to tailor suggestions to each customer's taste. This personalization enhances the overall customer experience and encourages repeat purchases.
3. **Feedback and Reviews**: Integrating a feedback and reviews system into the database allows customers to provide input on their ordering experience, food quality, and delivery service. Analyzing this feedback provides valuable insights into customer satisfaction levels and areas for improvement. Positive reviews can be leveraged for marketing purposes, while addressing negative feedback promptly can help retain customers and improve brand reputation.
4. **Loyalty Program Management**: Implementing a loyalty program within the CRM database incentivizes repeat purchases and fosters customer loyalty. By tracking customers' participation in the program and their redemption of rewards, the platform can identify its most loyal customers and tailor special offers to encourage continued patronage. This strengthens customer relationships and increases customer lifetime value.
5. **Integration with Social Media Platforms**: Integrating the CRM database with social media platforms enables the platform to engage with customers across multiple channels. Monitoring social media interactions, responding to inquiries or feedback, and leveraging user-generated content can enhance brand visibility and customer engagement. This integration facilitates direct communication with customers and allows the platform to address issues promptly, strengthening brand loyalty and advocacy.

In conclusion, by including these additional constructs in the CRM database, the online ordering platform can gain deeper insights into customer behavior and preferences. This enables the platform to deliver personalized experiences, improve customer satisfaction, and drive business growth. The database becomes a powerful tool for data-driven decision-making, enabling the platform to adapt to evolving customer needs and stay competitive in the market.

1. (10 points) Create a set of ppt slides that you would use to guide your presentation to the client. Make sure that the slides are presented from a management perspective.

# Useful Resources

To drawing the E-R diagram, you may use an online drawing tool, but be sure to employ the notation studied in class. Note that some tools mix conceptual with logical design. These must be separate so do not use a tool that does so.