The Coversheet	
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I have read and understood the Academic Misconduct statement.	Tick to confirm ☐
I have read and understood the Generative Artificial Intelligence use statement.	Tick to confirm ☐
I am satisfied that I have met the Learning Outcomes of this assignment (please check the Assignment Brief if you are unsure)	Met ☐

Self-Assessment – If there are particular aspects of your assignment on which you would like feedback, please indicate below. Optional for students
Suggested prompt questions- *How have you developed or progressed your learning in this work?* *What do you feel is the strongest part of this submission?* *What feedback would you give yourself?* *What part(s) of this assignment are you still unsure about?*

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1.1 Background of the Restaurant Chain

The restaurant franchise in question runs numerous sites throughout the region, serving a varied clientele. Each location seeks to deliver a distinctive culinary experience emphasizing quality and consistency. The franchise provides a diverse array of cuisines, encompassing appetizers, main meals, desserts, and beverages, according to the preferences of its target clientele.

Key Aspects:

- The network presently operates more than 10 outlets distributed throughout urban and suburban regions, hence enhancing accessibility for a wider audience.
- The restaurant serves families, working professionals, and culinary lovers desiring a varied cuisine and a pleasant dining atmosphere.
- Cuisine Offered: The menu features worldwide options including Italian, American, and Continental, alongside regionally inspired meals to cater to local tastes.
- Operational Difficulties: The rapidly expanding restaurant chain has multiple issues that require the establishment of a comprehensive Database Management System (DBMS):

1. Reservation Management: The manual processing of customer reservations frequently results in overbooking or missing bookings, leading to consumer discontent.
2. Inventory Monitoring: Erratic tracking of ingredient consumption and stock levels leads to wastage or the unavailability of essential ingredients.
3. Sales Reporting: The lack of automated reporting hinders the ability to monitor daily sales and assess the performance of menu items across locations.

The deployment of an integrated DBMS is critical for addressing operational inefficiencies, improving decision-making, and enhancing customer satisfaction through real-time insights. As Elmasri and Navathe (2020) highlight, enabling end-users to perform transactions directly, supported by robust and updatable databases, is essential for sectors like e-commerce and hospitality. Similarly, in the restaurant industry, digitizing activities such as reservations, inventory management, and sales reporting enables streamlined operations and better customer experiences.

1.2 Purpose of the Database Management System (DBMS)

The Database Management System (DBMS) for the restaurant chain is designed to tackle various operational difficulties and offer a consolidated platform for data management. The objective of the DBMS is as follows:

1. **To Optimize Operations Across Locations**

The restaurant franchise manages numerous locations, each with distinct operations. The DBMS will centralize functions including reservation management, inventory tracking, and sales monitoring across all branches, thus improving operational efficiency. Elmasri and Navathe (2020) assert that an effectively designed DBMS minimizes redundancy and enhances data accuracy through the integration of data sources.

2. To Improve Customer Experience via Effective Reservation and Inventory Management

The DBMS guarantees a flawless client experience with real-time reservation management and automated inventory adjustments. Avoiding overbookings and guaranteeing menu availability are essential for client happiness. Singh and Mittal (2021) emphasize that integrated systems substantially improve customer experience by reducing delays and errors.

3. Enhancing Data Reporting and Decision-Making

The DBMS facilitates the production of comprehensive reports, including daily sales summary, inventory status, and client trends. These insights facilitate data-driven decision-making, enabling the restaurant chain to respond adeptly to market demands.

1.3 Objectives of the Assessment

This evaluation seeks to build and implement a complete Database Management System that meets the operational and analytical requirements of the restaurant chain. The primary objectives are:

1. **To Design a Data Model That Is Stable**

The evaluation entails the development of an Entity-Relationship Diagram (ERD) that accurately depicts the relationships and dependencies within the restaurant's operations. The model guarantees scalability and clarity, thereby facilitating future improvements without the need for substantial redesign (Hoffer et al., 2020).

2. To Guarantee Adherence to the Most Effective Methods of Database Normalization

The design guarantees integrity and eliminates data redundancy by normalizing the database to the Third Normal Form (3NF). The assessment emphasizes the importance of establishing a clear and efficient database structure, as normalization is essential for ensuring data consistency.

3. To Generate Reports That Fulfill the Organization's Operational Requirements

The assessment entails formulating SQL queries to generate actionable results, including total sales by category, inventory status, and client reservation records. These reports correspond with the chain's strategic objectives of enhancing efficiency and profitability.

2. Requirements Analysis

2.1 Functional Requirements

1. **Manage customer reservations:**

- Customers may create, alter, and cancel reservations.
- Employees can authorize and monitor reservations.
- Reservations are monitored by branches and dates.

2. **Monitor inventory levels:**

- Inventory for each branch is assessed, encompassing stock quantities and replenishment needs.
- Collaboration with suppliers for inventory replenishment.

3. **Daily sales reports are generated:**

- Sales summaries for each branch are compiled on a daily basis.
- Revenue reports for restaurant categories and locations are produced.
- Analysis of sales by menu items and customer trends is conducted.

2.2 Non-Functional Requirements

1. **Scalability for future growth:**

- The system should support a growing number of restaurants, branches, and customers.
- Guarantee that the database can handle large volumes of transactions.

2. **Secure data handling:**

- Protect sensitive customer and payment information using encryption.
- Enforce strict user access rules for employees.

3. **High system availability:**

- Guarantee minimal downtime with a robust database infrastructure.
- Backup systems should be in place to restore data in the event of failures.

2.3 System Constraints

Financial constraints:

- The system must employ economical technologies.
- It is advised to use open-source database management systems like PostgreSQL or MySQL.

Existing hardware or software dependencies:

- The solution must be compatible with existing hardware or POS systems.
- The software must be compatible with the operating system and platform currently being used by the restaurant chain.

3.1 Data Model Overview

Entities	**Attributes**	**Key Constraints**	**Other**
Owner	Owner_ID, First_Name, Last_Name, Contact_No	Owner_ID (PK)	Validates Contact_No using a regex.
Restaurant	Restaurant_ID, Name, Type, Location, Owner_ID	Restaurant_ID (PK), Owner_ID (FK)	Cascading actions on Owner_ID
Branch	Branch_ID, Restaurant_ID, Location, Manager_Name, Contact_No	Branch_ID (PK), Restaurant_ID (FK)	Contact_No validated with a regex.
Employee	Employee_ID, Branch_ID, First_Name, Last_Name, Role, Hire_Date, Department	Employee_ID (PK), Branch_ID (FK)	
Customer	Customer_ID, First_Name, Last_Name, Email, Phone	Customer_ID (PK)	Email is unique.
Reservation	Reservation_ID, Customer_ID, Branch_ID, Reservation_Date, Number_of_People, Status	Reservation_ID (PK), Customer_ID (FK), Branch_ID (FK)	
Menu	Menu_ID, Item_Name, Description, Price, Category_ID	Menu_ID (PK), Category_ID (FK)	
Category	Category_ID, Category_Name, Category_Description	Category_ID (PK)	

Order	Order_ID, Customer_ID, Branch_ID, Order_Date, Total_Price	Order_ID (PK), Customer_ID (FK), Branch_ID (FK)	
Inventory	Inventory_ID, Ingredient_Name, Quantity, Unit, Reorder_Level, Branch_ID	Inventory_ID (PK), Branch_ID (FK)	
Supplier	Supplier_ID, Name, Address, Contact_No	Supplier_ID (PK)	
Report	Report_ID, Sales_Performance, Inventory_Status, Report_Date	Report_ID (PK)	

3. Database Design

3.2 Entity-Relationship Diagram (ERD)

The Detailed Entity-Relationship Diagram for Restaurant Chain Database Management System can be found in Appendix A.

Description: The ERD illustrates the relationships between key entities, such as Restaurant, Branch, Employee, Customer, and Reservation, along with their attributes and constraints.

3.3 Description of Entities and Relationships

Entities and Attributes

1. **Restaurant**

Attributes:

- Restaurant: Unique identifier for the restaurant.
- Name: Name of the restaurant.
- Type: Category of food offered.
- Location: General location of the restaurant.

Relationships:

Owned by: Associates each restaurant to its owner (Owner_ID).

Establishes: Connects restaurants to their branches.

2. **Branch**

Attributes:

- Branch_ID: Distinct identification for the branch.
- Restaurant_ID: Associates the branch with a particular restaurant.
- Location: The physical address of the branch.
- Manager_Name: The name of the branch manager.
- Contact_No: The branch's contact number.

Relationships:

Has: Links the branch to reservations (Branch_ID in Reservation).

Employs: Links the branch to its employees (Branch_ID in Employee).

Supplies: Connects the branch to inventory items (Branch_ID in Inventory).

3. **Owner**

Attributes:

- Owner_ID: Unique identifier for the owner.
- First_Name: The Owner’s first name.
- Last_Name: The Owner’s last name.
- Contact_No: Contact number of the owner.

Relationships:

Owns: Links the owner to a restaurant.

4. Customer

Attributes:

- Customer_ID: Unique identifier for the customer.
- First_Name: The Customer’s first name.
- Last_Name: The Customer’s last name.
- Email: The Customer’s email address.
- Phone: The Customer’s phone number.

Relationships:

- **Books:** Links the customer to reservations.
- **Places:** Links the customer to orders.

5. Reservation

- **Reservation_ID:** Unique identifier for the reservation.
- **Customer_ID:** Associates the reservation with a customer.
- **Branch_ID:** Links the reservation to a branch.
- **Reservation_Date:** The Date of the reservation.
- **Number_of_People:** Number of people in the reservation.
- **Reservation_Status:** Status of the reservation (e.g., Confirmed, Pending).

Relationships:

Approved by: Links the reservation to an employee.

6. Employee

Attributes:

Employee_ID: Unique identifier for the employee.

Branch_ID: Links the employee to a branch.

First_Name: Employee’s first name.

Last_Name: Employee’s last name.

Role: Job role of the employee.

Hire_Date: Date the employee was hired.

Department: Department the employee works in.

Relationships:

- **Processes:** Links the employee to orders.
- **Approves:** Links the employee to reservations

7. Menu

Attributes:

Menu_ID: Unique identifier for the menu item.

Item_Name: Name of the menu item.

Description: Description of the menu item.

Price: The Price of the menu item.

Category_ID: Associates the menu item with a category.

Relationships:

Links the menu item to orders.

8. **Inventory**

Attributes:

Inventory_ID: Unique identifier for the inventory item.

Ingredient_Name: Name of the inventory item.

Quantity: Available Inventory.

Unit: A standard measurement (e.g., kg, liters).

Reorder_Level: The minimum threshold for initiating a reorder.

Branch_ID: Links inventory items to a branch.

Relationships: Supplied by: Links the inventory to suppliers.

9. **Summary of Relationships**

- Every reservation associates a customer with a branch.
- Every branch is affiliated with a restaurant.
- Employees oversee bookings and facilitate order processing for branches.
- Menu items are classified and associated with orders.
- Inventory is provided by suppliers and associated with branches.

3.4 Assumptions and Business Rules

- Each reservation is linked to only one customer.
- Each branch belongs to exactly one restaurant.
- Inventory items are managed independently for each branch.
- Each employee is assigned to only one branch at a time.
- A reservation can only be approved by one employee.
- Orders can include multiple menu items.
- Ingredients in the inventory are used exclusively for menu items.
- Each restaurant must have at least one branch.

- Customers can book multiple reservations.
- Employees must belong to a branch to process orders or approve reservations.
- Categories group menu items based on cuisine or dish type.
- Suppliers provide inventory for multiple branches.
- Daily sales are recorded for each branch individually.
- Reports are generated for inventory and sales separately.
- Menu items are linked to a single category.
- Payment details for orders are stored securely.
- Customers can update or cancel reservations before the reservation date.
- Low-stock inventory triggers reorder notifications.
- Each menu item has a unique price and description.
- Restaurants must have an assigned owner.

4.0 Normalization Process

4.1 Initial ERD Analysis

The preliminary ERD design encompassed the fundamental linkages and qualities necessary for the restaurant management system. Nonetheless, it displayed the subsequent problems:

1. Data Redundancy:

Certain characteristics, like Category_Name in the Menu object, are redundantly duplicated for each menu item. This redundancy would result in heightened storage demands and discrepancies during updates.

Attributes connected to inventory, including Ingredient_Name and Branch_ID, exhibited a lack of normalization, which may result in data duplication for ingredients utilized across many branches.

2. Partial Dependencies:

In the Menu table, elements such as Category_Name were functionally dependent on Menu_ID but could be segregated into a separate table to prevent redundancy.

In the Inventory database, properties such as Branch_ID resulted in partial dependencies, as inventory may be associated with numerous branches.

2. **Transitive Dependencies:**

   Certain attributes in specific tables relied on non-primary keys. For instance, Sales_Performance in the Reports table was indirectly related to other attributes and relied on Sales_ID.

4. Complex Relationships:

The relationships between Employee processing Orders and approving Reservations were not clearly delineated, resulting in potential inconsistencies in role allocations.

Requirement for Normalization:

Normalization was routinely implemented to address these issues:

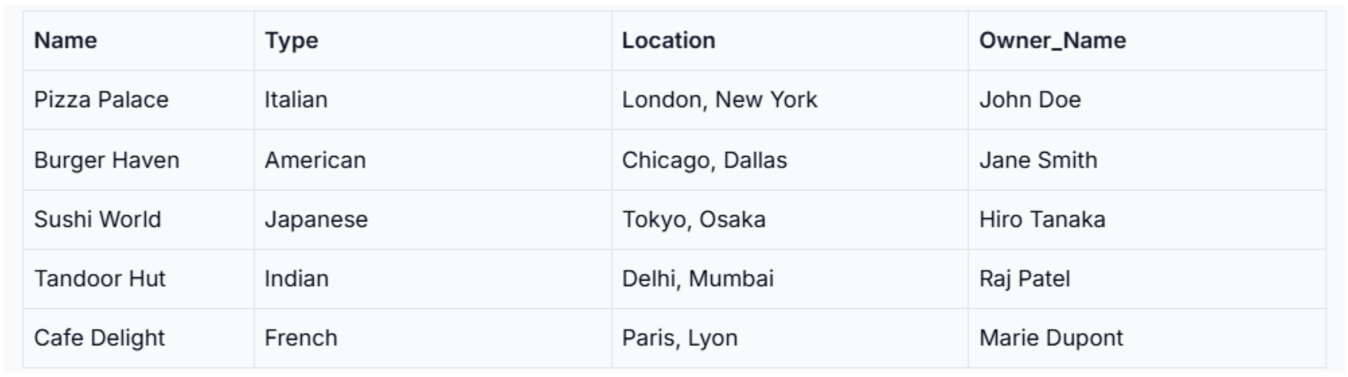
- Eliminated redundancy by partitioning attributes into associated tables.
- Guaranteed that all non-key attributes were entirely dependent on their primary key.
- Eliminated transitive dependencies by establishing supplementary entities, including Category and Supplier.
- Streamlined relationships by the explicit delineation of foreign keys and the enforcement of integrity restrictions.

4.2 Normalization Process for All Entities (1NF, 2NF, 3NF)

This report contains an in-depth explanation of the normalization process for all entities in your ERD, as well as populated tables with 5 to 10 rows at each stage (1NF, 2NF, and 3NF).

Entity 1: Restaurant

Unnormalized Restaurant Table



Name	Type	Location	Owner_Name
Pizza Palace	Italian	London, New York	John Doe
Burger Haven	American	Chicago, Dallas	Jane Smith
Sushi World	Japanese	Tokyo, Osaka	Hiro Tanaka
Tandoor Hut	Indian	Delhi, Mumbai	Raj Patel
Cafe Delight	French	Paris, Lyon	Marie Dupont

Figure 1

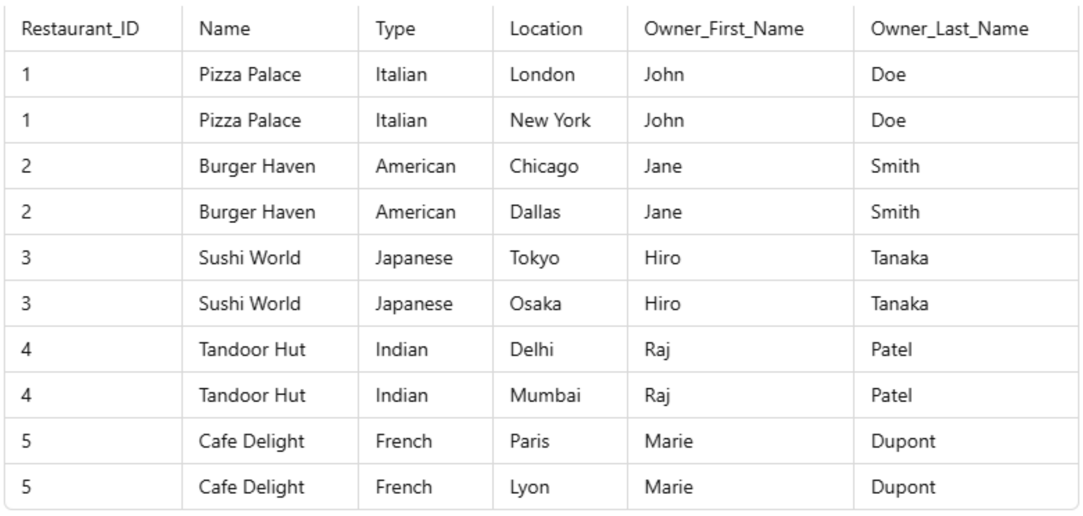
Step 1: First Normal Form (1NF)

Rule: Ensure atomic values and eliminate multivalued attributes.

Issues:

1. **Location contains multiple values.**
2. **Owner_Name is a composite attribute.**

Normalized Restaurant Table (1NF):



Restaurant_ID	Name	Type	Location	Owner_First_Name	Owner_Last_Name
1	Pizza Palace	Italian	London	John	Doe
1	Pizza Palace	Italian	New York	John	Doe
2	Burger Haven	American	Chicago	Jane	Smith
2	Burger Haven	American	Dallas	Jane	Smith
3	Sushi World	Japanese	Tokyo	Hiro	Tanaka
3	Sushi World	Japanese	Osaka	Hiro	Tanaka
4	Tandoor Hut	Indian	Delhi	Raj	Patel
4	Tandoor Hut	Indian	Mumbai	Raj	Patel
5	Cafe Delight	French	Paris	Marie	Dupont
5	Cafe Delight	French	Lyon	Marie	Dupont

Figure 2

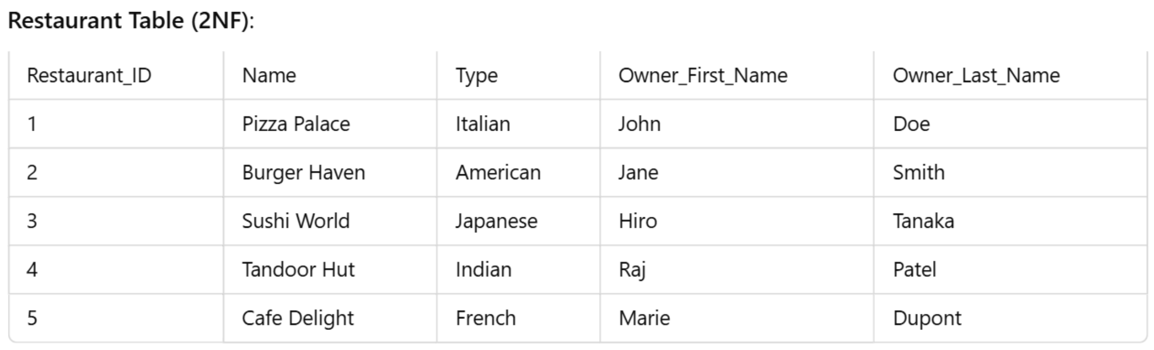
Step 2: Second Normal Form (2NF)

Rule: Eliminate partial dependencies.

Issues:

The Owner_First_Name and Owner_Last_Name are solely dependent on the Restaurant_ID, not on the complete composite key (Restaurant_ID, Location).

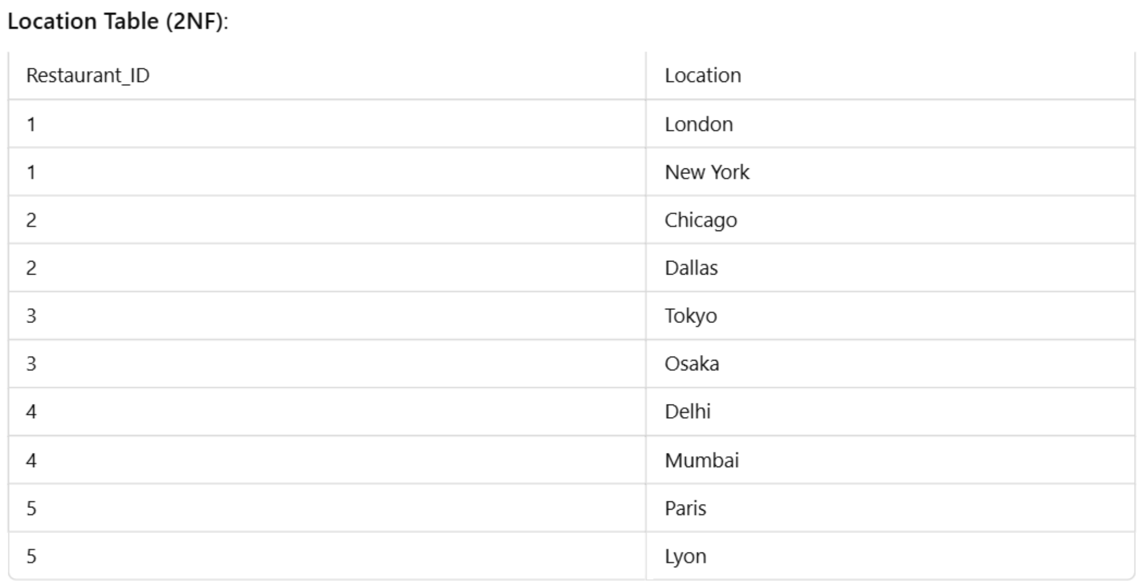
Solution: The table is divided into distinct Restaurant and Location tables.



Restaurant Table (2NF):

Restaurant_ID	Name	Type	Owner_First_Name	Owner_Last_Name
1	Pizza Palace	Italian	John	Doe
2	Burger Haven	American	Jane	Smith
3	Sushi World	Japanese	Hiro	Tanaka
4	Tandoor Hut	Indian	Raj	Patel
5	Cafe Delight	French	Marie	Dupont

Figure 3



Location Table (2NF):

Restaurant_ID	Location
1	London
1	New York
2	Chicago
2	Dallas
3	Tokyo
3	Osaka
4	Delhi
4	Mumbai
5	Paris
5	Lyon

Figure 4

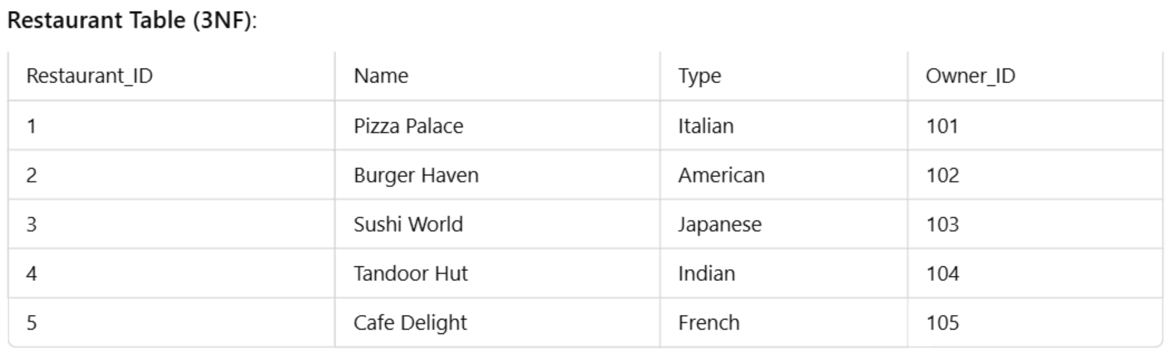
Step 3: Third Normal Form (3NF)

Rule: Eliminate transitive dependencies.

Issues:

In order to prevent redundancy, the Owner_First_Name and Owner_Last_Name columns may be transferred to an Owner table.

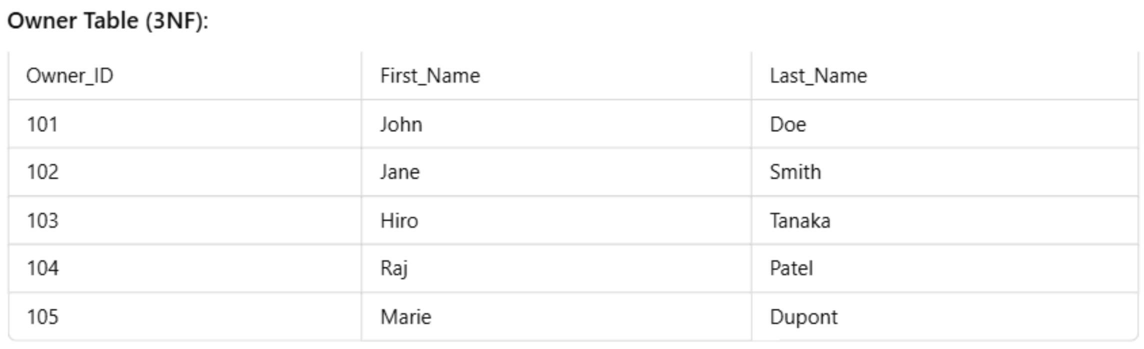
Solution: Utilize a foreign key to refer to a distinct Owner table.



Restaurant Table (3NF):

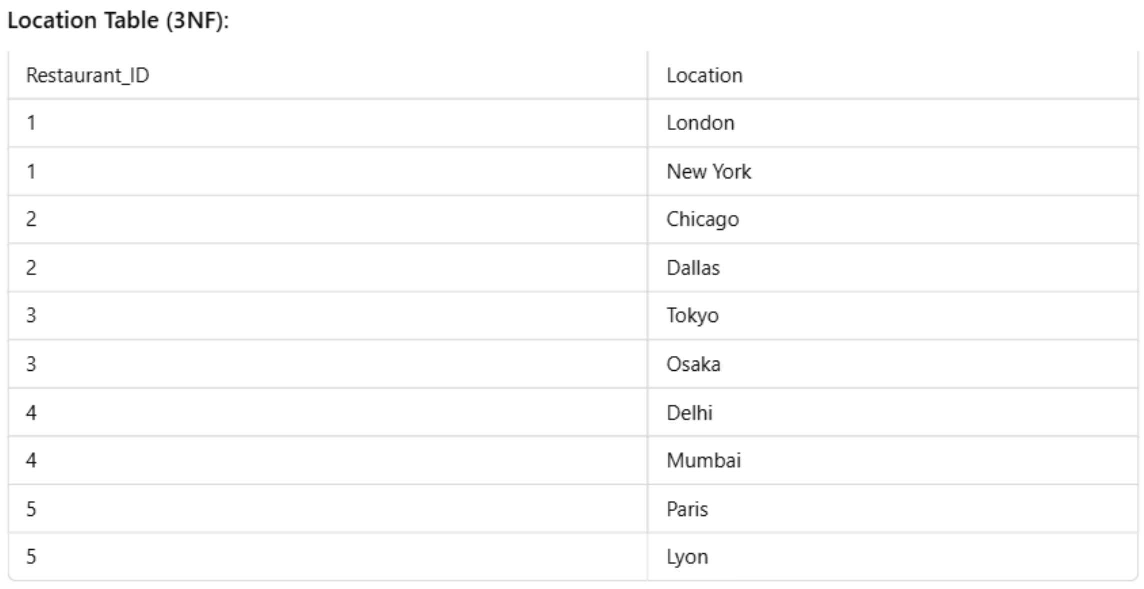
Restaurant_ID	Name	Type	Owner_ID
1	Pizza Palace	Italian	101
2	Burger Haven	American	102
3	Sushi World	Japanese	103
4	Tandoor Hut	Indian	104
5	Cafe Delight	French	105

Figure 5



Owner Table (3NF):

Owner_ID	First_Name	Last_Name
101	John	Doe
102	Jane	Smith
103	Hiro	Tanaka
104	Raj	Patel
105	Marie	Dupont



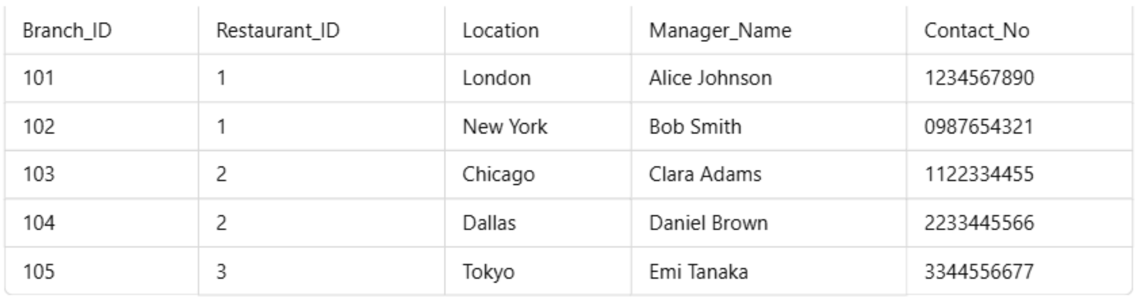
Location Table (3NF):

Restaurant_ID	Location
1	London
1	New York
2	Chicago
2	Dallas
3	Tokyo
3	Osaka
4	Delhi
4	Mumbai
5	Paris
5	Lyon

Figure 6

Entity 2: Branch

Unnormalized Branch Table



Branch_ID	Restaurant_ID	Location	Manager_Name	Contact_No
101	1	London	Alice Johnson	1234567890
102	1	New York	Bob Smith	0987654321
103	2	Chicago	Clara Adams	1122334455
104	2	Dallas	Daniel Brown	2233445566
105	3	Tokyo	Emi Tanaka	3344556677

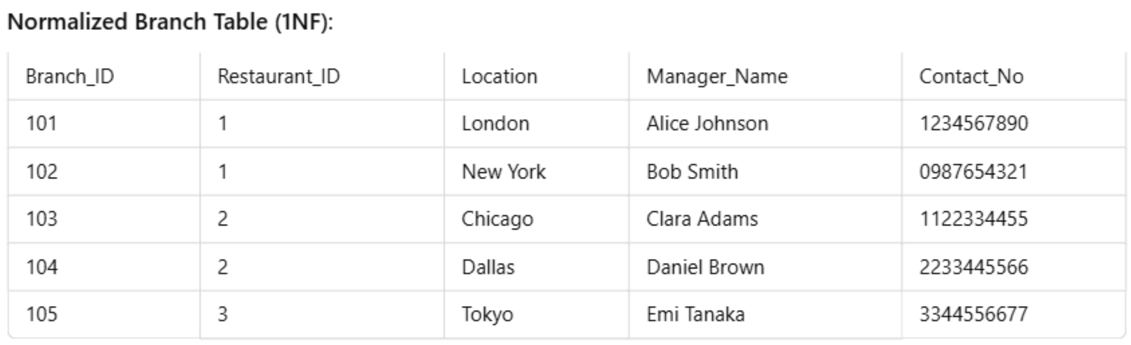
Figure 7

Step 1: First Normal Form (1NF)

Rule: Guarantee that the values are atomic.

Issues:

All values are already atomic; no changes needed.



Normalized Branch Table (1NF):

Branch_ID	Restaurant_ID	Location	Manager_Name	Contact_No
101	1	London	Alice Johnson	1234567890
102	1	New York	Bob Smith	0987654321
103	2	Chicago	Clara Adams	1122334455
104	2	Dallas	Daniel Brown	2233445566
105	3	Tokyo	Emi Tanaka	3344556677

Figure 8

Step 2: Second Normal Form (2NF)

Rule: Eliminate partial dependencies.

Problems:

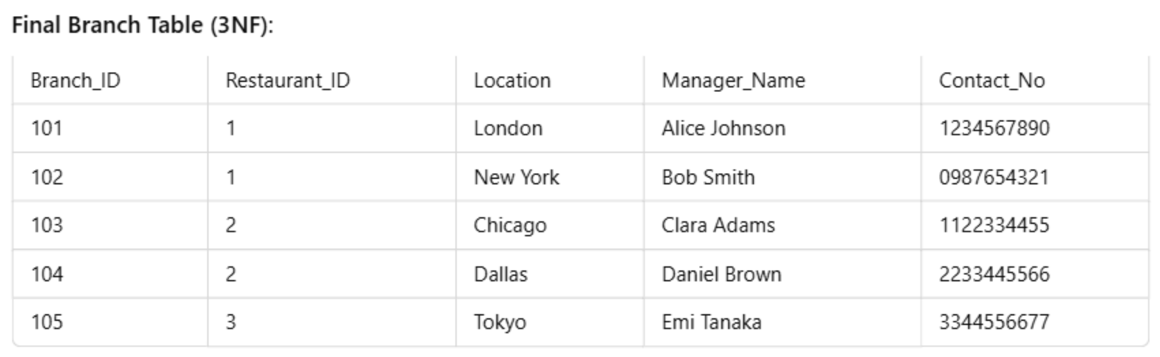
Location, Manager_Name, and Contact_No are all non-key attributes that are contingent upon the entire principal key (Branch_ID). 2NF is already satisfied by the table.

Step 3: Third Normal Form (3NF)

Rule: Discard transitive dependencies.

Issues:

No transitive dependencies. Already, the table meets the requirements of 3NF.



Final Branch Table (3NF):

Branch_ID	Restaurant_ID	Location	Manager_Name	Contact_No
101	1	London	Alice Johnson	1234567890
102	1	New York	Bob Smith	0987654321
103	2	Chicago	Clara Adams	1122334455
104	2	Dallas	Daniel Brown	2233445566
105	3	Tokyo	Emi Tanaka	3344556677

Figure 9

Entity 3: Customer

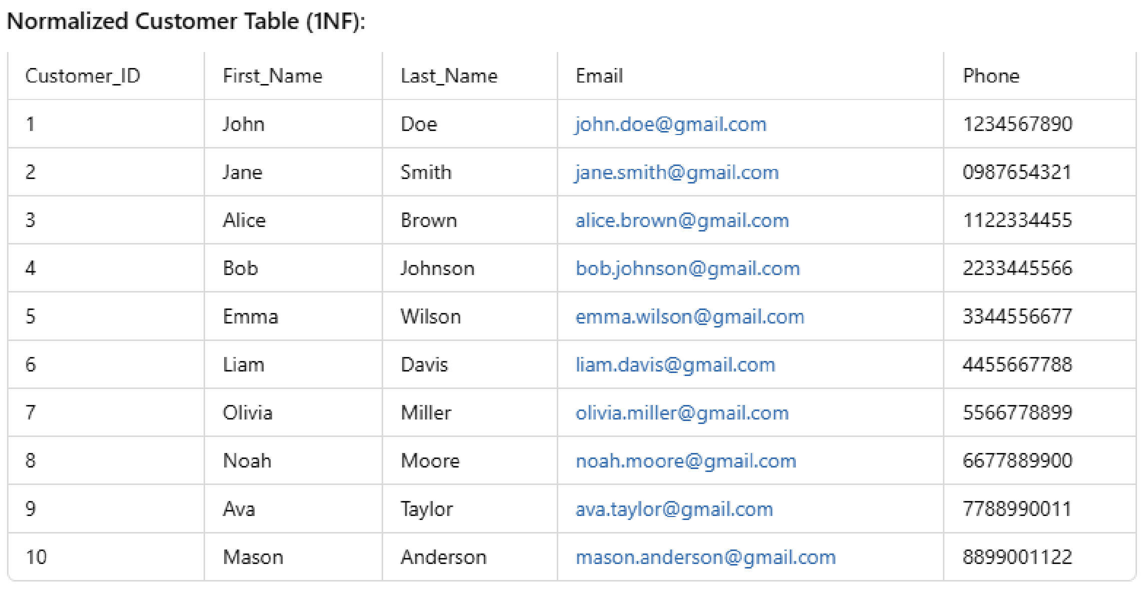
Unnormalized Customer Table

Step 1: First Normal Form (1NF)

Rule: Guarantee that the values are atomic.

Issues:

All attributes contain atomic values; no multivalued attributes exist.



Normalized Customer Table (1NF):

Customer_ID	First_Name	Last_Name	Email	Phone
1	John	Doe	john.doe@gmail.com	1234567890
2	Jane	Smith	jane.smith@gmail.com	0987654321
3	Alice	Brown	alice.brown@gmail.com	1122334455
4	Bob	Johnson	bob.johnson@gmail.com	2233445566
5	Emma	Wilson	emma.wilson@gmail.com	3344556677
6	Liam	Davis	liam.davis@gmail.com	4455667788
7	Olivia	Miller	olivia.miller@gmail.com	5566778899
8	Noah	Moore	noah.moore@gmail.com	6677889900
9	Ava	Taylor	ava.taylor@gmail.com	7788990011
10	Mason	Anderson	mason.anderson@gmail.com	8899001122

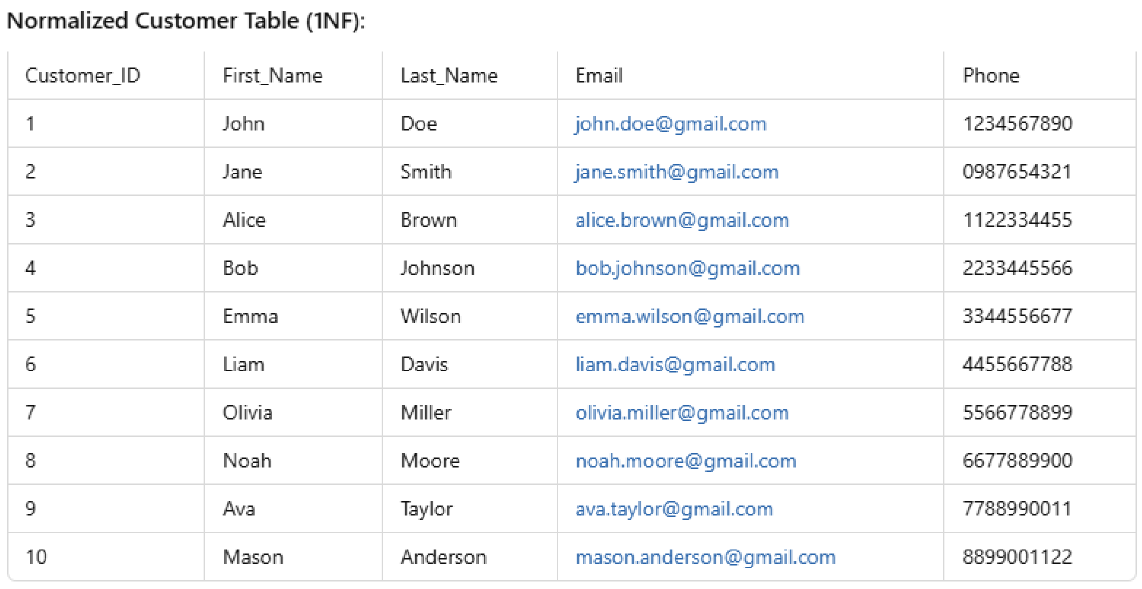
Figure 10

Step 2: Second Normal Form (2NF)

Rule: Eliminate partial dependencies.

Problems:

All attributes are entirely contingent upon the fundamental key (Customer_ID). 2NF is satisfied by the data.



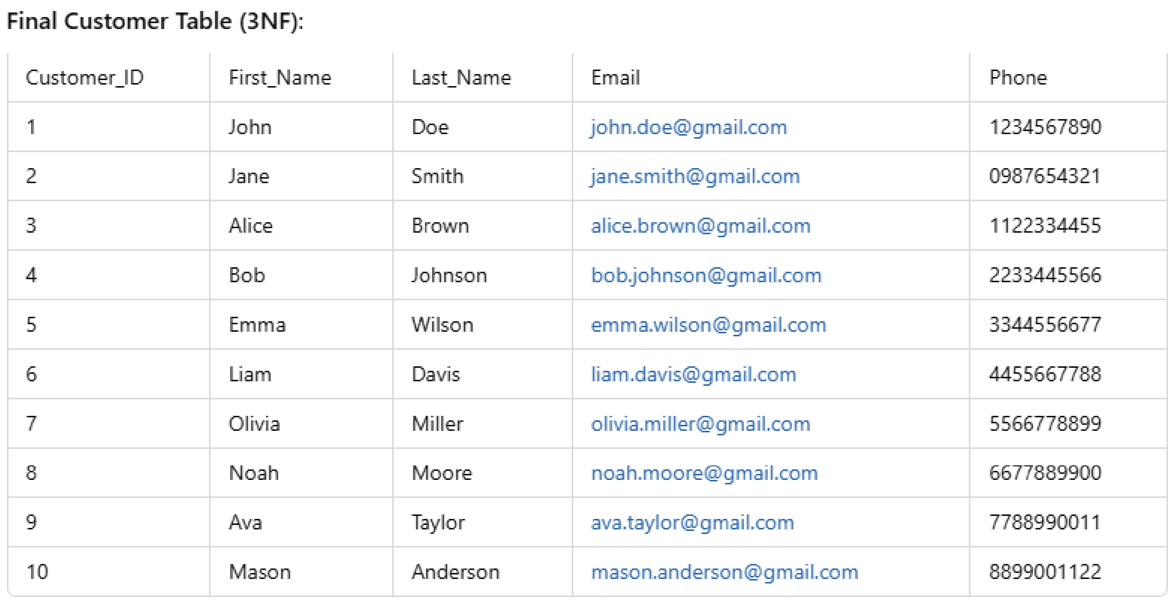
Normalized Customer Table (1NF):

Customer_ID	First_Name	Last_Name	Email	Phone
1	John	Doe	john.doe@gmail.com	1234567890
2	Jane	Smith	jane.smith@gmail.com	0987654321
3	Alice	Brown	alice.brown@gmail.com	1122334455
4	Bob	Johnson	bob.johnson@gmail.com	2233445566
5	Emma	Wilson	emma.wilson@gmail.com	3344556677
6	Liam	Davis	liam.davis@gmail.com	4455667788
7	Olivia	Miller	olivia.miller@gmail.com	5566778899
8	Noah	Moore	noah.moore@gmail.com	6677889900
9	Ava	Taylor	ava.taylor@gmail.com	7788990011
10	Mason	Anderson	mason.anderson@gmail.com	8899001122

Figure 11

Step 3: Third Normal Form (3NF)

Rule: Eliminate transitive dependencies.



Final Customer Table (3NF):

Customer_ID	First_Name	Last_Name	Email	Phone
1	John	Doe	john.doe@gmail.com	1234567890
2	Jane	Smith	jane.smith@gmail.com	0987654321
3	Alice	Brown	alice.brown@gmail.com	1122334455
4	Bob	Johnson	bob.johnson@gmail.com	2233445566
5	Emma	Wilson	emma.wilson@gmail.com	3344556677
6	Liam	Davis	liam.davis@gmail.com	4455667788
7	Olivia	Miller	olivia.miller@gmail.com	5566778899
8	Noah	Moore	noah.moore@gmail.com	6677889900
9	Ava	Taylor	ava.taylor@gmail.com	7788990011
10	Mason	Anderson	mason.anderson@gmail.com	8899001122

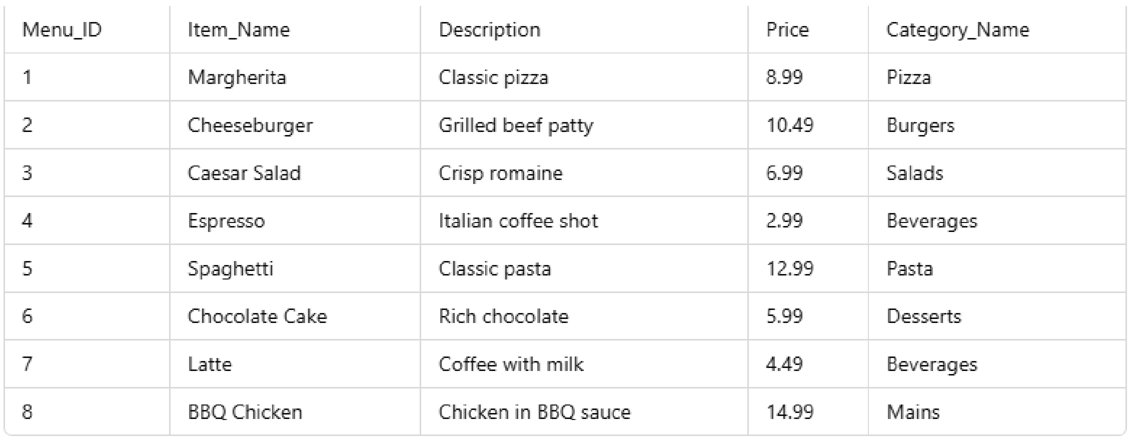
Figure 12

Problems:

There are no transitive dependencies. The 3NF is satisfied by the structure in its current state.

Entity 4: Menu

Unnormalized Menu Table



Menu_ID	Item_Name	Description	Price	Category_Name
1	Margherita	Classic pizza	8.99	Pizza
2	Cheeseburger	Grilled beef patty	10.49	Burgers
3	Caesar Salad	Crisp romaine	6.99	Salads
4	Espresso	Italian coffee shot	2.99	Beverages
5	Spaghetti	Classic pasta	12.99	Pasta
6	Chocolate Cake	Rich chocolate	5.99	Desserts
7	Latte	Coffee with milk	4.49	Beverages
8	BBQ Chicken	Chicken in BBQ sauce	14.99	Mains

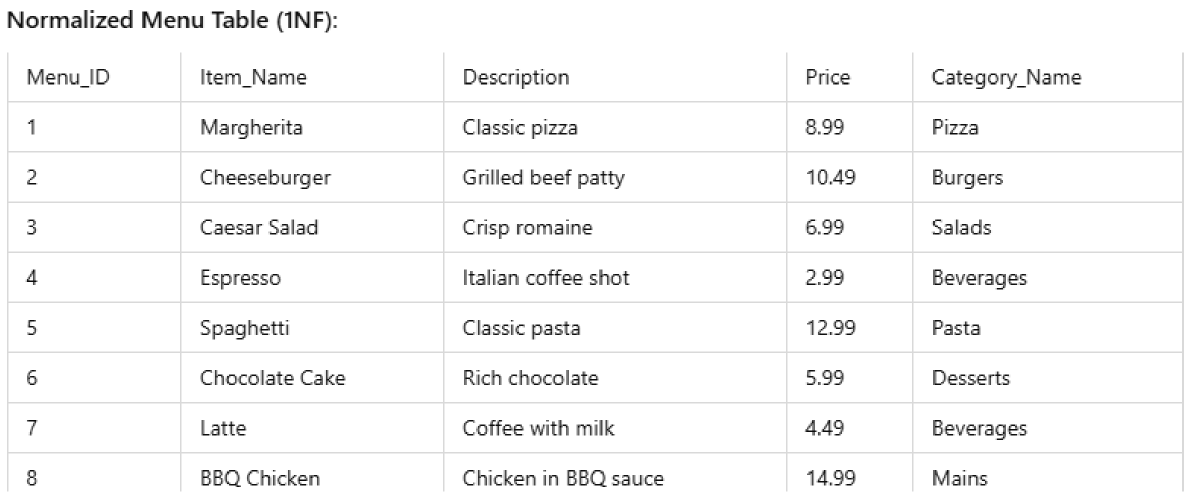
Figure 13

First Normal Form (1NF): Step 1

Rule: Guarantee that the values are atomic.

Problems:

Atomic values are present in all attributes; there are no multivalued attributes.



Normalized Menu Table (1NF):

Menu_ID	Item_Name	Description	Price	Category_Name
1	Margherita	Classic pizza	8.99	Pizza
2	Cheeseburger	Grilled beef patty	10.49	Burgers
3	Caesar Salad	Crisp romaine	6.99	Salads
4	Espresso	Italian coffee shot	2.99	Beverages
5	Spaghetti	Classic pasta	12.99	Pasta
6	Chocolate Cake	Rich chocolate	5.99	Desserts
7	Latte	Coffee with milk	4.49	Beverages
8	BBQ Chicken	Chicken in BBQ sauce	14.99	Mains

Figure 14

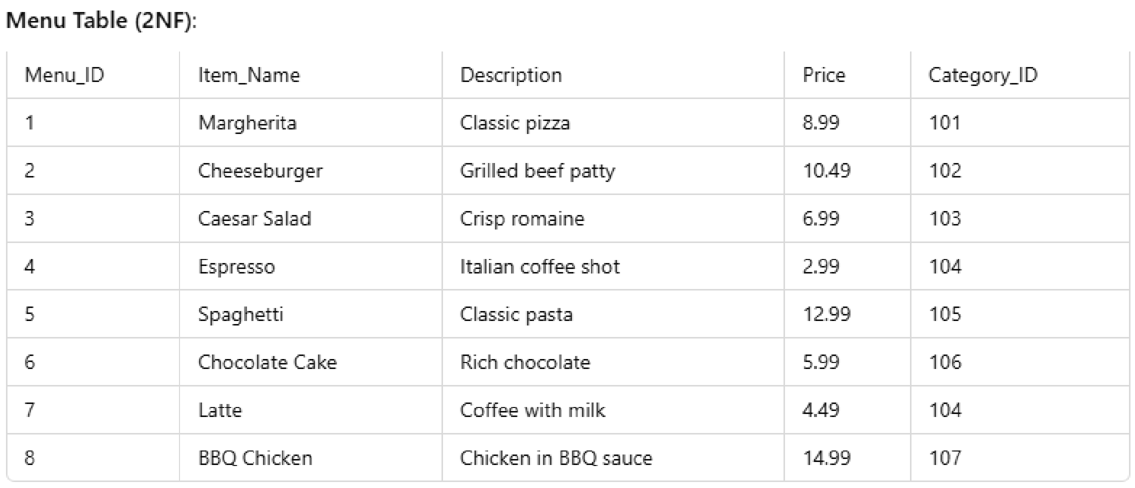
Step 2: Second Normal Form (2NF)

Rule: Eliminate partial dependencies.

Problems:

Menu_ID is a determinant of Category_Name; however, it may be relocated to a distinct Category table.

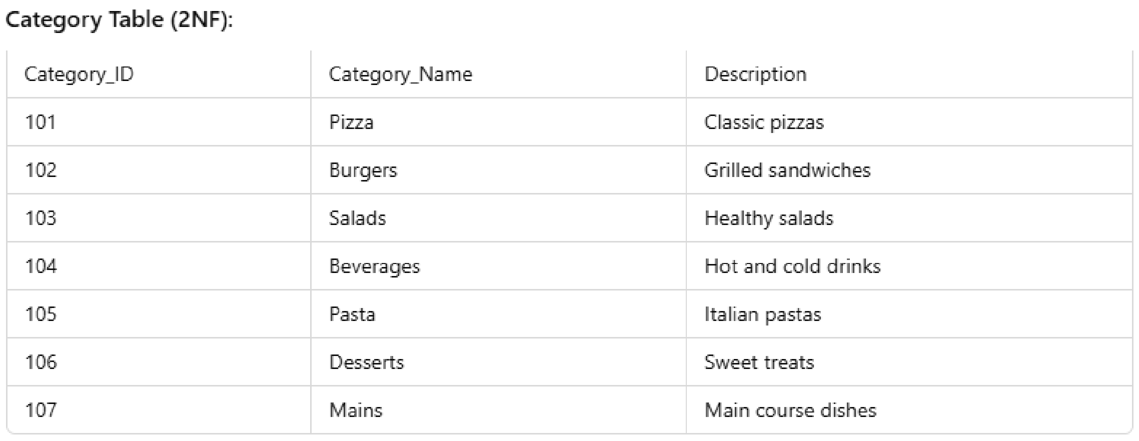
Solution: Create a Category table and reference it in the Menu table using a foreign key.



Menu Table (2NF):

Menu_ID	Item_Name	Description	Price	Category_ID
1	Margherita	Classic pizza	8.99	101
2	Cheeseburger	Grilled beef patty	10.49	102
3	Caesar Salad	Crisp romaine	6.99	103
4	Espresso	Italian coffee shot	2.99	104
5	Spaghetti	Classic pasta	12.99	105
6	Chocolate Cake	Rich chocolate	5.99	106
7	Latte	Coffee with milk	4.49	104
8	BBQ Chicken	Chicken in BBQ sauce	14.99	107

Figure 15



Category Table (2NF):

Category_ID	Category_Name	Description
101	Pizza	Classic pizzas
102	Burgers	Grilled sandwiches
103	Salads	Healthy salads
104	Beverages	Hot and cold drinks
105	Pasta	Italian pastas
106	Desserts	Sweet treats
107	Mains	Main course dishes

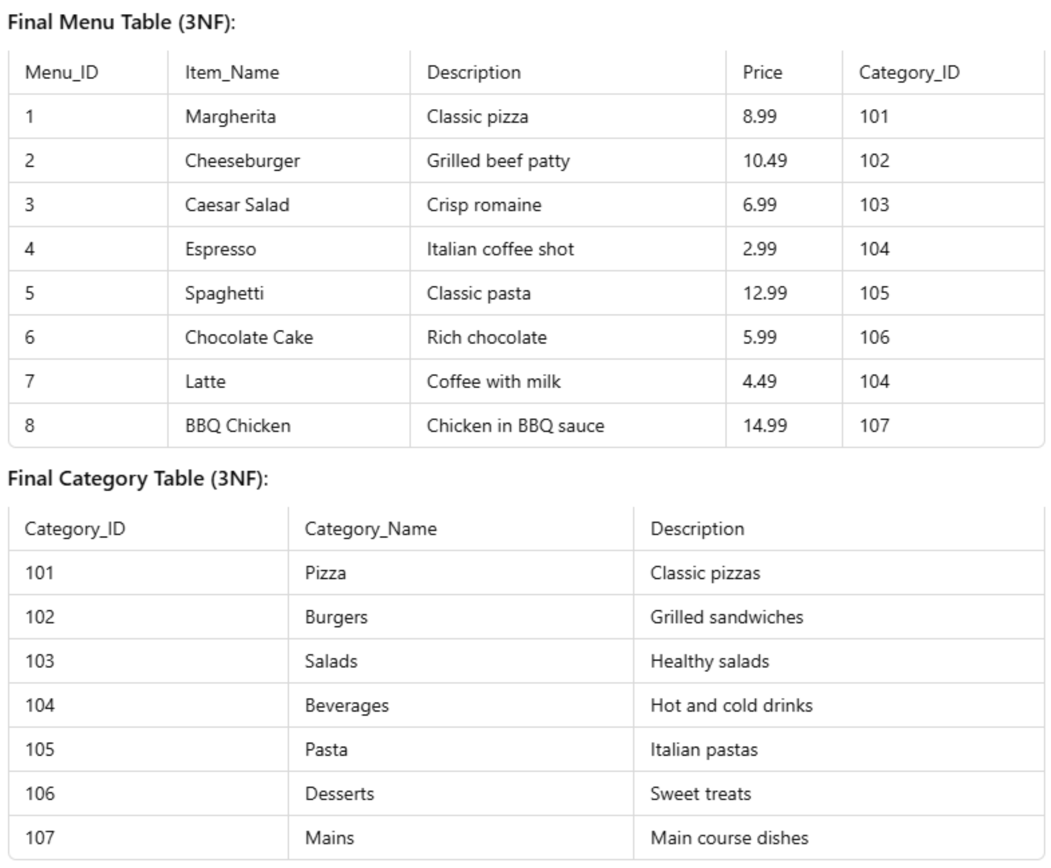
Figure 16

Step 3: Third Normal Form (3NF)

Rule: Eliminate transitive dependencies.

Problems:

The Menu and Category tables do not contain any transitive dependencies.



Final Menu Table (3NF):

Menu_ID	Item_Name	Description	Price	Category_ID
1	Margherita	Classic pizza	8.99	101
2	Cheeseburger	Grilled beef patty	10.49	102
3	Caesar Salad	Crisp romaine	6.99	103
4	Espresso	Italian coffee shot	2.99	104
5	Spaghetti	Classic pasta	12.99	105
6	Chocolate Cake	Rich chocolate	5.99	106
7	Latte	Coffee with milk	4.49	104
8	BBQ Chicken	Chicken in BBQ sauce	14.99	107

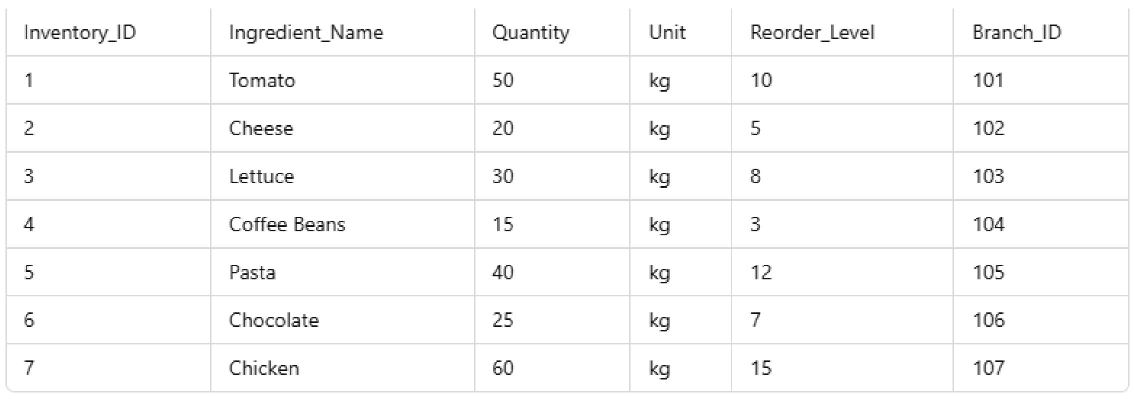
Final Category Table (3NF):

Category_ID	Category_Name	Description
101	Pizza	Classic pizzas
102	Burgers	Grilled sandwiches
103	Salads	Healthy salads
104	Beverages	Hot and cold drinks
105	Pasta	Italian pastas
106	Desserts	Sweet treats
107	Mains	Main course dishes

Figure 17

Entity 7: Inventory

Unnormalized Inventory Table



Inventory_ID	Ingredient_Name	Quantity	Unit	Reorder_Level	Branch_ID
1	Tomato	50	kg	10	101
2	Cheese	20	kg	5	102
3	Lettuce	30	kg	8	103
4	Coffee Beans	15	kg	3	104
5	Pasta	40	kg	12	105
6	Chocolate	25	kg	7	106
7	Chicken	60	kg	15	107

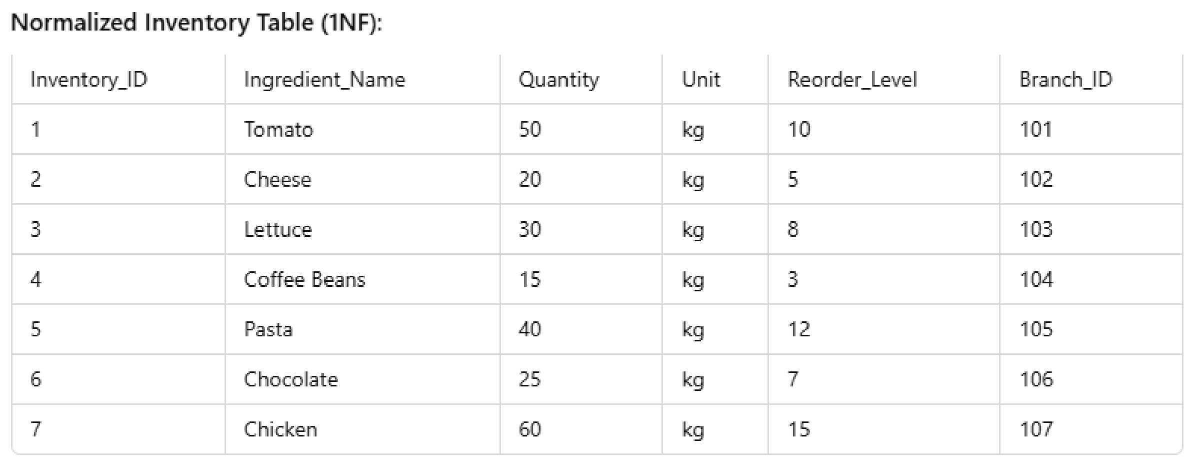
Figure 18

First Normal Form (1NF): Step 1

Rule: Guarantee that the values are atomic.

Problems:

Atomic values are present in all attributes; there are no multivalued attributes.



Normalized Inventory Table (1NF):

Inventory_ID	Ingredient_Name	Quantity	Unit	Reorder_Level	Branch_ID
1	Tomato	50	kg	10	101
2	Cheese	20	kg	5	102
3	Lettuce	30	kg	8	103
4	Coffee Beans	15	kg	3	104
5	Pasta	40	kg	12	105
6	Chocolate	25	kg	7	106
7	Chicken	60	kg	15	107

Figure 19

Step 2: Second Normal Form (2NF)

Rule: Eliminate partial dependencies.

Problems:

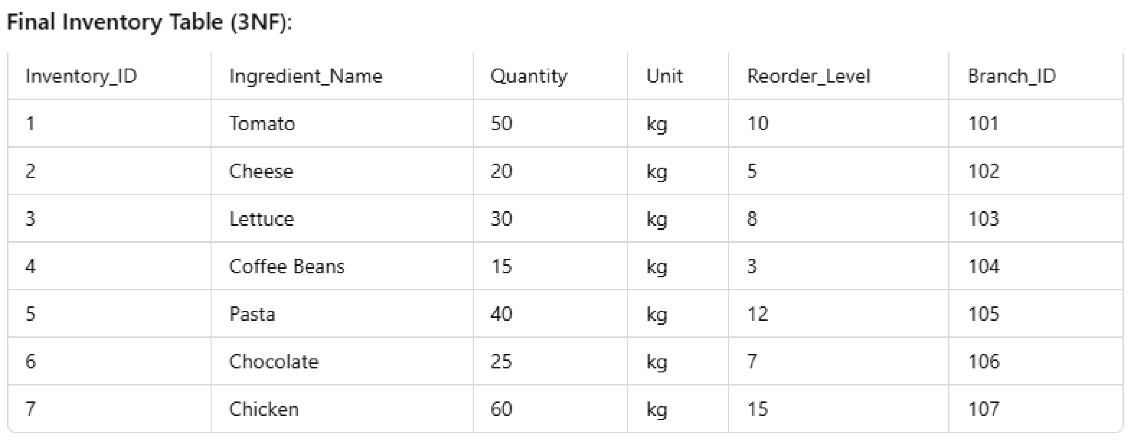
The fundamental key (Inventory_ID) is the determining factor for all non-key attributes. 2NF is satisfied by the data.

Step 3: Third Normal Form (3NF)

Rule: Eliminate transitive dependencies.

Problems:

The table does not contain any transitive dependencies. The 3NF is satisfied by the structure in its current state.

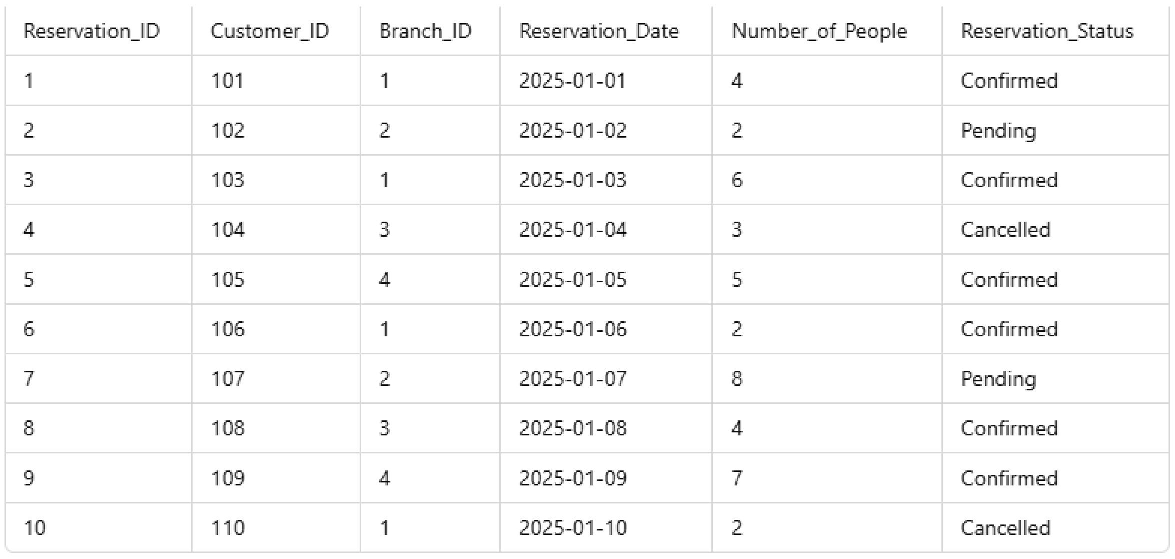


Final Inventory Table (3NF):

Inventory_ID	Ingredient_Name	Quantity	Unit	Reorder_Level	Branch_ID
1	Tomato	50	kg	10	101
2	Cheese	20	kg	5	102
3	Lettuce	30	kg	8	103
4	Coffee Beans	15	kg	3	104
5	Pasta	40	kg	12	105
6	Chocolate	25	kg	7	106
7	Chicken	60	kg	15	107

Figure 20

Entity: Reservation Unnormalized Reservation Table



Reservation_ID	Customer_ID	Branch_ID	Reservation_Date	Number_of_People	Reservation_Status
1	101	1	2025-01-01	4	Confirmed
2	102	2	2025-01-02	2	Pending
3	103	1	2025-01-03	6	Confirmed
4	104	3	2025-01-04	3	Cancelled
5	105	4	2025-01-05	5	Confirmed
6	106	1	2025-01-06	2	Confirmed
7	107	2	2025-01-07	8	Pending
8	108	3	2025-01-08	4	Confirmed
9	109	4	2025-01-09	7	Confirmed
10	110	1	2025-01-10	2	Cancelled

Figure 21

First Normal Form (1NF): Step 1

Rule: Guarantee that the values are atomic. Eliminate attributes that have multiple values.

Normalized Reservation Table (1NF):

Step 2: Second Normal Form (2NF)

Rule: Eliminate partial dependencies.

Analysis:

All non-key attributes (Reservation_Date, Number_of_People, Reservation_Status) depend wholly on the primary key (Reservation_ID).

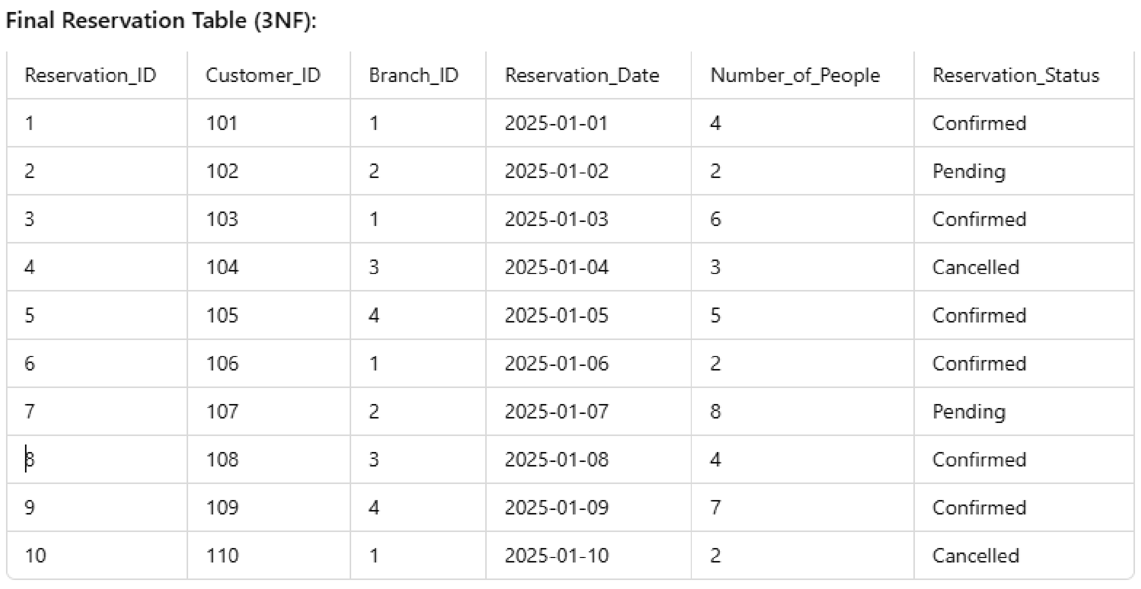
No further adjustments are required as the table already satisfies 2NF.

Step 3: Third Normal Form (3NF)

Rule: Eliminate transitive dependencies.

Examination:

There are no transitive dependencies. 3NF is satisfied by the data.



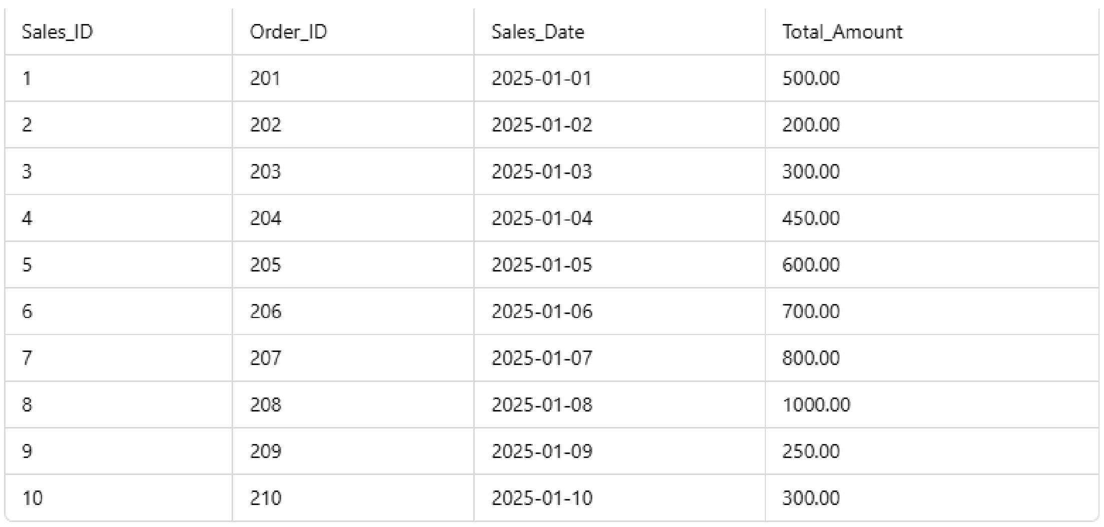
Final Reservation Table (3NF):

Reservation_ID	Customer_ID	Branch_ID	Reservation_Date	Number_of_People	Reservation_Status
1	101	1	2025-01-01	4	Confirmed
2	102	2	2025-01-02	2	Pending
3	103	1	2025-01-03	6	Confirmed
4	104	3	2025-01-04	3	Cancelled
5	105	4	2025-01-05	5	Confirmed
6	106	1	2025-01-06	2	Confirmed
7	107	2	2025-01-07	8	Pending
8	108	3	2025-01-08	4	Confirmed
9	109	4	2025-01-09	7	Confirmed
10	110	1	2025-01-10	2	Cancelled

Figure 22

Entity: Sales

Unnormalized Sales Table



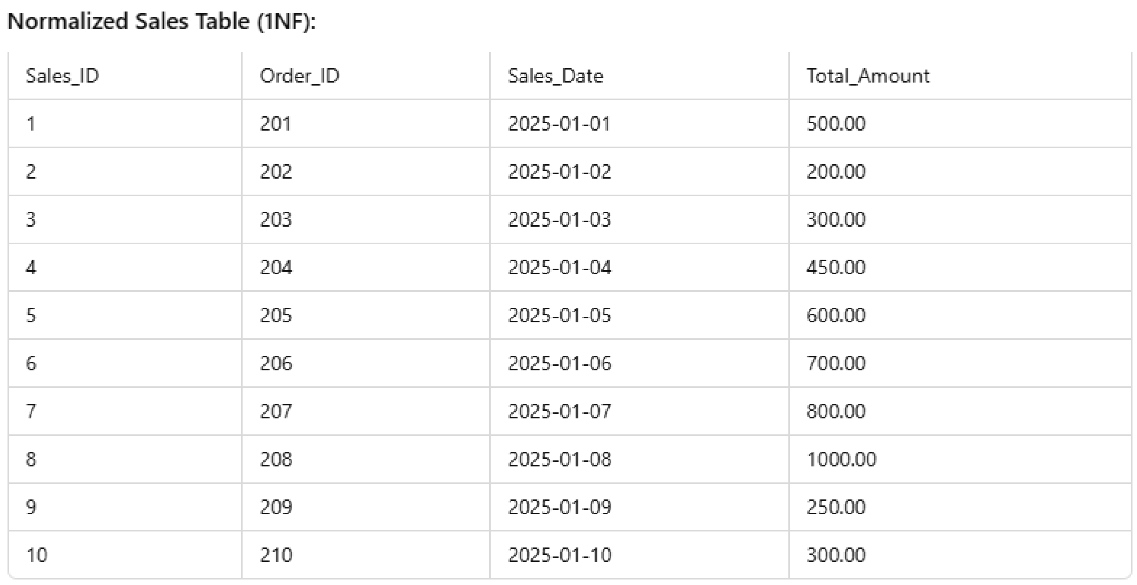
Sales_ID	Order_ID	Sales_Date	Total_Amount
1	201	2025-01-01	500.00
2	202	2025-01-02	200.00
3	203	2025-01-03	300.00
4	204	2025-01-04	450.00
5	205	2025-01-05	600.00
6	206	2025-01-06	700.00
7	207	2025-01-07	800.00
8	208	2025-01-08	1000.00
9	209	2025-01-09	250.00
10	210	2025-01-10	300.00

Figure 23

First Normal Form (1NF): Step 1

Rule: Guarantee that the values are atomic.

Normalized Sales Table (1NF):



Normalized Sales Table (1NF):

Sales_ID	Order_ID	Sales_Date	Total_Amount
1	201	2025-01-01	500.00
2	202	2025-01-02	200.00
3	203	2025-01-03	300.00
4	204	2025-01-04	450.00
5	205	2025-01-05	600.00
6	206	2025-01-06	700.00
7	207	2025-01-07	800.00
8	208	2025-01-08	1000.00
9	209	2025-01-09	250.00
10	210	2025-01-10	300.00

Figure 24

Step 2: Second Normal Form (2NF)

Rule: Eliminate partial dependencies.

Analysis:

All attributes that are not key are entirely dependent on the primary key (Sales_ID).

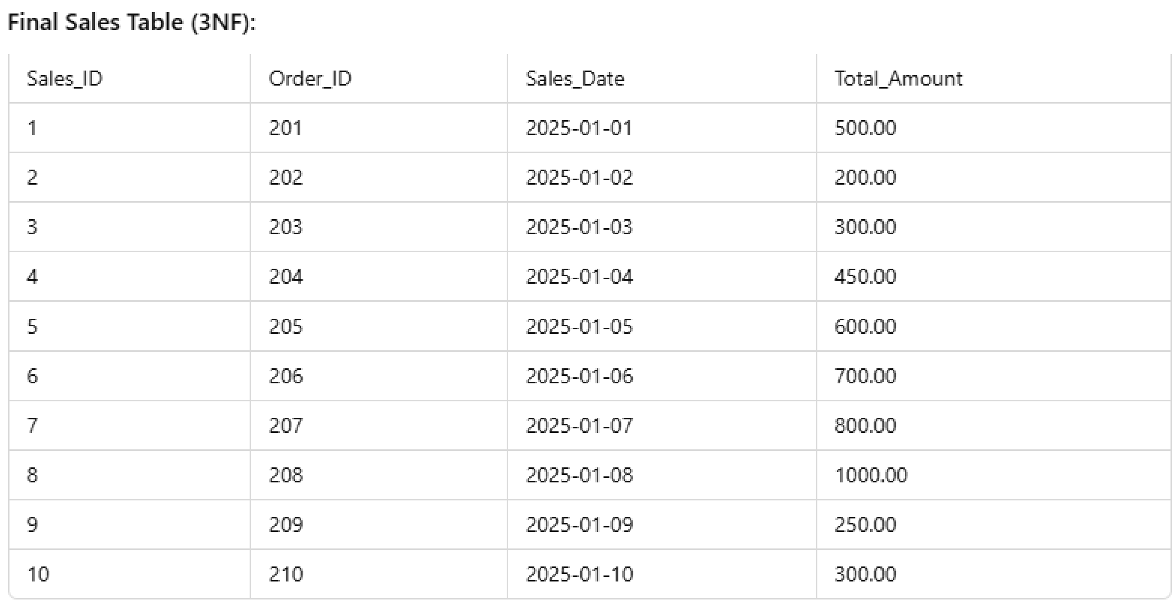
The table already meets 2NF, so no additional modifications are necessary.

Step 3: Third Normal Form (3NF)

Rule: Eliminate transitive dependencies.

Examination:

There are no transitive dependencies. 3NF is satisfied by the data.



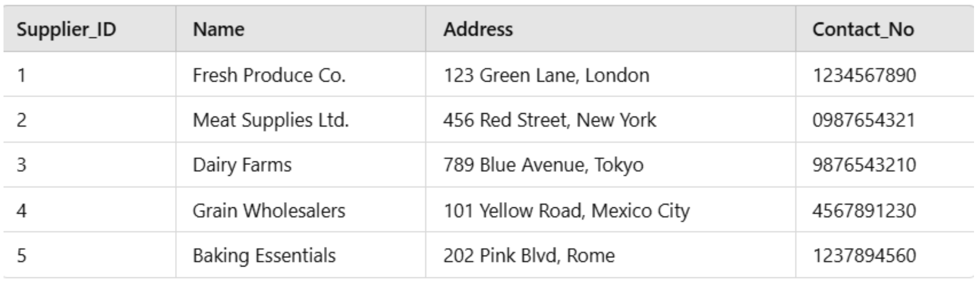
Final Sales Table (3NF):

Sales_ID	Order_ID	Sales_Date	Total_Amount
1	201	2025-01-01	500.00
2	202	2025-01-02	200.00
3	203	2025-01-03	300.00
4	204	2025-01-04	450.00
5	205	2025-01-05	600.00
6	206	2025-01-06	700.00
7	207	2025-01-07	800.00
8	208	2025-01-08	1000.00
9	209	2025-01-09	250.00
10	210	2025-01-10	300.00

Figure 25

Entity: Report

Unnormalized Supplier Table



Supplier_ID	Name	Address	Contact_No
1	Fresh Produce Co.	123 Green Lane, London	1234567890
2	Meat Supplies Ltd.	456 Red Street, New York	0987654321
3	Dairy Farms	789 Blue Avenue, Tokyo	9876543210
4	Grain Wholesalers	101 Yellow Road, Mexico City	4567891230
5	Baking Essentials	202 Pink Blvd, Rome	1237894560

Figure 26

First Normal Form (1NF)
To fulfill the requirements of First Normal Form (1NF), the table must:

Include solely atomic values.
Possess a distinct identifier (primary key).
The table complies with 1NF, as all values are atomic, and Supplier_ID serves as the primary key.

Second Normal Form (2NF) normalization
To fulfill the requirements of Second Normal Form (2NF), the table must:

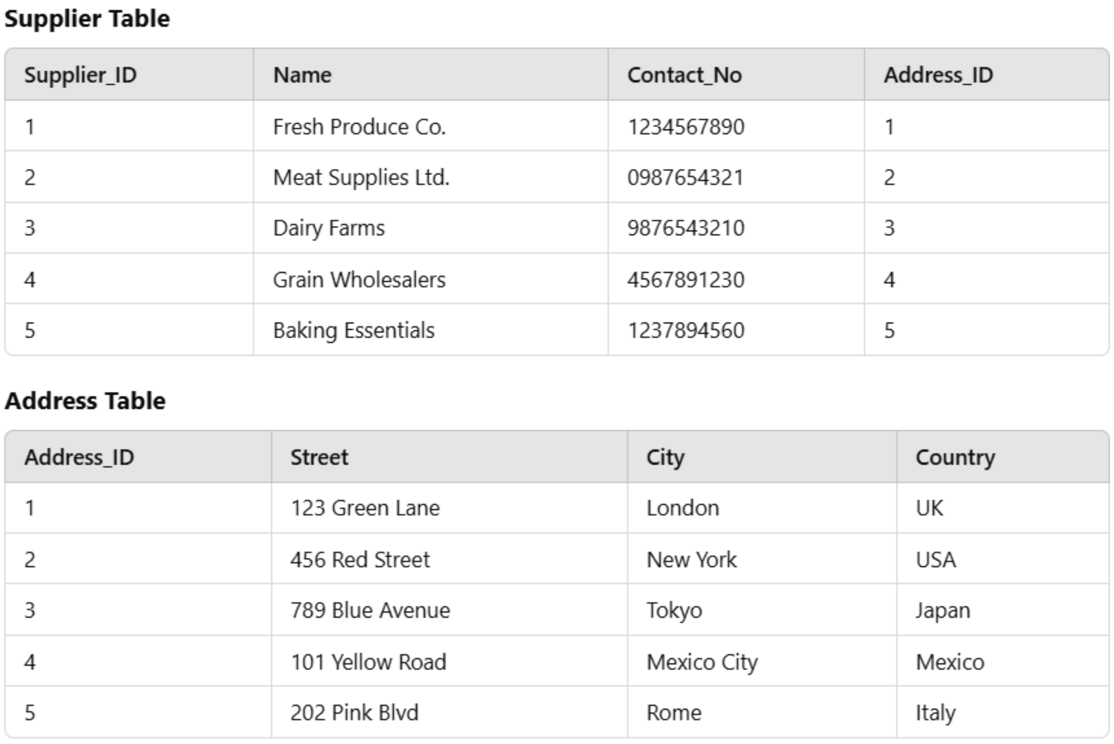
Adhere to First Normal Form (1NF).
Verify that all non-key properties are entirely dependent on the primary key.
The table fulfills this criterion, as Name, Address, and Contact_No are entirely dependent on Supplier_ID. No partial dependency exists as Supplier_ID is the sole key.

Third Normal Form (3NF) normalization
To comply with the Third Normal Form (3NF), the table must:

Achieve Second Normal Form (2NF).
Remove transitive dependencies (no non-key attribute relies on another non-key element).
The Address column comprises composite information (Street, City, Country) and can be disaggregated into distinct fields. This mitigates repetition and guarantees appropriate normalization.

Conclusive Normalized Tables

The original supplier table into two distinct tables: Supplier and Address.



Supplier Table

Supplier_ID	Name	Contact_No	Address_ID
1	Fresh Produce Co.	1234567890	1
2	Meat Supplies Ltd.	0987654321	2
3	Dairy Farms	9876543210	3
4	Grain Wholesalers	4567891230	4
5	Baking Essentials	1237894560	5

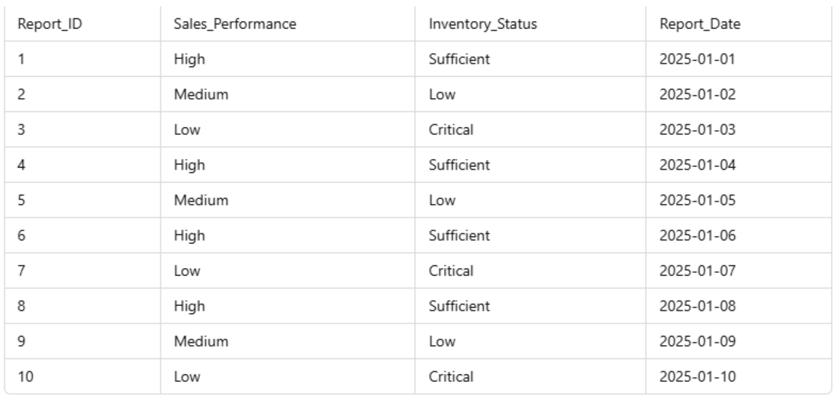
Address Table

Address_ID	Street	City	Country
1	123 Green Lane	London	UK
2	456 Red Street	New York	USA
3	789 Blue Avenue	Tokyo	Japan
4	101 Yellow Road	Mexico City	Mexico
5	202 Pink Blvd	Rome	Italy

Figure 27

Entity: Report

Unnormalized Report Table



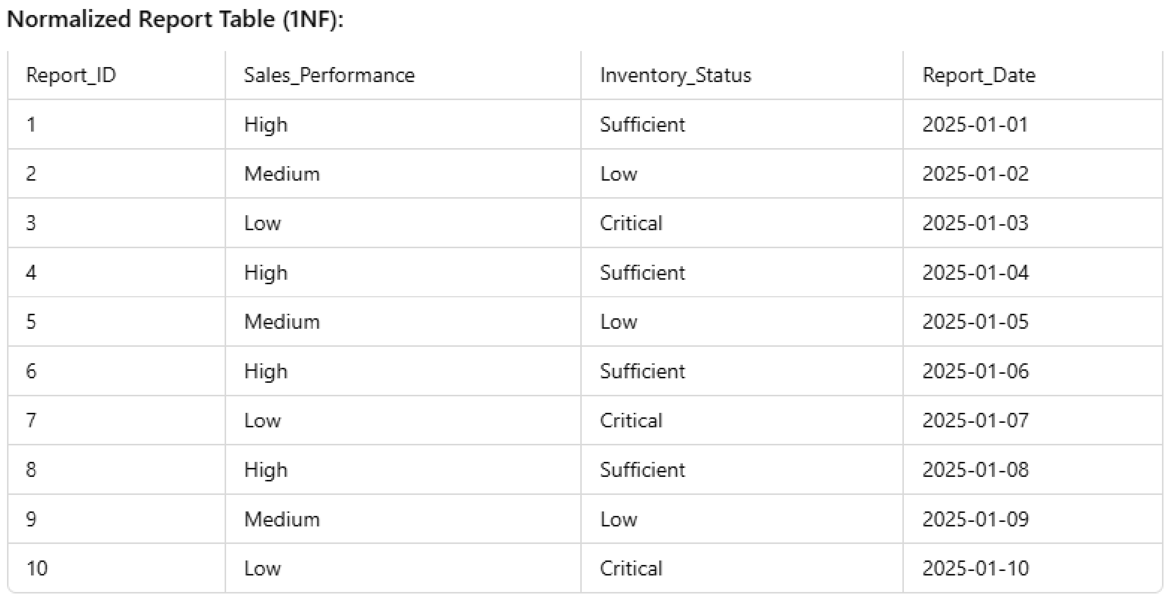
Report_ID	Sales_Performance	Inventory_Status	Report_Date
1	High	Sufficient	2025-01-01
2	Medium	Low	2025-01-02
3	Low	Critical	2025-01-03
4	High	Sufficient	2025-01-04
5	Medium	Low	2025-01-05
6	High	Sufficient	2025-01-06
7	Low	Critical	2025-01-07
8	High	Sufficient	2025-01-08
9	Medium	Low	2025-01-09
10	Low	Critical	2025-01-10

Figure 28

First Normal Form (1NF): Step 1

Rule: Guarantee that the values are atomic.

Normalized Report Table (1NF):



Normalized Report Table (1NF):

Report_ID	Sales_Performance	Inventory_Status	Report_Date
1	High	Sufficient	2025-01-01
2	Medium	Low	2025-01-02
3	Low	Critical	2025-01-03
4	High	Sufficient	2025-01-04
5	Medium	Low	2025-01-05
6	High	Sufficient	2025-01-06
7	Low	Critical	2025-01-07
8	High	Sufficient	2025-01-08
9	Medium	Low	2025-01-09
10	Low	Critical	2025-01-10

Figure 29

Step 2: Second Normal Form (2NF)

Rule: Eliminate partial dependence.

Examination:

All non-key properties are entirely dependent on the primary key (Report_ID).

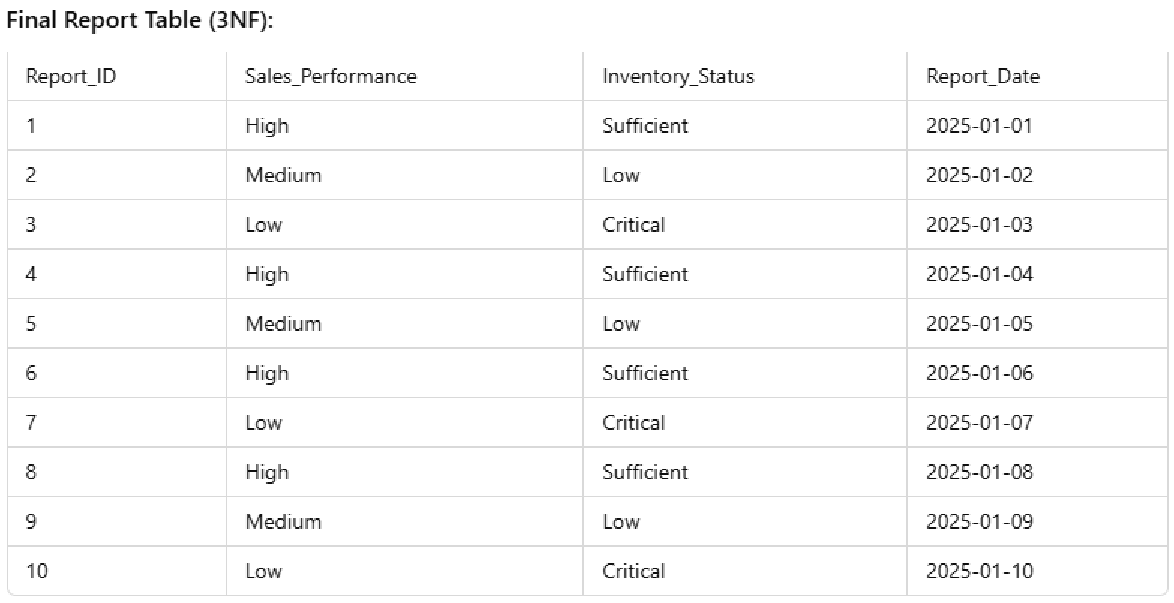
No other modifications are necessary, as the table already complies with Second Normal Form (2NF).

Step 3: Third Normal Form (3NF)

Rule: Eliminate transitive dependencies.

Examination:

There are no transitive dependencies present. The table complies with Third Normal Form (3NF).


Final Report Table (3NF):

Report_ID	Sales_Performance	Inventory_Status	Report_Date
1	High	Sufficient	2025-01-01
2	Medium	Low	2025-01-02
3	Low	Critical	2025-01-03
4	High	Sufficient	2025-01-04
5	Medium	Low	2025-01-05
6	High	Sufficient	2025-01-06
7	Low	Critical	2025-01-07
8	High	Sufficient	2025-01-08
9	Medium	Low	2025-01-09
10	Low	Critical	2025-01-10

Figure 30

4.4 Final Normalized Design in Third Normal Form (3NF)

The final design includes a collection of normalized tables wherein:

1. Tables for Restaurants and Branches:

- The Restaurant table is connected to Branches via Restaurant_ID (FK).
- Every branch is distinctly defined by features including Location, Manager_Name, and Contact_No.

2. Tables for Customers and Reservations:

- Customers are distinctly identifiable by Customer_ID, guaranteeing the accurate storage of all customer data, including Email and Phone.
- Reservations are standardized, associating Customer_ID and Branch_ID to prevent redundancy of branch or customer information.

3. Tables for Menu and Categories:

The Menu table references the Category table via Category_ID (FK), so preventing the repetition of category names in the menu items.

4. Tables for Orders, Sales, and Reports:

- Orders are executed inside a standardized framework, utilizing Customer_ID and Menu_ID while avoiding the redundancy of customer or menu information.
- Sales transactions are associated with orders, facilitating precise revenue tracking while distinguishing sales information from the order entity.
- Reports consolidate information from Sales and Inventory tables, offering performance insights while avoiding unnecessary data storage.

Elimination of Transitive Dependencies:

1. **Within the Menu entity:**

The Category_Name has been relocated to a distinct Category table, associated by Category_ID.

2. **Within the Reports entity:**

Properties such as Sales_Performance and Inventory_Status were directly linked to Report_ID, eliminating any indirect dependencies via Sales_ID or other properties.

Throughout all entities:

Attributes were meticulously examined and categorized into corresponding tables, guaranteeing that each non-key attribute was entirely and directly reliant on its primary key.

Advantages of the Final Structure:

- Enhanced Data Integrity: By eliminating redundancies and dependencies, updates or deletions are guaranteed to only affect pertinent tables, thereby preserving consistency.
- Decreased Storage Requirements: By dividing attributes into smaller tables, duplication is minimised, and storage usage is optimized.
- Improved Query Performance: Efficient joins and queries are facilitated by well-structured tables, particularly for intricate reporting requirements.

- Scalability: The system can effortlessly accommodate new branches, menu categories, or reports without the need for substantial schema modifications.

This finalized 3NF structure guarantees that the database is optimized for efficient data management and retrieval, thereby satisfying the functional and non-functional requirements specified in the assessment brief.

Calculating Reorder Level for Inventory:

The Reorder Level in the inventory table is determined by past consumption trends and replenishment lead time. The calculation can be performed using the formula:

Formula for Reorder Level:

Illustrative Computation:

Mean Daily Consumption: 10 units/day

Delivery Time: 5 days

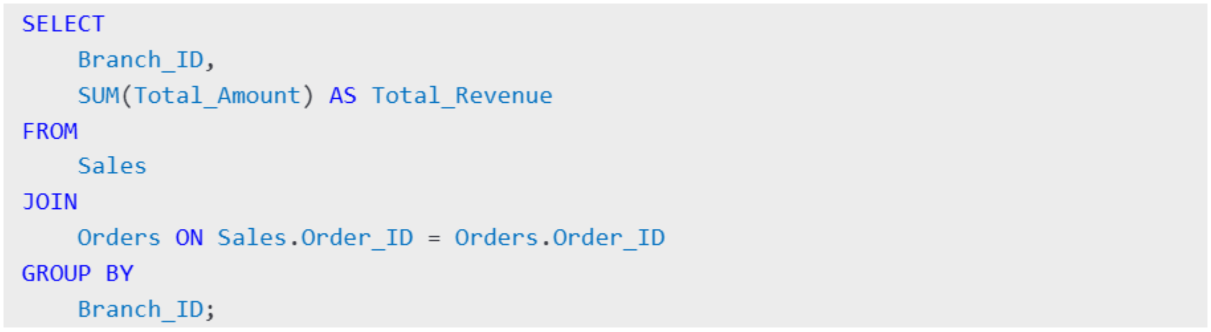
Safety Stock: 20 units

Reorder Threshold:

This value is stored as a static threshold in the inventory database for the purpose of monitoring stock levels.

SQL Query for Branch Revenue:

To calculate the revenue generated by each branch, the following SQL query can be used:



```sql
SELECT
    Branch_ID,
    SUM(Total_Amount) AS Total_Revenue
FROM
    Sales
JOIN
    Orders ON Sales.Order_ID = Orders.Order_ID
GROUP BY
    Branch_ID;
```

Figure 31

Explanation:

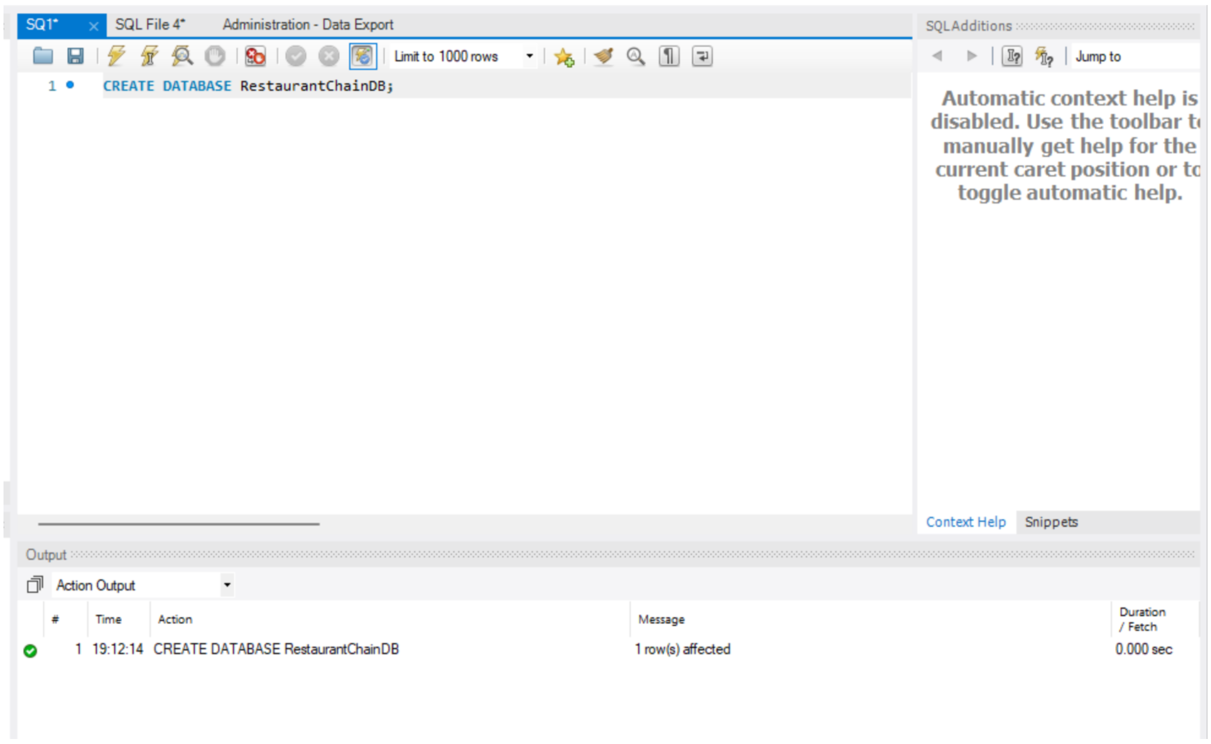
The query computes the total revenue (SUM(Total_Amount)) for each branch (Branch_ID) by combining the Sales table with the Orders table.

The GROUP BY clause categorizes the revenue totals by branch.

This finalized 3NF structure ensures the database is optimized for effective data management and retrieval, therefore fulfilling the functional and non-functional objectives outlined in the assessment brief.

5.1 Create Database

The **CREATE DATABASE** statement is commonly used in SQL to initialise a new database. As demonstrated in the script provided, the command for creating the database is:



```
CREATE DATABASE RestaurantChainDB;
```

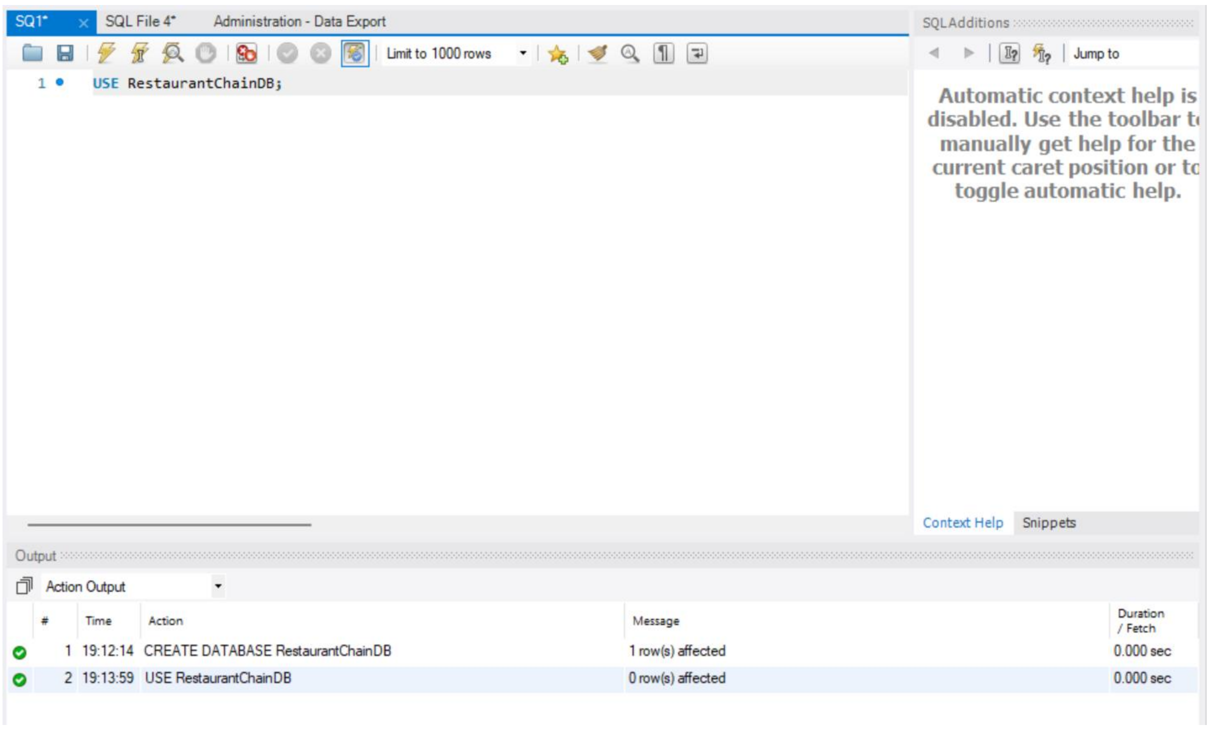
Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or to toggle automatic help.

```
#   Time      Action                                Message              Duration / Fetch
1   19:12:14  CREATE DATABASE RestaurantChainDB     1 row(s) affected    0.000 sec
```

Figure 32

This corresponds with the elucidation offered by W3Schools (n.d.), which emphasizes the role of this statement in establishing a database within a SQL context.

5.2 The **USE** statement in SQL is utilised to designate a certain database for subsequent actions. The command to utilize the database in the provided script is:


SQ1*
SQL File 4*
Administration - Data Export
Limit to 1000 rows
SQLAdditions
Jump to
Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or to toggle automatic help.
Context Help
Snippets
Output
Action Output

```
USE RestaurantChainDB;
```

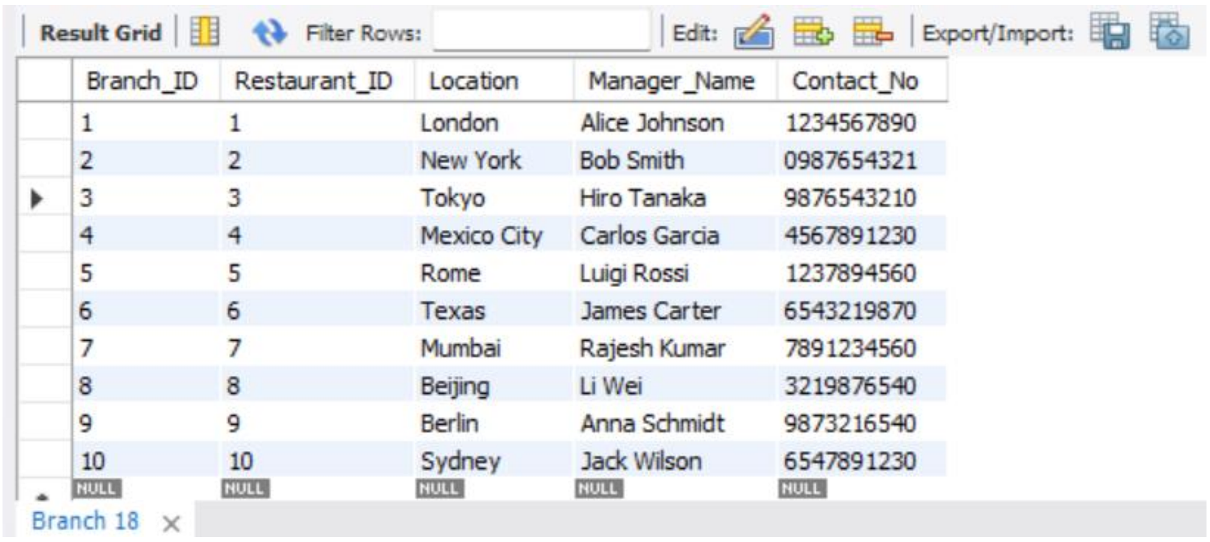
```
#  Time      Action                              Message              Duration / Fetch
1  19:12:14  CREATE DATABASE RestaurantChainDB   1 row(s) affected    0.000 sec
2  19:13:59  USE RestaurantChainDB               0 row(s) affected    0.000 sec
```

Figure 33

This aligns with W3Schools' (n.d.) description, which characterizes the USE statement as a method for designating the database context for running SQL queries.

5.3 **SQL Script for Creating Tables with Key Constraints**

Branch Table

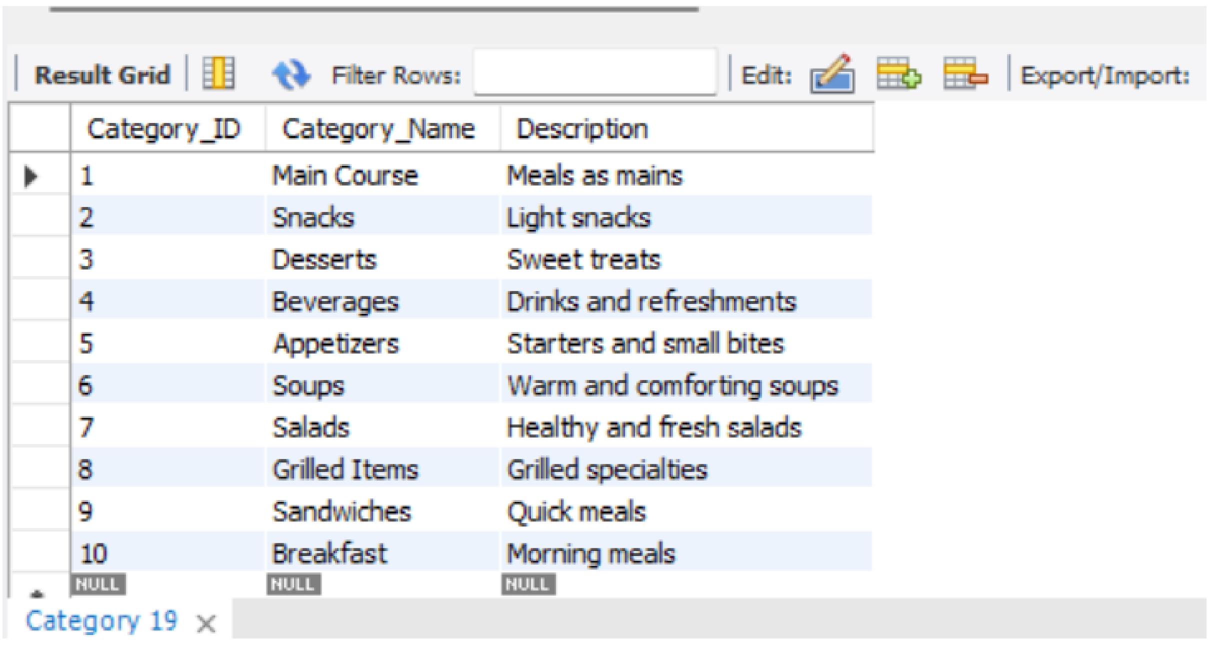


Branch_ID	Restaurant_ID	Location	Manager_Name	Contact_No
1	1	London	Alice Johnson	1234567890
2	2	New York	Bob Smith	0987654321
3	3	Tokyo	Hiro Tanaka	9876543210
4	4	Mexico City	Carlos Garcia	4567891230
5	5	Rome	Luigi Rossi	1237894560
6	6	Texas	James Carter	6543219870
7	7	Mumbai	Rajesh Kumar	7891234560
8	8	Beijing	Li Wei	3219876540
9	9	Berlin	Anna Schmidt	9873216540
10	10	Sydney	Jack Wilson	6547891230
NULL	NULL	NULL	NULL	NULL

Figure 34

The Branch table contains information about ten branches, including the following columns: Branch_ID, Restaurant_ID, Location, Manager_Name, and Contact_No. The Restaurant_ID foreign key is the connecting factor between each branch and its corresponding restaurant in this structure. In order to guarantee the data's integrity and dependability, NOT NULL constraints are implemented for all mandatory elements, including Branch_ID, Restaurant_ID, and Location.

In order to accommodate situations in which the data may not be immediately accessible, the optional elements, including Manager_Name and Contact_No, permit NULL values. This design guarantees adaptability without sacrificing the table's functionality or purpose. These constraints are consistent with the most effective methods of relational database administration, which promotes accuracy and consistency (W3Schools, no date).



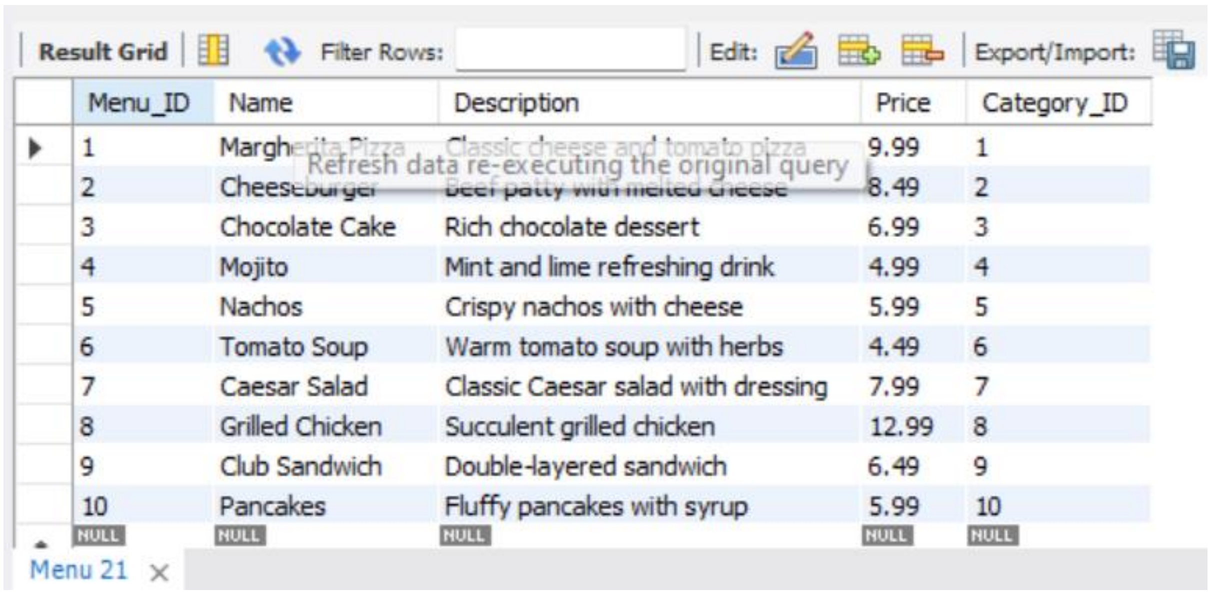
	Category_ID	Category_Name	Description
▶	1	Main Course	Meals as mains
	2	Snacks	Light snacks
	3	Desserts	Sweet treats
	4	Beverages	Drinks and refreshments
	5	Appetizers	Starters and small bites
	6	Soups	Warm and comforting soups
	7	Salads	Healthy and fresh salads
	8	Grilled Items	Grilled specialties
	9	Sandwiches	Quick meals
	10	Breakfast	Morning meals
	NULL	NULL	NULL

Figure 35

The Category table categorizes menu items into ten predetermined categories, such as Main Course, Snacks, and Desserts. The principal key is the Category_ID column, which uniquely identifies each category. Details regarding each category are furnished by the supplementary columns, Category_Name and Description.

In order to guarantee data integrity, constraints are enforced, including the NOT NULL constraint on Category_ID and Category_Name, which guarantees that each category is designated a distinct identifier and name (W3Schools, no date). In order to accommodate categories that may not necessitate further information, the Description column permits NULL values. This table design facilitates efficient data retrieval and promotes scalability when connected to the Menu table through foreign key relationships.

Menu Table



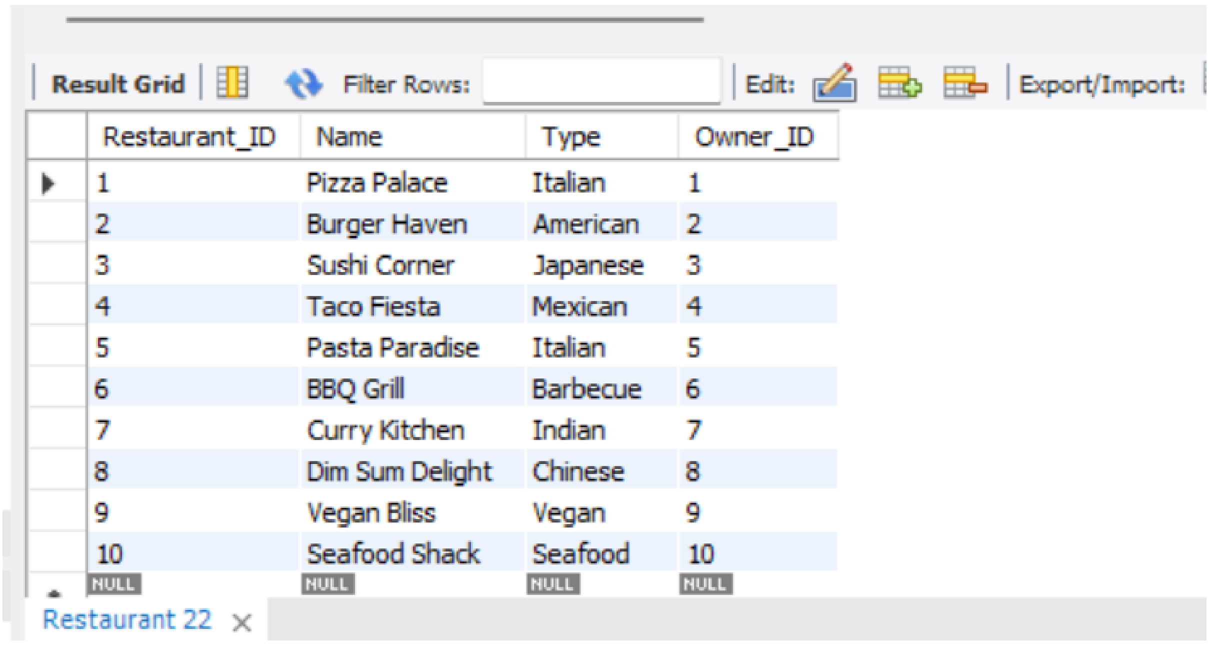
Menu_ID	Name	Description	Price	Category_ID
1	Margherita Pizza	Classic cheese and tomato pizza	9.99	1
2	Cheeseburger	Beef patty with melted cheese	8.49	2
3	Chocolate Cake	Rich chocolate dessert	6.99	3
4	Mojito	Mint and lime refreshing drink	4.99	4
5	Nachos	Crispy nachos with cheese	5.99	5
6	Tomato Soup	Warm tomato soup with herbs	4.49	6
7	Caesar Salad	Classic Caesar salad with dressing	7.99	7
8	Grilled Chicken	Succulent grilled chicken	12.99	8
9	Club Sandwich	Double-layered sandwich	6.49	9
10	Pancakes	Fluffy pancakes with syrup	5.99	10
NULL	NULL	NULL	NULL	NULL

Figure 36

The Menu table specifies the possibilities inside a restaurant system, with each menu item clearly identified by the Menu_ID, which serves as the main key. The table includes essential attributes such as Name, Description, Price, and Category_ID. The Price column is regulated with a CHECK constraint to prohibit the input of negative numbers.

The Category_ID serves as a foreign key, linking the menu item to its respective category in the Category table, thus improving the organization and retrieval of menu items by category. Columns such as Name and Price are subject to NOT NULL constraints, ensuring that every menu item has a name and a price. Nonetheless, the Description column accommodates NULL values, permitting the omission of details. This comprehensive structure guarantees data integrity and scalability for the menu system. Moreover, the integrity checker verifies actions that alter the database, assuring compliance with constraints and database regulations (Connolly and Begg, 2015).

Restaurant Table



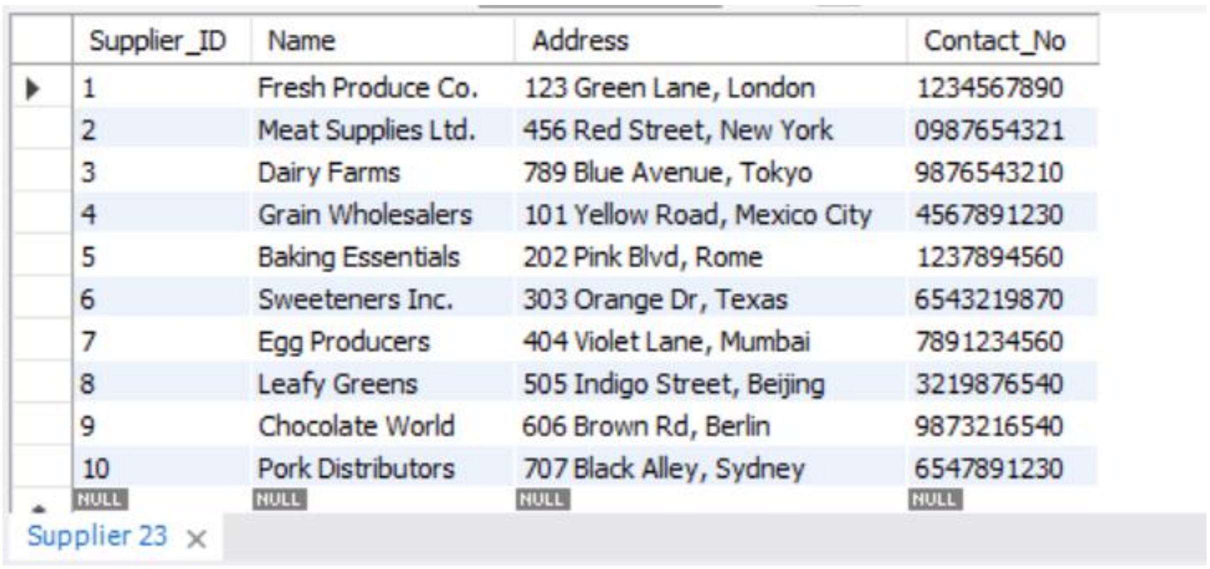
Restaurant_ID	Name	Type	Owner_ID
1	Pizza Palace	Italian	1
2	Burger Haven	American	2
3	Sushi Corner	Japanese	3
4	Taco Fiesta	Mexican	4
5	Pasta Paradise	Italian	5
6	BBQ Grill	Barbecue	6
7	Curry Kitchen	Indian	7
8	Dim Sum Delight	Chinese	8
9	Vegan Bliss	Vegan	9
10	Seafood Shack	Seafood	10
NULL	NULL	NULL	NULL

Figure 37

The Restaurant table is an essential element of the database, used to store and handle data on different eateries. Every restaurant is distinctly identified by the Restaurant_ID, which functions as the primary key. Essential properties like Name, Type, and Owner_ID guarantee thorough data representation. The Type column classifies restaurants by cuisine, following established categories such as "Italian," "American," and "Japanese," so ensuring data consistency.

The Owner_ID serves as a foreign key, connecting the restaurants to the relevant entries in the Owner table, thus preserving referential integrity. This relational framework, adhering to normalization principles, guarantees that the data is suitably organized to prevent redundancy and improve scalability. Columns like as Name and Type are subject to NOT NULL constraints, ensuring that each restaurant entry possesses established fundamental features (Connolly and Begg, 2015).

Supplier Table



Supplier_ID	Name	Address	Contact_No
1	Fresh Produce Co.	123 Green Lane, London	1234567890
2	Meat Supplies Ltd.	456 Red Street, New York	0987654321
3	Dairy Farms	789 Blue Avenue, Tokyo	9876543210
4	Grain Wholesalers	101 Yellow Road, Mexico City	4567891230
5	Baking Essentials	202 Pink Blvd, Rome	1237894560
6	Sweeteners Inc.	303 Orange Dr, Texas	6543219870
7	Egg Producers	404 Violet Lane, Mumbai	7891234560
8	Leafy Greens	505 Indigo Street, Beijing	3219876540
9	Chocolate World	606 Brown Rd, Berlin	9873216540
10	Pork Distributors	707 Black Alley, Sydney	6547891230
NULL	NULL	NULL	NULL

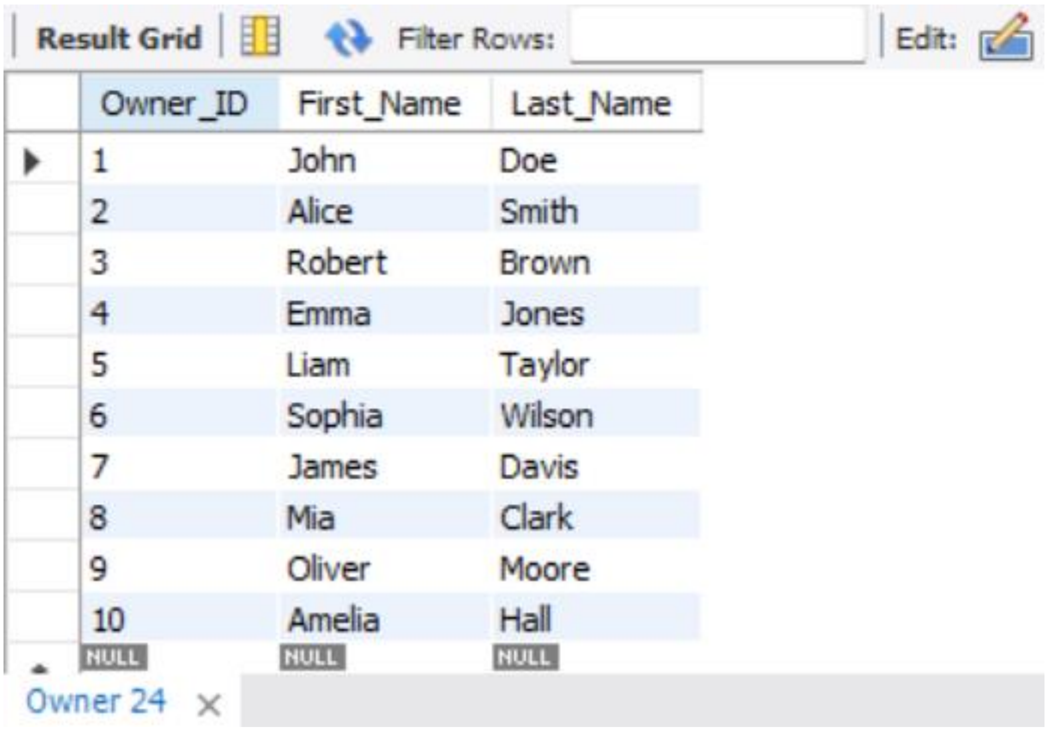
Figure 38

Report on Supplier Table

The **Supplier** table is a vital element of the relational database, storing details about suppliers that provide inventory items to the restaurant branches. Each supplier is uniquely identified by the Supplier_ID, serving as the primary key. Key attributes such as Name, Address, and Contact_No ensure comprehensive representation of supplier details, facilitating effective management and communication.

The Name and Contact_No columns are governed by NOT NULL constraints, ensuring that essential information about each supplier is provided. However, the Address column permits NULL values, offering flexibility for cases where address details may not be immediately available. This table structure adheres to the principles of normalization, as it ensures data integrity, reduces redundancy, and enhances scalability within the database system (Connolly and Begg, 2015).

Owner Table


Result Grid | Filter Rows: | Edit:

	Owner_ID	First_Name	Last_Name
▶	1	John	Doe
	2	Alice	Smith
	3	Robert	Brown
	4	Emma	Jones
	5	Liam	Taylor
	6	Sophia	Wilson
	7	James	Davis
	8	Mia	Clark
	9	Oliver	Moore
	10	Amelia	Hall
	NULL	NULL	NULL

Owner 24 ×

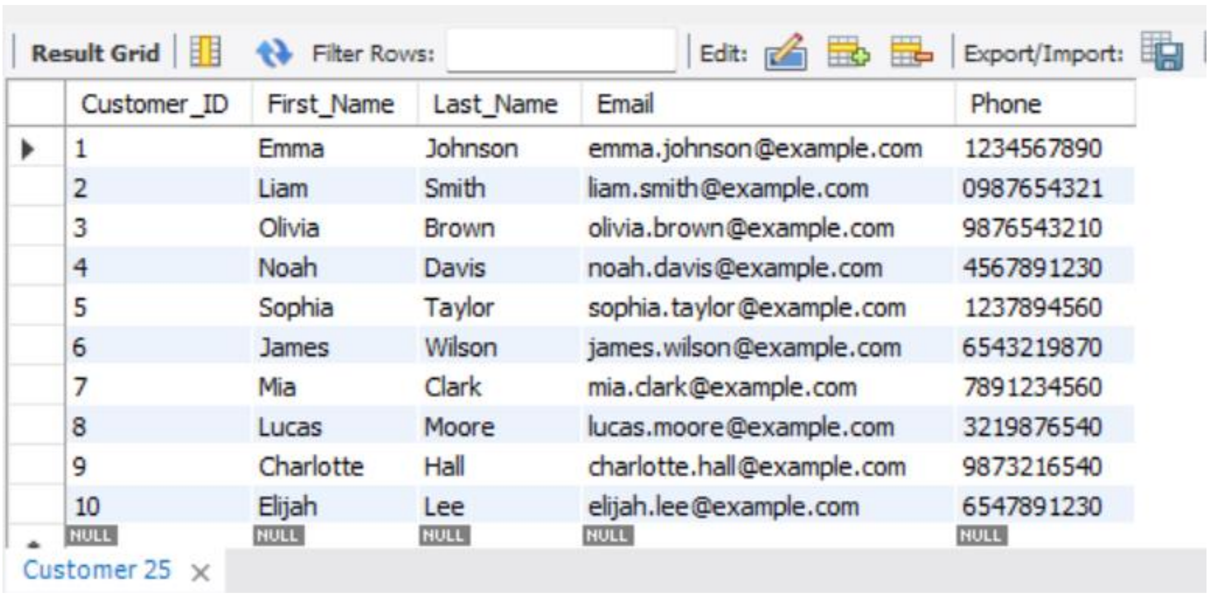
Figure 39

The **Owner** table contains essential information regarding the proprietors overseeing the restaurants within the system. Every owner is distinctly identified by the Owner_ID, which functions as the primary key. The table comprises properties like First_Name and Last_Name, facilitating the precise identification of each owner.

The First_Name and Last_Name columns are subject to NOT NULL restrictions, mandating the inclusion of crucial owner details. This approach improves data precision and mitigates the occurrence of incomplete information in the database. The lack of other optional features in this table enhances simplicity and concentrates exclusively on identifying owners.

This table complies with normalization standards by guaranteeing the uniqueness of each record and the atomicity of characteristics, hence preserving data integrity and eradicating redundancy (Connolly and Begg, 2015).

Customer Table



Result Grid | Filter Rows: | Edit: | Export/Import:

	Customer_ID	First_Name	Last_Name	Email	Phone
▶	1	Emma	Johnson	emma.johnson@example.com	1234567890
	2	Liam	Smith	liam.smith@example.com	0987654321
	3	Olivia	Brown	olivia.brown@example.com	9876543210
	4	Noah	Davis	noah.davis@example.com	4567891230
	5	Sophia	Taylor	sophia.taylor@example.com	1237894560
	6	James	Wilson	james.wilson@example.com	6543219870
	7	Mia	Clark	mia.clark@example.com	7891234560
	8	Lucas	Moore	lucas.moore@example.com	3219876540
	9	Charlotte	Hall	charlotte.hall@example.com	9873216540
	10	Elijah	Lee	elijah.lee@example.com	6547891230
*	NULL	NULL	NULL	NULL	NULL

Customer 25 ×

Figure 40

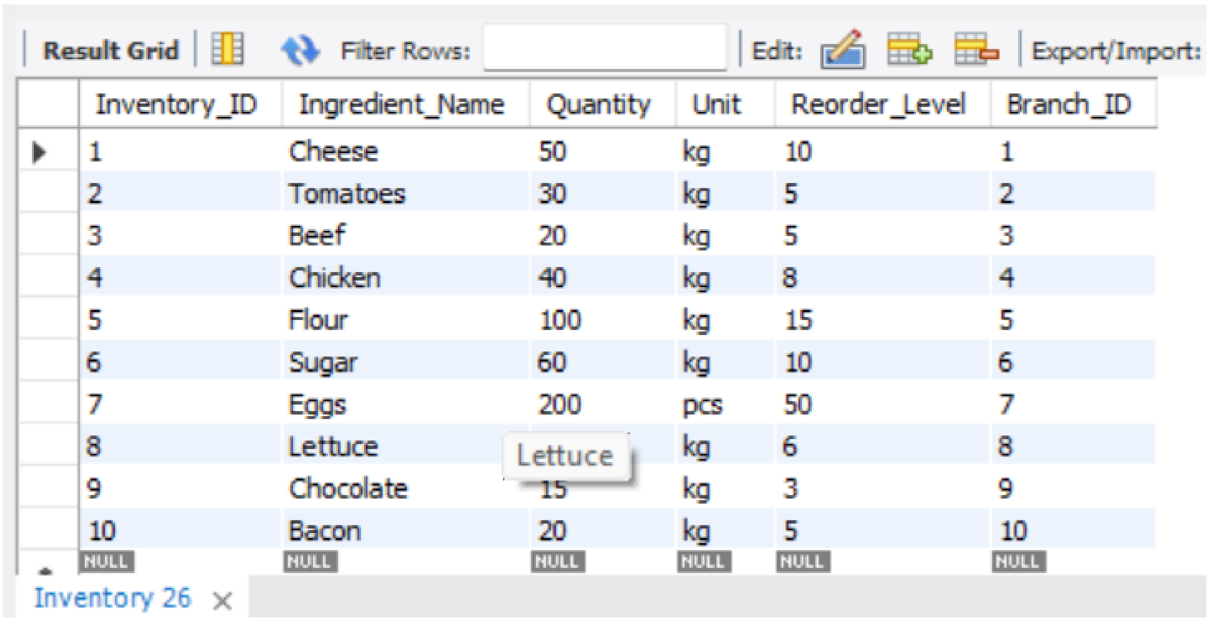
The Customer table offers a detailed summary of customer data, uniquely identifying each customer using the Customer_ID, which functions as the primary key. This guarantees that each consumer in the system is uniquely represented.

The principal attributes in this table comprise:

First_Name and Last_Name: These fields are constrained by NOT NULL requirements to guarantee that each customer is properly identified by their whole name.
Email: This field is essential for communication and is subject to a NOT NULL and UNIQUE constraint to exclude duplicate or absent email records, hence facilitating efficient customer identification.
Phone: Although not obligatory (NULL values are permissible), this field offers further contact information for clients.

The architecture complies with normalization principles by preserving atomic properties and eliminating redundancy. This guarantees that the table facilitates effective data storage and retrieval (Connolly and Begg, 2015).

Inventory Table



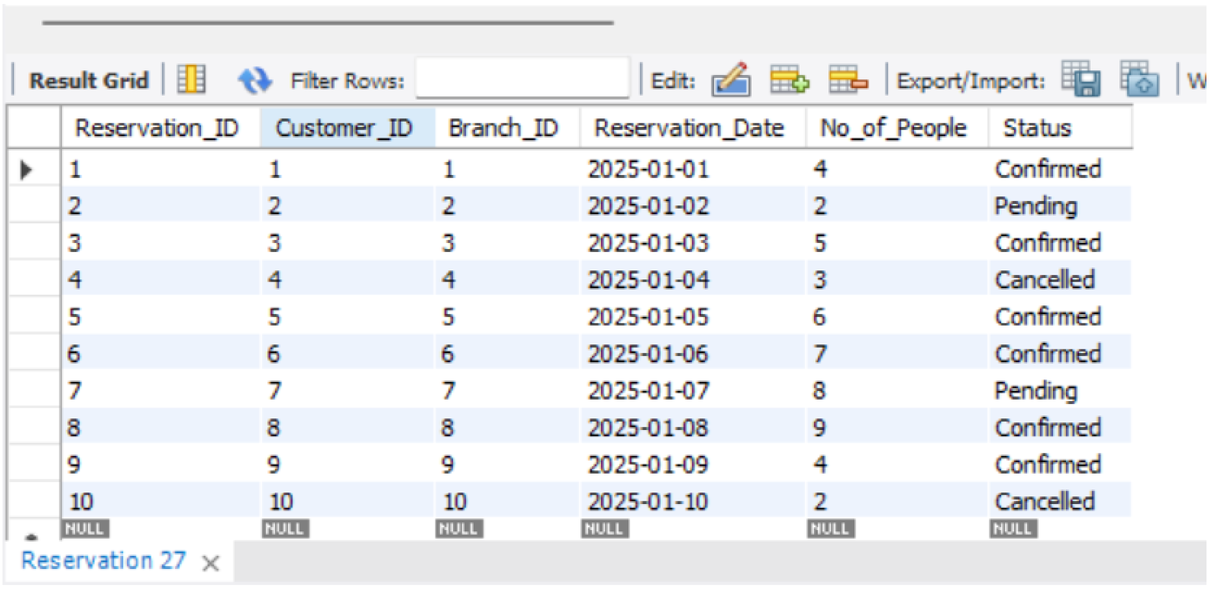
Inventory_ID	Ingredient_Name	Quantity	Unit	Reorder_Level	Branch_ID
1	Cheese	50	kg	10	1
2	Tomatoes	30	kg	5	2
3	Beef	20	kg	5	3
4	Chicken	40	kg	8	4
5	Flour	100	kg	15	5
6	Sugar	60	kg	10	6
7	Eggs	200	pcs	50	7
8	Lettuce	Lettuce	kg	6	8
9	Chocolate	15	kg	3	9
10	Bacon	20	kg	5	10
NULL	NULL	NULL	NULL	NULL	NULL

Figure 41

The Inventory table is essential for controlling the restaurant's supply and guaranteeing operational efficiency by monitoring ingredients and their quantities. Every inventory item is distinctly recognized by the Inventory_ID, which functions as the primary key.

The table encompasses essential attributes:

- **Ingredient_Name:** Denotes the designation of the ingredient, crucial for the identification and management of inventory items.
- **Quantity**: Denotes the present stock level of each element. A CHECK constraint guarantees the entry of only non-negative values, hence maintaining data integrity.
- **Unit**: Specifies the measurement unit (e.g., kg, pcs), ensuring uniformity in inventory management.
- **Reorder_Level**: Indicates the minimum inventory threshold that activates a reorder. This prevents stock shortages, which is essential for seamless restaurant operations.
- **Branch_ID**: Serves as a foreign key that associates each inventory item with a particular branch, facilitating localized inventory monitoring and administration. This table configuration guarantees precise and dynamic inventory oversight. It facilitates real-time updates of stock levels when inventory is utilized or restocked, a crucial practice for sustaining operational efficiency (Elmasri and Navathe, 2016).



Reservation_ID	Customer_ID	Branch_ID	Reservation_Date	No_of_People	Status
1	1	1	2025-01-01	4	Confirmed
2	2	2	2025-01-02	2	Pending
3	3	3	2025-01-03	5	Confirmed
4	4	4	2025-01-04	3	Cancelled
5	5	5	2025-01-05	6	Confirmed
6	6	6	2025-01-06	7	Confirmed
7	7	7	2025-01-07	8	Pending
8	8	8	2025-01-08	9	Confirmed
9	9	9	2025-01-09	4	Confirmed
10	10	10	2025-01-10	2	Cancelled
NULL	NULL	NULL	NULL	NULL	NULL

Figure 42

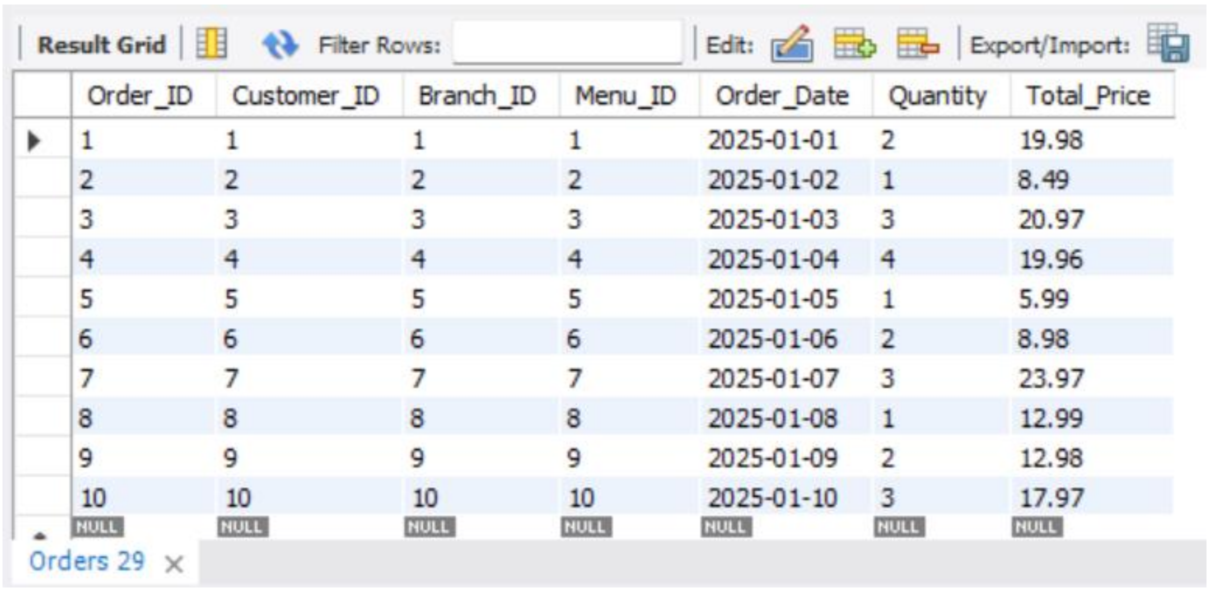
The Reservation table is essential for managing restaurant bookings, guaranteeing that each reservation is accurately recorded and individually recognizable through the Reservation_ID, the table's primary key.

Key characteristics and their functions comprise:

• Customer_ID: Serves as a foreign key connecting reservations to designated customers in the Customer database, facilitating effective customer relationship management.
• Branch_ID: Functions as a foreign key that links reservations to a specific restaurant branch in the Branch table.
• Reservation_Date: Records the reservation date, facilitating effective scheduling and conflict management.
• No_of_People: Indicates the quantity of visitors for each reservation. This attribute is regulated by a CHECK constraint that permits only positive values.
• Status: Represents the reservation's present condition (e.g., Confirmed, Pending, Cancelled) employing an ENUM constraint for data integrity.

The table is structured to maintain normalization principles, minimizing redundancy and assuring compliance with functional dependencies, in accordance with the formal limitations of the relational model. This approach guarantees data consistency, integrity, and scalability for the reservation system (Elmasri and Navathe, 2016).

Order Table



Order_ID	Customer_ID	Branch_ID	Menu_ID	Order_Date	Quantity	Total_Price
1	1	1	1	2025-01-01	2	19.98
2	2	2	2	2025-01-02	1	8.49
3	3	3	3	2025-01-03	3	20.97
4	4	4	4	2025-01-04	4	19.96
5	5	5	5	2025-01-05	1	5.99
6	6	6	6	2025-01-06	2	8.98
7	7	7	7	2025-01-07	3	23.97
8	8	8	8	2025-01-08	1	12.99
9	9	9	9	2025-01-09	2	12.98
10	10	10	10	2025-01-10	3	17.97
NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 43

The Orders table is an essential element of the restaurant management system, enabling the recording and administration of customer orders. Every order is distinctly recognized by the Order_ID, which serves as the primary key.

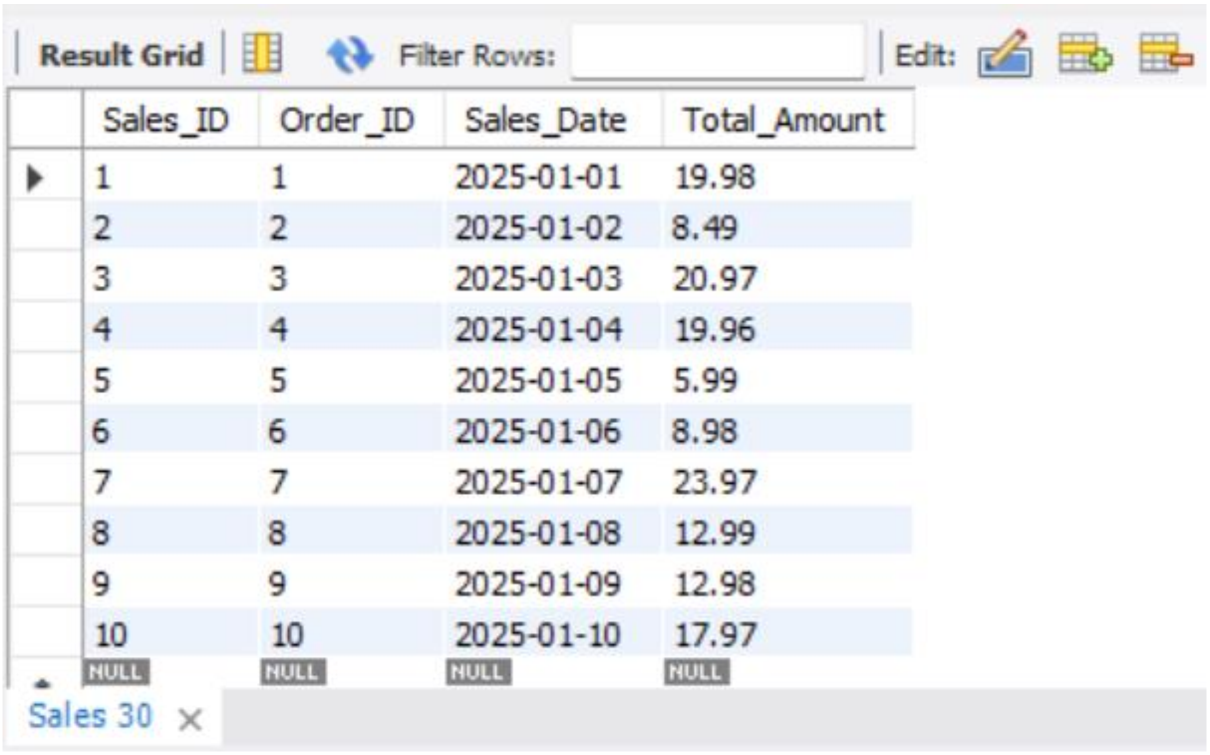
Essential characteristics and their functions comprise:

- **Customer_ID:** Associates the order with a particular customer, functioning as a foreign key linked to the Customer database, so providing the traceability of customer transactions.
- **Branch_ID:** Denotes the branch at which the order was placed, serving as a foreign key to the Branch table.
- **Menu_ID:** Associates the order with a particular menu item through a foreign key linked to the Menu table.
- **Order_Date:** Captures the date of the order, facilitating temporal study of sales and trends.
  Quantity: Records the number of products ordered, with a CHECK constraint that permits only positive numbers.

- **Total_Price:** Denotes the aggregate cost of the order, computed based on the amount and price of the menu items. A CHECK constraint guarantees that this number is non-negative.

The Orders table design complies with normalization standards by ensuring that each column is dependent on the primary key and by avoiding redundancy. This method guarantees data integrity, consistency, and scalability in the order management process (Elmasri and Navathe, 2016).

Order Table



Result Grid | Filter Rows: | Edit:

Sales_ID	Order_ID	Sales_Date	Total_Amount
1	1	2025-01-01	19.98
2	2	2025-01-02	8.49
3	3	2025-01-03	20.97
4	4	2025-01-04	19.96
5	5	2025-01-05	5.99
6	6	2025-01-06	8.98
7	7	2025-01-07	23.97
8	8	2025-01-08	12.99
9	9	2025-01-09	12.98
10	10	2025-01-10	17.97
NULL	NULL	NULL	NULL

Sales 30 ×

Figure 44

The Sales table in the restaurant management system monitors financial activities associated with customer orders. Every transaction is distinctly recognized by the Sales_ID, which functions as the primary key.

Essential characteristics comprise:

- Order_ID: Associates the sale with a particular order, functioning as a foreign key linked to the Orders table. This relationship guarantees that each sale is associated with a legitimate customer order.

- Sales_Date: Records the date of the sale, facilitating the analysis of sales trends and patterns over time.

- Total_Amount: Denotes the aggregate monetary value of the transaction. A CHECK constraint guarantees that the total value remains non-negative.
  The Sales table's design facilitates precise monitoring of the restaurant's revenue generation. Linking to the Orders table with a foreign key facilitates thorough reporting and analysis of financial performance. This configuration exemplifies optimal database normalization procedures, as delineated by Elmasri and Navathe (2016), hence guaranteeing the integrity and scalability of the sales management process.

5.3.1 Database Schemas for Each Table

A database schema defines how data is organized within a relational database. This includes logical constraints such as table names, fields, data types, and the relationships between these entities (IBM, no date). Below is a detailed schema for each table in the restaurant management system:

1. Owner Table

- **Primary Key**: Owner_ID
- **Attributes**:
  - Owner_ID: Integer, NOT NULL, Primary Key.
  - First_Name: Varchar (50), NOT NULL.
  - Last_Name: Varchar (50), NOT NULL.

2. Restaurant Table

- **Primary Key**: Restaurant_ID
- **Foreign Key**: Owner_ID references Owner (Owner_ID)
- **Attributes**:
  - Restaurant_ID: Integer, NOT NULL, Primary Key.
  - Name: Varchar (100), NOT NULL.
  - Type: ENUM (e.g., Italian, American, etc.), NOT NULL.
  - Owner_ID: Integer, NOT NULL, Foreign Key.

3. Branch Table

- **Primary Key**: Branch_ID

- **Foreign Key**: Restaurant_ID references Restaurant (Restaurant_ID)
- **Attributes**:
    - Branch_ID: Integer, NOT NULL, Primary Key.
    - Restaurant_ID: Integer, NOT NULL, Foreign Key.
    - Location: Varchar (100), NOT NULL.
    - Manager_Name: Varchar (100).
    - Contact_No: Varchar (15).

4. Category Table

- **Primary Key**: Category_ID
- **Attributes**:
    - Category_ID: Integer, NOT NULL, Primary Key.
    - Category_Name: Varchar (50), NOT NULL.
    - Description: Varchar (255).

5. Menu Table

- **Primary Key**: Menu_ID
- **Foreign Key**: Category_ID references Category (Category_ID)
- **Attributes**:
    - Menu_ID: Integer, NOT NULL, Primary Key.
    - Name: Varchar (100), NOT NULL.
    - Description: Varchar (255).
    - Price: Decimal (10, 2), NOT NULL, CHECK (Price >= 0).
    - Category_ID: Integer, NOT NULL, Foreign Key.

6. Customer Table

- **Primary Key**: Customer_ID
- **Attributes**:
    - Customer_ID: Integer, NOT NULL, Primary Key.
    - First_Name: Varchar (50), NOT NULL.
    - Last_Name: Varchar (50), NOT NULL.
    - Email: Varchar (100), NOT NULL, UNIQUE.
    - Phone: Varchar (15).

7. Inventory Table

- **Primary Key**: Inventory_ID
- **Foreign Key**: Branch_ID references Branch (Branch_ID)
- **Attributes**:
    - Inventory_ID: Integer, NOT NULL, Primary Key.
    - Ingredient_Name: Varchar (100), NOT NULL.
    - Quantity: Integer, NOT NULL, CHECK (Quantity >= 0).
    - Unit: ENUM (e.g., kg, pcs, etc.), NOT NULL.
    - Reorder_Level: Integer, NOT NULL, CHECK (Reorder_Level >= 0).
    - Branch_ID: Integer, NOT NULL, Foreign Key.

8. Supplier Table

- **Primary Key: Supplier_ID**
- **Attributes:**
    - **Supplier_ID: Integer, NOT NULL, Primary Key.**
    - **Name: Varchar (100), NOT NULL.**
    - **Address: Varchar (255).**
    - **Contact_No: Varchar (15).**

9. Reservation Table

- **Primary Key: Reservation_ID**
- **Foreign Keys: Customer_ID references Customer (Customer_ID), Branch_ID references Branch (Branch_ID)**
- **Attributes:**
    - **Reservation_ID: Integer, NOT NULL, Primary Key.**
    - **Customer_ID: Integer, NOT NULL, Foreign Key.**
    - **Branch_ID: Integer, NOT NULL, Foreign Key.**
    - **Reservation_Date: Date, NOT NULL.**
    - **No_of_People: Integer, NOT NULL, CHECK (No_of_People > 0).**
    - **Status: ENUM (e.g., Confirmed, Pending, Cancelled), NOT NULL.**

10. Orders Table

- **Primary Key: Order_ID**
- **Foreign Keys: Customer_ID references Customer (Customer_ID), Branch_ID references Branch (Branch_ID), Menu_ID references Menu (Menu_ID)**
- **Attributes:**
    - **Order_ID: Integer, NOT NULL, Primary Key.**
    - **Customer_ID: Integer, NOT NULL, Foreign Key.**
    - **Branch_ID: Integer, NOT NULL, Foreign Key.**
    - **Menu_ID: Integer, NOT NULL, Foreign Key.**
    - **Order_Date: Date, NOT NULL.**
    - **Quantity: Integer, NOT NULL, CHECK (Quantity > 0).**
    - **Total_Price: Decimal (10, 2), NOT NULL, CHECK (Total_Price >= 0).**

11. Sales Table

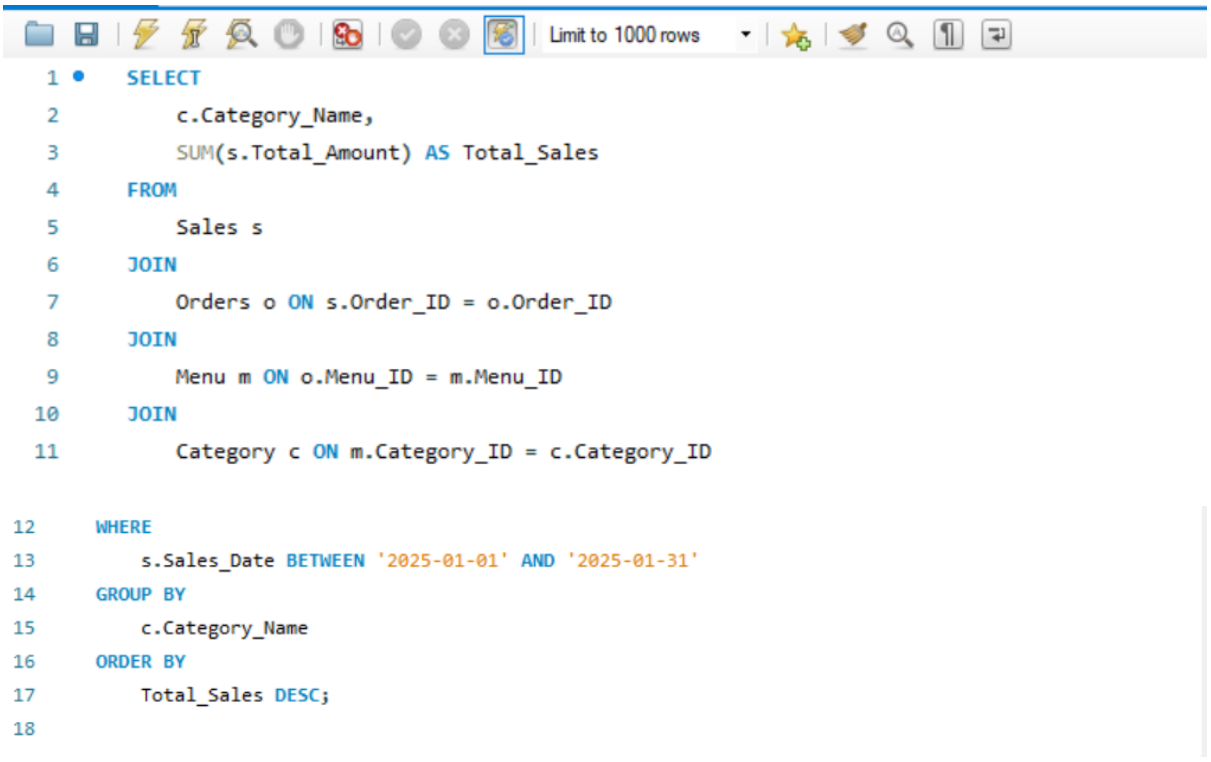
- **Primary Key: Sales_ID**
- **Foreign Key: Order_ID references Orders (Order_ID)**
- **Attributes:**
    - **Sales_ID: Integer, NOT NULL, Primary Key.**
    - **Order_ID: Integer, NOT NULL, Foreign Key.**
    - **Sales_Date: Date, NOT NULL.**
    - **Total_Amount: Decimal (10, 2), NOT NULL, CHECK (Total_Amount >= 0).**

12. Reports Table

- **Primary Key: Report_ID**
- **Attributes:**
    - **Report_ID: Integer, NOT NULL, Primary Key.**
    - **Sales_Performance: ENUM (e.g., High, Medium, Low), NOT NULL.**

- **Inventory_Status: ENUM (e.g., Sufficient, Low, Critical), DEFAULT 'Sufficient'.**
- **Report_Date: Date, NOT NULL.**

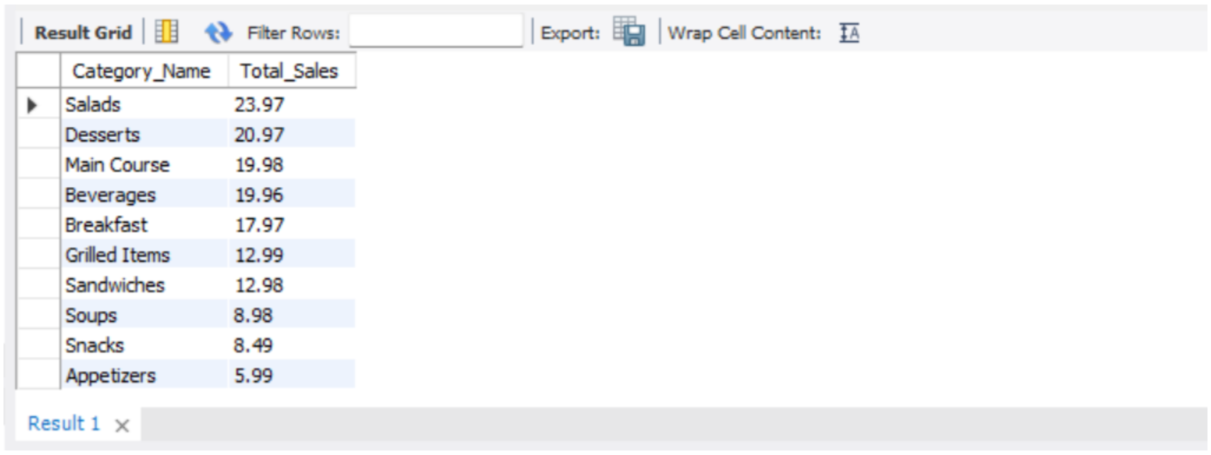
6.1 Total Sales for Each Menu Category (Date Range)



```sql
SELECT
    c.Category_Name,
    SUM(s.Total_Amount) AS Total_Sales
FROM
    Sales s
JOIN
    Orders o ON s.Order_ID = o.Order_ID
JOIN
    Menu m ON o.Menu_ID = m.Menu_ID
JOIN
    Category c ON m.Category_ID = c.Category_ID

WHERE
    s.Sales_Date BETWEEN '2025-01-01' AND '2025-01-31'
GROUP BY
    c.Category_Name
ORDER BY
    Total_Sales DESC;
```

Figure 45

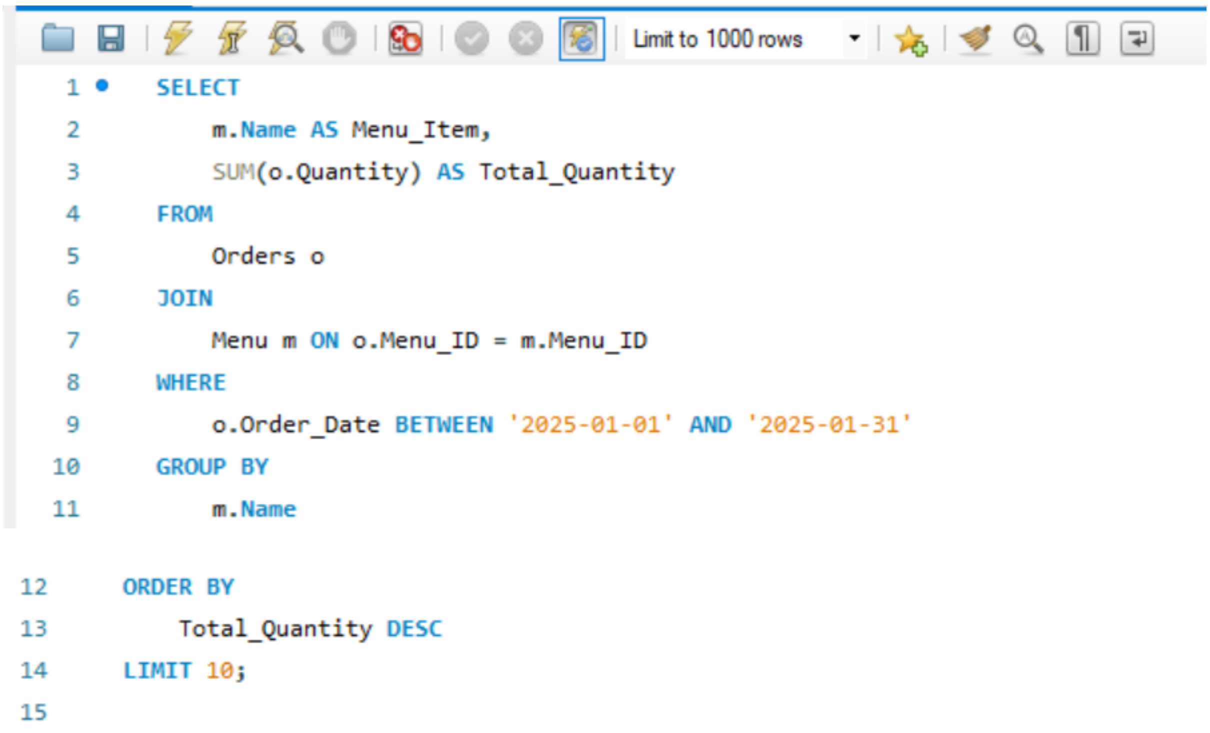


Category_Name	Total_Sales
Salads	23.97
Desserts	20.97
Main Course	19.98
Beverages	19.96
Breakfast	17.97
Grilled Items	12.99
Sandwiches	12.98
Soups	8.98
Snacks	8.49
Appetizers	5.99

Figure 46

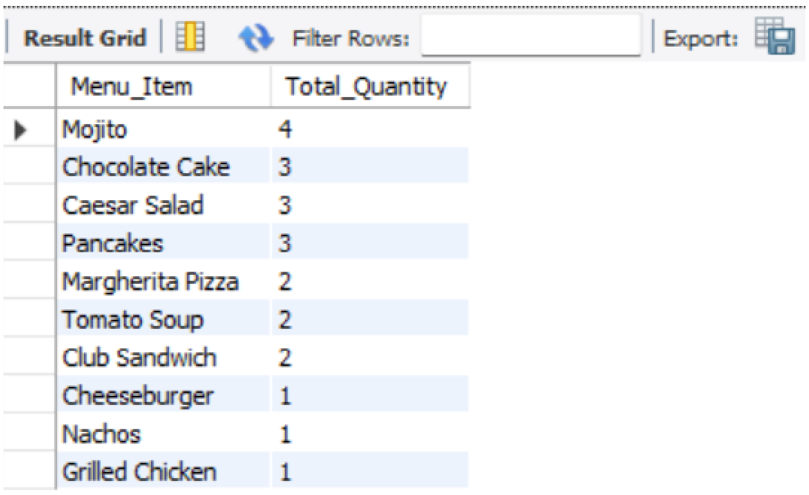
This query computes the aggregate sales for each menu category.
The JOIN statements link the Sales, Orders, Menu, and Category tables.
The WHERE clause restricts results to a particular date range (January 2025).
The outcome is categorized by Category_Name and arranged in descending order based on total sales.

6.2 Top 10 Most Popular Menu Items (Date Range)



```
SELECT
    m.Name AS Menu_Item,
    SUM(o.Quantity) AS Total_Quantity
FROM
    Orders o
JOIN
    Menu m ON o.Menu_ID = m.Menu_ID
WHERE
    o.Order_Date BETWEEN '2025-01-01' AND '2025-01-31'
GROUP BY
    m.Name
ORDER BY
    Total_Quantity DESC
LIMIT 10;
```

Figure 47

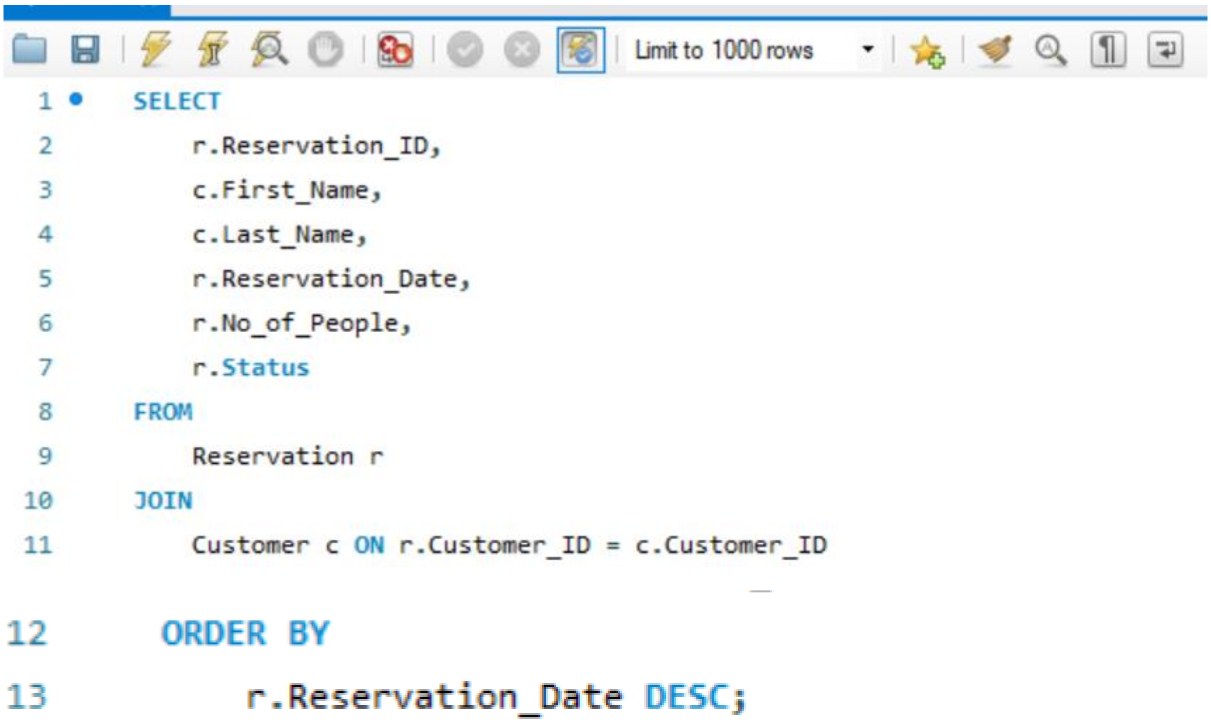


Menu_Item	Total_Quantity
Mojito	4
Chocolate Cake	3
Caesar Salad	3
Pancakes	3
Margherita Pizza	2
Tomato Soup	2
Club Sandwich	2
Cheeseburger	1
Nachos	1
Grilled Chicken	1

Figure 48

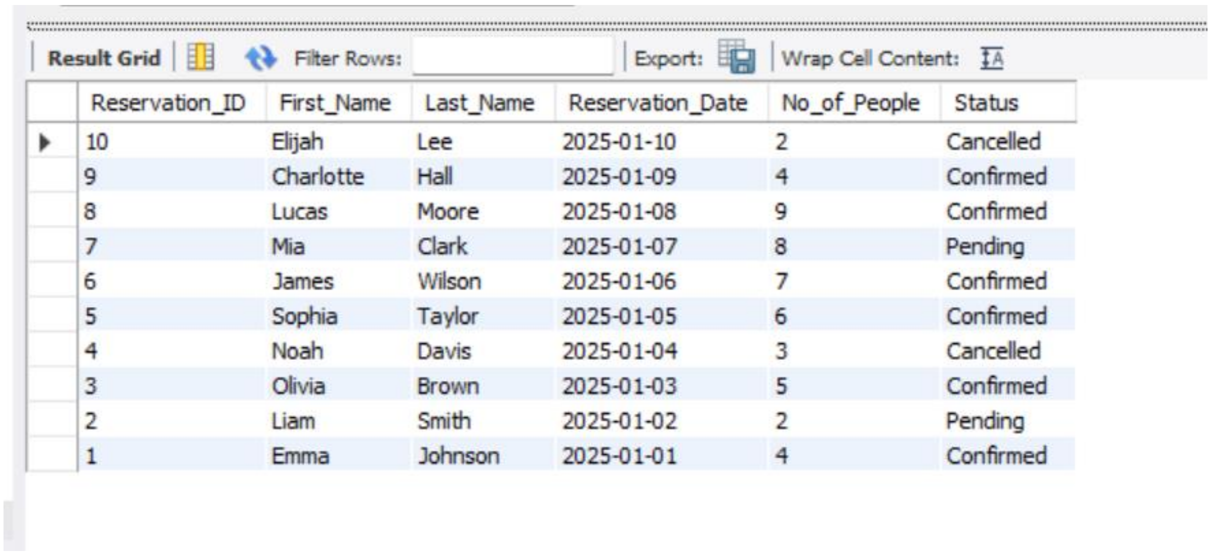
This query determines the top 10 most popular menu items according to total quantity sold. It employs SUM(o.Quantity) to ascertain the aggregate quantity for each menu item. The LIMIT clause confines the output to the foremost 10 results.

6.3 Customer Reservation History



```sql
SELECT
    r.Reservation_ID,
    c.First_Name,
    c.Last_Name,
    r.Reservation_Date,
    r.No_of_People,
    r.Status
FROM
    Reservation r
JOIN
    Customer c ON r.Customer_ID = c.Customer_ID
ORDER BY
    r.Reservation_Date DESC;
```

Figure 49



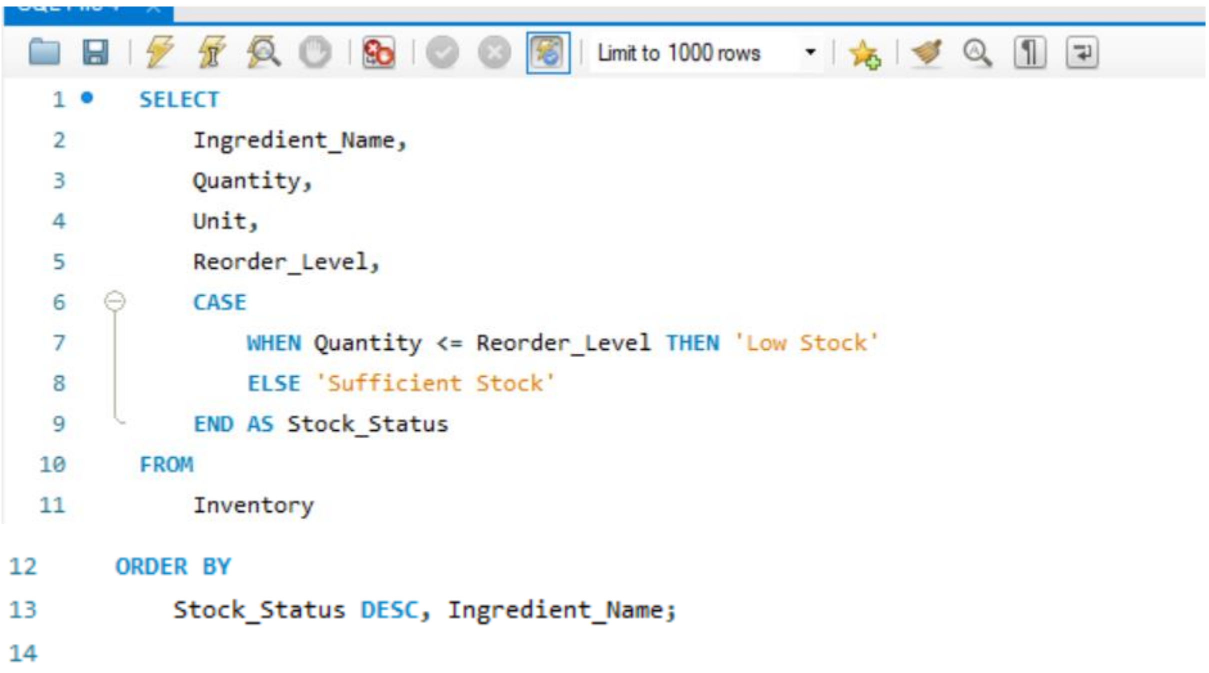
Reservation_ID	First_Name	Last_Name	Reservation_Date	No_of_People	Status
10	Elijah	Lee	2025-01-10	2	Cancelled
9	Charlotte	Hall	2025-01-09	4	Confirmed
8	Lucas	Moore	2025-01-08	9	Confirmed
7	Mia	Clark	2025-01-07	8	Pending
6	James	Wilson	2025-01-06	7	Confirmed
5	Sophia	Taylor	2025-01-05	6	Confirmed
4	Noah	Davis	2025-01-04	3	Cancelled
3	Olivia	Brown	2025-01-03	5	Confirmed
2	Liam	Smith	2025-01-02	2	Pending
1	Emma	Johnson	2025-01-01	4	Confirmed

Figure 50

This query retrieves the reservation history, encompassing customer information and reservation status.

The JOIN connects the Reservation table to the Customer table.
The results are arranged in descending order by reservation date.

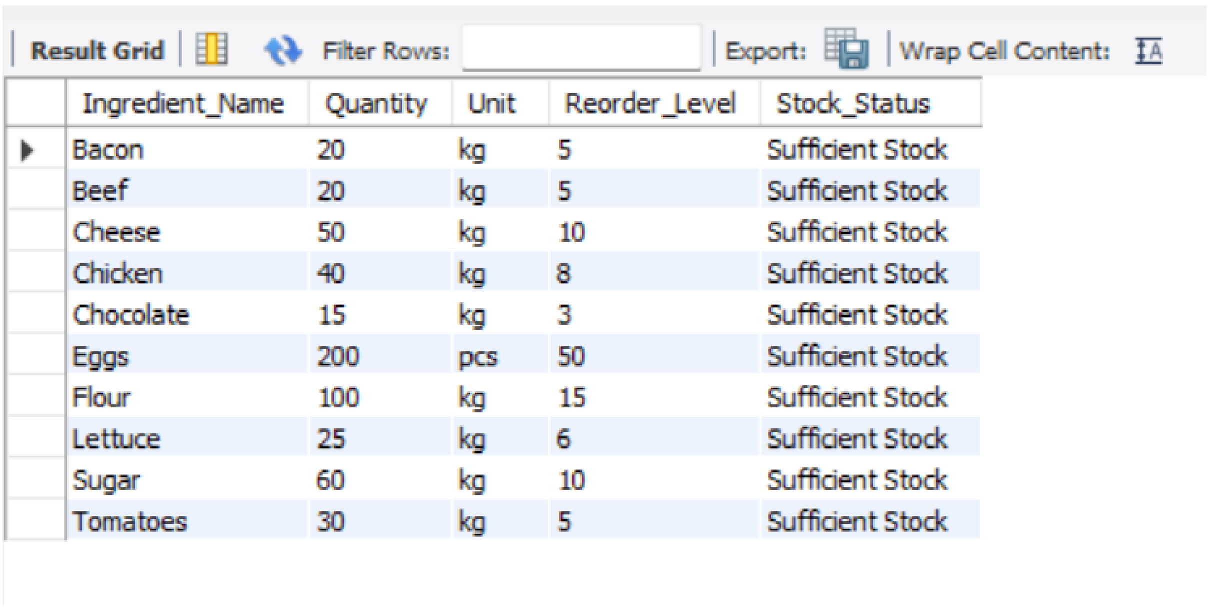
6.4 Current Inventory Levels by Ingredient



Limit to 1000 rows

```sql
SELECT
    Ingredient_Name,
    Quantity,
    Unit,
    Reorder_Level,
    CASE
        WHEN Quantity <= Reorder_Level THEN 'Low Stock'
        ELSE 'Sufficient Stock'
    END AS Stock_Status
FROM
    Inventory
ORDER BY
    Stock_Status DESC, Ingredient_Name;
```

Figure 51



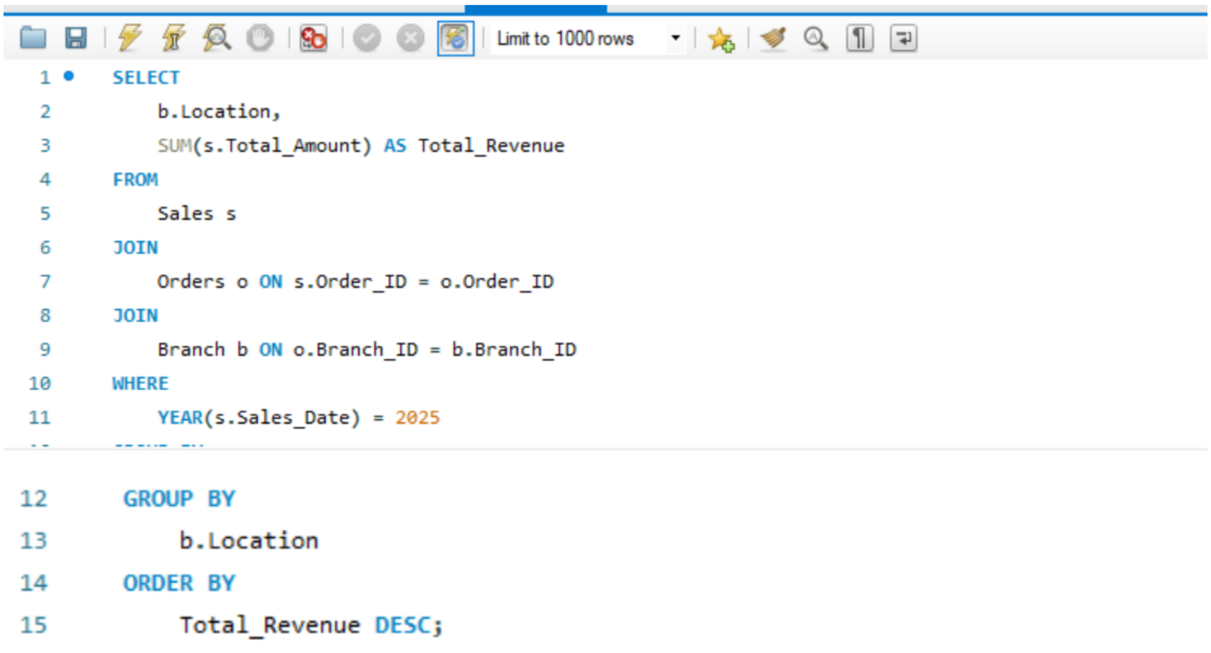
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Ingredient_Name	Quantity	Unit	Reorder_Level	Stock_Status
Bacon	20	kg	5	Sufficient Stock
Beef	20	kg	5	Sufficient Stock
Cheese	50	kg	10	Sufficient Stock
Chicken	40	kg	8	Sufficient Stock
Chocolate	15	kg	3	Sufficient Stock
Eggs	200	pcs	50	Sufficient Stock
Flour	100	kg	15	Sufficient Stock
Lettuce	25	kg	6	Sufficient Stock
Sugar	60	kg	10	Sufficient Stock
Tomatoes	30	kg	5	Sufficient Stock

Figure 52

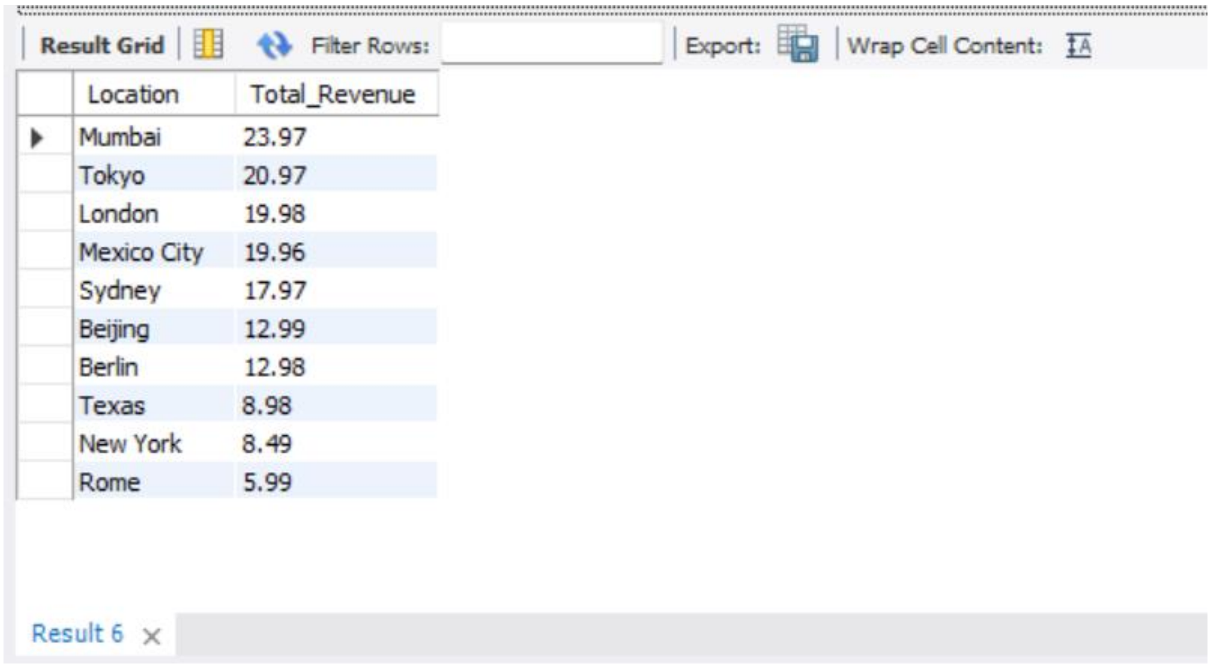
This query obtains the present inventory levels for each ingredient.
A CASE statement classifies stock levels as "Low Stock" or "Sufficient Stock" according to the Reorder_Level.

6.5 Revenue by Restaurant Location (Last Year)



```sql
SELECT
    b.Location,
    SUM(s.Total_Amount) AS Total_Revenue
FROM
    Sales s
JOIN
    Orders o ON s.Order_ID = o.Order_ID
JOIN
    Branch b ON o.Branch_ID = b.Branch_ID
WHERE
    YEAR(s.Sales_Date) = 2025
GROUP BY
    b.Location
ORDER BY
    Total_Revenue DESC;
```

Figure 53

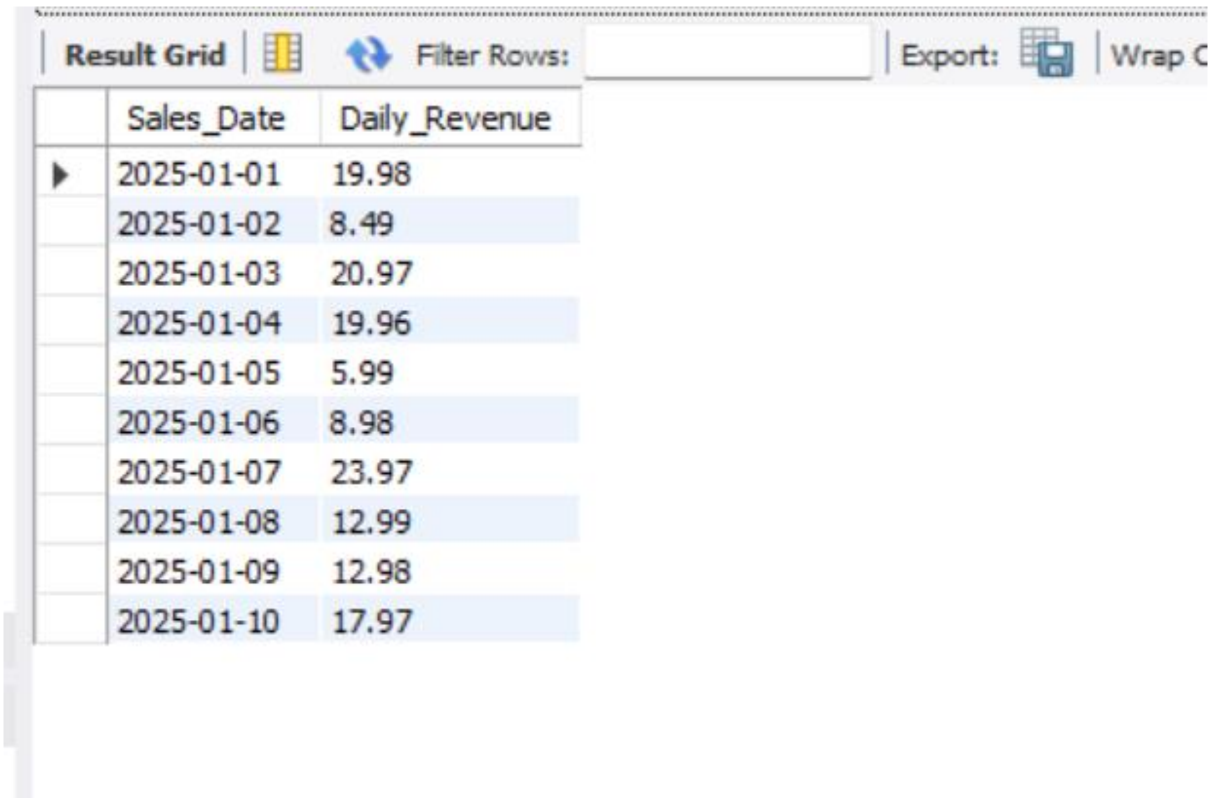


Location	Total_Revenue
Mumbai	23.97
Tokyo	20.97
London	19.98
Mexico City	19.96
Sydney	17.97
Beijing	12.99
Berlin	12.98
Texas	8.98
New York	8.49
Rome	5.99

Figure 54

This query computes the total revenue generated at each restaurant location for the year 2025. This is accomplished by aggregating the Total_Amount from the Sales dataset, joining it with the Orders table to associate sales data with branch IDs, and subsequently joining with the Branch table to retrieve location names. The query restricts the data to encompass just sales from 2025 with the WHERE clause and arranges the results by location. The locations are categorized by the Location column, with total revenue arranged in descending order to prioritize the highest-earning sites.

7.1 Daily Revenue Reports



Sales_Date	Daily_Revenue
2025-01-01	19.98
2025-01-02	8.49
2025-01-03	20.97
2025-01-04	19.96
2025-01-05	5.99
2025-01-06	8.98
2025-01-07	23.97
2025-01-08	12.99
2025-01-09	12.98
2025-01-10	17.97

Figure 55

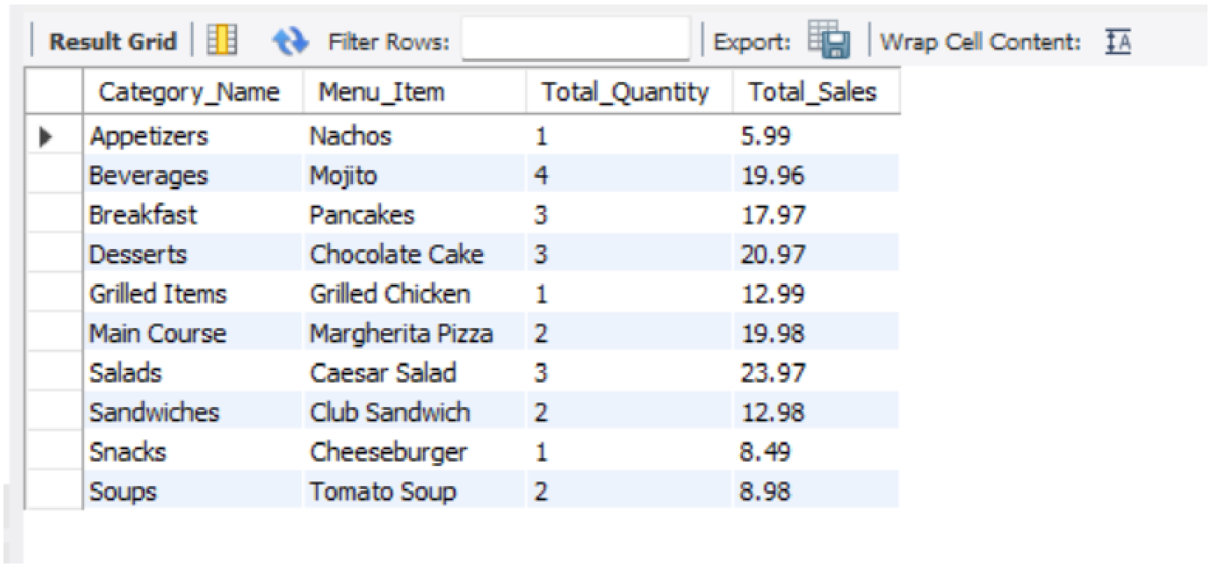
Sales_Date: The date on which sales transactions occur.
Daily Revenue: The aggregate revenue produced on the specified date.

Key Insights:

- The peak revenue was documented on January 7, 2025, amounting to $23.97.
- The minimum revenue was recorded on January 5, 2025, totaling $5.99.
- The revenue data reveals consistent daily entries, indicating stable firm operations.

- Revenue exhibits daily changes, potentially driven by factors such as weekday patterns, promotions, or particular events.

7.2 Itemized Sales Reports by Category



Category_Name	Menu_Item	Total_Quantity	Total_Sales
Appetizers	Nachos	1	5.99
Beverages	Mojito	4	19.96
Breakfast	Pancakes	3	17.97
Desserts	Chocolate Cake	3	20.97
Grilled Items	Grilled Chicken	1	12.99
Main Course	Margherita Pizza	2	19.98
Salads	Caesar Salad	3	23.97
Sandwiches	Club Sandwich	2	12.98
Snacks	Cheeseburger	1	8.49
Soups	Tomato Soup	2	8.98

Figure 56

Data Insights:
1. Revenue by Menu Categories
The table presents sales performance and total amounts for different menu items classified into categories such as Appetizers, Beverages, Breakfast, Desserts, and others.

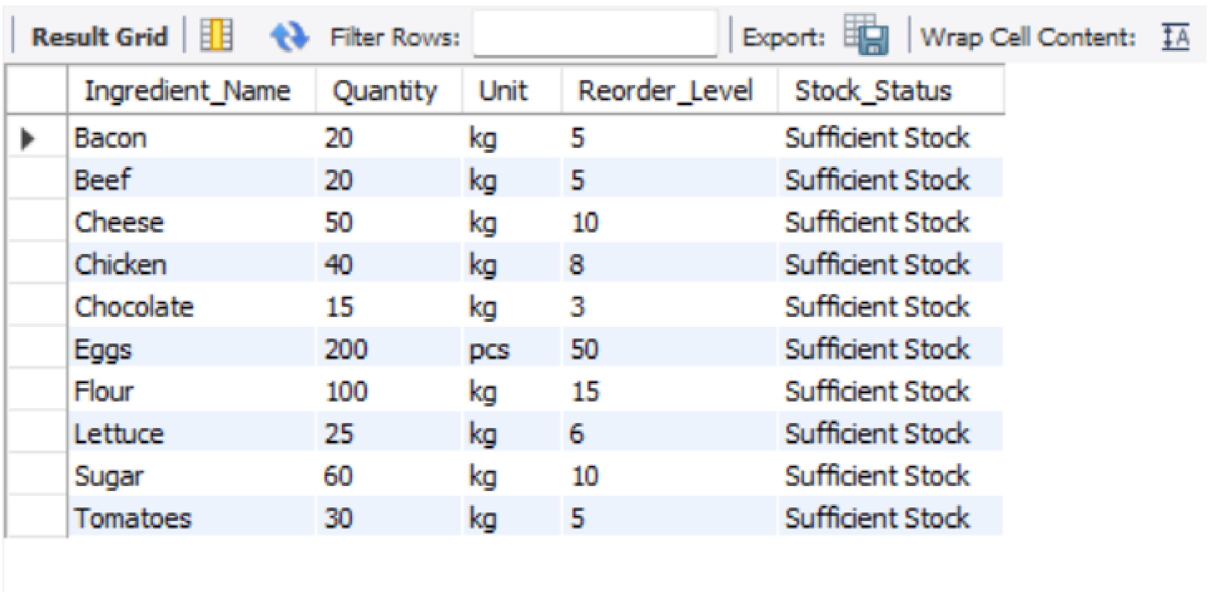
Categories and goods with optimal performance:

Salads (e.g., Caesar Salad): Achieved the highest sales revenue, amounting to $23.97 with a quantity sold of 3.
Desserts, such as Chocolate Cake, exhibit substantial sales at $20.97, signifying a client inclination for sweet confections.
Beverages (e.g., Mojito): Contributed substantially with $19.96, indicating elevated demand for drinks.
Main Course (e.g., Margherita Pizza): A fundamental selection generating revenue of $19.98.
Underperforming categories:

Appetizers (e.g., Nachos): Generated merely $5.99, indicating diminished customer

preference.
Snacks (e.g., Cheeseburger): Sales are comparatively lower at $8.49.

7.3 Inventory Reports



Ingredient_Name	Quantity	Unit	Reorder_Level	Stock_Status
Bacon	20	kg	5	Sufficient Stock
Beef	20	kg	5	Sufficient Stock
Cheese	50	kg	10	Sufficient Stock
Chicken	40	kg	8	Sufficient Stock
Chocolate	15	kg	3	Sufficient Stock
Eggs	200	pcs	50	Sufficient Stock
Flour	100	kg	15	Sufficient Stock
Lettuce	25	kg	6	Sufficient Stock
Sugar	60	kg	10	Sufficient Stock
Tomatoes	30	kg	5	Sufficient Stock

Figure 57

Inventory Condition:

The inventory of ingredients seems adequate for all goods.

Principal observations:

- Eggs possess a substantial inventory of 200 units, with a reorder threshold set at 50, signifying adequate stock levels.
- Flour (100 kg) and cheese (50 kg) demonstrate adequate quantities for impending requirements.

Essential Insights:
Chocolate possesses a stock of 15 kilogram, which exceeds its reorder threshold of 3 kg, indicating that rapid replenishment is unnecessary.

Tomatoes and beef, at 30 kg and 20 kg, respectively, exceed reorder thresholds, guaranteeing seamless operations.

8. Security Considerations & System Deployment

8.1 Data Safeguarding Protocols

To protect confidential information:

- Encryption Techniques: All client and payment information is secured by AES-256 encryption for data at rest and TLS 1.3 for data in transit.
- User Roles and Access Management: Role-based access control (RBAC) is employed to guarantee that users may access only the data pertinent to their duties (e.g., managers may examine reports but are prohibited from altering database schemas).
- Audit Trails: Documenting and overseeing all system access and alterations to identify unauthorized actions.

8.2 Management of Sensitive Information

- Storage of Sensitive Data: Personal customer information, including email addresses and phone numbers, is stored in encrypted sections inside the database.
- Data Anonymization: When possible, sensitive customer information is anonymized for reporting to adhere to data minimization rules.
- Secure Authentication: Passwords are hashed using bcrypt, and multi-factor authentication (MFA) is mandatory for system access.

8.3 Deployment to Production Environment Testing Process:

- Unit tests and integration tests assure data integrity across modules.
- Security testing, including penetration tests, is undertaken to identify vulnerabilities.
- Deployment Workflow: A staged deployment process is followed: development > testing > staging > production.
- Continuous Integration/Continuous Deployment (CI/CD) pipelines automate testing and deployment.

Verification Steps:

Post-deployment checks guarantee the system performs as planned without data loss.
8.4 Compliance with Security Standards

GDPR Compliance: Ensuring transparency about how customer data is gathered and utilized.

Providing clients with rights to view and wipe their data.

PCI DSS Compliance: Enforcing rigorous protocols for the management and storage of payment information.

Consistently evaluating the security of the payment infrastructure.

8.5 Documentation of Design and Technical Elements

- Database Schema Design: A comprehensive Entity-Relationship (ER) diagram illustrating table interrelations and attributes.
- API Documentation: Comprehensive documentation of endpoints utilized for customer and reservation management, accompanied by examples for developers.
- System Architecture: A comprehensive diagram illustrating components such as database servers, application servers, and user interfaces.

9. Limitations and Prospective Improvement

9.1 Identified Constraints
Current Limitation: The system does not offer multi-language support, hence limiting accessibility for users who are not fluent in the native language.

9.2 Suggestions for Enhancement
Proposed Feature: Integration with external delivery applications to optimize order delivery efficiency and elevate customer experience.

11. Conclusion
The evaluation and advancement of the Database Management System (DBMS) for the restaurant chain have markedly improved operational efficiency, data accessibility, and scalability. The analysis and implementation yielded the following key findings:

Enhanced Data Organization: The normalized database structure minimizes data redundancy and improves data integrity, facilitating efficient storing and retrieval of essential business information.

Optimized Operations: The system proficiently oversees essential functions, encompassing inventory monitoring, reservation administration, and order processing. This has led to enhanced workflows and a decrease in manual errors.

Actionable Insights: The DBMS facilitates data-driven decision-making and identifies opportunities for operational enhancement through the development of reports, including daily revenue summaries, itemized sales by category, and inventory tracking.

The system design facilitates integration with third-party delivery software and includes features such as multi-language support, thereby accommodating potential future requirements.

Security and Compliance: The implementation of encryption protocols, user roles, and access restrictions guarantees the secure storage and management of sensitive customer and corporate data, in accordance with GDPR and PCI DSS regulations.

The DBMS delivers a comprehensive framework for managing business operations and serves as a basis for future improvements, including the expansion of multi-language support and integration with third-party applications. These enhancements will position the restaurant business for enduring growth and client contentment.

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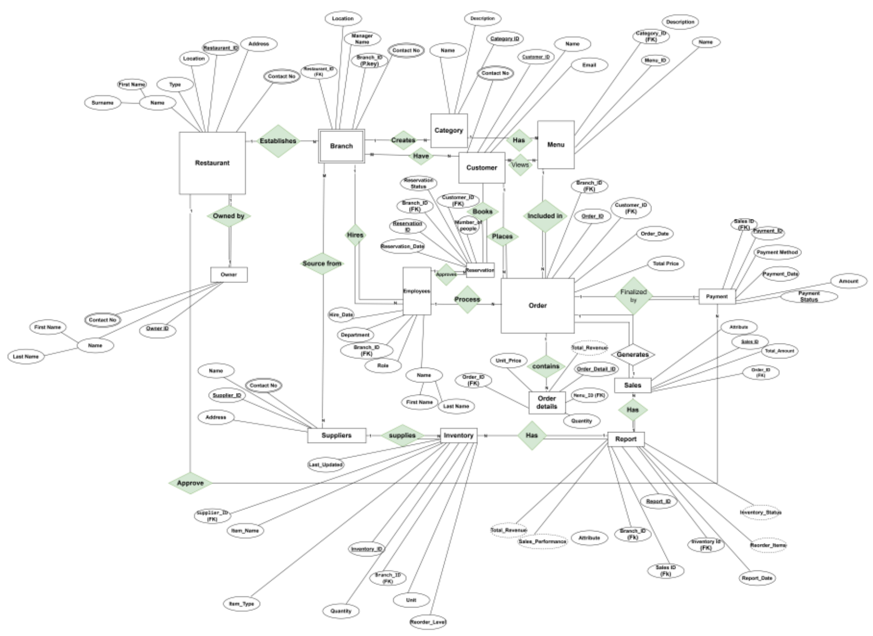
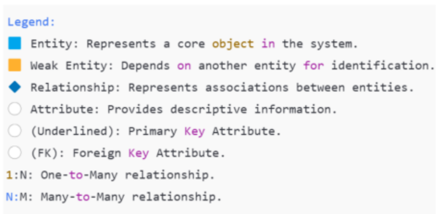
Appendices

Appendix A: Entity-Relationship Diagram (ERD)

Entity-Relationship Diagram for Restaurant Chain Database Management System..




Legend:
🟦 Entity: Represents a core object in the system.
🟧 Weak Entity: Depends on another entity for identification.
🔷 Relationship: Represents associations between entities.
○ Attribute: Provides descriptive information.
○ (Underlined): Primary Key Attribute.
○ (FK): Foreign Key Attribute.
1:N: One-to-Many relationship.
N:M: Many-to-Many relationship.