

Design of Normalized Database Schema

CS5200 Practicum I

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Part B: Design Normalized Database

1. Functional Dependencies Before and After Normalization

1.1 Functional Dependencies Before Normalization

The dataset represents restaurant visits and contains various attributes related to the visit, restaurant, server, and customer information. Below are the functional dependencies before normalization:

Table 1: Functional Dependencies Before Normalization

Determinant	Dependent_Attributes
VisitID	VisitDate, VisitTime, MealType, PartySize, WaitTime, FoodBill, TipAmount, DiscountApplied, PaymentMethod, OrderedAlcohol, AlcoholBill, Restaurant, ServerEmpID, CustomerName
Restaurant	ServerEmpID, ServerName, StartDateHired, EndDateHired, HourlyRate, ServerBirthDate, ServerTIN
ServerEmpID	ServerName, StartDateHired, EndDateHired, HourlyRate, ServerBirthDate, ServerTIN
CustomerName	CustomerPhone, CustomerMail, LoyaltyMember, Gender
PaymentMethod	DiscountApplied

1.2 Functional Dependencies After Normalization

After normalizing the database to 3NF, the functional dependencies are:

Table 2: Functional Dependencies After Normalization

Determinant	Dependent_Attributes
VisitID	VisitDate, VisitTime, MealType, PartySize, WaitTime, FoodBill, TipAmount, DiscountApplied, PaymentID, OrderedAlcohol, AlcoholBill, RestaurantID, ServerEmpID, CustomerID
RestaurantID	RestaurantName
ServerEmpID	ServerName, StartDateHired, EndDateHired, HourlyRate, ServerBirthDate, ServerTIN
CustomerID	CustomerName, CustomerPhone, CustomerMail, LoyaltyMember
PaymentID	PaymentMethod, DiscountApplied

2. Normalization Process: From 1NF to 3NF

2.1 First Normal Form (1NF)

To achieve **1NF**, the following changes were made:

- Removed duplicate and multi-valued attributes.
- Ensured atomicity by breaking down non-atomic values.
- Added primary keys where missing.
- Renamed **Restaurant** column to **RestaurantName** for clarity.
- Assigned appropriate data types (e.g., **WaitTime** changed to **INT**, **VisitTime** changed to **TIME**).

2.2 Second Normal Form (2NF)

To achieve **2NF**, the following changes were made:

- **Eliminated partial dependencies:**
 - **RestaurantName** was dependent on **RestaurantID**, so a **Restaurant** table was created.
 - **Customer details** were moved into the **Customer** table.

2.3 Third Normal Form (3NF)

To achieve **3NF**, the following changes were made:

- **Removed transitive dependencies:**
 - **PaymentMethod** was moved to a **Payment** table.
 - **Server details** were moved to a separate **Server** table.

2.4 Normalized Tables in 3NF

```
##
## ### Restaurant Table
##
##
## |Column.Name      |Data.Type   |Constraints
## |:-----|:-----|:-----|
## |RestaurantID (PK)|INT         |PRIMARY KEY, AUTO_INCREMENT |
## |RestaurantName   |VARCHAR(255)|UNIQUE, NOT NULL           |
##
## ### Customer Table
##
##
## |Column.Name      |Data.Type   |Constraints
## |:-----|:-----|:-----|
## |CustomerID (PK) |INT         |PRIMARY KEY, AUTO_INCREMENT |
## |CustomerName    |VARCHAR(255)|NOT NULL                    |
## |CustomerPhone   |VARCHAR(20) |DEFAULT NULL                |
## |CustomerMail    |VARCHAR(255)|DEFAULT NULL                |
## |LoyaltyMember   |TINYINT(1) |DEFAULT NULL                |
##
## ### Server Table
##
##
```

```

## |Column.Name      |Data.Type      |Constraints      |
## |:-----|:-----|:-----|
## |ServerEmpID (PK) |INT            |PRIMARY KEY, AUTO_INCREMENT |
## |ServerName       |VARCHAR(255)   |NOT NULL        |
## |StartDateHired   |DATE           |DEFAULT NULL    |
## |EndDateHired     |DATE           |DEFAULT NULL    |
## |HourlyRate       |DECIMAL(5,2)   |DEFAULT 0.00    |
## |ServerBirthDate  |DATE           |DEFAULT NULL    |
## |ServerTIN        |VARCHAR(20)    |UNIQUE, DEFAULT NULL |
##
## ### Visit Table
##
##
## |Column.Name      |Data.Type      |Constraints      |
## |:-----|:-----|:-----|
## |VisitID (PK)     |INT            |PRIMARY KEY, AUTO_INCREMENT |
## |CustomerID (FK)  |INT            |REFERENCES Customer ON DELETE SET NULL |
## |RestaurantID (FK)|INT            |REFERENCES Restaurant ON DELETE CASCADE |
## |ServerEmpID (FK) |INT            |REFERENCES Server ON DELETE SET NULL |
## |PaymentID (FK)   |INT            |REFERENCES Payment ON DELETE SET NULL |
## |VisitDate        |DATE           |NOT NULL        |
## |VisitTime        |TIME           |DEFAULT NULL    |
## |MealType         |VARCHAR(50)    |NOT NULL        |
## |PartySize        |INT            |NOT NULL        |
## |WaitTime         |INT            |DEFAULT NULL    |
## |FoodBill         |DECIMAL(10,2)  |NOT NULL        |
## |TipAmount        |DECIMAL(10,2)  |DEFAULT 0.00    |
## |OrderedAlcohol   |TINYINT(1)     |DEFAULT 0        |
## |AlcoholBill      |DECIMAL(10,2)  |DEFAULT 0.00    |
##
## ### Payment Table
##
##
## |Column.Name      |Data.Type      |Constraints      |
## |:-----|:-----|:-----|
## |PaymentID (PK)   |INT            |PRIMARY KEY, AUTO_INCREMENT |
## |PaymentMethod    |VARCHAR(50)    |UNIQUE, NOT NULL |
## |DiscountApplied  |DECIMAL(5,2)   |DEFAULT 0.00    |

```

3. Entity-Relationship Diagram (ERD)

