**Database Schema and Normalization**

**Database Schema Development**

The database schema for the Car Dealership Management System (CDMS) is designed to store and organize data efficiently, ensuring data integrity and supporting all the required functionalities. The schema includes tables for managing car inventory, salespersons, customers, and sales records. Each table is carefully structured to store relevant data, with relationships defined between tables to reflect real-world interactions.

**Tables:**

1. CarInventory

- CarID (Primary Key): `INT`, Auto Increment

- Year: `INT`

- Make: `VARCHAR(50)`

- Model: `VARCHAR(50)`

- Type: `VARCHAR(50)`

- Price: `DECIMAL(10, 2)`

2. SalesPerson

- SalesPersonID (Primary Key): `INT`, Auto Increment

- FirstName: `VARCHAR(50)`

- LastName: `VARCHAR(50)`

- PhoneNumber: `VARCHAR(15)`

- Email: `VARCHAR(100)`

- HireDate: `DATE`

-UserID: ‘INT’

3. Customer

- CustomerID (Primary Key): `INT`, Auto Increment

- FirstName: `VARCHAR(50)`

- LastName: `VARCHAR(50)`

- PhoneNumber: `VARCHAR(15)`

- Email: `VARCHAR(100)`

- Address: `VARCHAR(100)`

- City: `VARCHAR(50)`

- State: `VARCHAR(50)`

- Zip: `VARCHAR(10)`

4. RecordSales

- SaleID (Primary Key): `INT`, Auto Increment

- SalesPersonID (Foreign Key): `INT`

- CarID (Foreign Key): `INT`

- CustomerID (Foreign Key): `INT`

- SalesPrice: `DECIMAL(10, 2)`

**5**. UserLogin

-UserID (Primary Key): INT, Auto Increment

-Username: NVARCHAR(50)

-Password: NVARCHAR(255)

-Email: NVARCHAR(100)

-Role: NVARCHAR(50)

**Normalization**

Normalization is applied to the database schema to eliminate redundancy and ensure data integrity. The schema is designed to meet the requirements of the third normal form (3NF).

1NF: First Normal Form

- Each table in the schema has atomic (indivisible) values for each attribute.

- Each column contains only one type of data.

- Each table has a primary key to uniquely identify each record.

2NF: Second Normal Form

- All non-key attributes are fully dependent on the primary key.

- The `RecordSales` table, for example, links to the `SalesPerson`, `CarInventory`, and `Customer` tables using foreign keys, ensuring that all data is directly related to the unique identifier (SaleID).

3NF: Third Normal Form

- The schema removes any transitive dependency; all attributes are directly dependent on the primary key.

- For instance, the `Customer` table stores the customer's address details (City, State, Zip) directly, without duplicating this information across multiple records.

**Functional Dependencies:**

- In the `CarInventory` table, `Year`, `Make`, `Model`, `Type`, and `Price` are dependent on `CarID`.

- In the `SalesPerson` table, `FirstName`, `LastName`, `PhoneNumber`, `Email`, and `HireDate’ ,’UserID’ are dependent on `SalesPersonID`.

- In the `Customer` table, `FirstName`, `LastName`, `PhoneNumber`, `Email`, `Address`, `City`, `State`, and `Zip` are dependent on `CustomerID`.

- In the `RecordSales` table, `SalesPrice` is dependent on `SaleID`, while `SalesPersonID`, `CarID`, and `CustomerID` ensure relational integrity with their respective tables.

**Relational Integrity**

- Primary Keys: Each table has a primary key that uniquely identifies each record.

- Foreign Keys: The `RecordSales` table includes foreign keys (`SalesPersonID`, `CarID`, `CustomerID`) that establish relationships between sales records and the associated salesperson, car, and customer.

- Referential Integrity: The use of foreign keys ensures that records in the `RecordSales` table correspond to existing records in the `SalesPerson`, `CarInventory`, and `Customer` tables, preventing orphaned records.

**Final Schema Structure:**

The resulting schema is well-normalized, with no redundant data, ensuring that the database is efficient, easy to maintain, and free of anomalies during data operations like insertion, deletion, and updating.

This normalization process helps in reducing redundancy, improving data integrity, and ensuring that the schema is optimized for performance and scalability.