CREATE TABLE Customers (

Customer\_ID NUMBER GENERATED ALWAYS AS IDENTITY PRIMARY KEY,

First\_Name VARCHAR2(50) NOT NULL,

Last\_Name VARCHAR2(50) NOT NULL,

Email VARCHAR2(100) NOT NULL,

Phone\_Number VARCHAR2(15),

License\_Number VARCHAR2(20) UNIQUE NOT NULL,

Address VARCHAR2(255)

);

#### Functional Dependencies:

Customer\_ID → First\_Name, Last\_Name, Email, Phone\_Number, License\_Number, Address

License\_Number → First\_Name, Last\_Name, Email, Phone\_Number, Address

Explanation:

Customer\_ID is the primary key, so it uniquely determines all other columns in the Customers table.

License\_Number is unique for each customer, so it can also function as an alternate key to determine other customer details.

CREATE TABLE Cars (

Car\_ID NUMBER GENERATED ALWAYS AS IDENTITY PRIMARY KEY,

Make VARCHAR2(50) NOT NULL,

Model VARCHAR2(50) NOT NULL,

Year NUMBER(4) CHECK (Year >= 1886),

License\_Plate VARCHAR2(10) UNIQUE NOT NULL,

VIN VARCHAR2(17) UNIQUE NOT NULL,

Daily\_Rental\_Price NUMBER(10, 2) NOT NULL,

Availability\_Status VARCHAR2(20) CHECK (Availability\_Status IN ('Available', 'Rented', 'Under\_Maintenance')),

Location\_ID NUMBER REFERENCES Locations(Location\_ID)

);

#### Functional Dependencies:

Car\_ID → Make, Model, Year, License\_Plate, VIN, Daily\_Rental\_Price, Availability\_Status, Location\_ID

License\_Plate → Car\_ID, Make, Model, Year, VIN, Daily\_Rental\_Price, Availability\_Status, Location\_ID

VIN → Car\_ID, Make, Model, Year, License\_Plate, Daily\_Rental\_Price, Availability\_Status, Location\_ID

Explanation:

Car\_ID is the primary key, uniquely determining all other attributes in the Cars table.

License\_Plate and VIN are also unique, making them candidate keys, as each of them can uniquely determine the rest of the car’s details.

CREATE TABLE Rental\_Transactions (

Rental\_ID NUMBER GENERATED ALWAYS AS IDENTITY PRIMARY KEY,

Customer\_ID NUMBER REFERENCES Customers(Customer\_ID),

Car\_ID NUMBER REFERENCES Cars(Car\_ID),

Rental\_Start\_Date DATE NOT NULL,

Rental\_End\_Date DATE,

Total\_Cost NUMBER(10, 2),

Status VARCHAR2(20) CHECK (Status IN ('Active', 'Completed', 'Cancelled'))

);

#### Functional Dependencies:

Rental\_ID → Customer\_ID, Car\_ID, Rental\_Start\_Date, Rental\_End\_Date, Total\_Cost, Status

Explanation:

Rental\_ID is the primary key, uniquely determining all other columns in the Rental\_Transactions table. It defines a single transaction, and each rental transaction is uniquely identified by this ID.

CREATE TABLE Payments (

Payment\_ID NUMBER GENERATED ALWAYS AS IDENTITY PRIMARY KEY,

Rental\_ID NUMBER REFERENCES Rental\_Transactions(Rental\_ID),

Payment\_Amount NUMBER(10, 2) NOT NULL,

Payment\_Date DATE NOT NULL,

Payment\_Method VARCHAR2(20) CHECK (Payment\_Method IN ('Credit Card', 'Cash', 'Debit'))

);

#### Functional Dependencies:

Payment\_ID → Rental\_ID, Payment\_Amount, Payment\_Date, Payment\_Method

Rental\_ID, Payment\_Date → Payment\_ID, Payment\_Amount, Payment\_Method

Explanation:

Payment\_ID is the primary key, uniquely determining the details of each payment.

Rental\_ID and Payment\_Date together could also be considered a composite candidate key, as a rental transaction may have multiple payments on different dates, but each payment on a specific date for a rental is unique.

CREATE TABLE Car\_Maintenance (

Maintenance\_ID NUMBER GENERATED ALWAYS AS IDENTITY PRIMARY KEY,

Car\_ID NUMBER REFERENCES Cars(Car\_ID),

Maintenance\_Date DATE NOT NULL,

Description VARCHAR2(255),

Maintenance\_Cost NUMBER(10, 2)

);

#### Functional Dependencies:

Maintenance\_ID → Car\_ID, Maintenance\_Date, Description, Maintenance\_Cost

Car\_ID, Maintenance\_Date → Maintenance\_ID, Description, Maintenance\_Cost

Explanation:

Maintenance\_ID is the primary key, uniquely determining each maintenance entry.

Car\_ID and Maintenance\_Date together also act as a composite key, as each maintenance activity on a specific date for a car is unique.

CREATE TABLE Locations (

Location\_ID NUMBER GENERATED ALWAYS AS IDENTITY PRIMARY KEY,

Location\_Name VARCHAR2(100) NOT NULL,

Address VARCHAR2(255) NOT NULL,

Phone\_Number VARCHAR2(15)

);

#### Functional Dependencies:

Location\_ID → Location\_Name, Address, Phone\_Number

Location\_Name → Location\_ID, Address, Phone\_Number

Explanation:

Location\_ID is the primary key, uniquely identifying each location and its associated information.

Location\_Name could serve as an alternate key since each location has a unique name, allowing it to also determine the address and phone number.

Let’s examine each table to confirm it’s in 3NF:

1. **Customers Table**
   * **Primary Key**: Customer\_ID.
   * Each non-key attribute (e.g., First\_Name, Last\_Name, Email, etc.) is directly dependent on the primary key Customer\_ID or on License\_Number, which is unique and acts as an alternate key.
   * **No Transitive Dependencies**: There are no non-key attributes that depend on other non-key attributes.
   * **Conclusion**: **3NF**.
2. **Cars Table**
   * **Primary Key**: Car\_ID.
   * Each non-key attribute (e.g., Make, Model, Year, License\_Plate, VIN, etc.) is fully dependent on the primary key Car\_ID or on License\_Plate and VIN, which are unique and could serve as candidate keys.
   * **No Transitive Dependencies**: All attributes are either directly dependent on Car\_ID or on other candidate keys.
   * **Conclusion**: **3NF**.
3. **Rental\_Transactions Table**
   * **Primary Key**: Rental\_ID.
   * Each non-key attribute (e.g., Customer\_ID, Car\_ID, Rental\_Start\_Date, etc.) is fully dependent on the primary key Rental\_ID.
   * **No Transitive Dependencies**: All attributes are directly dependent on Rental\_ID, and there are no non-key attributes that depend on each other.
   * **Conclusion**: **3NF**.
4. **Payments Table**
   * **Primary Key**: Payment\_ID.
   * Each non-key attribute (e.g., Rental\_ID, Payment\_Amount, Payment\_Date, etc.) is directly dependent on the primary key Payment\_ID.
   * **No Transitive Dependencies**: There are no non-key attributes depending on other non-key attributes.
   * **Conclusion**: **3NF**.
5. **Car\_Maintenance Table**
   * **Primary Key**: Maintenance\_ID.
   * Each non-key attribute (e.g., Car\_ID, Maintenance\_Date, Description, etc.) is fully dependent on the primary key Maintenance\_ID.
   * **No Transitive Dependencies**: All attributes are directly dependent on Maintenance\_ID, with no dependencies between non-key attributes.
   * **Conclusion**: **3NF**.
6. **Locations Table**
   * **Primary Key**: Location\_ID.
   * Each non-key attribute (e.g., Location\_Name, Address, Phone\_Number) is fully dependent on the primary key Location\_ID.
   * **No Transitive Dependencies**: All attributes are either dependent on Location\_ID or Location\_Name (an alternate key), with no dependencies between non-key attributes.
   * **Conclusion**: **3NF**.