



## UNIVERSITI MALAYSIA SARAWAK

### Faculty of Computer Science and Information Technology

#### Assignment/Project/Report Cover Sheet

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Course Code: TMF2034	Course Name: Database Concept and Design		
Assignment/Project/Report Title:	Project	Lecturer:	AP Dr. Lee Nung Kion
Due Date: 21 June 2025	Date Submitted: 26 June 2025		

This cover sheet must be completed, signed and firmly attached to the front of the submission. All work must be submitted by the due date. If an extension of work is granted, an extension acknowledgement slip must be signed by the lecturer/tutor and attached to the assignment/project/report. Please note that it is your responsibility to retain copies of your assignment.

#### **Plagiarism and Collusion are methods of cheating that are addressed in the Peraturan Akademik Universiti Malaysia Sarawak para 11: Etika Akademik**

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Plagiarism is the presentation of work which has been copied in whole or in part from another person's work, or from any other source such as the Internet, published books or periodicals without due acknowledgement given in the text.

##### **Collusion**

Collusion is the presentation of work that is the result in whole or in part of unauthorized collaboration with another person or persons.

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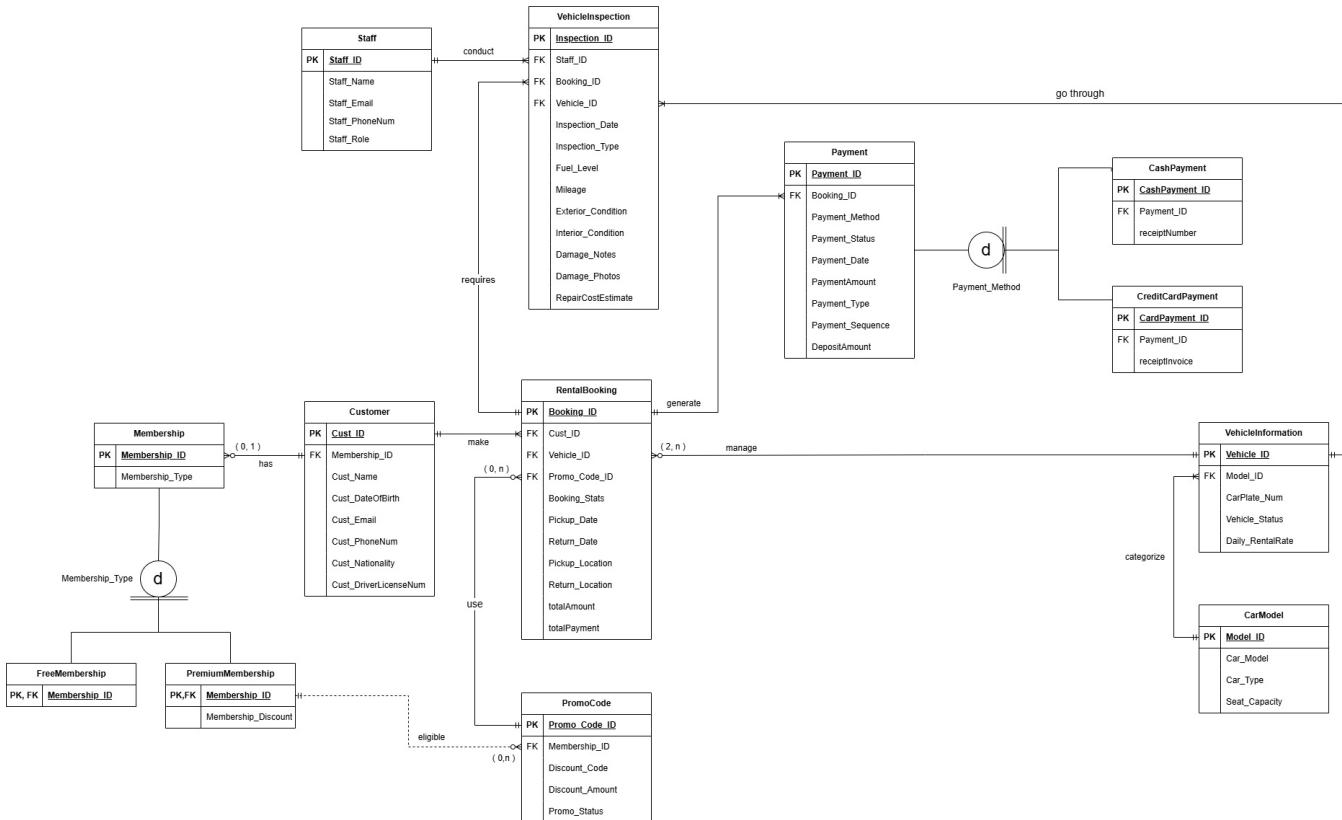
**Upon placing signature above, I certify that I have not plagiarized the work of others or participated in unauthorized collusion when preparing this assignment.**

**I also certify that I have taken proper care in safeguarding my work and have made all reasonable efforts to ensure that my work is not able to be copied.**

**MARK :**

# Relational Database Diagram

## 1. Updated ERD



Justification:

1. Membership Table is changed into a specialization hierarchy. Membership acts as the supertype while FreeMembership and PremiumMembership as subtypes. Discriminator attribute Membership\_Type is added with disjoint constraint. This will clearly distinguish the type of membership as Free and Premium Membership has different benefits. It prevents invalid membership combinations and ensures that each customer has only membership type.
2. The Payment Table is also changed into a specialization hierarchy. Payment acts as the supertype while CashPayment and CreditCardPayment as the subtypes. Payment\_Method works as the discriminator attribute. This directly addresses the previous requirement that “customers may choose to pay using either credit card or cash. It will also distinguish the payment methods since it requires different tracking information. It also supports the statement “up to two split payments per rental booking” requirement by allowing multiple payment records with different methods.
3. More attributes are added into VehicleInspection attributes (Damage\_Notes, Damage\_Photos, RepairCostEstimate) for clear damage documentation.
4. PromoCode relationship is modified as now it has direct connection to Membership entity to fulfill the promo codes are “available exclusively for premium members” in the requirements
5. Clearer attribute name (Cust\_Contact → Cust\_PhoneNum & Cust\_DOB → Cust\_DateOfBirth)
6. It has refined relationship cardinalities and the correct type of relationship compared to the previous ERD.

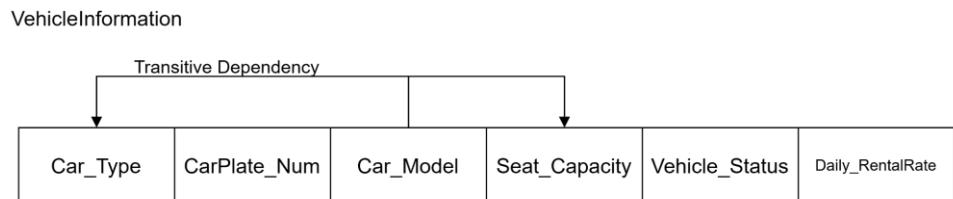
## 2. Relational Database Schema

1. Staff(Staff\_ID, Staff\_Name, Staff\_Email, Staff\_PhoneNum, Staff\_Role)
2. Customer(Cust\_ID, Cust\_Name, Cust\_Email, Cust\_PhoneNum, Cust\_DateOfBirth, Membership\_ID, Cust\_Nationality, Cust\_DriverLicenseNum)
3. Membership(Membership\_ID, Membership\_Type)
4. FreeMembership(Membership\_ID)
5. PremiumMembership(Membership\_ID, Membership\_Discount)
6. VehicleInformation(Vehicle\_ID, CarPlate\_Num, Vehicle\_Status, Daily\_RentalRate, Model\_ID)
7. CarModel(Model\_ID, Car\_Model, Car\_Type, Seat\_Capacity)
8. RentalBooking(Booking\_ID, Cust\_ID, Vehicle\_ID, Promo\_Code\_ID, Booking\_Stats, Pickup\_Date, Return\_Date, Pickup\_Location, Return\_Location)
9. Payment(Payment\_ID, Booking\_ID, Payment\_Status, Payment\_Method, Payment\_Date, PaymentAmount, Payment\_Type, Payment\_Sequence, DepositAmount, totalAmount, totalPayment)
10. CashPayment(CashPayment\_ID, Payment\_ID, receiptNumber)
11. CreditCardPayment(Payment\_ID, CardPayment\_ID, receiptInvoice)
12. PromoCode(Promo\_Code\_ID, Discount\_Amount, Membership\_ID, Discount\_Code, Promo\_Status)
13. VehicleInspection(Inspection\_ID, Staff\_ID, Booking\_ID, Vehicle\_ID, Inspection\_Date, Inspection\_Type, Fuel\_Level, Mileage, Exterior\_Condition, Interior\_Condition, Damage\_Notes, Damage\_Photos, RepairCostEstimate)

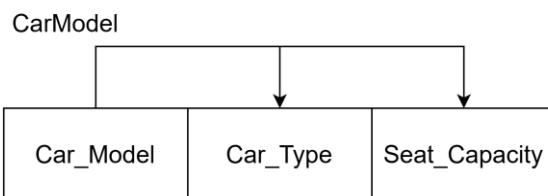
### 3. Normalization

Based on the ERD above, almost all the tables pass 1NF, 2NF and 3NF normalization except for VehicleInformation where both of them violate the 3NF normalization.

VehicleInformation	
PK	<u>Vehicle_ID</u>
	Car_Type
	CarPlate_Num
	Car_Model
	Seat_Capacity
	Vehicle_Status
	Daily_RentalRate



Transitive Dependency exists in the table for the Car\_Model where this attribute could determine the Car\_Type and Seat\_Capacity. Both Car\_Type and Seat\_Capacity are functionally dependent on Car\_Model meanwhile Car\_Model is functionally dependent on Vehicle\_ID. This causes data redundancy where the same car model information is repeated for each vehicle. There will also be update anomalies where changing a car model's type or seat capacity requires updating multiple records.



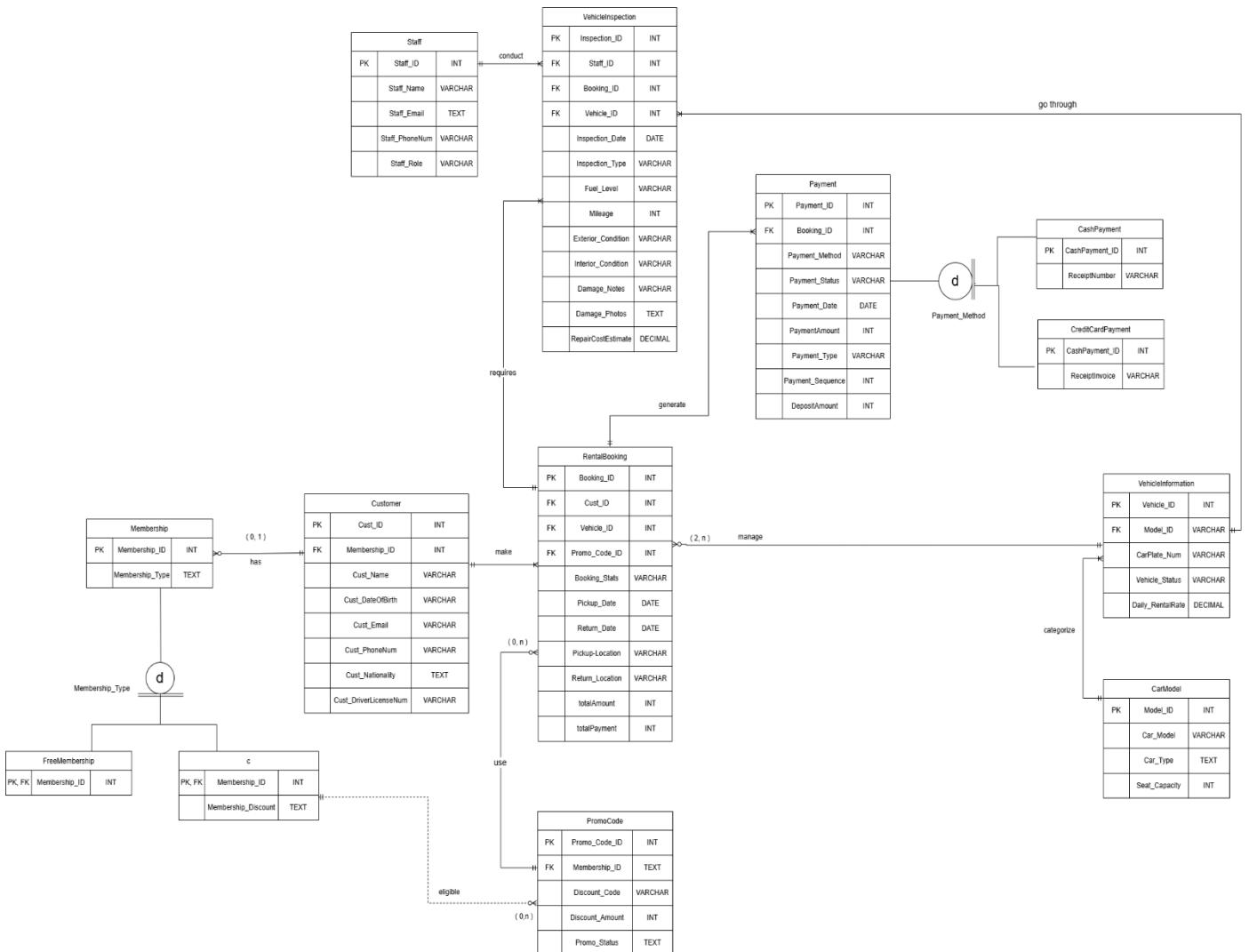
VehicleInformation	
PK	<u>Vehicle_ID</u>
FK	Model_ID
	CarPlate_Num
	Vehicle_Status
	Daily_RentalRate

CarModel	
PK	<u>Model_ID</u>
	Car_Model
	Car_Type
	Seat_Capacity

To solve this problem, a new table is created for Car\_Model and updates the VehicleInformation table. This eliminates the redundancy issues and the car model information will be stored once. The data will also be consistent as there is no duplicate car type and capacity information.

## 4. Crow's Foot relational database diagram



# Database Application

```
MariaDB [ZoomRentals]> select * from rentalbooking;
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Booking_ID | Cust_ID | Vehicle_ID | Promo_Code_ID | Booking_Status | Pickup_Date | Return_Date | Pickup_Location | Return_Location | totalAmount | totalPayment |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 6 | 6 | 1 | 1 | Confirmed | 2025-05-01 | 2025-05-03 | Vivacity | Vivacity | 600.00 | 500.00 |
| 7 | 7 | 2 | 2 | Ongoing | 2025-06-10 | 2025-06-13 | UNIMAS | UNIMAS | 450.00 | 430.00 |
| 8 | 8 | 3 | 3 | Completed | 2025-04-28 | 2025-04-22 | Kuching International Airport | Kuching International Airport | 360.00 | 355.00 |
| 9 | 9 | 4 | 4 | Cancelled | 2025-06-01 | 2025-06-05 | UNIMAS | UNIMAS | 480.00 | 6.00 |
| 10 | 10 | 5 | 5 | Completed | 2025-06-15 | 2025-06-16 | Summer Mall | Summer Mall | 210.00 | 180.00 |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
5 rows in set (0.001 sec)

MariaDB [ZoomRentals]> select * from staff;
+-----+-----+-----+-----+
| Staff_ID | Staff_Name | Staff_Email | Staff_PhoneNum | Staff_Role |
+-----+-----+-----+-----+
| 1 | Faris | faris@rent.my | 0128001111 | Technician |
| 2 | Lina Lee | lee@rent.my | 0133333333 | Clerk |
| 3 | Jordan | jordan@rent.my | 0115899999 | Manager |
| 4 | Hafiz | hafiz@rent.my | 0165553333 | Clerk |
| 5 | Jordan | jordan@rent.my | 0147778899 | Technician |
+-----+-----+-----+-----+
5 rows in set (0.001 sec)

MariaDB [ZoomRentals]> select * from vehicleinformation;
+-----+-----+-----+-----+-----+
| Vehicle_ID | CarPlate_Num | Vehicle_Status | Daily_RentalRate | Model_ID |
+-----+-----+-----+-----+
| 1 | WXA123W | available | 200.00 | 1 |
| 2 | BNL4321 | booked | 150.00 | 2 |
| 3 | JKL9881 | available | 180.00 | 3 |
| 4 | PQR2468 | booked | 120.00 | 4 |
| 5 | ZXY7654 | available | 210.00 | 5 |
+-----+-----+-----+-----+
5 rows in set (0.001 sec)

MariaDB [ZoomRentals]> select * from vehicleinspection;
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Inspection_ID | Staff_ID | Booking_ID | Vehicle_ID | Inspection_Date | Inspection_Type | Fuel_Level | Mileage | Exterior_Condition | Interior_Condition | Damage_Notes | Damage_Photos | RepairCostEstimate |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | 1 | 6 | 1 | 2025-05-01 | Pickup | 0 | 12000 | Good | Clean | None | photo1.jpg | 0.00 |
| 2 | 3 | 6 | 1 | 2025-05-03 | Return | Half | 12200 | Scratch on door | Clean | Minor scratch on door | photo2.jpg | 50.00 |
| 3 | 2 | 7 | 2 | 2025-05-10 | Pickup | Three-Quarters | 30000 | Good | Good | None | photo3.jpg | 0.00 |
| 4 | 1 | 7 | 2 | 2025-06-03 | Return | Quarter | 15250 | Good | Stains on seat | Seat stain reported | photo4.jpg | 30.00 |
| 5 | 3 | 8 | 3 | 2025-04-20 | Pickup | Full | 45000 | Good | Good | None | photo5.jpg | 0.00 |
| 6 | 2 | 8 | 3 | 2025-04-22 | Return | Half | 45150 | Dented bumper | Good | Bumper dent | photo6.jpg | 120.00 |
| 7 | 1 | 9 | 4 | 2025-06-01 | Pickup | Full | 18000 | Good | Good | None | photo7.jpg | 0.00 |
| 8 | 5 | 9 | 4 | 2025-06-05 | Return | Full | 18000 | Good | Good | Booking was cancelled | photo8.jpg | 0.00 |
| 9 | 2 | 10 | 5 | 2025-05-15 | Pickup | Half | 50000 | Excellent | Excellent | None | photo9.jpg | 0.00 |
| 10 | 1 | 10 | 5 | 2025-06-16 | Return | Quarter | 51000 | Excellent | Dirty mats | Interior needs cleaning | photo10.jpg | 20.00 |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
10 rows in set (0.001 sec)

MariaDB [ZoomRentals]>
```

```

MariaDB [ZoomRentals]> select * from customer;
+-----+-----+-----+-----+-----+-----+-----+
| Cust_ID | Membership_ID | Cust_Name | Cust_DateOfBirth | Cust_Email | Cust_PhoneNum | Cust_Nationality | Cust_DriverLicenseNum |
+-----+-----+-----+-----+-----+-----+-----+
| 6 | 1 | Ali | 2000-08-11 | alii@gmail.com | 0123456789 | Malaysian | D12345678 |
| 7 | 2 | Siti | 1999-11-22 | siti@gmail.com | 0139876543 | Malaysian | D23456789 |
| 8 | 1 | John Tan | 1998-02-05 | john@gmail.com | 0147654321 | Singaporean | D34567890 |
| 9 | 2 | Kim Jong Yoon | 2001-12-31 | kimjy@gmail.com | 0171122334 | Korean | D45678901 |
| 10 | 1 | Mike Chong | 1995-06-17 | mike@gmail.com | 0169988776 | Malaysian | D56789012 |
+-----+-----+-----+-----+-----+-----+-----+
5 rows in set (0.001 sec)

MariaDB [ZoomRentals]> select * from freemembership;
+-----+
| Membership_ID |
+-----+
| 1 |
+-----+
1 row in set (0.004 sec)

MariaDB [ZoomRentals]> select * from membership;
+-----+-----+
| Membership_ID | Membership_Type |
+-----+-----+
| 1 | Free |
| 2 | Premium |
+-----+-----+
2 rows in set (0.039 sec)

MariaDB [ZoomRentals]> select * from payment;
+-----+-----+-----+-----+-----+-----+-----+-----+
| Payment_ID | Booking_ID | Payment_Method | Payment_Status | Payment_Date | PaymentAmount | Payment_Type | Payment_Sequence | DepositAmount |
+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | 6 | cash | Paid | 2025-04-29 | 100.00 | Deposit | 1 | 100.00 |
| 2 | 6 | cash | Paid | 2025-05-03 | 400.00 | Balance | 2 | 0.00 |
| 3 | 7 | card | Paid | 2025-06-13 | 430.00 | Full Payment | 0 | 100.00 |
| 4 | 8 | cash | Paid | 2025-04-22 | 355.00 | Full Payment | 0 | 50.00 |
| 5 | 9 | card | Failed | 2025-06-05 | 0.00 | Cancelled | 0 | 0.00 |
| 6 | 10 | cash | Paid | 2025-06-14 | 50.00 | Deposit | 1 | 50.00 |
| 7 | 10 | cash | Paid | 2025-06-16 | 130.00 | Balance | 2 | 0.00 |
+-----+-----+-----+-----+-----+-----+-----+-----+
7 rows in set (0.001 sec)

MariaDB [ZoomRentals]> select * from premiummembership;
+-----+-----+
| Membership_ID | Membership_Discount |
+-----+-----+
| 2 | 0.05 |
+-----+-----+
1 row in set (0.041 sec)

MariaDB [ZoomRentals]> select * from promocode;
+-----+-----+-----+-----+
| Promo_Code_ID | Membership_ID | Discount_Code | Discount_Amount | Promo_Status |
+-----+-----+-----+-----+
| 1 | 1 | DISC10 | 10.00 | Active |
| 2 | 2 | SAVE20 | 20.00 | unused |
| 3 | 1 | DEAL5 | 5.00 | used |
| 4 | 2 | MYSTERY15 | 15.00 | unused |
| 5 | 1 | FIRST30 | 30.00 | used |
+-----+-----+-----+-----+
5 rows in set (0.001 sec)

```

```

MariaDB [(none)]> use ZoomRentals
Database changed
MariaDB [ZoomRentals]> show tables;
+-----+
| Tables_in_zoomrentals |
+-----+
| carmodel |
| cashpayment |
| creditcardpayment |
| customer |
| freemembership |
| membership |
| payment |
| premiummembership |
| promocode |
| rentalbooking |
| staff |
| vehicleinformation |
| vehicleinspection |
+-----+
13 rows in set (0.041 sec)

MariaDB [ZoomRentals]> select * from carmodel;
+-----+-----+-----+
| Model_ID | Car_Model | Car_Type | Seat_Capacity |
+-----+-----+-----+
| 1 | Toyota Fortuner | SUV | 7 |
| 2 | Honda Civic | Sedan | 5 |
| 3 | Perodua Alza | MPV | 7 |
| 4 | Myvi | Hatchback | 5 |
| 5 | Hilux | Pickup | 5 |
+-----+-----+-----+
5 rows in set (0.001 sec)

MariaDB [ZoomRentals]> select * from cashpayment;
+-----+-----+-----+
| CashPayment_ID | receiptNumber | Payment_ID |
+-----+-----+-----+
| 1 | R1001 | 1 |
| 2 | R1002 | 2 |
| 3 | R1003 | 4 |
| 4 | R1004 | 6 |
| 5 | R1005 | 7 |
+-----+-----+-----+
5 rows in set (0.007 sec)

MariaDB [ZoomRentals]> select * from creditcardpayment;
+-----+-----+-----+
| CardPayment_ID | receiptInvoice | Payment_ID |
+-----+-----+-----+
| 1 | INV1001 | 3 |
| 2 | INV1002 | 5 |
+-----+-----+-----+
2 rows in set (0.041 sec)

```

# Appendix

