Relational Schema

1. Customer (customer_id, name, contact, driving_license)
    - Primary Key (PK): customer_id
    - Functional Dependency:
        - customer_id → {name, contact, driving_license}
    - BCNF Justification:
        - No partial dependencies or transitive dependencies.
        - The only non-trivial FD is customer_id → {name, contact, driving_license}, where the LHS is a candidate key. Therefore, this relation is in BCNF.

2. Car (car_id, model, make, year, color, category, rental_status, price_id)
    - Primary Key (PK): car_id
    - Foreign Key (FK): price_id → Price(price_id)
    - Functional Dependency:
        - car_id → {model, make, year, color, category, rental_status, price_id}
    - BCNF Justification:
        - No partial dependencies or transitive dependencies.
        - The only non-trivial FD is car_id → {all attributes}, where car_id is the candidate key. This relation is in BCNF.

3. Price (price_id, base_price, seasonal_adjustment, promotion_discount)
    - Primary Key (PK): price_id
    - Functional Dependency:
        - price_id → {base_price, seasonal_adjustment, promotion_discount}
    - BCNF Justification:
        - The only non-trivial FD is price_id → {all attributes}, where price_id is the primary key. There are no other dependencies. This relation is in BCNF.

4. Booking (booking_id, customer_id, start_date, end_date, total_cost)

- Primary Key (PK): booking_id
- Foreign Key (FK): customer_id → Customer(customer_id)
    - Functional Dependency:
- booking_id → {customer_id, start_date, end_date, total_cost}
- BCNF Justification:
    - The only non-trivial FD is booking_id → {all attributes}, where booking_id is the primary key. This relation is in BCNF.

5. Car_Booking (car_id, booking_id)

- Primary Key (PK): (car_id, booking_id)
- Foreign Keys (FK):
    - car_id → Car(car_id)
    - booking_id → Booking(booking_id)
- Functional Dependency:
    - (car_id, booking_id) → {} (no non-trivial FDs)
- BCNF Justification:
    - The composite key (car_id, booking_id) is the only candidate key, and there are no non-trivial FDs. This relation is in BCNF.

6. Maintenance_Record (maintenance_record_id, car_id, maintenance_type, maintenance_date)

- Primary Key (PK): maintenance_record_id
- Foreign Key (FK): car_id → Car(car_id)
- Functional Dependency:
    - maintenance_record_id → {car_id, maintenance_type, maintenance_date}
- BCNF Justification:
    - The only non-trivial FD is maintenance_record_id → {all attributes}, where maintenance_record_id is the primary key. This relation is in BCNF.

7. Report (report_id, booking_id, type, generated_date, details)

- Primary Key (PK): report_id
- Foreign Key (FK): booking_id → Booking(booking_id)
- Functional Dependency:
  - report_id → {booking_id, type, generated_date, details}
- BCNF Justification:
  - The only non-trivial FD is report_id → {all attributes}, where report_id is the primary key. This relation is in BCNF.

Functional Dependencies Overview

1. Customer
   1.1. customer_id → {name, contact, driving_license}
2. Car
   2.1. car_id → {model, make, year, color, category, rental_status, price_id}
3. Price
   3.1. price_id → {base_price, seasonal_adjustment, promotion_discount}
4. Booking
   4.1. booking_id → {customer_id, start_date, end_date, total_cost}
5. Car_Booking
   5.1. (car_id, booking_id) → {}
6. Maintenance_Record
   6.1. maintenance_record_id → {car_id, maintenance_type, maintenance_date}
7. Report
   7.1. report_id → {booking_id, type, generated_date, details}

BCNF Justification

All relations are in BCNF because:

1. In each relation, for every non-trivial FD, the **left-hand side (LHS)** is a **superkey**.
2. There are no partial or transitive dependencies.