PHASE 2

Database Design

Group 12

Business rules

1. **Vehicle Ownership and Eligibility:**
    - The company owns a fleet of vehicles categorised into small, mid, and large.
    - Only individuals aged 18 or older with a valid driver's licence for at least one year are eligible to rent a vehicle**.**
2. **Reservation Requirements**:
    - Customers must make a reservation before renting a vehicle.
    - During the reservation, customers must specify:
        i. Pickup date and time
        ii. Drop-off date and time
        iii. Pickup location
        iv. Drop-off location
        v. Desired vehicle type (small, mid, large)
3. **Vehicle Condition and Availability**:
    - Vehicles are available for rent only if they are in good condition.
    - The company ensures 24/7 availability of services at all locations.
4. **Rental Locations**

- The company has multiple rental locations in different cities across the country

Conceptual design

Entities

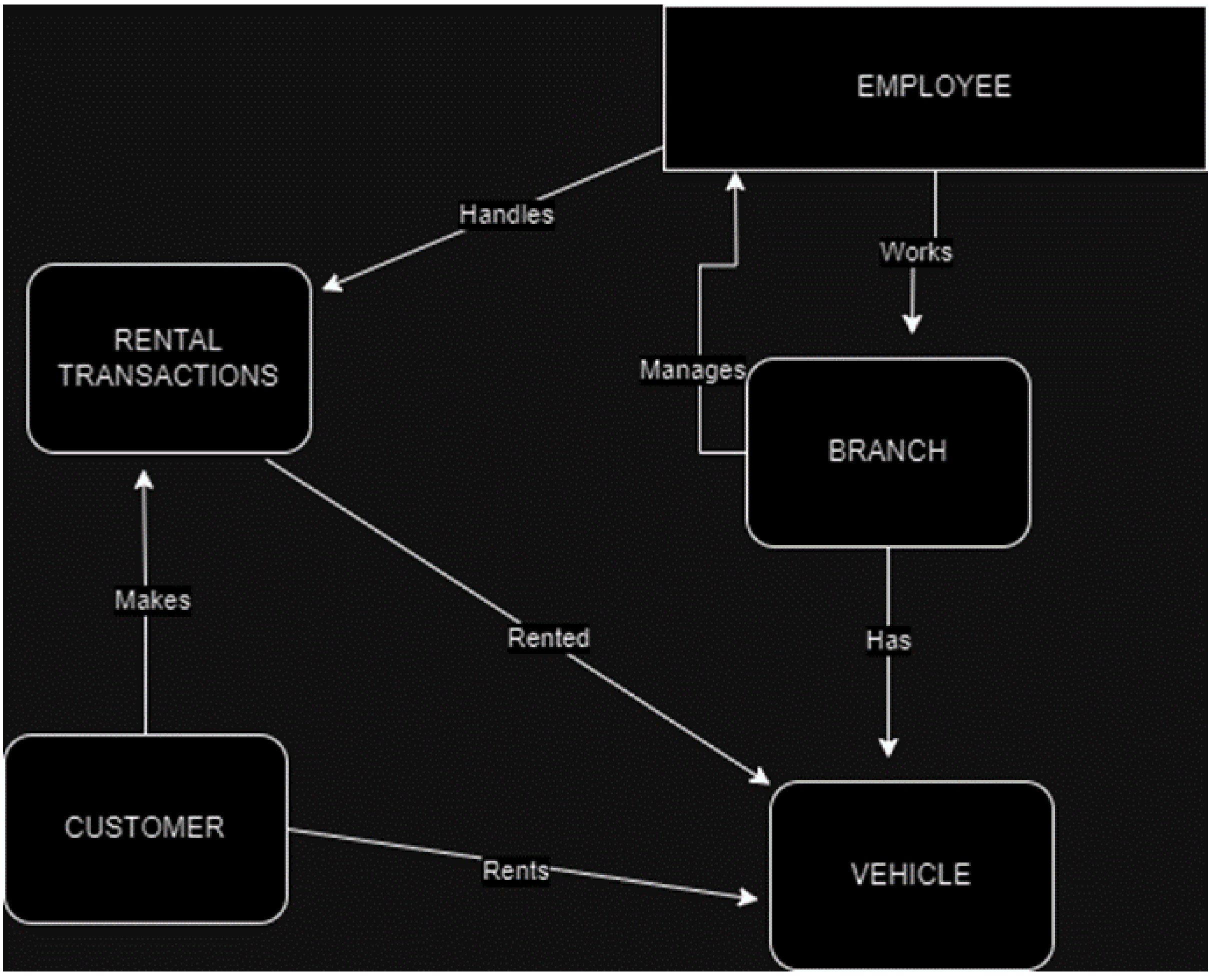
- Vehicle
    - **Attributes:** Vehicle ID number, Model, colour, vehicle type, condition, rental history, availability, licence plate number, mileage
- Customer
    - **Attributes:** Customer ID, full name, contact information (phone number, email address, physical address), Date of birth, ID number, payment information, Rental history
- Rental transaction
    - **Attributes:** Rental ID, *Customer ID*, *Vehicle ID*, Rental start date and time, Rental end date and time, Rental duration, total rental cost, mileage at start and end, vehicle condition, return location, Rental status, Employee id (employee handling the rental transaction)
- Employee
    - **Attributes:** Employee ID, Full name, contact information (Phone number, email address, and physical address), date of birth, Employee role/position, department (e.g., Rental Operations, Customer Service, Maintenance), Employment start date, Manager/supervisor, bank account information
- Branch
    - **Attributes:** Branch ID, Branch name, address (street address, city, state/province, and postal/ZIP code), contact information (phone number, email address)

Relationships

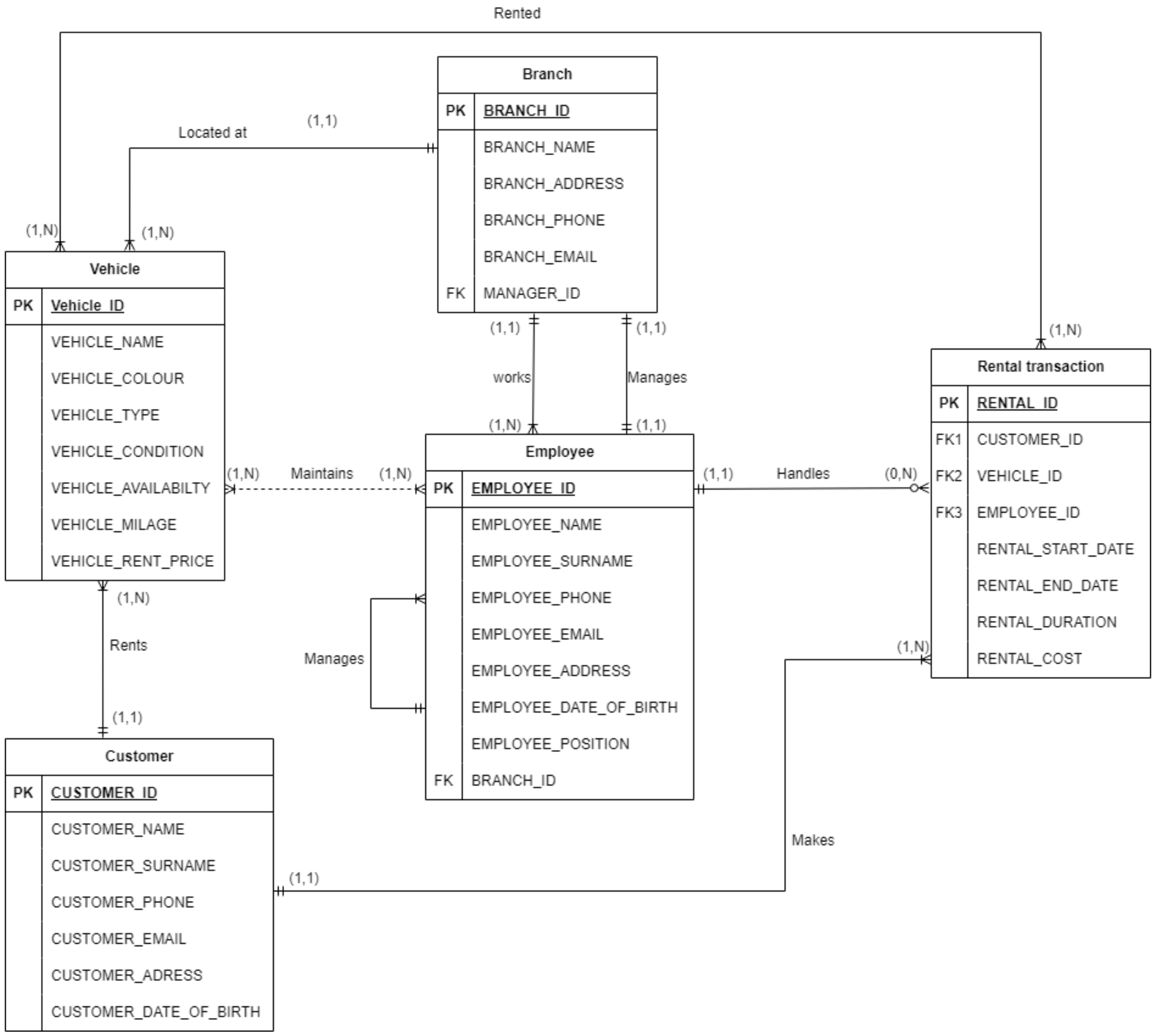
1. **Customer rents a vehicle: One-to-Many**
   A customer can rent multiple vehicles.
   The Rental entity has a foreign key CustomerID which references the Customer entity
2. **Customer makes a rental transaction: One-to-Many**
   A customer can engage in multiple rental transactions.
   The RentalTransaction entity has a foreign key CustomerID which references the Customer entity.
3. **Employee handles rental transaction: One-to-Many**
   An employee can handle multiple rental transactions.
   The RentalTransaction entity has a foreign key EmployeeID which references the Employee entity
4. **Employee helps customer with rental transaction (Ternary relationship)**
   This is a ternary relationship involving the Employee, Customer, and RentalTransaction entities
5. **Employee works at a branch: Many-to-One**
   An employee works at one branch.
   The Employee entity has a foreign key BranchID which references the Branch entity
6. **Employee manages a branch: One-to-One**
   An employee manages one branch.
   The Branch entity has a foreign key ManagerID which references the Employee entity.
7. **Vehicle is rented at a branch (weak): Many-to-One**
   A vehicle is rented at one branch.
   The Vehicle entity has a foreign key BranchID which references the Branch entity.
8. **Customer visits a branch (weak relationship): Many-to-Many**
   A customer can visit multiple branches, and a branch can be visited by multiple customers.
   This is typically represented by a junction table connecting Customer and Branch entities
9. **Vehicle is rented during a rental transaction: One-to-One**
   Each rental transaction involves the rental of one vehicle.
   The RentalTransaction entity has a foreign key VehicleID which references the Vehicle entity.
10. **Vehicle is maintained by an employee (weak relationship): Many-to-One**
    A vehicle is maintained by one employee.
    The Vehicle entity has a foreign key MaintenanceEmployeeID which references the Employee entity.
11. **Rental transaction is made at a branch (weak relationship): Many-to-One**
    A rental transaction is associated with one branch where it takes place.
    The RentalTransaction entity has a foreign key BranchID which references the Branch entity
12. **Branch is located at Address: Many-to-One**
    Each branch is uniquely located at one address.

The Branch entity has a mandatory foreign key AddressID which references the Address entity.

CONCEPTUAL MODEL



Initial Entity relationship diagram



Multi-valued attributes:

- BRANCH_PHONE
- CUSTOMER_PHONE
- EMPLOYEE_PHONE

Derived attributes:

- Rental_Duration
- Rental_Cost

Composite attributes:

- Employee_Address
- Customer_Address
- Branch_Address

Mandatory relationships:

- (Rental Transaction). A rental transaction must involve a Customer and a Vehicle (M:1 or 1:M depending on how rentals are handled).
- (Employee - Branch). If the Employee table stores branch management information, there might be a mandatory relationship where an Employee must manage a Branch (1:1).

Strong relationships:

- Vehicles exist even if they are never rented

- Branches always exist even if no one manages them or no rental occurs there.

Optional relationships:

- (Vehicle - Rental Transaction). A vehicle might never be rented (1:0 or 1:N).
- (Branch - Rental Transaction). A branch might not have any rentals (1:0 or 1:N).

Logical design

1. Mapping the Conceptual Model to the Relational Model

Strong entities:

VEHICLE (**VEHICLE_ID**, VEHICLE_NAME, VEHICLE_COLOR, VEHICLE_TYPE, VEHICLE_CONDITION, VEHICLE_AVAILABILITY, VEHICLE_MILEAGE, VEHICLE_RENT_PRICE)

PRIMARY KEY: VEHICLE_ID

CUSTOMER (**CUSTOMER_ID**, CUSTOMER_NAME, CUSTOMER_SURNAME CUSTOMER_PHONE, CUSTOMER_EMAIL, CUSTOMER_ADRESS, CUSTOMER_DATE_OF_BIRTH, CUSTOMER_AGE)

PRIMARY KEY: CUSTOMER_ID

supertype/subtype relationships

EMPLOYEE (**EMPLOYEE_ID**, EMPLOYEE_NAME, EMPLOYEE_SURNAME, EMPLOYEE_PHONE, EMPLOYEE_EMAIL, EMPLOYEE_ADDRESS, EMPLOYEE_POSITION, *BRANCH_ID*)

Primary key: EMPLOYEE_ID
Foreign key: BRANCH_ID REFERENCES BRANCH

BRANCH (**BRANCH_ID**, BRANCH_NAME, BRANCH_ADDRESS, BRANCH_PHONE, BRANCH_EMAIL, *EMPLOYEE_ID*)

Primary Key: BRANCH_ID
Foreign key: EMPLOYEE_ID REFERENCES EMPLOYEE

higher-degree relationships:

RENTAL TRANSACTION (**RENTAL_ID**, *CUSTOMER_ID*, *VEHICLE_ID*, *EMPLOYEE_ID*, RENTAL_START_DATE, RENTAL_END_DATE, RENTAL_DURATION, RENTAL_COST)

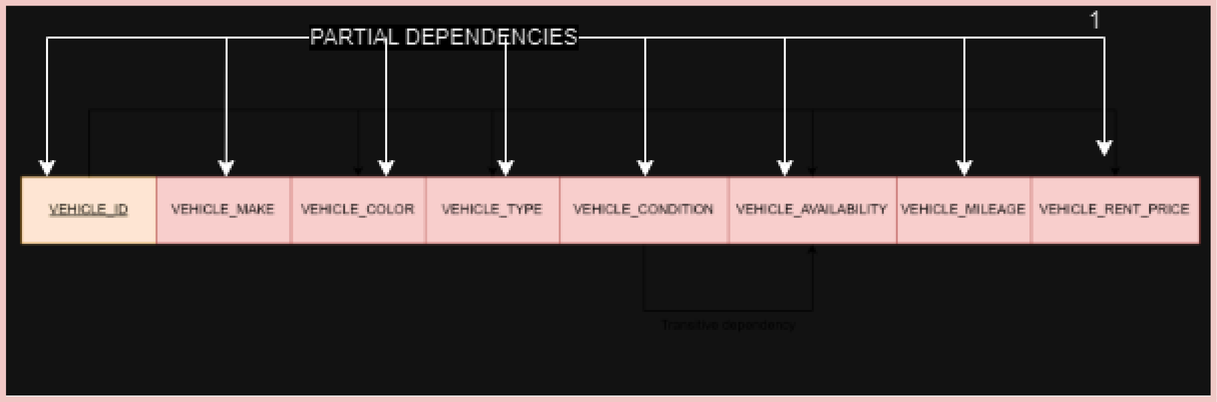
Primary key: RENTAL_ID
Foreign key: CUSTOMER_ID REFERENCES CUSTOMER

VEHICLE_ID REFERENCES VEHICLE
EMPLOYEE_ID REFERENCES EMPLOYEE

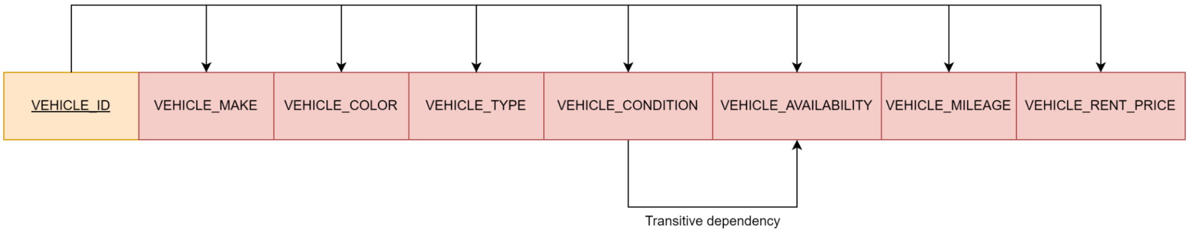
2. Normalisation

Table: Vehicle

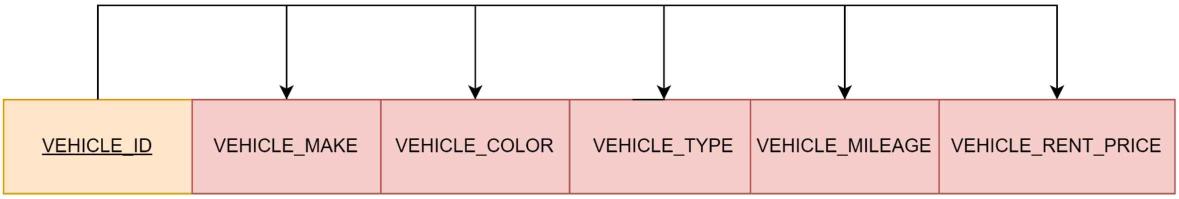
1NF

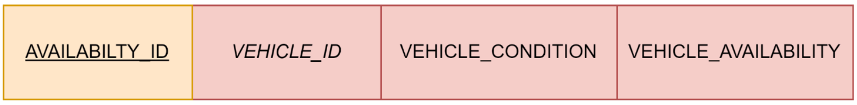


2NF

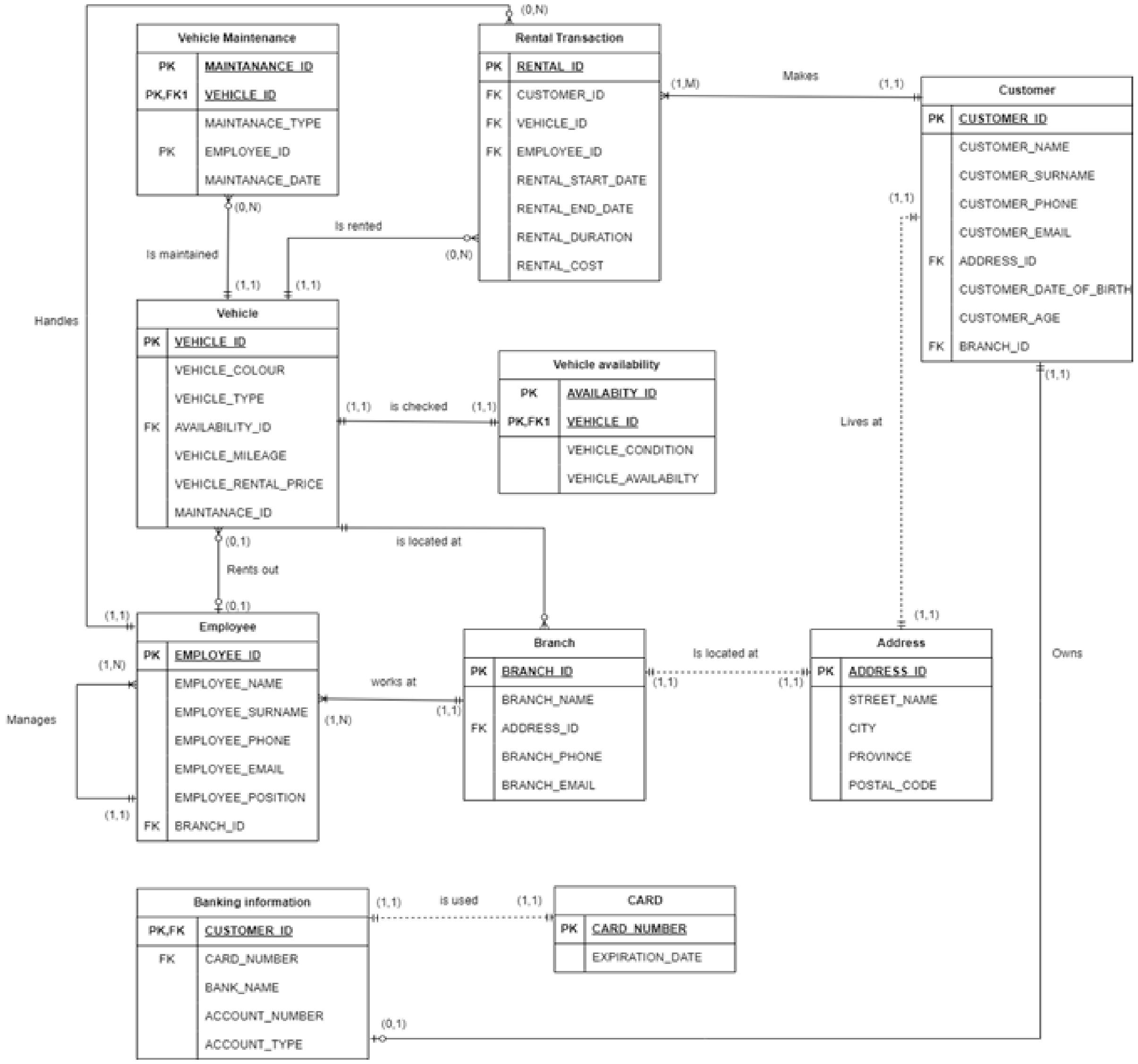


3NF





Logical Entity Relationship diagram



Group Member contribution

Student Number	Phase 1 Contribution	Phase 2 Contribution
37320629	100%	100%
42618282	100%	100%
37574175	100%	100%
40837335	100%	100%
35111550	100%	100%
34812938	100%	100%
28844467	100%	100%