



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



 Search Course

Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-

Design a Car Rental System

Let's design a car rental system where customers can rent vehicles.

We'll cover the following



- System Requirements
- Use case diagram
- Class diagram
- Activity diagrams
- Code

A Car Rental System is a software built to handle the renting of automobiles for a short period of time, generally ranging from a few hours to a few weeks. A car rental system often has numerous local branches (to allow its user to return a vehicle to a different location), and primarily located near airports or busy city areas.

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



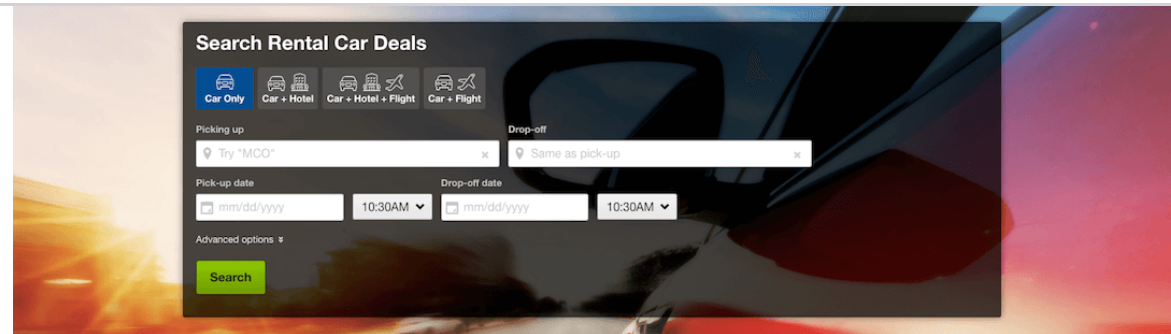
 Search Course

Design a Parking Lot
(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design Amazon - Online Shopping System
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

Design Stack Overflow
(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)



System Requirements

#

We will focus on the following set of requirements while designing our Car Rental System:

1. The system will support the renting of different automobiles like cars, trucks, SUVs, vans, and motorcycles.
2. Each vehicle should be added with a unique barcode and other details, including a parking stall number which helps to locate the vehicle.
3. The system should be able to retrieve information like which member took a particular vehicle or what vehicles have been rented out by a specific member.

PK



 **educative** (/learn)



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



 Search Course

Design a Parking Lot
System
(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-

4. The system should collect a late-fee for vehicles returned after the due date.



5. Members should be able to search the vehicle inventory and reserve any available vehicle.

6. The system should be able to send notifications whenever the reservation is approaching the pick-up date, as well as when the vehicle is nearing the due date or has not been returned within the due date.

7. The system will be able to read barcodes from vehicles.

8. Members should be able to cancel their reservations.

9. The system should maintain a vehicle log to track all events related to the vehicles.

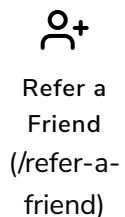
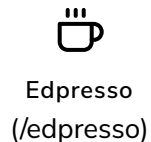
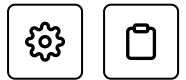
10. Members can add rental insurance to their reservation.

11. Members can rent additional equipment, like navigation, child seat, ski rack, etc.

12. Members can add additional services to their reservation, such as roadside assistance, additional driver, wifi, etc.

Use case diagram

#



Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



 Search Course

Design a Parking Lot
System
(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-

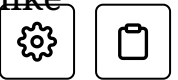
- **Receptionist:** Mainly responsible for adding and modifying vehicles and workers. Receptionists can also reserve vehicles.
- **Member:** All members can search the catalog, as well as reserve, pick-up, and return a vehicle.
- **System:** Mainly responsible for sending notifications about overdue vehicles, canceled reservation, etc.
- **Worker:** Mainly responsible for taking care of a returned vehicle and updating the vehicle log.

Here are the top use cases of the Car Rental System:

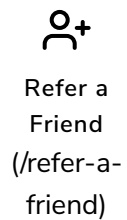
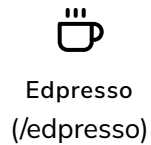
- **Add/Remove/Edit vehicle:** To add, remove or modify a vehicle.
- **Search catalog:** To search for vehicles by type and availability.
- **Register new account/Cancel membership:** To add a new member or cancel an existing membership.
- **Reserve vehicle:** To reserve a vehicle.
- **Check-out vehicle:** To rent a vehicle.
- **Return a vehicle:** To return a vehicle which was checked-out to a member.

PK

- **Add equipment:** To add an equipment to a reservation like navigation, child seat, etc.



- **Update car log:** To add or update a car log entry, such as refueling, cleaning, damage, etc.



Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



Q Search Course

Design a Parking Lot
System
(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



Search Course

System

(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design a Parking Lot

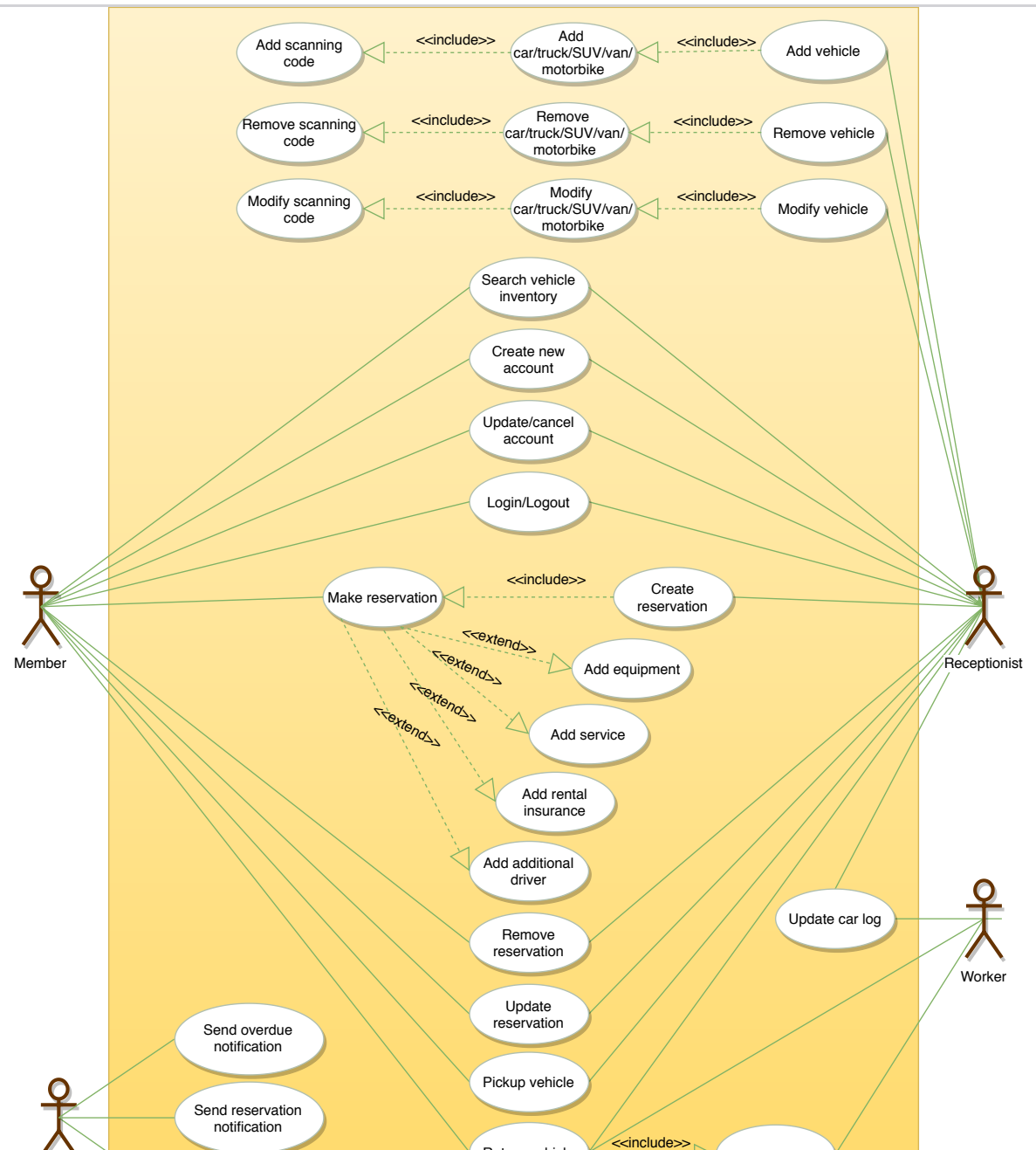
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

Design Amazon - Online Shopping System

(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Design Stack Overflow

(/courses/grokking-the-object-



Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



🔍 Search Course

Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Stack Overflow
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Class diagram

#

Here are the main classes of our Car Rental System:

- **CarRentalSystem:** The main part of the organization for which this software has been designed.
- **CarRentalLocation:** The car rental system will have multiple locations, each location will have attributes like 'Name' to distinguish it from any other locations and 'Address' which defines the address of the rental location.
- **Vehicle:** The basic building block of the system. Every vehicle will have a barcode, license plate number, passenger capacity, model, make, mileage, etc. Vehicles can be of multiple types, like car, truck, SUV, etc.
- **Account:** Mainly, we will have two types of accounts in the system, one will be a general member and the other will be a receptionist. Another account can be of the worker taking care of the returned vehicle.



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



 Search Course

Design a Parking Lot
System
(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

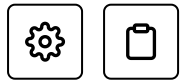
Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-

- **VehicleReservation:** This class will be responsible for managing reservations for a vehicle.
- **Notification:** Will take care of sending notifications to members.
- **VehicleLog:** To keep track of all the events related to a vehicle.
- **RentalInsurance:** Stores details about the various rental insurances that members can add to their reservation.
- **Equipment:** Stores details about the various types of equipment that members can add to their reservation.
- **Service:** Stores details about the various types of service that members can add to their reservation, such as additional drivers, roadside assistance, etc.
- **Bill:** Contains different bill-items for every charge for the reservation.

PK



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed

Search Course

System

(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design a Parking Lot

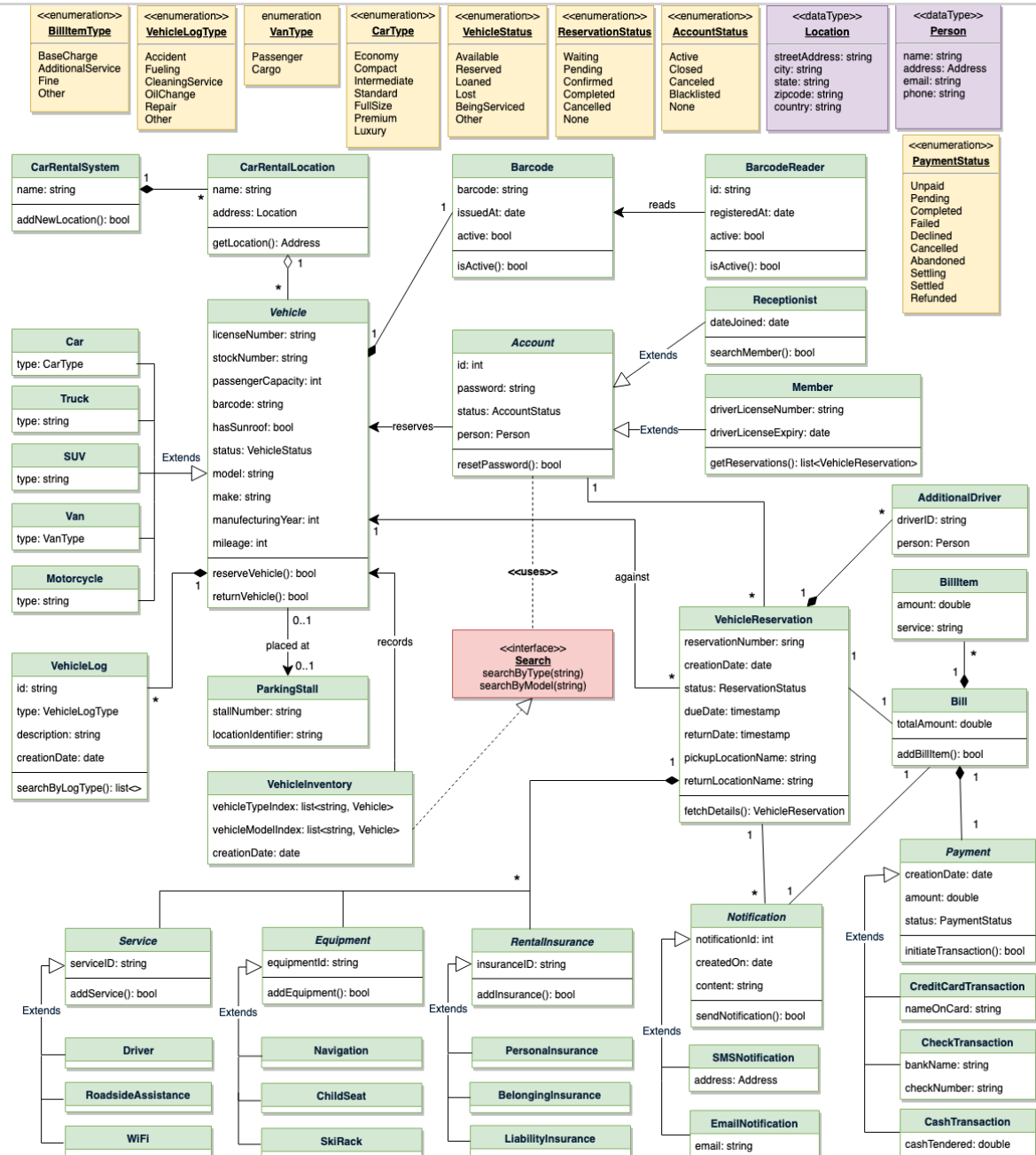
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

Design Amazon - Online Shopping System

(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Design Stack Overflow

(/courses/grokking-the-object-



Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)
64% completed

Search Course

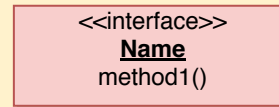
System
(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

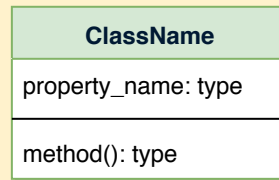
Design Amazon - Online Shopping System
(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-oriented-design-interview/...

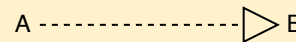
UML conventions



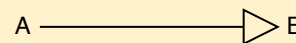
Interface: Classes implement interfaces, denoted by Generalization.



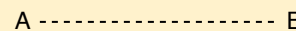
Class: Every class can have properties and methods. Abstract classes are identified by their *Italic* names.



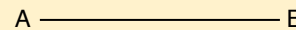
Generalization: A implements B.



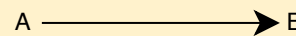
Inheritance: A inherits from B. A "is-a" B.



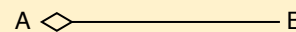
Use Interface: A uses interface B.



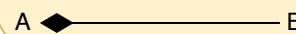
Association: A and B call each other.



Uni-directional Association: A can call B, but not vice versa.



Aggregation: A "has-an" instance of B. B can exist without A.



Composition: A "has-an" instance of B. B cannot exist without A.

Activity diagrams

#

Pick up a vehicle: Any member can perform this activity. Here are

PK



educative(/learn)

the steps to pick up a vehicle:



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



Search Course

System

(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design a Parking Lot

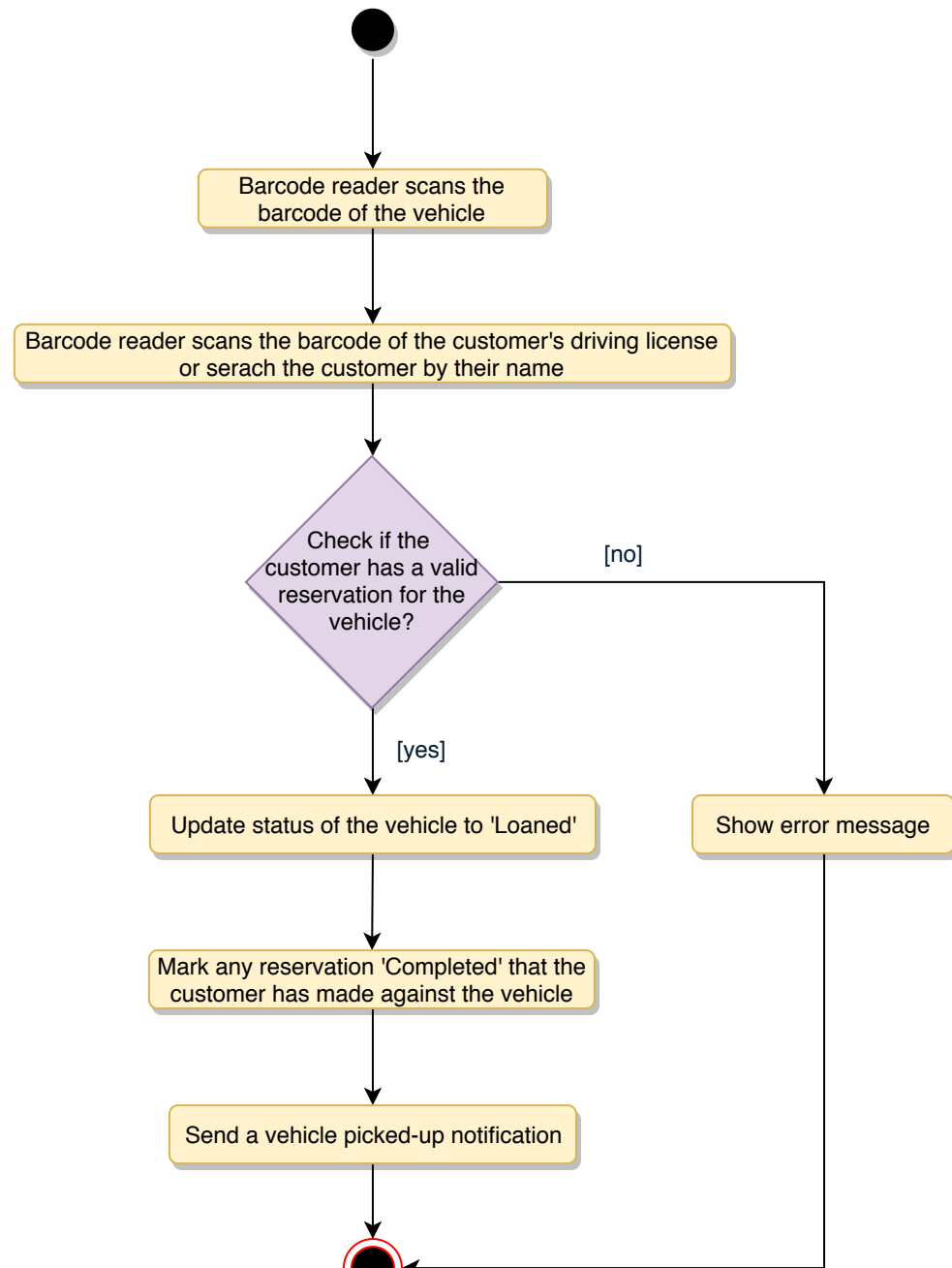
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System

(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow

(/courses/grokking-the-object-



Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



Search Course

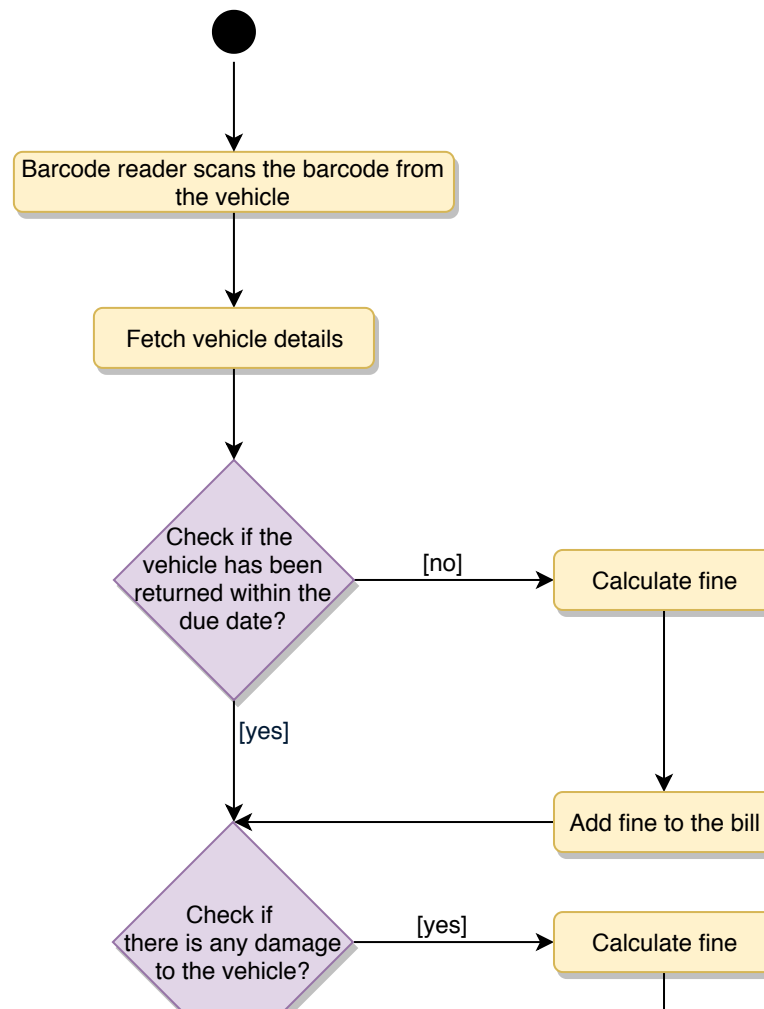
System
(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

Design Amazon - Online Shopping System
(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-oriented-design-interview/stack-overflow)

Return a vehicle: Any worker can perform this activity. While returning a vehicle, the system must collect a late fee from the member if the return date is after the due date. Here are the steps for returning a vehicle:



PK



educative(/learn)



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



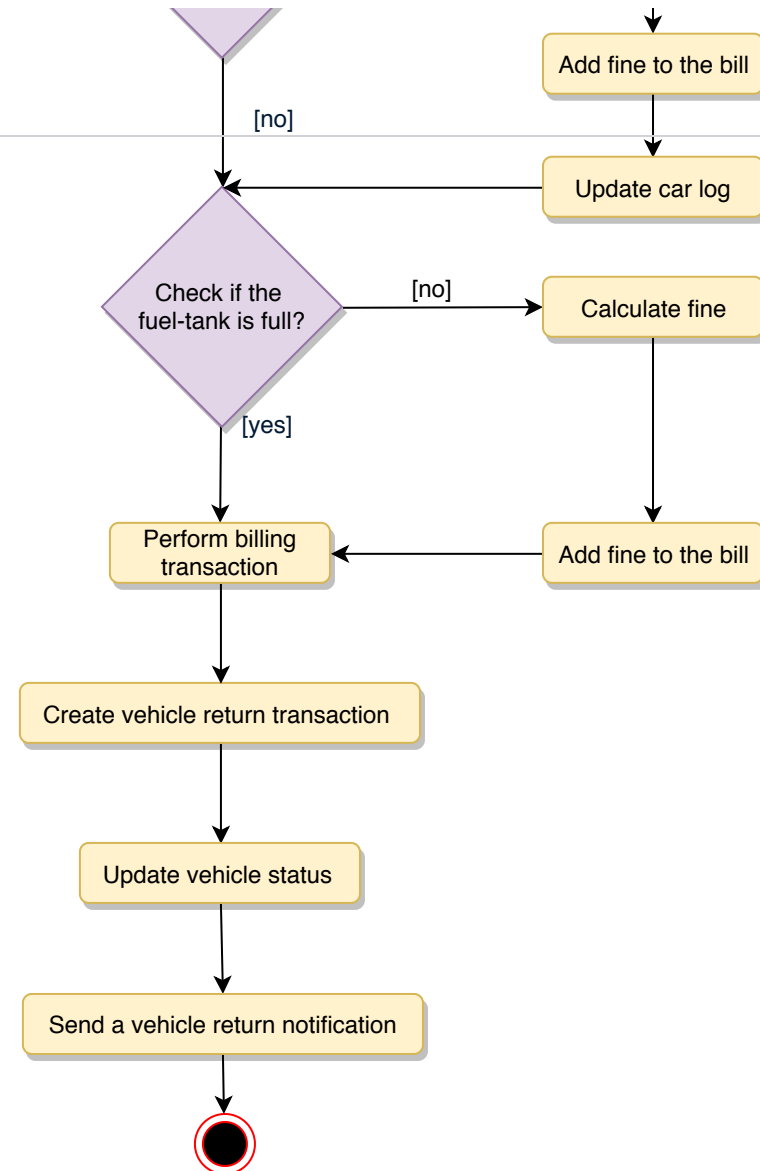
Search Course

System
(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-

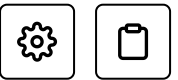




Code

#

Here is the high-level definition for the classes described above.

PK


Explore
(/explore)
Tracks
(/tracks)
My Courses
(/mycourses)
Edpresso
(/edpresso)
Refer a
Friend
(/refer-a-
friend)
Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



System
(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-

Enums, data types and constants: Here are the required enums,
data types, and constants:

 Java Python

```
1 public enum BillItemType {
2     BASE_CHARGE, ADDITIONAL_SERVICE, FINE, OTHER
3 }
4
5 public enum VehicleLogType {
6     ACCIDENT, FUELING, CLEANING_SERVICE, OIL_CHANGE, REPAIR, OTHER
7 }
8
9 public enum VanType {
10     PASSENGER, CARGO
11 }
12
13 public enum CarType {
14     ECONOMY, COMPACT, INTERMEDIATE, STANDARD, FULL_SIZE, PREMIUM, LU
15 }
16
17 public enum VehicleStatus {
18     AVAILABLE, RESERVED, LOANED, LOST, BEING_SERVICED, OTHER
19 }
20
21 public enum ReservationStatus {
22     ACTIVE, PENDING, CONFIRMED, COMPLETED, CANCELLED, NONE
23 }
24
25 public enum AccountStatus {
```

PK

26 ACTIVE, CLOSED, CANCELED, BLACKLISTED, BLOCKED
27 }
28





Explore
(/explore)


Tracks
(/tracks)


My Courses
(/mycourses)


Edpresso
(/edpresso)


Refer a
Friend
(/refer-a-
friend)


Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



 Search Course

Design a Parking Lot
(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design Amazon - Online Shopping System
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

Design Stack Overflow
(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Account, Member, Receptionist, and Additional Driver: These classes represent different people that interact with our system:

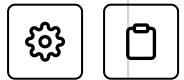
 Java

 Python

```
1 // For simplicity, we are not defining getter and setter functions
2 // assume that all class attributes are private and accessed through
3 // public getter method and modified only through their public setter
4
5 public abstract class Account {
6     private String id;
7     private String password;
8     private AccountStatus status;
9     private Person person;
10
11     public boolean resetPassword();
12 }
13
14 public class Member extends Account {
15     private int totalVehiclesReserved;
16
17     public List<VehicleReservation> getReservations();
18 }
19
20 public class Receptionist extends Account {
21     private Date dateJoined;
22
23     public List<Member> searchMember(String name);
24 }
25
```

PK

```
26 public class AdditionalDriver {
27     private String driverID;
28     private Person person;
```



Explore (/explore)

Tracks (/tracks)

My Courses (/mycourses)

Edpresso (/edpresso)

Refer a Friend (/refer-a-friend)

Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)
64% completed

Search Course

System
(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

Design Amazon - Online Shopping System
(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-

CarRentalSystem and CarRentalLocation: These classes represent the top level classes:

Java

Python

```
1 public class CarRentalLocation {
2     private String name;
3     private Address location;
4
5     public Address getLocation();
6 }
7
8 public class CarRentalSystem {
9     private String name;
10    private List<CarRentalLocation> locations;
11
12    public boolean addNewLocation(CarRentalLocation location);
13 }
14
```

Vehicle, VehicleLog, and VehicleReservation: To encapsulate a vehicle, log, and reservation. The VehicleReservation class will be responsible for processing the reservation and return of a vehicle:

Java

Python

```
1 public abstract class Vehicle {
```


PK



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



 Search Course

System

(/courses/grokking-the-object-
oriented-design-
interview/RMIM3NgjAyR)

Design a Parking Lot

(/courses/grokking-the-object-
oriented-design-
interview/gxM3gRxmr8Z)

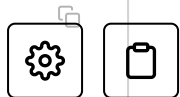
Design Amazon - Online
Shopping System

(/courses/grokking-the-object-
oriented-design-
interview/Bn8PMllro6Q)

Design Stack Overflow

(/courses/grokking-the-object-

```
2 private String licenseNumber;
3 private String stockNumber;
4 private int passengerCapacity;
5 private String barcode;
6 private boolean hasSunroof;
7 private VehicleStatus status;
8 private String model;
9 private String make;
10 private int manufacturingYear;
11 private int mileage;
12
13 private List<VehicleLog> log;
14
15 public boolean reserveVehicle();
16
17 public boolean returnVehicle();
18 }
19
20 public class Car extends Vehicle {
21     private CarType type;
22 }
23
24 public class Van extends Vehicle {
25     private VanType type;
26 }
27
28 public class Truck extends Vehicle {
```



VehicleInventory and Search: VehicleInventory will implement an interface 'Search' to facilitate the searching of vehicles:



Java



Python

PK



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017)

64% completed



System
(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

Design Amazon - Online Shopping System
(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-oriented-design-interview/...

```
1 public interface Search {
2     public List<Vehicle> searchByType(String type);
3     public List<Vehicle> searchByModel(String model);
4 }
5
6 public class VehicleInventory implements Search {
7     private HashMap<String, List<Vehicle>> vehicleTypes;
8     private HashMap<String, List<Vehicle>> vehicleModels;
9
10    public List<Vehicle> searchByType(String query) {
11        // return all vehicles of the given type.
12        return vehicleTypes.get(query);
13    }
14
15    public List<Vehicle> searchByModel(String query) {
16        // return all vehicles of the given model.
17        return vehicleModels.get(query);
18    }
19 }
20
```



← Back

(/courses/grokking-

the-

object-

oriented-

Designing an Online Stock Brokerage Sys...
interview/RM8ol3m2o3w)

Next →



MARK AS COMPLETED

(/courses/grokking-

the-

object-

oriented-

Designing an In...
interview/gxMOMDVKIBk)



Report



Ask a Question

(https://discuss.educative.io/c/grokking-the-object-oriented-design-interview/design-gurus/object-oriented-design-case-studies/design



Explore
(/explore)



Tracks
(/tracks)



My Courses
(/mycourses)



Edpresso
(/edpresso)



Refer a
Friend
(/refer-a-
friend)



Create

Grokking the Object Oriented Design Interview

(/collection/5668639101419520/56922017

64% completed



 Search Course

Design a Parking Lot
System
(/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR)

Design a Parking Lot
(/courses/grokking-the-object-oriented-design-interview/gxM3gRxmr8Z)

Design Amazon - Online
Shopping System
(/courses/grokking-the-object-oriented-design-interview/Bn8PMllro6Q)

Design Stack Overflow
(/courses/grokking-the-object-