Objective

The objective of this team project is for you to apply what you have learned in class to design and develop a database application using PostgreSQL. The project is to be done in teams of four students. The project consists of the following four tasks:

(P01) Design an ER data model for the application. Your ER model should capture as many of the application's requirements as possible.

(P02) Translate your ER data model into a relational database schema. Your relational schema should capture as many of the application's constraints as possible.

(P03) Implement an SQL or PL/pgSQL functions/procedures for each of the functionalities listed in Application Functionalities.

(P03) Implement triggers as required by the specification.

Background

Barg Car is a car rental company started by students in NUS. You and your team is are hired by the President of Barg Car to develop the backend application (*i.e.*, database, do not worry about server) for the company. You do not have to worry about frontend as long as the backend is robust and consistent.

Application Description

Barg Car is an online car rental company with several physical offices. Each office must have at least one employee. Cars are parked in one of the offices.

To rent a car, a customer first register their information online on via an app. Then they choose a car model, the pickup location (*i.e.*, one of the offices), the start date, and the number of days they want to rent the car.

For each car model, the company has a specific daily rent price as well as a fixed deposit price. To make a booking, the customer will have to make a payment using a credit card. At this point, the booking is made with a unique booking id and the booking date is also recorded.

If there is a car available at a particular location, Barg Car assigns a specific car with a specific license plate number to the booking. A car is available if the car belongs to the location, it is not being rented in the duration of the rent, and it is not damaged. A car is rented if between start date and (start date + number of day) there is a booking. However, a car may be returned early, in which case the car will be available the following day. We will assume that the car will not be returned late. Once the available car is assigned, the assigned car is guaranteed to be available at the pickup location on the given start date.

Additionally, given the booking id, the customer may also hire a driver. A driver is also an employee of Barg Car. The driver need not be hired for the full duration of the booking but cannot be hired before the start date or after the return date (*i.e.*, after the start date + the number of days). For instance, if the start date is 15/01/2024 and the booking is 5 days, the return date is 20/01/2024. For simplicity, a driver can only be hired for consecutive days. As such, for the duration above, the customer cannot hire a driver on 15/01/2024 and 17/01/2024, skipping 16/01/2024. However, the customer may hire a driver from 16/01/2024 to 19/01/2024.

To guarantee that a specific car is available at the given location, each specific car belongs to only one location. Although customers are allowed to return the car to any location, the company will move the car to its correct location. This is done overnight with the guarantee that if a car is returned to a different location on 20/01/2024, it will be available at the correct location by 21/01/2024. You do not have to worry about how Barg Car handles this.

On the start date of the rent, an employee of Barg Car at the pickup location will pass the key to the customer. This has to be recorded in the database for tracking purposes. When the customer returns the car at any location, another employee at the return location (*which may be different from the pickup location*) will receive the key from the customer. If the total cost for the rent is lower than the deposit, the difference is returned. Otherwise, additional payment is to be made by the customer using credit card. Note that the total cost for the rent is the number of days times the daily rent price. Even if the car is returned early, we will still charge for the entire booking duration.

Consider a car with a daily rent price of $200 and a deposit of $1500 is rented from 20/10/2024. If the car is rented for 4 days but is returned on 22/02/2024, the total cost is $800. So $700 (*i.e.*, $1500 - $800) from the deposit is returned to the customer. On the other hand, if the car is rented for 10 days, the customer must pay an additional $500.

Application Requirement

Basic Records

The application must record the customer information including full name, email address, and phone number. Optionally, their age, date of birth, and home address may also be recorded. Each customer should be uniquely identified by their email address.

The application should also record employees information. However, unlike customer, each ~~customer~~ employee is uniquely identified by their employee id. The full name and phone number of the employees must also be recorded. Each employee is located at only one particular location identified by the location zip code. Furthermore, the location name are also recorded and there are no two locations with the same name.

A special employee called a driver should also be recorded. On top of the other employee information, a driver must have a Private Hire Car Driver's Vocational License (PDVL)[1].

There are two kinds of records for cars. The first kind is the car model. The record for the car model consists of the brand of the car, the model of the car, the capacity, and the rental pricing information. The capacity is maximum number of passengers (*including a driver, if any*) and is dependent on both the brand and model of the car[2]. The rental pricing information consists of two information: the daily rent price and the deposit amount.

The second kind is the details of a specific car. A car detail is uniquely identified by the license plate number of the car. Other information includes the color of the car, the year the car was produced, and the location of the car. The location of the car will be one of the company location.

Other Information

A customer may make a booking of a particular car model. There are no limits to how many bookings a customer can make for a car or a car model, but each booking will only consists of information about a customer and a car model. A booking is uniquely identified by the booking id. Additional information that needs to be recorded are the start date, the number of days, the pickup location, the credit card number used to make the payment, as well as the booking date.

The database should allow a customer to book two different cars with the same car model, for the same date, and from the same location. This is why each booking must have a unique booking id. Since a booking consists of information about a customer and a car model, to book two different cars with the same car model, the customer must make two different bookings.

Given a booking, the system will assign a particular car for the given booking. By car, we meant the details of the car. This may not be done immediately as it may depends on car availability. As such, there

[1] https://onemotoring.lta.gov.sg/content/onemotoring/home/driving/vocational_licence/vocational_licence_application.html

[2] https://www.hotcars.com/times-car-brands-used-the-same-model-names/

may be a booking without a car in the database. Potentially, we may want to cancel the booking after 2 days without any available car. For instance, if a booking is made on 15/01/2024, we may start to cancel the booking on 17/01/2024 if no car is deemed available.

Given a booking, the customer may also hire a driver. At most one driver can be hired for a given booking as each booking is for a single car. The cost of hiring a driver is fixed so we simply record the start date of the hiring as well as the number of days a driver is hired. This duration should be within the duration of the car rental. Additionally, we also must record the credit card information used for the payment of the cost of hiring the driver.

Alternatively, the customer may also drive the car on their own. For simplicity, if no driver is hired, we assume that the customer has a driver's license. The customer should only be able to hire a driver if a car is assigned to the booking. This is to avoid cancellation of the driver should the booking is cancelled because a car is not available.

On the rental start date, an employee working in the pickup location hand over the car key to the customer. We must record the employee information and the booking id corresponding to the hand over. Similarly, at the end of the rental, an employee working in the return location receive the car key from the customer and record the difference between the total cost and the deposit (*i.e.*, total cost minus deposit). This amount may be negative (*i.e.*, parts of the deposit is returned to the customer) or positive (*i.e.*, the customer pay additional cost). If the amount is positive, the credit card information used to pay the additional cost is also recorded. We must also record the employee information and the booking id.

Basic Functionalities

The following basic functionalities may be used to guide your design. The application should

- allow customers to register their information.
- allow customers to search for car model based on certain condition (*e.g.*, number of passengers, *etc*).
- allow customers to make a booking.
- allow customers to hire a driver.
- allow employees to hand over keys to a customer for a particular booking.
- allow employees to certify that a car is fit to be rented again.
- (*potentially automatically*) allow cancellation of a booking if no car is available from a particular location after 2 days.
- (*potentially automatically*) assign a car to a booking.