INF 1343 Data Modeling and Database Design

Assignment 2: Database Design, April. 3rd, 2023

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Executive Summary:

This project is to analyze the car rental process of the Rentalcars company and then design the database for the company. Renralcars.com is a large-scale online car rental service provider that serves as an intermediary between customer and car rental companies. Through conducting interview calls with the branch vice-president and different roles involved in the car rental process, we get a deep understanding of the whole process and identify the current information system of the business, especially the database management system. We conducted secondary research to figure out the detailed attributes for each entity and their relationships in Rentalcars.com and modeled the ER Diagram. This project is a continuation of Assignment 1, we updated our ERD diagram and then converted the ERD into tables through ER-to-Relational Mapping algorithm. Note that the table is normalized. We implement ten views and ten queries as well as three triggers to the database to ensure the full views of tables to be exposed to all users. A updated and thorough data catalog is implemented to constrain the data. Finally, we consider the legal aspects, ethical aspects as well as security aspects to dealing with the data and contribute to the design of the database.

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Section 1. Context for the Study (Updated)

Rentalcars.com is a large-scale online platform that offers car rental services from a range of car rental companies. The business began in 2004 as TravelJigsaw and is headquartered in Manchester, UK. The company now operates in over 160 countries all over the world, including the United States, Canada, Europe, and Australia. Based on our investigation and interviews, as of 2021, Rentalcar.com has more than 4,000 employees working across various locations around the world, offering clients access to rental cars from more than 900 car rental companies. Each year, millions of users visit their website to book rental cars successfully.

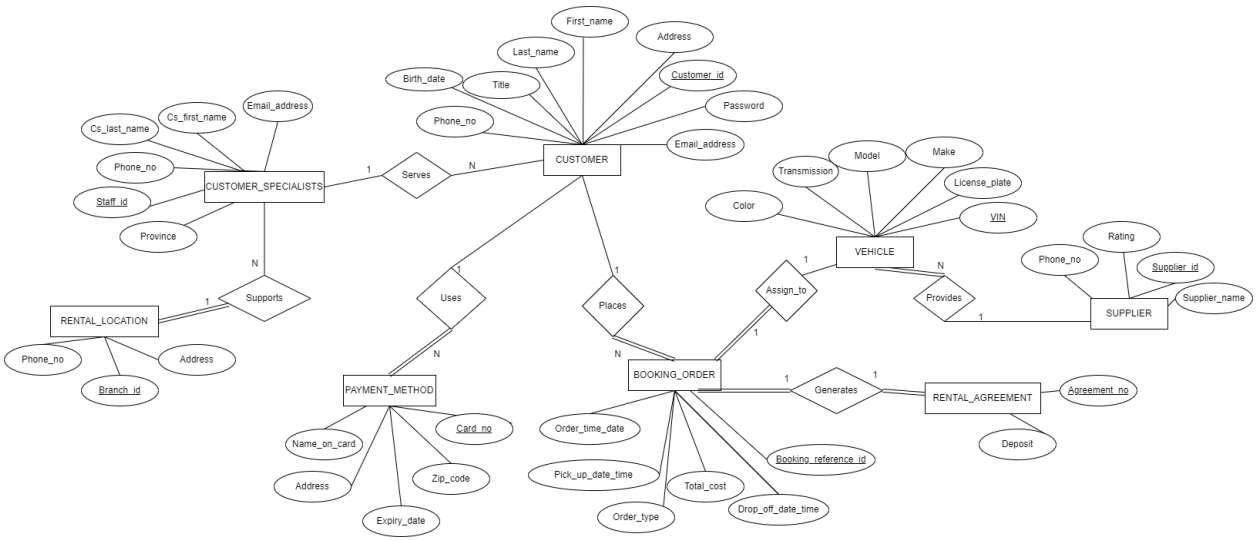
The external objective of the RentalCars company is to connect customers who have the demand of renting a car with car rental companies, letting customers to search for the available cars and compare rental car options from multiple suppliers on the website, and finding the appropriate vehicles for the customer based on their location and budgets. And then allowing customers to book the cars and pay the bill on the website. Finally, Rentalcars.com will provide an order summary for both the customer and the car rental company. The internal objective for the RentalCar company is to find reliable car suppliers and expand their network with the rental cars supplier, ensuring the maintenance of the website, and improving the user experience for both online and offline services. The organization objectives of Rentalcars.com is to expand their market share, explore new regions, simplify the rental process and enhance their customer services. The scopes of the Rentalcars.com are to demonstrate how their database provides a variety of results based on the customers search, providing an order summary for both the customer and the car rental company, storing incoming data from the suppliers, retrieving data which is relevant to the customers search query and managing transactions from customers and to external companies.

The major work processes for Rentalcars.com is to allow customers to browse the rental cars from various suppliers, initiating the booking orders on the website, processing payment on the website, and providing offline instructions after placing the order. After that, the offline rental locations will assign a customer specialist to assist the customer for the check-in and check-out matters. For the searching process, the automated system will take customers' requests for car rentals into consideration, checking the availability of the requested car and dates. For booking orders, given that this is an online platform, customers are expected to fulfill the personal information, then customers can place the booking orders. Booking orders consist of the order type, booking reference ID, pick-up time and date, drop-off information, etc. A rental agreement will be generated from the booking order and customers are supposed to agree with certain conditions to place the order successfully. The Rentalcars.com will send order summaries to both their customers and suppliers. As for the payment, the online bill will accept card payments only and the card information such as the card number, name on the card will be recorded under the customer's private account. Once the payment completes, a vehicle provided by a supplier will be assigned to the booking order for the customer to use. The offline rental location will assign a customer specialist to serve the customer when doing the check-in and check-out process. This process involves verifying the customer's identity and eligibility for driving, confirming their bookings, and providing them with the rental agreement and keys to the vehicle. When the rental period is over, the customer drops-off the car to the rental company and the customer specialist checks the vehicle condition for any damages before refunding the deposit.

The existing information systems that the RentalCars company has are user interface system, database management system, communication system and analytics system. User interface is the front-end component of the system that users interact with when searching information for car rentals on the Rentalcars.com. In general, the user interface includes a search engine, filters, and sorting functions that enable customers to find the most suitable car rental options. The database management system is the back-end component of the system that records and manages all data related to car rentals, such as pricing, availability, and location. The database management system ensures that the data is accurate,

up-to-date, and easily accessible to users. The communication system facilitates communication between Rentalcars.com and car rental companies, as well as between Rentalcars.com and users. The communication system has practices such as email notifications, customer services. The analytics system collects and analyzes data such as user behavior and preferences on the platform. The analytics system can provide insights into user trends, popular rental car options, and areas for improvement. In this assignment, we are gonna focus on the database system of Rentalcars.com to dig deeper into its eight entities as well as and their attributes and relationships.

Section 2. Modelling using ERD diagram (Updated)



The above ERD diagram represents entities, their attributes and relationship between different entities along with the cardinality values for a Car Rental system. Customer entity represents the individuals who rent a car from the company. Customer specialists entity represents the staff members of the company that assist customers with their queries and requests. Vehicle entity lists all the available cars to be rented along with their specifications. Payment method entity lists the modes of payment along with the customer's transaction details. Booking order entity represents the booking details summary of the rented car. Rental agreement entity represents the agreement details between the customer and the company. Supplier entity represents the details of the supplier that provided that vehicle to the company. Rental location entity represents the details about the car rental company's branches. The relationship between these entities include-

1. One customer can place zero or many booking orders, and one booking order can be placed by one and only one customer.
2. One customer specialist can serve many customers, or no customers if he doesn't receive any task , and one customer can be served by only one customer specialist, or no specialist if he doesn't have any request.
3. One customer specialist can provide support to zero or many rental locations, and one rental location should be supported by at least one specialist.
4. One supplier can provide many vehicles, or no vehicles if its service is temporarily paused, and one vehicle can be provided by one and only one supplier.

5. One customer can have many payment methods, or no payment methods if he decides not to add payment methods first, and each payment method should only be held by one customer.
6. One booking order generates one rental agreement, and each rental agreement is generated by one booking order.
7. One vehicle should be assigned to one booking order, or no booking orders if it's not in service. One booking order must have one and only one vehicle assigned.

Section 3. Tables (Schema and Instances)

Schema example in figure 3.1

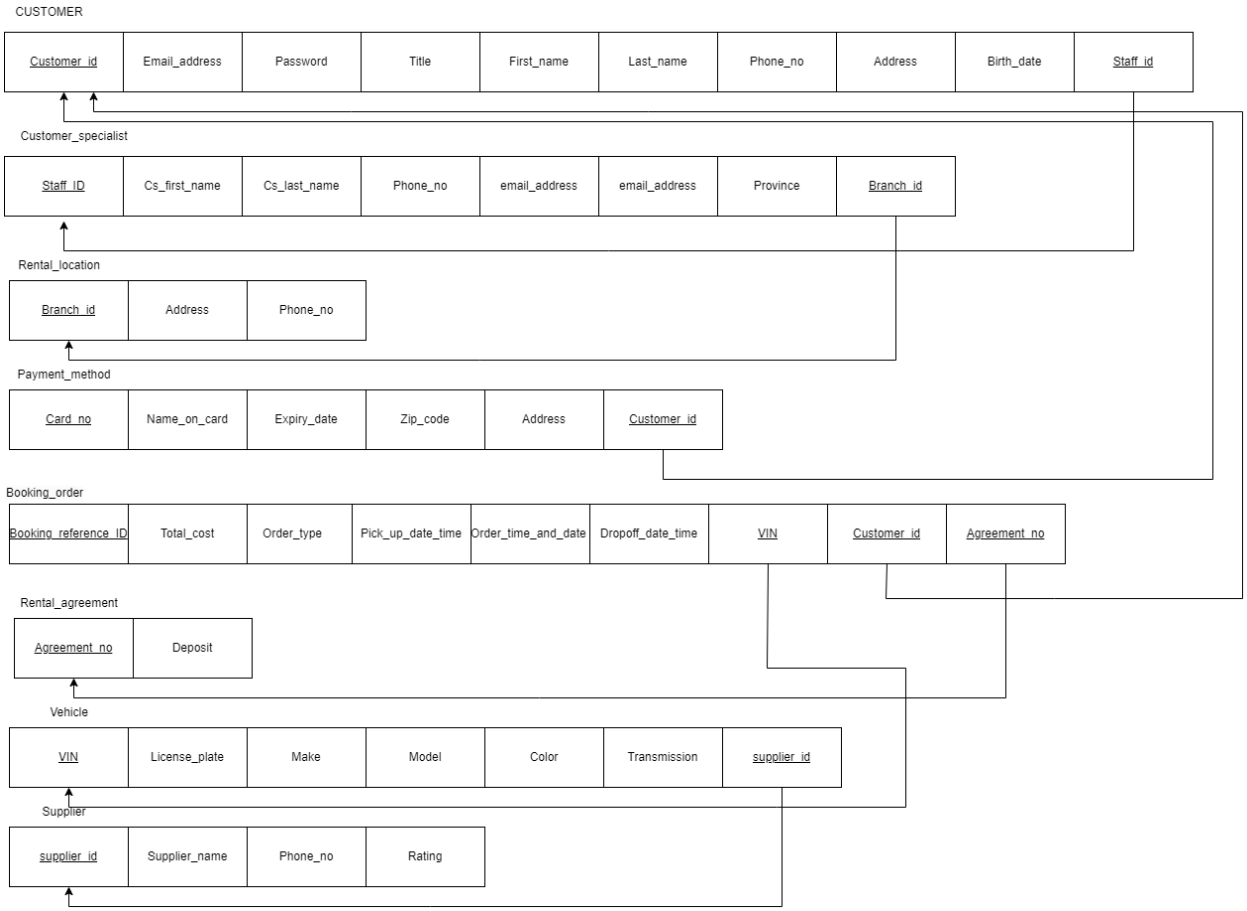


Figure 3.1

Instances example in figure 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9

CUSTOMER

Customer_id	Email_address	Password	Title	First_name	Last_name	Phone_no	Address	Birth_date	CUSTOMER_SPECIALIST_Staff_id
1234567890	johndoe@email.com	abc123	Mr	John	Doe	(567)-890-1774	123 Main St	1990-05-01	SID12345
1234567891	janesmith@email.com	xyz789	Mrs	Jane	Smith	(234)-567-8901	456 Oak Avenue	1980-01-15	SID12346
1234567892	bobsmith@email.com	abc123	Mr	Bob	Smith	(345)-678-9012	7890 Maple Road	1970-07-21	SID12347
1234567893	sarahlee@email.com	abc123	Mrs	Sarah	Lee	(456)-789-0123	140 Saint George St	1957-02-11	SID12348
1234567894	alexjones@email.com	abc123	Mr	Alex	Jones	(567)-890-1234	321 Eglinton Avenue	1970-12-17	SID12349
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 3.2

CUSTOMER_SPECIALIST

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

Staff_id	Cs_first_name	Cs_last_name	Phone_no	Email_address	RENTAL_LOCATION_Branch_id	Province
SID12345	Emily	Kim	(101)-010-1010	EmilyK123@email.com	1	ON
SID12346	David	Li	(010)-101-0101	DavidLi@email.com	2	ON
SID12347	Samantha	Hacker	(202)-202-2020	SamanthaH@email.com	3	BC
SID12348	Alex	Smith	(202)-020-0202	AlexS@email.com	4	AB
SID12349	RAchel	Min	(303)-030-3030	RachelM123@email.com	5	AB
NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 3.3

RENTAL_LOCATION

Result Grid | Filter Rows: | Edit:

Branch_id	Address	Phone_no
1	123 Main St, Toronto,ON	(212)-555-1234
2	456 Elm St, Toronto, ON	(212)-555-5678
3	789 Oak St, Ottawa, ON	(312)-555-9012
4	234 Pine St, British Columbia, BC	(305)-555-3456
5	567 Maple St, Alberta, AL	(415)-555-7890
NULL	NULL	NULL

Figure 3.4

PAYMENT_METHOD

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

Card_no	Name_on_card	Expiry_date	Zip_code	Address	CUSTOMER_Customer_id
1111222233334440	Bob Smith	12/25	M2E1W6	789 Maple Road	1234567892
1234567890123450	John Doe	10/24	M5S1W4	123 Main St	1234567890
5555666677778880	Sarah Lee	11/26	F5S1W3	140 Saint George st	1234567893
9876543210123450	Jane Smith	11/24	G5D1W5	456 Oak Avenue	1234567891
9999888877776660	Alex Jones	13/27	J5S1F3	321 Eglinton Avenue	1234567894
NULL	NULL	NULL	NULL	NULL	NULL

Figure 3.5

BOOKING_ORDER

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

Booking_reference_id	VEHICLE_VIN	CUSTOMER_Customer_id	Order_time_date	Pick_up_date_time	Drop_off_date_time	Total_cost	Order_type	RENTAL_AGREEMENT_Agreement_no
BR001	ABC12345678901234	1234567890	2022-05-01 10:00:00	2022-05-02 10:00:00	2022-05-03 12:00:00	350.50	Leisure	1001
BR002	PQR12345678901255	1234567891	2022-05-02 23:00:00	2022-05-03 10:00:00	2022-05-04 12:00:00	533.50	Business	1002
BR003	XYZ12345678901266	1234567892	2022-05-03 20:00:00	2022-05-04 10:00:00	2022-05-05 12:00:00	430.50	Leisure	1003
BR004	IJK12345678901277	1234567893	2022-05-04 10:32:00	2022-05-05 11:00:00	2022-05-06 12:00:00	330.50	Business	1004
BR005	KLM12345678901288	1234567894	2022-05-05 19:20:00	2022-05-06 12:00:00	2022-05-07 12:00:00	550.50	Business	1005
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 3.6

RENTAL_AGREEMENT

Result Grid | Filter Rows:

Agreement_no	Deposit
1001	750.00
1002	1000.00
1003	750.00
1004	750.00
1005	1000.00
NULL	NULL

Figure 3.7

VEHICLE

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

VIN	License_plate	Make	Model	Color	Transmission	SUPPLIER_Supplier_id
ABC12345678901234	GHI-789	Acura	MDX	Black	Automatic	1001
IJK12345678901277	ABC-123	Volvo	V70	Silver	Manual	1004
KLM12345678901288	JKL-012	Chevrolet	Impala LTZ	White	Automatic	1005
PQR12345678901255	DEF-456	Chevrolet	Cavalier	Red	Automatic	1002
XYZ12345678901266	MNO-345	BMW	5 Series	White	Automatic	1003
NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 3.8

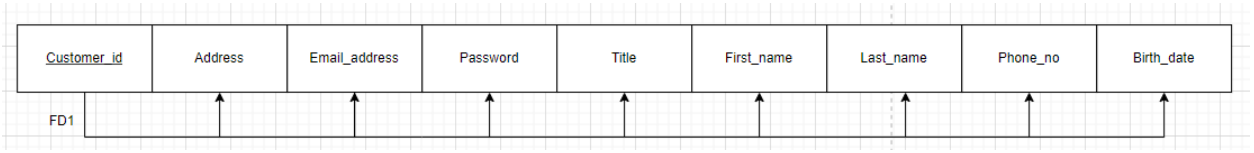
SUPPLIER

Supplier_id	Supplier_name	Phone_no	Rating
1001	ABC Inc	(567)-890-1774	5.0
1002	XYZ Corp	(234)-567-8901	4.2
1003	PQR Ltd	(345)-678-9012	3.8
1004	MNO Corp	(456)-789-0123	5.0
1005	LMN Inc.	(567)-890-1234	5.0
NULL	NULL	NULL	NULL

Figure 3.9

Section 4. Normalization

Customer:



1 NF: The table is in 1st normal form as the composite attribute Name was subdivided into First Name and Last name and all attributes will contain atomic values.

2 NF: The table is in 2nd normal form because it has a full functional dependency. The only primary key is “customer_id” and it determines all other non-key attributes.

3 NF: The table is in 3rd normal form as there are no transitive dependencies between the non-prime attributes and the customer_id primary key.

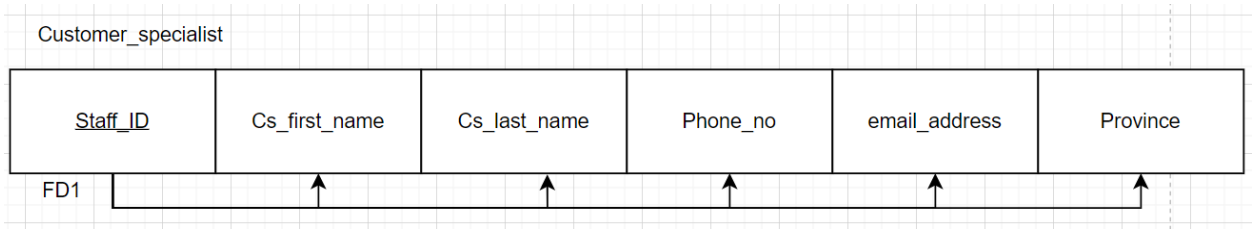
For below tables, they satisfy normalisation due to following reasons-

1 NF: The tables are in 1st normal form because there are no composite attributes, multivalued attributes, or nested relations. Each attribute contains atomic values.

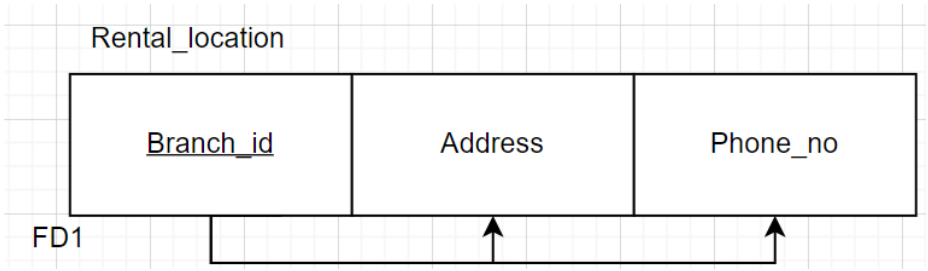
2 NF: The tables are in 2nd normal form because each non prime attribute is fully functionally dependent on the primary keys.

3 NF: The tables are in 3rd normal form as no non-prime attribute is transitively dependent on their respective primary keys.

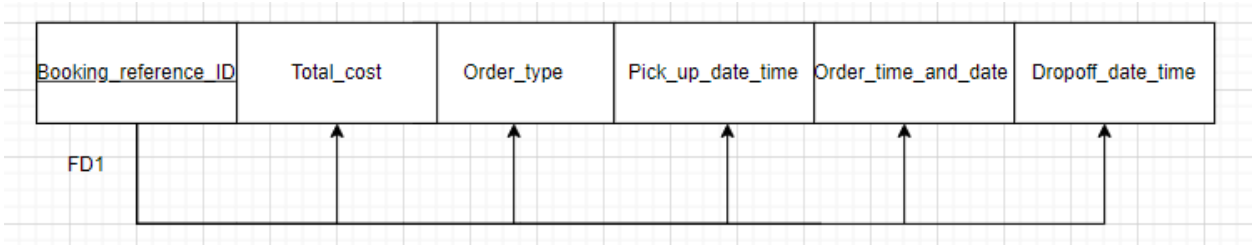
Customer_specialist



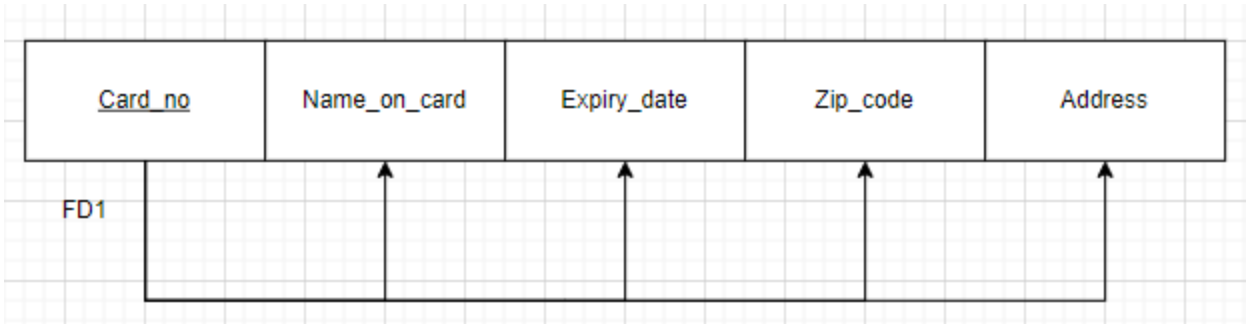
Rental_location



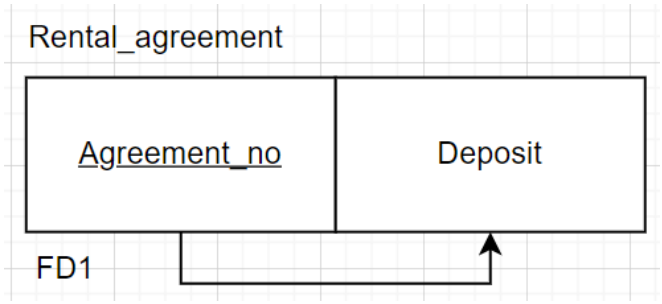
Booking_orders:



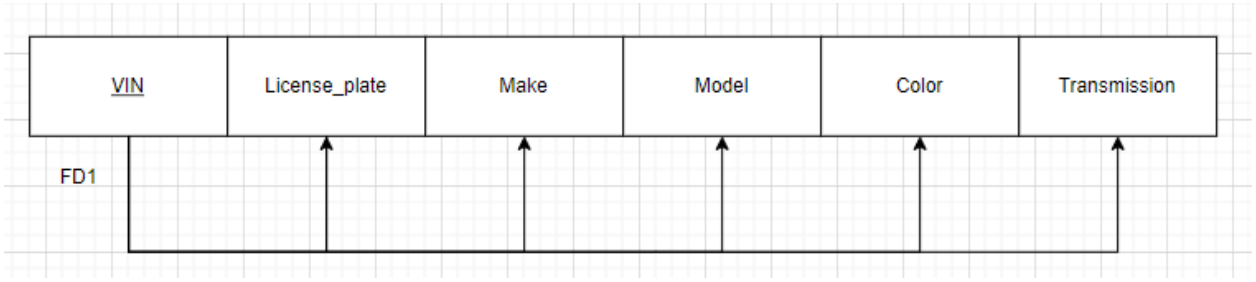
Payment_methods:



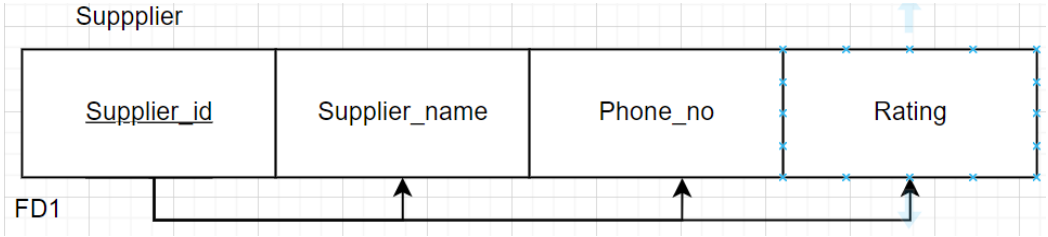
Rental_agreement



Vehicle:



Supplier:



Section 5. Views

1. View to restrict access to sensitive customer information columns: (password, phone_no, address)

SQL statement:

```
CREATE VIEW customer_secured_information AS
SELECT customer_id, email_address, title, first_name, last_name, birth_date
FROM customer;
```

Instance:

customer_id	email_address	title	first_name	last_name	birth_date
1234567890	johndoe@email.com	Mr	John	Doe	1990-05-01
1234567891	janesmith@email.com	Mrs	Jane	Smith	1980-01-15
1234567892	bobsmith@email.com	Mr	Bob	Smith	1970-07-21
1234567893	sarahlee@email.com	Mrs	Sarah	Lee	1957-02-11
1234567894	alexjones@email.com	Mr	Alex	Jones	1970-12-17

2. Only allow access of customer specialists who provide support in specific provinces

SQL statement:

```
CREATE VIEW customer_specialist_information AS
SELECT *
FROM customer_specialist
WHERE province LIKE '%ON%';
```

Instance:

Staff_id	Cs_first_name	Cs_last_name	Phone_no	Email_address	RENTAL_LOCATION_Branch_id	Province
SID12345	Emily	Kim	(101)-010-1010	EmilyK123@email.com	1	ON
SID12346	David	Li	(010)-101-0101	DavidLi@email.com	2	ON

3. View to provide access to specific rows to display the customers booking information

SQL statement:

```
CREATE VIEW customer_booking_agreement AS
SELECT customer.customer_id, customer.first_name, customer.last_name,
booking_order.booking_reference_id, booking_order.order_time_date, booking_order.pick_up_date_time,
booking_order.drop_off_date_time, booking_order.order_type , rental_agreement.agreement_no,
rental_agreement.deposit
FROM customer
JOIN booking_order ON customer.customer_id = booking_order.CUSTOMER_Customer_id
JOIN rental_agreement ON booking_order.RENTAL_AGREEMENT_Agreement_no =
rental_agreement.Agreement_no;
```

Instance:

customer_id	first_name	last_name	booking_reference_id	order_time_date	pick_up_date_time	drop_off_date_time	order_type	agreement_no	deposit
1234567890	John	Doe	BR001	2022-05-01 10:00:00	2022-05-02 10:00:00	2022-05-03 12:00:00	Leisure	1001	750.00
1234567890	John	Doe	BR007	2022-05-01 10:00:00	2022-05-05 10:00:00	2022-04-03 12:00:00	Leisure	1001	750.00
1234567891	Jane	Smith	BR002	2022-05-02 23:00:00	2022-05-03 10:00:00	2022-05-04 12:00:00	Business	1002	1000.00
1234567892	Bob	Smith	BR003	2022-05-03 20:00:00	2022-05-04 10:00:00	2022-05-05 12:00:00	Leisure	1003	750.00
1234567893	Sarah	Lee	BR004	2022-05-04 10:32:00	2022-05-05 11:00:00	2022-05-06 12:00:00	Business	1004	750.00
1234567894	Alex	Jones	BR005	2022-05-05 19:20:00	2022-05-06 12:00:00	2022-05-07 12:00:00	Business	1005	1000.00

4. View to provide access to selective columns of customer's payment method

SQL statement:

```
CREATE VIEW customer_payment_information AS
SELECT
customer.customer_id,customer.first_name,customer.last_name,payment_method.name_on_card,
payment_method.zip_code,payment_method.address
FROM customer
JOIN payment_method ON customer.customer_id = payment_method.CUSTOMER_Customer_id ;
```

Instance:

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

customer_id	first_name	last_name	name_on_card	zip_code	address
1234567890	John	Doe	John Doe	M5S1W4	123 Main St
1234567891	Jane	Smith	Jane Smith	G5D1W5	456 Oak Avenue
1234567892	Bob	Smith	Bob Smith	M2E1W6	789 Maple Road
1234567893	Sarah	Lee	Sarah Lee	F5S1W3	140 Saint George st
1234567894	Alex	Jones	Alex Jones	J5S1F3	321 Eglinton Avenue

5.View to provide access to selective columns of vehicle supplier information

SQL statement:

```
CREATE VIEW vehicle_supplier AS
SELECT vehicle.VIN, vehicle.license_plate, vehicle.make,vehicle.model, supplier.supplier_id,
supplier.supplier_name, supplier.rating
FROM vehicle
JOIN supplier ON vehicle.SUPPLIER_Supplier_id = supplier.supplier_id;
```

Instance:

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

VIN	license_plate	make	model	supplier_id	supplier_name	rating
ABC12345678901234	GHI-789	Acura	MDX	1001	ABC Inc	5.0
IJK12345678901277	ABC-123	Volvo	V70	1004	MNO Corp	5.0
KLM12345678901288	JKL-012	Chevrolet	Impala LTZ	1005	LMN Inc.	5.0
PQR12345678901255	DEF-456	Chevrolet	Cavalier	1002	XYZ Corp	4.2
XYZ12345678901266	MNO-345	BMW	5 Series	1003	PQR Ltd	3.8

6. View to provide access to specific columns of customer's vehicle booking summary

SQL statement:

```
CREATE VIEW customer_vehicle_information AS
SELECT customer.customer_id, customer.title,  customer.first_name, customer.last_name,
booking_order.booking_reference_id, booking_order.order_type, vehicle.VIN, vehicle.make,
vehicle.model, vehicle.color
FROM customer
JOIN  booking_order ON customer.customer_id = booking_order.CUSTOMER_Customer_id
JOIN  vehicle ON booking_order.vehicle_vin = vehicle .VIN;
```

Instance:

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

customer_id	title	first_name	last_name	booking_reference_id	order_type	VIN	make	model	color
1234567890	Mr	John	Doe	BR001	Leisure	ABC12345678901234	Acura	MDX	Black
1234567890	Mr	John	Doe	BR007	Leisure	ABC12345678901234	Acura	MDX	Black
1234567891	Mrs	Jane	Smith	BR002	Business	PQR12345678901255	Chevrolet	Cavalier	Red
1234567892	Mr	Bob	Smith	BR003	Leisure	XYZ12345678901266	BMW	5 Series	White
1234567893	Mrs	Sarah	Lee	BR004	Business	IJK12345678901277	Volvo	V70	Silver
1234567894	Mr	Alex	Jones	BR005	Business	KLM12345678901288	Chevrolet	Impala LTZ	White

7. **View to restrict access to sensitive vehicle information before booking**

SQL statement:

```
CREATE VIEW pre_booking_vehicle_information AS
SELECT make, model, color, transmission
FROM vehicle;
```

Instance:

Result Grid | Filter Rows:

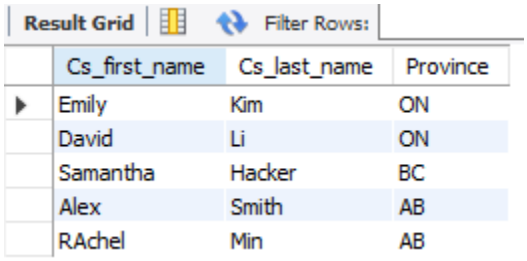
make	model	color	transmission
Acura	MDX	Black	Automatic
Volvo	V70	Silver	Manual
Chevrolet	Impala LTZ	White	Automatic
Chevrolet	Cavalier	Red	Automatic
BMW	5 Series	White	Automatic

8. **View to only provide the most basic information about customer specialists**

SQL statement:

```
CREATE VIEW specialist_basic AS
SELECT Cs_first_name, Cs_last_name, Province
FROM Customer_Specialist;
```

Instance:



Result Grid | Filter Rows:

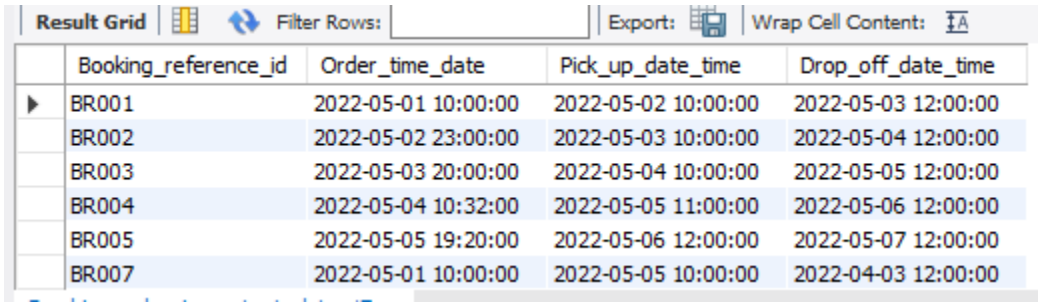
Cs_first_name	Cs_last_name	Province
Emily	Kim	ON
David	Li	ON
Samantha	Hacker	BC
Alex	Smith	AB
RAchel	Min	AB

9. View to provide the important dates of booking orders and hide all other information

SQL statement:

```
CREATE VIEW Bookingorder_important_dates AS
SELECT Booking_reference_id, Order_time_date, Pick_up_date_time, Drop_off_date_time
FROM Booking_Order;
```

Instance:



Result Grid | Filter Rows: | Export: | Wrap Cell Content:

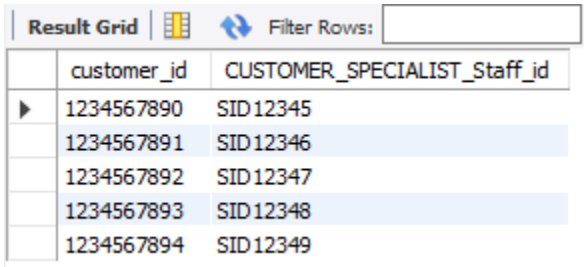
Booking_reference_id	Order_time_date	Pick_up_date_time	Drop_off_date_time
BR001	2022-05-01 10:00:00	2022-05-02 10:00:00	2022-05-03 12:00:00
BR002	2022-05-02 23:00:00	2022-05-03 10:00:00	2022-05-04 12:00:00
BR003	2022-05-03 20:00:00	2022-05-04 10:00:00	2022-05-05 12:00:00
BR004	2022-05-04 10:32:00	2022-05-05 11:00:00	2022-05-06 12:00:00
BR005	2022-05-05 19:20:00	2022-05-06 12:00:00	2022-05-07 12:00:00
BR007	2022-05-01 10:00:00	2022-05-05 10:00:00	2022-04-03 12:00:00

10. View to access which customer specialist is serving which customer.

SQL statement:

```
CREATE VIEW customer_specialist_assignment AS
select customer_id, CUSTOMER_SPECIALIST_Staff_id
FROM Customer;
```

Instance:



Result Grid | Filter Rows:

customer_id	CUSTOMER_SPECIALIST_Staff_id
1234567890	SID12345
1234567891	SID12346
1234567892	SID12347
1234567893	SID12348
1234567894	SID12349

```
select * from customer_secured_information;
```

```
select * from customer_specialist_information ;
select * from customer_booking_agreement  ;
select * from customer_payment_information;
select * from vehicle_supplier;
select * from customer_vehicle_information;
select * from pre_booking_vehicle_information;
select * from  specialist_basic;
select * from Bookingorder_important_dates;
select * from customer_specialist_assignment;
```

Section 6. Queries

1. **List of all the information about the vehicles provided by the supplier 'ABC Inc.' Display the supplier name at the same time.**

SQL statement:

```
SELECT vehicle.*, supplier.supplier_name

FROM vehicle, supplier

WHERE supplier.supplier_id = SUPPLIER_Supplier_id AND supplier.Supplier_name = 'ABC Inc';
```

Instance:

VIN	License_plate	Make	Model	Color	Transmission	SUPPLIER_Supplier_id	supplier_name
ABC12345678901234	GHI-789	Acura	MDX	Black	Automatic	1001	ABC Inc

2. **List the license_plate of vehicles that are supplied by XYZ Corp, with the supplier's name and ID.**

SQL statement:

```
SELECT Supplier_name, S.Supplier_ID, License_plate

FROM Supplier S JOIN Vehicle V on S.Supplier_id = SUPPLIER_supplier_id

WHERE Supplier_name = 'XYZ Corp';
```

Instance:

Supplier_name	Supplier_ID	License_plate
XYZ Corp	1002	DEF-456

3. **Change the phone number of the customer whose ID is 1234567890 to '(909)-090-9090'.**

Instance before Update SQL statement:

Customer_id	Email_address	Password	Title	First_name	Last_name	Phone_no	Address	Birth_date	CUSTOMER_SPECIALIST_Staff_id
1234567890	johndoe@email.com	abc123	Mr	John	Doe	(567)-890-1774	123 Main St	1990-05-01	SID12345

SQL statement:

```
UPDATE Customer
SET Phone_no = '(909)-090-9090'
WHERE Customer_id = '1234567890';
```

Instance after Update SQL statement:

Customer_id	Email_address	Password	Title	First_name	Last_name	Phone_no	Address	Birth_date	CUSTOMER_SPECIALIST_Staff_id
1234567890	johndoe@email.com	abc123	Mr	John	Doe	(909)-090-9090	123 Main St	1990-05-01	SID12345

4. **Display all suppliers whose ratings are higher than 4.**

SQL statement:

```
SELECT *

FROM Supplier

WHERE Rating > 4;
```

Instance:

Supplier_id	Supplier_name	Phone_no	Rating
1001	ABC Inc	(567)-890-1774	5.0
1002	XYZ Corp	(234)-567-8901	4.2
1004	MNO Corp	(456)-789-0123	5.0
1005	LMN Inc.	(567)-890-1234	5.0
NULL	NULL	NULL	NULL

5. **Show the customers' first and last names in a single column.**

SQL statement:

```
SELECT CONCAT(First_name,' ', Last_name) AS 'CustomerName'

FROM Customer;
```

Instance:

'CustomerName'
John Doe
Jane Smith
Bob Smith
Sarah Lee
Alex Jones

6. **Update email address of customer_specialist whose staff_id is SID12345**

Instance before Update SQL statement:

Staff_id	Cs_first_name	Cs_last_name	Phone_no	Email_address	RENTAL_LOCATION_Branch_id	Province
SID12345	Emily	Kim	(101)-010-1010	EmilyK123@email.com	1	ON

SQL statement:

```
UPDATE customer_specialist

SET email_address = 'Emily.Kim77@gmail.com'

WHERE staff_id = 'SID12345';
```

Instance after Update SQL statement:

Staff_id	Cs_first_name	Cs_last_name	Phone_no	Email_address	RENTAL_LOCATION_Branch_id	Province
SID12345	Emily	Kim	(101)-010-1010	Emily.Kim77@gmail.com	1	ON

7. **Update address of rental_location where branch_id is 3**

Instance before Update SQL statement:

3	789 Oak St, Ottawa, ON	(312)-555-9012

SQL statement:

```
UPDATE rental_location

SET address = '89 Palm Avenue, Ottawa, ON'

WHERE branch_id = '3';
```

Instance after Update SQL statement:

3	89 Palm Avenue, Ottawa, ON	(312)-555-9012

8. **Select Customer ID, first name, last name and booking reference number where order date is '2022-05-01'**

SQL statement:

```
SELECT customer.customer_id, customer.first_name,customer.last_name,
booking_order.Booking_reference_id

FROM booking_order

INNER JOIN customer

ON booking_order.CUSTOMER_Customer_id = customer.customer_id WHERE Order_time_date LIKE
'%2022-05-01%'
```

ORDER BY customer_id;

Instance:

	customer_id	first_name	last_name	Booking_reference_id
▶	1234567890	John	Doe	BR001

9. **Select customer id, first name, last name, booking reference id and VIN, license plate where customer purchased a chevrolet.**

SQL statement:

SELECT customer.customer_id, customer.first_name,customer.last_name,
booking_order.Booking_reference_id, vehicle.VIN, vehicle.license_plate

FROM

((booking_order

INNER JOIN customer

ON booking_order.CUSTOMER_Customer_id = customer.customer_id)

INNER JOIN vehicle

ON booking_order.VEHICLE_VIN = vehicle.VIN) where make LIKE '%Chevrolet%';

Instance:

	customer_id	first_name	last_name	Booking_reference_id	VIN	license_plate
▶	1234567894	John	Doe	BR005	KLM12345678901288	JKL-012
	1234567891	Jane	Smith	BR002	PQR12345678901255	DEF-456

10. **Select supplier information that supplied Vehicle with make ‘Acuna’**

SQL statement:

select supplier.supplier_id, supplier.supplier_name, supplier.phone_no, supplier.rating

FROM supplier

INNER JOIN vehicle on supplier.supplier_id = vehicle.SUPPLIER_Supplier_id

WHERE make like 'Acura';

Instance:

	supplier_id	supplier_name	phone_no	rating
▶	1001	ABC Inc	(567)-890-1774	5.0

Section 7. Triggers

1. **Trigger to check the length of inserted password in the customer table**

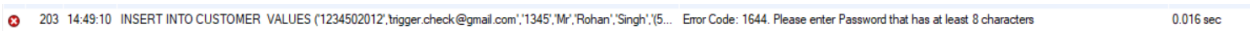
SQL statement:

```
CREATE DEFINER=`root`@`localhost` TRIGGER `customer_BEFORE_INSERT` BEFORE INSERT
ON `customer` FOR EACH ROW BEGIN
   DECLARE password_length INTEGER;
   SET password_length = LENGTH(NEW.Password);
   IF password_length < 8 THEN
      SIGNAL SQLSTATE '45000'
      SET MESSAGE_TEXT = 'Please enter Password that has at least 8 characters';
   END IF;
END
```

Insert query-

```
INSERT INTO CUSTOMER
VALUES ('1234502012','trigger.check@gmail.com','1345','Mr','Rohan','Singh','(567)-890-1774','123
Main St','1990-5-1','SID12345');
```

Instance:



2. **Trigger to convert the name of card into upper case**

SQL statement:

```
CREATE DEFINER = CURRENT_USER TRIGGER `mydb`.`payment_method_BEFORE_INSERT`
BEFORE INSERT ON `payment_method` FOR EACH ROW
BEGIN
SET NEW.name_on_card = UPPER(New.name_on_card);
END
```

```
CREATE DEFINER = CURRENT_USER TRIGGER `mydb`.`payment_method_BEFORE_UPDATE`
BEFORE UPDATE ON `payment_method` FOR EACH ROW
```

```
BEGIN
SET NEW.name_on_card = UPPER(New.name_on_card);
END

INSERT INTO PAYMENT_METHOD
VALUES ('9999088007776661','frank lampard','13/27','J5S1F3','321 Eglinton Avenue','1234567894');
```

Instance:

	9999088007776661	FRANK LAMPARD	13/27	J5S1F3	321 Eglinton Avenue	1234567894

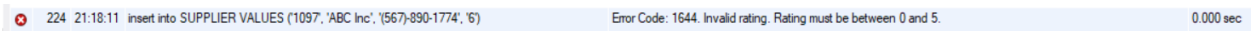
3. **Trigger to check if the drop off date is earlier than the pick up date for a booking order before inserting.**

SQL statement:

```
CREATE DEFINER=`root`@`localhost` TRIGGER `supplier_BEFORE_INSERT` BEFORE INSERT
ON `supplier` FOR EACH ROW BEGIN
  IF NEW.Rating > 5 THEN
    SIGNAL SQLSTATE '45000'
      SET MESSAGE_TEXT = 'Invalid rating. Rating must be between 0 and 5.';
  END IF;
END

INSERT into SUPPLIER VALUES ('1097', 'ABC Inc', '(567)-890-1774', '6');
```

Instance:



Section 8. Database Catalog (Modified)

Table name: CUSTOMER

Entity: CUSTOMER

Attribute Name	Attribute Type	Attribute Domain	Attribute Constraints	Description
Customer_id	VARCHAR(10)	10-digit characters	Primary Key	The ID number of a customer after

				becoming a customer of the company.
Email_address	VARCHAR(255)	0 to 255-digit characters	Not Null	The email address of the customer entered by them when they register for accounts.
Password	VARCHAR(45)	8 to 45-digit characters	Not Null	The Passwords of a customer's account .
Title	VARCHAR(45)	0 to 45-digit characters	Not Null	The title of a customer.
First_name	VARCHAR(255)	0 to 45-digit characters	Not Null	The first name of a customer.
Last_name	VARCHAR(255)	0 to 45-digit characters	Not Null	The last name of a customer.
Phone_no	VARCHAR (20)	10-digits-characters	Not Null	The phone number of a customer.
Address	VARCHAR(255)	0 to 255-digit characters	Not Null	A customer's home or mailing address.
Birth_date	DATE	Jan 1, 1900 to current date	Not Null	The birth date of a customer.

Table name: BOOKING_ORDER
Entity: BOOKING_ORDER

Attribute Name	**Attribute Type**	**Attribute Domain**	**Attribute Constraints**	**Description**
Booking_reference_id	VARCHAR(45)	0 to 45-digit characters	Primary Key	The ID number of a booking order placed by a customer.
VIN	VARCHAR(17)	17-digit characters	Foreign Key	A foreign key from the Vehicle table

Customer_id	VARCHAR(10)	10-digit characters	Foreign Key	A foreign key from the Customer table.
Order_date_and_time	DATETIME	Jan 1, 1900 to Dec 31, 9999	Not Null	The date and time when the order is placed by a customer.
Pick_up_date_time	DATETIME	Current date and time to Dec 31, 9999 23:59:59	Not Null	The date and time when the vehicle involved in this order is picked up by the customer.
Drop_off_date_time	DATETIME	Current date and time to Dec 31, 9999 23:59:59	Not Null	The date and time when the vehicle involved in this order is dropped off by the customer.
Total_cost	DECIMAL (10,2)	0 to 10-digit decimal number, 2 after decimal point	Not Null	The total cost of the order.
Order_type	VARCHAR(45)	0 to 45-digit characters	Not Null	The type of order, including leisure or business.
Agreement_no	VARCHAR(45)	0 to 45-digit characters	Foreign Key	A foreign key from the Rental_Agreement table.

Table name: PAYMENT_METHOD
Entity: PAYMENT_METHOD

Attribute Name	**Attribute Type**	**Attribute Domain**	**Attribute Constraints**	**Description**
Card_no	VARCHAR(16)	16-digit numbers	Primary Key	The number of the bank cards used by customers as payment methods.
Name_on_card	VARCHAR(255)	0 to 45-digit characters	Not Null	Whole names of customers that appear on their

				cards
Expiry_date	VARCHAR(45)	0 to 45-digit characters	Not Null	The expiry dates of the cards
Zip_code	VARCHAR(10)	0 to 10-digit characters	Not Null	The zip codes entered by the customers.
Address	VARCHAR(255)	0 to 255-digit characters	Not Null	Billing addresses entered by the customers.
Customer_id	VARCHAR(10)	10-digit characters	Foreign Key	A foreign key from the Customer table.

Table name: VEHICLE
Entity: VEHICLE

Attribute Name	**Attribute Type**	**Attribute Domain**	**Attribute Constraints**	**Description**
VIN	VARCHAR(17)	17-digit characters	Primary Key	Vehicle Identification Number. A unique identifying code given to a vehicle when it's manufactured
License_plate	VARCHAR(45)	0 to 45-digit characters	Not Null, Unique	The license_plate of the vehicle.
Make	VARCHAR(45)	0 to 45-digit characters	Not Null	The brand/manufacturer of the vehicle.
Model	VARCHAR(45)	0 to 45-digit characters	Not Null	The specific model of the vehicle.
Color	VARCHAR(45)	0 to 45-digit characters	Not Null	The color of the vehicle.
Transmission	VARCHAR(45)	{Manual, Automatic}	Not Null	The type of transmission used by a vehicle.

Supplier_id	VARCHAR(45)	0 to 45-digit characters	Foreign Key	A foreign key from the supplier table.

Table name: SUPPLIER
Entity: SUPPLIER

Attribute Name	Attribute Type	Attribute Domain	Attribute Constraints	Description
Supplier_name	VARCHAR(255)	0 to 45-digit characters	Not Null	The name of a supplier.
Supplier_id	VARCHAR(45)	0 to 45-digit characters	Primary Key	An ID number for a supplier.
Phone_no	VARCHAR (20)	10-digits-characters	Not Null	The phone number of a supplier.
Rating	DECIMAL (4,1)	0 to 4-digit decimal number, 2 after decimal point	Not Null	The rating of the supplier, ranging from 0 to 5.

Table name: RENTAL_LOCATION
Entity: RENTAL_LOCATION

Attribute Name	Attribute Type	Attribute Domain	Attribute Constraints	Description
Branch_id	VARCHAR(45)	0 to 45-digit characters	Primary Key	The ID of a rental location.
Address	VARCHAR(255)	0 to 255-digit characters	Not Null	The address of a rental location.
Phone_no	VARCHAR (20)	10-digits-characters	Not Null	The phone number of a rental location.

Table name: RENTAL_AGREEMENT
Entity: RENTAL_AGREEMENT

Attribute Name	Attribute Type	Attribute Domain	Attribute Constraints	Description

Agreement_no	VARCHAR(45)	0 to 45-digit characters	Primary Key	The ID number of a rental agreement for a booking order.
Deposit	DECIMAL(10,2)	0 to 10-digit decimal number, 2 after decimal point	Not Null	The amount of deposit stated by the agreement.

Table name: CUSTOMER_SPECIALIST
Entity: CUSTOMER_SPECIALIST

Attribute Name	**Attribute Type**	**Attribute Domain**	**Attribute Constraints**	**Description**
Staff_ID	VARCHAR(45)	0 to 45-digit characters	Primary Key	The ID of a customer specialist.
Cs_first_name	VARCHAR(255)	0 to 45-digit characters	Not Null	The first name of a customer specialist.
Cs_last_name	VARCHAR(255)	0 to 45-digit characters	Not Null	The last name of a customer specialist.
Phone_no	VARCHAR (20)	10-digits-characters	Not Null	The phone number used by the specialist.
Email_address	VARCHAR(255)	0 to 255-digit characters	Not Null	The email address used by the specialist.
Province	VARCHAR(45)	{NL, PE, NS, NB, QC, ON, MB, SK, AB, BC, YT, NT, NU}	Not Null.	The province of the customer specialist.
RENTAL_LOCATION_Branch_id	VARCHAR(45)	0 to 45-digit characters	Foreign Key	A foreign key from the Rental Location table.

Section 9. Legal Aspects

The first legal aspect we considered is the Personal Information Protection and Electronic Documents Act (PIPEDA), a federal privacy law in Canada, which aims to govern the private sector organizations that collect and disclose the clients' personal information for commercial activities. The PIPEDA applies to our case because we are collecting and storing account_holders' personal information when they register the account and place the order on the website. According to the Office of the Privacy Commissioner of Canada, under PIPEDA, personal information includes any factual or subjective information, recorded or not, about an identifiable individual. Our database will record the customer's age, name, ID,address, and customer's driving license and other identifying information. The PIPEDA serves as an indispensable legal guidance when we run our database. Under the direction of the PIPEDA, there are three essential principles that we should keep in mind. First of all, customer's consent must be obtained before collecting, using or disclosing their identifying information. We should give a consent form that clearly states the purposes, reasons for collecting these data and guarantee that their personal data is used for the listed purpose only. As long as the customer clicks the 'agree' button on the website, then the personal information can be collected. Second, we are responsible for data security. Customers will store their personal information on the website, but we still have to implement some secured practices to ensure the data security. For example, we should remind the account_holder to set a complex password when logging into their account. From a database designer's perspective, we can limit the access to our database with authority only. Enhancing technical safeguard is also important to secure the data. Third, we should allow customers to correct or update their personal information to make sure the data is accurate and real-time. Or for example, allowing the customer to double-check the important information such as ID, or sin number by setting the function of re-entering the longer numbers to let customers confirm the information. We should allow consumers to correct the information in a regular period instead of blocking their request to revise it.

The second legal aspect we considered is the Canadian Anti-Spam Legislation (CASL). According to the Office of the Privacy Commissioner of Canada, CASL is a Canadian law that governs the commercial electronic messages(CEMs) sent to the receivers in the commercial activities. Given that we will send electronic messages such as the order-related information, payment receipt, or potential advertisement to the customer via email or messages. The CASL guides us to send appropriate messages to our customers and ensures information security. Under the direction of the CASL, there are three important principles that we should keep in mind. The very first one is that the customer's consent must be obtained before sending electronic messages to them. Customers have the right to receive the messages or not. In order to obtain the consent, we must state what kind of messages and the purpose for sending the CEMs to our customers. Also, we need to provide an easier way for our customers to subscribe or unsubscribe the messages in the future directions. Second, keeping the record of the consents and all messages sent to the customer. And make sure they are accurate and always prepare for the inspection by the Canadian Radio-television and Telecommunications Commission (CRTC) if requested. This also implies that we should have an enhanced information encryption system to store these records. Third, ensure the content of the CEMs to be accurate and send reliable information such as updates for the car rental to our customers. For example, when we send the car pick-up location and time to our customers, making a clear statement of the time refers to which location, and the location of the company is accessible. Before sending the service questionnaire to our customers, we need to get consent from the customers in case that they are receiving unwanted messages from us. According to Noboru(2022), the CASL requires the organization to include their identification information in each CEM. The identification information includes the name of the organization, contact of our rental car company, specific address of the rental location or website. The CASL guides our data starting from obtaining the customer's consent which is in the rental_agreement entity, enhancing our message accuracy and improving the security of the stored information to avoid the information beaching.

The third legal aspect we considered is the Consumer Privacy Protection Act(CPPA) in Canada. Because we will collect customer's personal information and the payment information when placing an order. The CPPA sets out various requirements for businesses, including those that collect and use personal information from consumers. The law was introduced in 2000 and applies to any organization that collects, uses, or discloses personal information for the purpose of commercial activities. According to David(2022), a privacy lawyer, explaining that the new CPPA will apply to the collection, use and disclosure of personal information in the course of commercial activity and to employee information of federally-regulated organizations. The new CPPA will apply to the design of rental car databases in the following four ways. First of all, the CPPA requires the business who wants to collect, use or disclose client's personal information with the agreed consent. A consent form that clearly states the purposes, reasons for collecting these data should be given to inform the customer. As long as the customer showed explicit consent then the personal information can be collected. Second, CPPA poses restrictions on use and sharing of customer's information. The CPPA supervises us that all the collected information such as customer's name, ID, address or card card number must be used within the scope of the car rental process. We can't overuse the customer's information or share customer's information to the third-party without authorization or consent. Third, the CPPA performs a huge amount of penalties for non-appliance. According to the government of Canada, non-appliance fines of up to 5% of revenue or $25 million, whichever is greater, and administrative monetary penalties of up to 3% of revenue or $10 million, whichever is greater. In that sense, we should make sure our database design for the rental car company is in compliance with CPPA to protect customer's personal information and avoid any legal and financial consequences.

Group Discussion:

Generally speaking, all of the three legal aspects we mentioned above guide us carefully to collect, store and use the customer's personal and identifying information. All of them mentioned that a consent must be obtained before collecting or sharing the personal information from the customer. A clear consent with the purpose and the way to collect or use the customer's information must be shown. PIPEDA also focuses on enhancing data security from the organization's perspective. For example, organizations can design a user-friendly system that reminds users to set difficult passwords and allow users to flexibly edit or update their information to ensure the data accuracy. Instead, the CPPA also strictly governs the use and sharing of customer's personal information as well as perform high penalties to regular the organizations and protect customer's personal information and avoid any legal and financial consequences. Both PIPEDA and CPPA give us a strong awareness of getting consent from the customer when collecting their information, carefully use their data in the rental process and protect the user's information through technical enforcement. CASL provides CEMs guidance for us and lets us know to ensure the data reliability for the rental information, and leave the company information whenever email or contact our customers. CASL not only guides us to send appropriate messages to our customers but ensures information security as well. Following CASL, we also need to build an extra database to store the CEMs sent to the customers in case for the inspection by the Canadian Radio-television and Telecommunications Commission (CRTC) if requested. The three legal aspects in Canadian laws we discussed cover a wide range of knowledge to protect the user's personal and identifying information. As a database designer for the rental car company, it is vital for us to obtain the consent whenever collecting or sharing user's personal information or sending CEMs under the PIPEDA and CPPA, ensuring the CEMs sent to the customer is trustful and reliable under CASL, protecting the user's personal information and avoid the misuse or leakage of the information stored in the database, making it easier for customers to edit or update their personal information, as well as keeping the record for the CEMs messages via email.

As a rental car company, it is unavoidable for us to collect the customer's personal information and so it will be subject to PIPEDA and CPPA. All three legal aspects are conducive to protecting the data within the scope of our rental car database design.

Section 10. Ethical Aspects

The first ethical aspect we considered is managing the data with integrity. Intuitively, the organizations should treat the collected data from the customers with respect, honesty and privacy, making sure that the customer's data is used ethically in the business process. There are four key principles that we should follow in our car rental scenario. First of all, collect the data that is used for the car rental purpose only and get the consent from the customer before collecting the data. For example, when an account_holder rents a car through the Rental Cars website, the company will collect the mandatory information such as the customer's name, address, driver's license, and credit card numbers. But, consent must be obtained. Second, ensure transparency for the use of the personal information. Providing comprehensive information about why is collecting these personal data, where and how will the collected information be used. Organizations must inform and acquire agreement when they share the customer's data to the third party. For example, we can create a private policy that states how the data being collected, used or shared. And explain why these data are necessary to be collected, how the organization secured the data. Third, retain and dispose of the customer's data in compliance under the guidance of certain regulations. Retain the customers' data when it is necessary and dispose of the customers' data when it is no longer needed. For example, it is required to retain the customer's rental agreement in a certain period suggested by the law, but after that once the customer's data is no longer needed in the database, delete the customer's rental agreement. When customers close their account, we should delete all electronic or paper-based customer's records securely, for example, using a shredding approach to securely remove the client's recorded data. To manage the customer's data with integrity, we should collect the information that is necessary for the rental process and must obtain the consent before collecting customers' identifying information. Instead, make sure the data practices are transparent to the customers. Finally, retaining and disposing of the customer's data appropriately. Only retain the customer's data when necessary and remove the customer's data securely.

The second ethical aspect we considered while maintaining the database was ensuring that the user's privacy is protected and the information is kept strictly confidential. According to a Deloitte Canada survey, about 90% of users globally would cut relations with a company if they find out that their data is used unethically and their privacy and confidentiality is not safeguarded. The organization should prioritize the privacy aspect of the data collected from users to make sure the user's trust in the organisation is not misused. In addition to taking the user's consent the collected data should be stored securely and utilised only for legitimate business purposes. The company should adopt the practice of de-identifying the dataset by eliminating all pieces of personally identifiable information before analysing the dataset and establishing further relationships between different variables of interest. This method also aids in finding correlations without connecting specific data points to specific identities. It is important to store sensitive information such as the customer's address, phone number, and payment information securely. It is the company's responsibility to ensure that user's private data is not outsourced to other organizations or made available publicly. There should be strict restrictions on the employees and other stakeholders to access user data. Additionally, the organization can further secure the data using suitable encryption techniques, dual authentication password protection and even file encryption providing a good medium to secure the data privacy and confidentiality. The car rental organization should follow all applicable national data protection or privacy laws, and other data privacy-related laws or regulations. In addition to law compliances, the organization should steer clear of any grey areas of the policy that can be interpreted as ethically questionable by the user's in terms of privacy and user confidentiality. The organisation needs a better grasp of the cultural quirks that affect ethical standards of their users in order to avoid these mistakes. Organizations should take necessary measures and train the employee's on how

to actively avoid engaging in actions that can harm privacy, and ensure that all the employee's agree to abide by the company's privacy policies. For example: The car rental company should host mandatory interactive training sessions followed by testing the employee's to ensure the employee's were engaged and grasped all the content. On the instances of breach of sensitive data, it is the responsibility of the car rental organisations to report the affected stakeholders.

When we talk about ethics aspects of dealing with data, we are covering a wide range of topics in the discussion. It may include moral responsibilities of three kinds of behaviours: gathering, protecting and using the data, and also what kind of influences it will have (2021). For companies that hold vast data about users and other stakeholders, they need to learn about some principles about data ethics. One of them can be the ownership of data. The target groups that are collected data from should have the ownership and control of their personal information. In our case, it can be the customers and the third-party suppliers. Data collection will be implemented when the customers fill out their information and create accounts, and they must have the rights to know what info is collected and how the data will be used by the company. Consent forms, agreements, terms and conditions, and privacy policies are some common practices to help them understand companies' rules about data collection and usage. It leads the topic about data transparency, which means the data subjects should be allowed to know how the company is going to collect, store and use the information. They also need to have the rights to update and remove their personal information without barriers. Privacy is also a crucial theme of data ethics. It is important to protect the customers' personally identifiable information. Although they may fill the consent forms and agree with the companies' data policies, it doesn't mean they are willing to make the information become public to others. In addition, data privacy also matters inside the organization. The data collected by the company should not be all available for all the employees. Their accessibility to the data should depend on their jobs, and if they need extra data they should make applications and follow the organizational policies. From the ethical aspect, the Views we created in our assignment can act as a method for protecting the privacy of data, since they restrict the access to some sensitive data about some entities. Moreover, when we need to analyze the customers' data for business purposes, we need to maintain ethical and legal accountability when dealing with them. It is important to establish measures such as guidelines for forecasting, analysis, and inference. It is crucial to be aware of potential unconscious biases in algorithms and to understand the data being collected to ensure fair representation of all consumers (2022). It is important to prevent big data from institutionalizing unfair biases.

Group Discussion:

In general, it is clear now that the car rental organization can benefit greatly by adhering to the ethics like data integrity, data security and confidentiality and data ownership. The principles of data integrity highlighted the importance of getting the users consent before storing the data. This will help in developing trust between the customers and the company. Customers tend to use the products of companies they trust and even recommend others which will in turn benefit and boost the business revenue of the organization. Providing transparency about why the data is collected not only creates awareness among users about the use of their data but also lays emphasis on the company's policies. This shows the purpose for which the data is collected and provides accurate and consistent data being collected. This helps the organizations in providing better customer service which improves customer satisfaction and thus promotes positive feedback about the business of the organization. Informing the users about their data being shared with any third-party user further enhances the trust that is developed. It further helps in improving the reputation of the organization and also helps in collaborating with the third-party better. Finally, deleting user data when no longer required benefits the organization in not only complying with the policies but also reducing the storage costs and improving the quality of the data that is stored. It can in turn help in improving the decision-making of the organization. Data integrity can thus help our car rental company by enhancing operational effectiveness, offering superior customer service, adhering to rules, and boosting income. An organization that secures users data privacy and

confidentiality gains an advantage over competitors. It demonstrates reliability and adherence to policies. Ownership of the client information obtained gives car rental companies greater control over how that information is used. This can entail restricting access to select individuals or utilizing the data in ways that are consistent with the objectives of the organization. Thus, following these data ethics can help our car rental organization in numerous ways while safeguarding and achieving long-term growth and sustainability.

Section 11. Security Aspects

The first security aspect we considered is to apply encryption to secure the data in our rental car database. According to the Internet Society(2022), Encryption is the process of scrambling or enciphering data so it can be read only by someone with the means to return it to its original state. It is a crucial feature of a safe and trustworthy Internet. It helps provide data security for sensitive information. Given that our database will store customers' identifying and sensitive information such as their name, address, driver license information as well as the payment information such as the credit card number. Applying encryption to our database benefits and ensures the security for the stored information because the data can only be accessed or read by people who have the correct key to decrypt it. In that sense, encryption is not only to protect the customers' sensitive data, but potentially avoid the information beaches. The application of encryption can be applied to our database to protect several sensitive data. First of all, encryption helps to safeguard the credit card transaction on the website. Again, according to the Internet Society(2022), Financial transactions and private messaging communications often use encryption to increase security. When a customer enters their credit card number and other card information on the website, the entered data will automatically be encrypted and stored in our database in an encrypted pattern as well. With the encryption applied to our rental car database, it can prevent the illegal access to obtain the customer's credit card information from reading the customer's information. Second, encryption can be applied to customer's personal information as well. In order to protect the customer's privacy, we can also encrypt customers' personal information such as name, phone number and address to prevent information beaches for illegal use. Third, applying encryption to secure the customer's driver license and ID information can further protect the customers' privacy and their identity information as well. Deploying encryption to the customer's ID and driving license can avoid the identity thief and other potential fraud. To deploy encryption to our database, we can take advantage of the existing encryption softwares to encrypt the sensitive data that is stored in our rental car database.

The second security aspect considered is to take data backup and safeguard data against disasters by having efficient disaster recovery procedures in place. Data backups are crucial preventive measures against data loss or data corruption. Taking backups of data regularly will help in restoring crucial, sensitive data in case of a security breach, hardware failure or any other unprecedented catastrophe. The organisations should encourage consistent backup policies across all the servers and backup hardware in the company. Given that our car rental organisation has a big customer, staff, supplier, vehicle inventory database, having the backup of the information will help the business to reduce periods of downtime and prevent significant loss of earnings. The organisation can adhere to either of these data backup solutions- Cloud backup services have helped businesses in storing information securely. The data that is stored using cloud services is easily accessible to the car rental organisation in case of a disaster. It is crucial for the organisation to devise a strategy plan that allocates the automation of backup procedure on a particular hardware for specific categories of data as external hard drives and appliances do not provide a lot of flexibility. The data can also be maintained in backups that are in a remote location. It helps in ensuring that the data is not accessible to any personnel and maintaining it in a secure remote location secures it during any disaster while also making the data accessible for the organisations. If this option does not stand feasible, the organisation can consider collaborating with several service providers.

Database security aspect covers various topics, and the purpose is to ensure the safety of the data in the database, the database management system (DBMS) itself, the associated applications, the physical servers or virtual servers and hardware, and the infrastructures and equipment for accessing the database (3). For this project we are focusing on the protection of the data, and the first thing we need to secure is the access control. Physical and virtual access to the DBMS and important data should be limited (4). The company should not let random people have the ability to open the database and see the data. The employees in the company should access the database with mandatory login entry. Thus, the company should give the employees accounts, PIN numbers, tokens or cards to login and access the database. Only the people with the user names, passwords and any other login tools can see and use the data. To protect the data storage, the company should implement some policies and processes. For instance, they can encrypt the data and make a management system to track encryption keys if they have any. They can also have backup and recovery plans to prevent its business from completely shutting down, if its system or the cloud service is attacked by malware and ransomware. The company should also carefully evaluate and decide which employees should have these accounts. If the data needs to be removed, the company also needs to ensure its DBMS can delete the data safely and completely. Data erasure can be a good way to erase the data permanently. It can also involve overwriting the sensitive data with a series of 0s and 1s (5). In our case, if a customer wants to stop using the company's service and delete his account, the company needs to ensure they will not hold the customer's personal information and other related data anymore to respect the rights of the customers.

Group Discussion:

After discussing the results as a group, we all agree that although it's easy to find and understand the data security practices, it would be complicated to implement and there are still many things and details that need to be considered. The security of data in a rental car database is crucial. Encryption is a necessary security aspect that can help protect the data by scrambling or enciphering it, making it unreadable without the correct decryption key. However, it can't individually ensure the safety of the data. Data backup is another critical security aspect that organizations must consider to prevent data loss or corruption in case of a security breach, hardware failure, or any other disaster. The company may suffer from a complete shutdown of services, system downtime, and huge financial and reputational loss if it doesn't have any backup plans and policies. Cloud backup services provide an efficient and secure way to store data and enable easy access to it during disasters. Moreover, some threats are from the internal of the organization, so access control becomes an essential security aspect that organizations should implement to restrict access to the database and the data. Employees, if they are permitted, must access the database through mandatory login entry with user names, passwords, tokens, or cards to ensure data security. Thus, we can say that we need to ensure transparency to the customers, but also ensure the regulated and limited access to the database to the employees. Data erasure is another security aspect that can help delete data safely and completely when required. If a customer wants to stop using the company's service and delete their account, the company must ensure that it deletes all personal information and related data to respect the customer's rights. However, it may cause issues if the customer needs to get some booking order history after deleting the account. The company may need to consider whether it should keep some records legally and ethically to help customers in this case.

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Statement of individual contributions:

Jiaqi Han: Normalization, Data Catalog, Schema, Views, Queries, Triggers, Legal Aspects, Ethical Aspects, Security Aspects

Rohit Pandit: Normalization, ERD diagram, Schema, Views, Queries, Triggers, Legal Aspects, Ethical Aspects, Security Aspects

Zeqing Yu: Normalization, Executive summary, Context of the study, Views, Queries, Triggers, Legal Aspects, Ethical Aspects, Security Aspects