Course Title: Database

Car2Go

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Introduction

The scenario we have selected consist of a car rental company called Car2Go. It offers different car models, colors and "year made" to customers in different company locations. The objective of this project is to create a Database that will follow the instructions given to our scenario. For the team roles, we haven't really given a role or a big task to anyone in particular. We all worked equally at each step of the project and helped each other out.
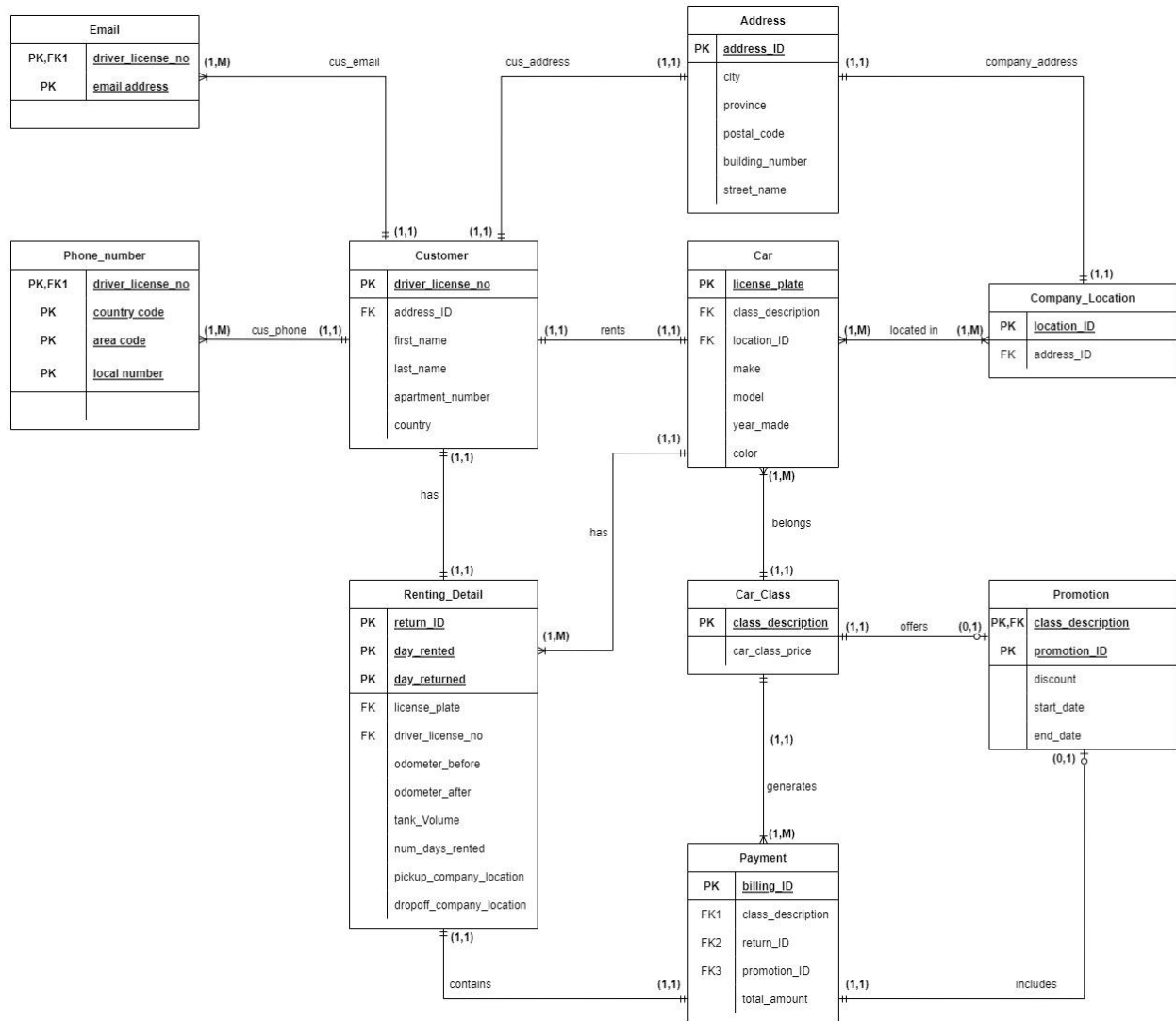
Scenario description

Description:

The company Car2Go is a car rental company that has several locations and offers a multitude of classes such as subcompact, compact, sedan and luxury. Each car has a different make, model, year made and color. Also, they each have a unique identification number and a unique license plate. When a car is rented, the company keeps track of the mileage, tank, and the date (before and after a car is rented). The rented car can be returned to a different location. A customer can only rent one car at a time and request a specific class. For every customer, the company keeps record of their full name, mailing address, zero or more phone numbers, zero or more email addresses and the driver's license number (unique for each customer). If the company does not have a vehicle of the class requested, the customer can get a higher class for the same price (free upgrade). All cars of the same class are priced the same. The drop-off charge is calculated by the car's class, the duration in days (minimum 1) and if there is any weekly promotion. In certain weeks of the year, the company has a promotion (usually 50%, not always) that only affects a single class of car at a time.

Business Rules and Assumptions:

1. Each car has a unique license plate
2. Customer can only rent one car at a time
3. If the car requested by the customer is not available, they can get a car of higher class at the same price as the car requested
4. Company keeps track of the rented cars
5. Company keeps record of the customer
6. All cars in the same class have the same price
7. Drop-off charge can be found with the price of the car, duration in days, and promotion, if there are any.
8. For every car rented, the company keeps the odometer reading before it is rented and after it is returned
9. The cars rented in a particular location may be returned to a different location
10. When a car is being returned the company records the tank Volume and indicate whether the tank is empty, quarter full, half full, three quarters full, or full.
11. The company also keeps track of the day a car was rented and returned

Conceptual Design of the Database

Email

PK,FK1	driver_license_no
PK	email address

Address

PK	address_ID
	city
	province
	postal_code
	building_number
	street_name

(1,M) — cus_email — (1,1) — cus_address — (1,1) — company_address — (1,1)

Phone_number

PK,FK1	driver_license_no
PK	country code
PK	area code
PK	local number

Customer

PK	driver_license_no
FK	address_ID
	first_name
	last_name
	apartment_number
	country

Car

PK	license_plate
FK	class_description
FK	location_ID
	make
	model
	year_made
	color

Company_Location

PK	location_ID
FK	address_ID

(1,M) — cus_phone — (1,1)
(1,1) — rents — (1,1)
(1,M) — located in — (1,M)
(1,1) — belongs — (1,M)

has (1,1) ... (1,1)
has (1,1) ... (1,M)

Renting_Detail

PK	return_ID
PK	day_rented
PK	day_returned
FK	license_plate
FK	driver_license_no
	odometer_before
	odometer_after
	tank_Volume
	num_days_rented
	pickup_company_location
	dropoff_company_location

Car_Class

PK	class_description
	car_class_price

Promotion

PK,FK	class_description
PK	promotion_ID
	discount
	start_date
	end_date

(1,1) — offers — (0,1)
(1,1) — generates — (1,M)
(0,1)

Payment

PK	billing_ID
FK1	class_description
FK2	return_ID
FK3	promotion_ID
	total_amount

contains (1,1) ... (1,1)
includes (1,1)

3

Logical Database Schema

- **Email (** driver_license_no, email_address **)**
- **Phone_Number (** driver_license_no, country_code, area_code, local_number **)**
- **Address (** address_ID, city, province, postal_code, building_number, street_name **)**
- **Customer (** driver_license_no, address_ID, first_name, last_name, apartment_number, country **)**
- **Company_Location (** location_ID, address_ID **)**
- **Car (** license_plate, class_description, location_ID, make, model, year_made, color **)**
- **Car_Class (** class_description, car_class_price **)**
- **Renting_Detail (** return_ID, day_rented, day_returned, license_plate, driver_license_no, odometer_before, odometer_after, tank_volume, num_days_rented, pickup_company_location, dropoff_company_location **)**
- **Promotion (** class_description , promotion_ID, discount, start_date, end_date **)**
- **Payment (** billing_ID, class_description, return_ID, promotion_ID, total_amount **)**

FOREIGN KEYS	REFERENCING RELATION	REFERENCED RELATION
driver_license_no	EMAIL	CUSTOMER
driver_license_no	PHONE_NUMBER	CUSTOMER
Address_ID	CUSTOMER	ADDRESS
Address_ID	COMPANY_LOCATION	ADDRESS
Location_ID	CAR	COMPANY_LOCATION
class_description	CAR	CAR_CLASS
license_plate	RENTING_DETAIL	CAR
driver_license_no	RENTING_DETAIL	CUSTOMER
pickup_company_location	RENTING_DETAIL	COMPANY_LOCATION
dropoff_company_location	RENTING_DETAIL	COMPANY_LOCATION
class_description	PROMOTION	CAR_CLASS
class_description	PAYMENT	CAR_CLASS
return_id	PAYMENT	RENTING_DETAIL

Functional Dependencies:

- Address_ID -> (city, province, postal_code, building_number, street_name)
- Driver_liscence_no -> (address_ID, first_name, last_name, apartment_number, country)
- Location_ID -> (address_ID)
- License_plate -> (class_description, location_ID, make, model, year_made, color)
- Class_description -> (car_class_price)
- Return_ID -> (day_rented, day_returned, license_plate, driver_license_no, odometer_before, odometer_after, tank_volume, num_days_rented, pickup_company_location, dropoff_company_location)
- class_description , promotion_ID -> (discount, start_date, end_date)
- billing_ID -> (class_description, return_ID, promotion_ID, total_amount)

Database Normalization:

For the Normalization, we removed the columns "Email" and "Phone_Number" from Customer table because we would have more than one value for some attributes. Instead, we created two separate tables called "Email" and "Phone_Number". This change allowed us to successfully implement the First Normal Form (1NF) of our ER Diagram. For the Second Normal Form, the table Address was added to the ER Diagram in order to identify the addresses for each record in the tables Customer and Company_Location.

Database Tables: Attributes and Constraints

ADDRESS TABLE:

address_ID,
PRIMARY KEY
NOT NULL

CUSTOMER TABLE:

DRIVER_LICENSE_NO	ADDRESS_ID
PRIMARY KEY	NOT NULL
NOT NULL	FOREIGN KEY

EMAIL TABLE:

DRIVER_LICENSE_NO	EMAIL_ADDRESS
PRIMARY KEY	PRIMARY KEY
NOT NULL	
FOREIGN KEY	

PHONE_NUMBER TABLE:

DRIVER_LICENSE_NO	COUNTRY_CODE	AREA_CODE	LOCAL_NUMBER
PRIMARY KEY	PRIMARY KEY	PRIMARY KEY	PRIMARY KEY
FOREIGN KEY			

COMPANY_LOCATION TABLE:

LOCATION_ID	ADDRESS_ID
PRIMARY KEY	NOT NULL
NOT NULL	FOREIGN KEY

CAR_CLASS TABLE:

CLASS_DESCRIPTION
PRIMARY KEY
NOT NULL

CAR TABLE:

LICENSE_PLATE	CLASS_DESCRIPTION	LOCATION_ID
PRIMARY KEY	NOT NULL	NOT NULL
FOREIGN KEY	FOREIGN KEY	FOREIGN KEY

PROMOTION TABLE:

PROMOTION_ID	CLASS_DESCRIPTION
PRIMARY KEY	PRIMARY KEY
	NOT NULL

RENTING_DETAIL TABLE:

RETURN_ID	DAY_RENTED	DAY_RETURNED	LICENSE_PLATE	DRIVER_LICENSE	PICKOFF	DROPOFF
PRIMARY K	PRIMARY K	PRIMARY K	FOREIGN K	FOREIGN K	FOREIGN K	FOREIGN K
NOT NULL	NOT NULL	NOT NULL	NOT NULL	NOT NULL	NOT NULL	NOT NULL

PAYMENT TABLE:

BILLING_ID	CLASS_DESCRIPTION	PROMOTION_ID	RETURN_ID
UNIQUE	FOREIGN KEY	CHECK	CHECK
	NOT NULL		NOT NULL

SNAPSHOTS:

Figure 1: Address Table

Figure 2: Customer Table

Figure 3: Company_Location Table

Figure 4: Car_Class Table

	LICENSE_PLATE	CLASS_DESCRIPTION	LOCATION_ID	MAKE	MODEL	YEAR_MADE	COLOR
1	F012345	Luxury	COM001	Rolls Royce	Phantom	2018	Silver Metallic
2	F098765	Luxury	COM004	Bentley	Continental GT	2020	White
3	F123456	Sedan	COM001	Toyota	Corolla	2015	White
4	F234567	Compacts	COM002	Honda	Accord	2022	Blue
5	F345678	Subcompacts	COM001	Kia	Soul	2016	Orange

Figure 5: Car Table

	PROMOTION_ID	CLASS_DESCRIPTION	DISCOUNT	START_DATE	END_DATE
1	P001	Sedan	50	2020-02-28	2020-03-06
2	P002	Compacts	40	2020-07-12	2020-07-18
3	P003	Subcompacts	60	2020-09-29	2020-10-05
4	P004	Luxury	25	2020-12-31	2021-01-06

Figure 6: Promotion Table

	DRIVER_LICENSE_NO	EMAIL_ADDRESS
1	B5504-300403-08	maria.blake@gmail.com
2	F3382-188281-96	nicole.ford@gmail.com
3	F6615-411514-19	adam.ford@gmail.com
4	G7726-522625-20	marie.girouard@gmail....
5	H2271-077170-85	matthew.hudson@gm...

Figure 7: Email Table

	DRIVER_LICENSE_NO	COUNTRY_CODE	ARE_CODE	LOCAL_CODE
1	B5504-300403-08	+1	786	901-2345
2	F3382-188281-96	+1	604	789-0123
3	F6615-411514-19	+1	310	098-8765
4	G7726-522625-20	+1	404	986-6543
5	H2271-077170-85	+1	514	678-9012

Figure 8: Phone_Number Table

	RETURN_ID	DAY_RENTED	DAY_RETURNED	LICENSE_PLATE	DRIVER_LICENSE_NO	ODOMETER_BEFORE	ODOMETER_AFTER	TANK_VOLUME	NUM_DAYS_RENTED	PICKUP_COMPANY_LOCATION	DROPOFF_COMPANY_LOCATION
1	RD001	2020-02-24	2020-03-24	F123456	S6615-411514-19	93124	100032	Full	29	AD001	AD002
2	RD002	2021-08-24	2022-08-24	F234567	S7726-522625-30	2456	25785	Empty	365	AD004	AD004
3	RD003	2020-03-12	2020-03-15	F567890	V8837-633736-41	55238	56873	Quarter Full	4	AD002	AD003
4	RD004	2020-05-30	2022-06-10	F765432	J9948-744847-52	67582	69321	Three Quarter...	12	AD004	AD002
5	RD005	2022-09-29	2022-10-01	F456789	S0059-855958-63	43879	44154	Full	3	AD003	AD004

Figure 9: Renting_Detail Table

	BILLING_ID	CLASS_DESCRIPTION	PROMOTION_ID	RETURN_ID	TOTAL_AMOUNT
1	BL001	Sedan	P001	RD001	5800.00
2	BL002	Compacts	NULL	RD002	118625.00
3	BL003	Luxury	NULL	RD003	8000.00
4	BL004	Subcompacts	NULL	RD004	3000.00
5	BL005	Luxury	P004	RD006	46500.00

Figure 10: Payment Table

Challenges and Suggestions for improvements

Challenges:
- ER Diagram
- Connecting the tables
- Finding the primary keys
- Creating functions
- Creating attributes (constraint errors)
- Having a good number of tables
- Normalization (2NF)
- Variable datatype
- Query Number 10:
- Calculating the price with and without promotion
  - Solution: Cartesian Product

Suggestions for improvements:
We would like to organize the source code better to make it cleaner and clearer (easier to understand). Also, we would like to write the code in a way that you just need to hit execute without selecting different parts of the code to run it. Finally, we want to make sure the ER diagram is well done and complete before coding to make it easier.

Conclusions and Future Work

Conclusions:
In conclusion, this project helped us learn a lot of important things such as creating a database, using SQL, and managing our time and work as a team.

Future Work:
For data analyst roles, SQL is again the most in-demand skill, listed in 57.4% of all data analyst jobs. As a result, having experience with SQL and creating database will help us a lot getting a good job in the future.