DATABASE MANAGEMENT SYSTEMS DESIGN

TERM PROJECT – PHASE 1 & 2

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1. INTRODUCTION

RentACar wishes to implement a database to control all aspects of its operations, including tracking car inventories, rental contracts, and billing. The following statements of business rules and relationships are used to construct a relational model:

- Each VEHICLE is uniquely identified by a Vehicle Identification Number (VIN). When customers make a reservation there needs to be a vehicle available for rent. Therefore, vehicle has an additional attribute to show the availability. It could be 'Y' if available, 'R' if reserved, 'C' if confirmed.

- Each vehicle description includes a MODEL that consist of the make (i.e., Ford, Honda…), year and name.

- Each model belongs to a CLASS with two different rental rates: daily and weekly rate. Rental prices are determined based on the class (i.e., Van, Pickup Truck, Mid-size car, SUV…).

- Each vehicle is assigned to a BRANCH and each branch can have one or more vehicles. Branch is identified by a unique Location ID and includes an address.

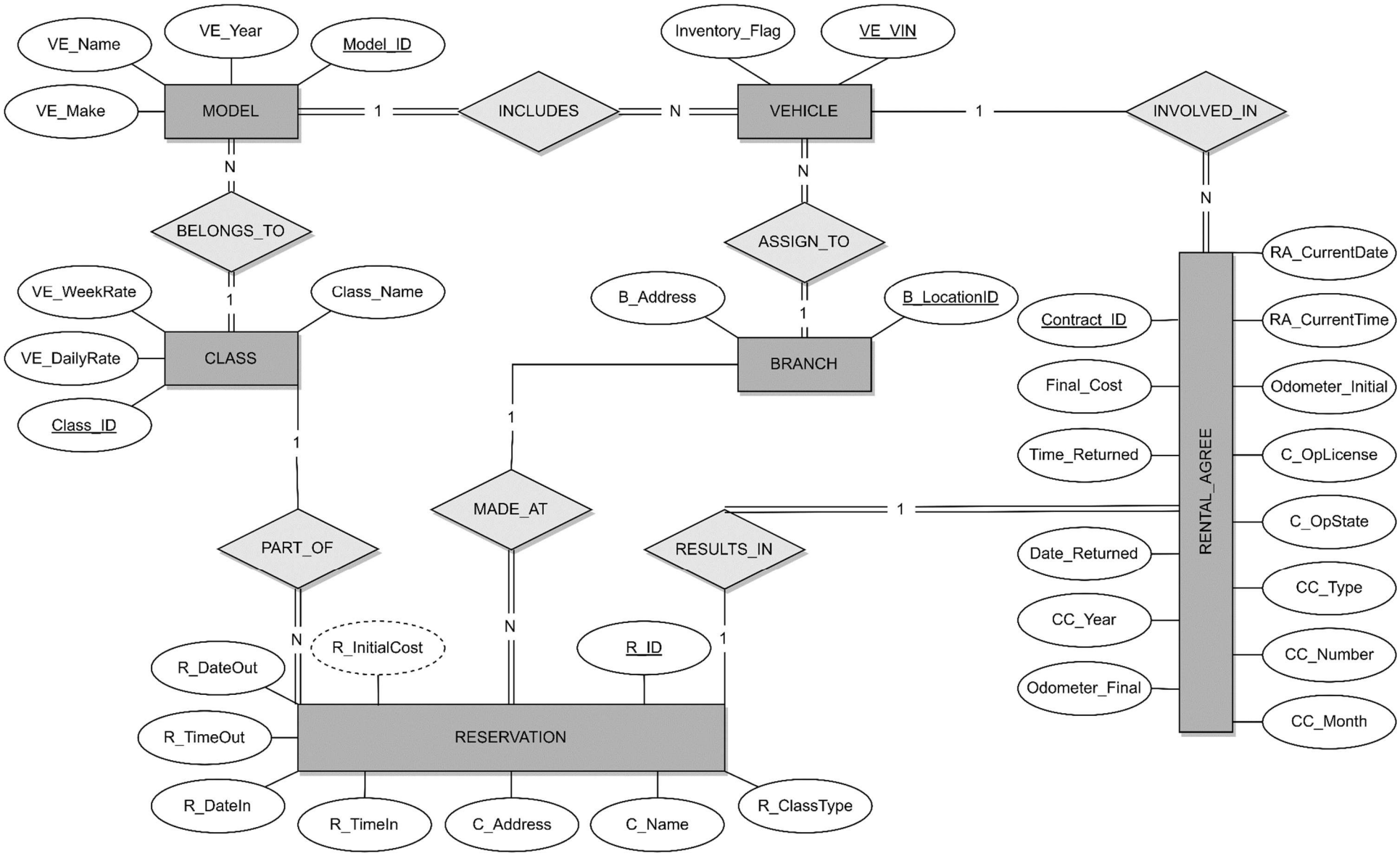
- RESERVATION carries the details about Customer name, address, class type (daily or weekly rental), rate, and duration of the rental with start and end time. A reservation is made for the pickup of a particular class at a specific branch.

- RESERVATION, MODEL and CLASS would have an artificial ID that increments by 1 from maximum value and serves to uniquely identify each entry.

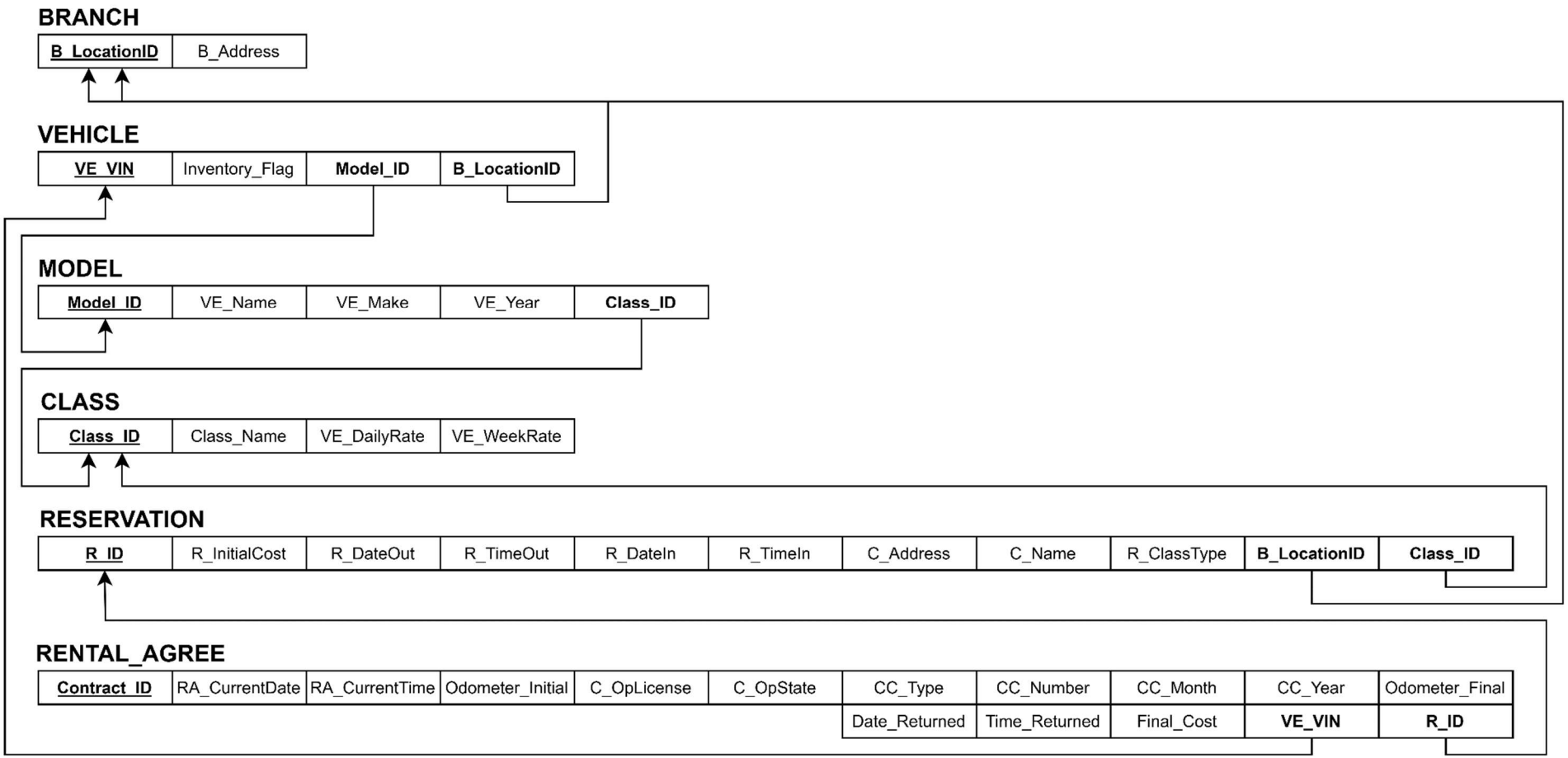
- When a reservation is confirmed, a RENTAL AGREEMENT is made. A reservation gets confirmed when the customer arrives to the branch to pick up the car. Rental Agreement is uniquely identified by the Contract ID, includes the vehicle VIN, current date, and time for the rental to start and initial odometer reading. Entity also carries customer information: license number, state that issued the license, credit card number, type (i.e., Visa, MasterCard…), expiration month and year.

- When vehicle is returned, the rental agreement incorporates information such as final odometer reading, date and time returned, and final rental rate. This forms the complete operations cycle.

2. ENTITY-RELATIONSHIP (ER) SCHEMA



3. RELATIONAL MODEL



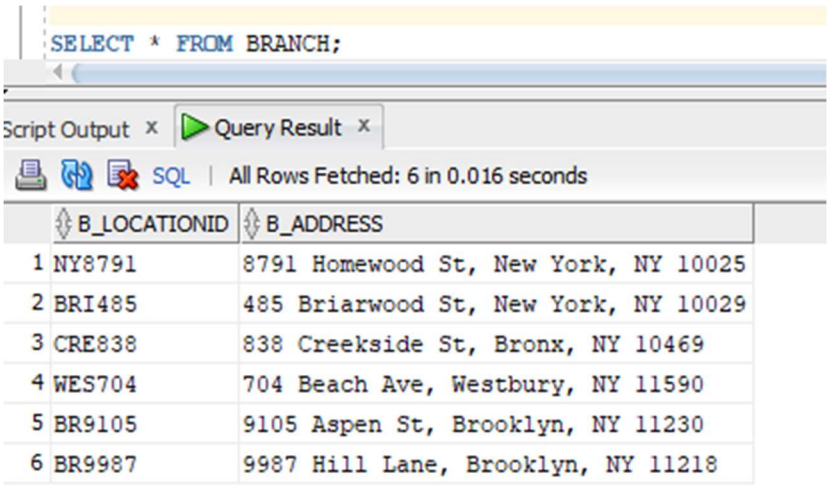
4. SQL STATEMENTS TO CREATE DATABASE AND TABLES

```
CREATE TABLE BRANCH (
        B_LocationID        VARCHAR(15)         NOT NULL,
        B_Address           VARCHAR(50)         NOT NULL,
        PRIMARY KEY (B_LocationID));
/

CREATE TABLE VEHICLE (
        VE_VIN              VARCHAR(17)         NOT NULL,
        Inventory_Flag      VARCHAR(1)          NOT NULL,
        Model_ID            VARCHAR(15)         NOT NULL,
        B_LocationID        VARCHAR(15),
        PRIMARY KEY (VE_VIN),
        FOREIGN KEY (B_LocationID) REFERENCES BRANCH (B_LocationID) ON DELETE SET
        NULL);
/

CREATE TABLE MODEL (
        Model_ID            VARCHAR(15)         NOT NULL,
        VE_Name             VARCHAR(25)         NOT NULL,
        VE_Make             VARCHAR(15)         NOT NULL,
        VE_Year             INT                 NOT NULL,
        Class_ID            VARCHAR(15)         NOT NULL,
        PRIMARY KEY (Model_ID));
/

ALTER TABLE VEHICLE ADD CONSTRAINT Veh_mod FOREIGN KEY (Model_ID) REFERENCES MODEL
(Model_ID);
/

CREATE TABLE CLASS (
        Class_ID            VARCHAR(15)         NOT NULL,
        Class_Name          VARCHAR(15)         NOT NULL,
        VE_DailyRate        DECIMAL(10,2)       NOT NULL,
        VE_WeekRate         DECIMAL(10,2)       NOT NULL,
        PRIMARY KEY (Class_ID));
/

ALTER TABLE MODEL ADD CONSTRAINT Mod_cla FOREIGN KEY (Class_ID) REFERENCES CLASS
(Class_ID);
/

CREATE TABLE RESERVATION (
        R_ID                VARCHAR(15)         NOT NULL,
        R_InitialCost       DECIMAL(10,2)       NOT NULL,
        R_DateOut           DATE                NOT NULL,
        R_TimeOut           INT                 NOT NULL,
        R_DateIn            DATE                NOT NULL,
        R_TimeIn            INT                 NOT NULL,
        C_Address           VARCHAR(50)         NOT NULL,
        C_Name              VARCHAR(30)         NOT NULL,
        R_ClassType         VARCHAR(15)         NOT NULL,
        B_LocationID        VARCHAR(15),
        Class_ID            VARCHAR(15),
        PRIMARY KEY (R_ID),
        FOREIGN KEY (B_LocationID) REFERENCES BRANCH (B_LocationID) ON DELETE SET
        NULL,
```

```
        FOREIGN KEY (Class_ID) REFERENCES CLASS (Class_ID) ON DELETE SET NULL);
/

CREATE TABLE RENTAL_AGREE (
        Contract_VIN        VARCHAR(15)         NOT NULL,
        RA_CurrentDate      DATE                NOT NULL,
        RA_CurrentTime      INT                 NOT NULL,
        Odometer_Initial    INT                 NOT NULL,
        C_OpLicense         VARCHAR(15)         NOT NULL,
        C_OpState           VARCHAR(15)         NOT NULL,
        CC_Type             VARCHAR(15)         NOT NULL,
        CC_Number           INT                 NOT NULL,
        CC_Month            INT                 NOT NULL,
        CC_Year             INT                 NOT NULL,
        Odometer_Final      INT,
        Date_Returned       DATE,
        Time_Returned       INT,
        Final_Cost          DECIMAL(10,2),
        VE_VIN              VARCHAR(17),
        R_ID                VARCHAR(15),
        PRIMARY KEY (Contract_VIN),
        FOREIGN KEY (VE_VIN) REFERENCES VEHICLE (VE_VIN) ON DELETE SET NULL,
        FOREIGN KEY (R_ID) REFERENCES RESERVATION (R_ID) ON DELETE SET NULL);
/
```

5. DATASET

5.1. BRANCH



```
SELECT * FROM BRANCH;
```

Script Output | Query Result | SQL | All Rows Fetched: 6 in 0.016 seconds

	B_LOCATIONID	B_ADDRESS
1	NY8791	8791 Homewood St, New York, NY 10025
2	BRI485	485 Briarwood St, New York, NY 10029
3	CRE838	838 Creekside St, Bronx, NY 10469
4	WES704	704 Beach Ave, Westbury, NY 11590
5	BR9105	9105 Aspen St, Brooklyn, NY 11230
6	BR9987	9987 Hill Lane, Brooklyn, NY 11218

5.2. VEHICLE

```
SELECT * FROM VEHICLE;
```

Script Output × Query Result ×

SQL | Fetched 50 rows in 0.02 seconds

	VE_VIN	INVENTORY_FLAG	MODEL_ID	B_LOCATIONID
1	WBSPM9C52BE202514	A	BU89_CEN	NY8791
2	5NPEB4AC1DH576656	A	BU92_REG	NY8791
3	1GNEL19X73B130926	A	AC95_INT	NY8791
4	JH4DA1844GS001970	A	GM03_SIE	NY8791
5	2FMDK4KC4CBA27842	A	CH04_SIE	NY8791
6	JH4DC4450SS003654	R	FO05_E35	NY8791
7	5FNRL38209B014050	A	HO09_ODY	NY8791
8	2G4WB54T1N1466114	A	SE10_SAT	NY8791
9	1GNKVGED5CJ196120	A	HY10_ELA	NY8791

5.3. MODEL

```
SELECT * FROM MODEL;
```

Script Output × Query Result ×

SQL | All Rows Fetched: 49 in 0.025 seconds

	MODEL_ID	VE_NAME	VE_MAKE	VE_YEAR	CLASS_ID
1	AC86_INT	Integra	Acura	1986	SUV04
2	CA87_DEV	DeVille	Cadillac	1987	LUX04
3	AC88_INT	Integra	Acura	1988	LUX02
4	BU89_CEN	Century	Buick	1989	HYB01
5	AC91_INT	Integra	Acura	1991	LUX01
6	BU92_REG	Regal	Buick	1992	COM01
7	BU92_PAR	Park Avenue	Buick	1992	LUX03
8	AC95_INT	Integra	Acura	1995	LUX02
9	PO95_GRA	Grand Am	Pontiac	1995	SPO01

5.4. CLASS

```
SELECT * FROM CLASS;
```

Script Output | Query Result | SQL | All Rows Fetched: 25 in 0.017 seconds

	CLASS_ID	CLASS_NAME	VE_DAILYRATE	VE_WEEKRATE
1	COM01	Compact	81.1	429.83
2	COM02	Compact	88.81	470.69
3	COM03	Compact	89.88	476.36
4	ELE01	Electric	134.34	712
5	ELE02	Electric	145.59	771.63
6	ELE03	Electric	153.39	812.97
7	HYB01	Hybrid	153.49	813.5
8	HYB02	Hybrid	155.75	825.48
9	HYB03	Hybrid	158.84	841.85

5.5. RESERVATION

```
SELECT * FROM RESERVATION;
```

Script Output | Query Result | SQL | Fetched 50 rows in 0.019 seconds

	R_ID	R_INITIALCOST	R_DATEOUT	R_TI...	R_DATEIN	R_TIMEIN	C_ADDRESS	C_NAME	R_CLASSTYPE	B_LOCATIONID	CLASS_ID
1	001LUX02	2006.13	2022-01-11	14	2022-01-23	10	675 Birchwood S...	Lars Gilbertson	Luxury	BR9105	LUX02
2	002SED01	957.11	2022-02-11	14	2022-02-24	10	7155 Hillside S...	Gerardo Sampson	Sedan	BRI485	SED01
3	003SUV02	183.3	2022-03-01	12	2022-03-03	8	9861 Sunset Dr,...	Deena Koons	SUV	WES704	SUV02
4	004VAN01	2697.97	2022-03-08	15	2022-04-01	10	64 Lawrence Rd,...	Elyza Mabe	Van	NY8791	VAN01
5	005HYB01	3054.45	2022-03-11	10	2022-04-05	8	283 Lakeview Rd...	Kyrie Sawyer	Hybrid	CRE838	HYB01
6	006ELE01	846.34	2022-04-01	10	2022-04-09	9	67 Cedarwood Rd...	Rashard Wen	Electric	BRI485	ELE01
7	007COM03	1878.49	2022-05-04	9	2022-05-30	9	7876 Durham Rd,...	Caleigh Starkey	Compact	BRI485	COM03
8	008MIN01	705.12	2022-05-09	12	2022-05-15	8	8488 Hillcrest ...	Kaylene Riddick	Minivan	WES704	MIN01
9	009LUX04	4335.76	2022-05-25	11	2022-06-21	10	790 Walnutwood ...	Lakin Malott	Luxury	BR9987	LUX04

5.6. RENTAL AGREEMENT

```
SELECT * FROM RENTAL_AGREE;
```

Script Output × | Query Result ×

SQL | All Rows Fetched: 40 in 0.018 seconds

	CONTR...	RA_CURR...	RA_CUR...	ODOMETE...	C_OPLIC...	C_O...	CC_...	CC_NUMBER	CC_...	CC...	ODOMET...	DATE_R...	TIME_R...	FINAL...	VE_VIN	R_ID
1	001_0...	2022-01-11	14	68266	T34223...	NY	DINERS	3009116...	5	2023	69130	2022-0...	17	2200.9	1G8ZH127...	00...
2	002_0...	2022-02-11	13	76206	G35212...	NY	VISA	4716103...	10	2024	77870	2022-0...	12	957.11	1FDWE35S...	00...
3	003_0...	2022-03-01	13	95145	R84512...	NY	VISA	4532375...	5	2024	95397	2022-0...	17	274.95	1G8MG35X...	00...
4	004_0...	2022-03-08	16	154037	M77802...	CT	MAS...	5138616...	2	2029	155357	2022-0...	17	2840.72	1GTEC14W...	00...
5	005_0...	2022-03-11	9	65410	R33653...	PA	AMEX	3770594...	9	2026	68735	2022-0...	10	3207.94	1G8ZG127...	00...
6	006_0...	2022-04-01	12	185839	F58167...	NJ	MAS...	5442403...	10	2028	186239	2022-0...	10	846.34	1G2NE55D...	00...
7	007_0...	2022-05-09	11	179564	P68088...	PA	AMEX	3475478...	11	2027	179816	2022-0...	16	822.64	2HNYD283...	00...
8	008_0...	2022-05-25	10	136920	X87278...	NY	UNI...	6223051...	7	2028	139080	2022-0...	10	4335.76	2S3TD52V...	00...
9	009_0...	2022-06-03	12	98291	K73275...	NY	MAS...	5208488...	9	2024	99804	2022-0...	12	2648.87	4KLB4J1N...	01...

6. SQL STATEMENTS TO UPDATE 1 COLUMN

6.1. BRANCH: Update the address of the branch location 'NY8791' to '5 North St Jersey City'.

```
UPDATE    BRANCH
SET       B_Address = '5 North St Jersey City'
WHERE     B_LocationID = 'NY8791';
```

6.2. VEHICLE: Update the Inventory_Flag of the first GMC Sierra 1500 from 2003 to R.

```
UPDATE    VEHICLE
SET       Inventory_Flag = 'R'
WHERE     VE_VIN = (
        SELECT    VE_VIN
        FROM      VEHICLE
        WHERE     Inventory_Flag = 'A' AND Model_ID = 'GM03_SIE' AND ROWNUM = 1);
```

6.3. MODEL: Update the Vehicle name of the Acura Integra 1986 to Integra type S. It is incorrectly registered without the type.

```
UPDATE    MODEL
SET       Name = 'Integra type S'
WHERE     Model_ID = 'AC86_INT' AND VE_Name = 'Integra';
```

6.4. CLASS: Update the Daily and Weekly rate of the Sedan type 1 to $30 and $120 respectively due to Easter week promotion.

```
UPDATE    CLASS
SET       VE_DailyRate = 30, VE_WeekRate = 120
WHERE     Class_ID = 'SED01';
```

6.5. RESERVATION: Update the Reservation '001LUX02' as the customer wants to downgrade to an SUV type 2.

```
UPDATE    RESERVATION
SET       R_ClassType = 'SUV', Class_ID = 'SUV02'
WHERE     R_ID = '001LUX02';
```

6.6. RENTAL AGREEMENT: Update the Rental agreement attributes like Odometer readings, Vehicle VIN, and Final cost after the customer downgrade for Reservation '001LUX02'.

```
UPDATE    RENTAL_AGREE
SET       VE_VIN = '5TEWN72N63Z275910', Odometer_Initial = 134355,
          Odometer_Final = 135219, Final_Cost = '1100.45'
WHERE     Contract_ID = '001_001LUX02';
```

7. SQL STATEMENTS TO DELETE 1 ROW

7.1. BRANCH: Branch on 8791 Homewood St has not had the expected profit margin for more than a year and this needs to be closed.

```
DELETE
FROM      BRANCH
WHERE     B_LocationID = 'NY8791';
```

7.2. VEHICLE: Vehicle with VINV 5NPEB4AC1DH576656 is no longer in good condition and has to be discarded.

```
DELETE
FROM      VEHICLE
WHERE     VE_VIN = '5NPEB4AC1DH576656';
```

7.3. MODEL: Acura Integra 1986 model is no longer in production and supported, so these vehicles are discarded for now and will be replaced with the newer models. Deleting only 1 row as per the requirement.

```
DELETE
FROM      MODEL
WHERE     Model_ID = ‘AC86_INT’;
```

7.4. CLASS: Car Rental wants to stop renting out sport cars because of the high accident rate.

```
DELETE
FROM      CLASS
WHERE     Class_ID = 'SPO01';
```

7.5. RESERVATION: Suppose that a customer wants to cancel the reservation ‘015SUV02’.

```
DELETE
FROM    RESERVATION
WHERE   R_ID = '015SUV02';
```

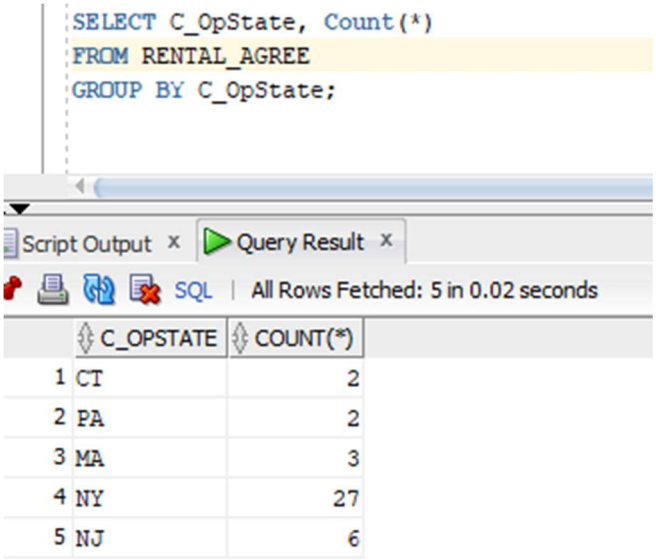
7.6. RENTAL AGREEMENT: Delete rental agreement associated with reservation ‘015SUV02’.

```
DELETE
FROM    RENTAL_AGREE
WHERE   Contract_ID = '013_015SUV02';
```

8. QUERIES IN SQL

8.1. GROUP BY: List how many rental agreements are made by the customers based on the state that issued the driving license.

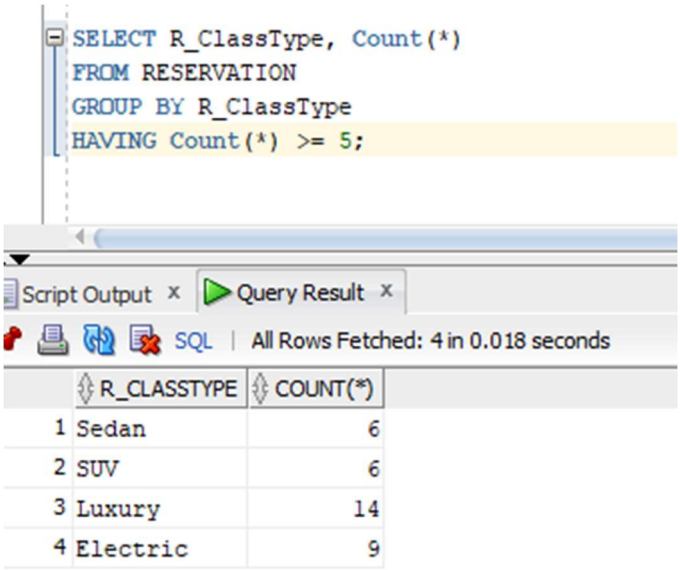
```
SELECT    C_OpState, Count(*)
FROM      RENTAL_AGREE
GROUP BY  C_OpState;
```



	C_OPSTATE	COUNT(*)
1	CT	2
2	PA	2
3	MA	3
4	NY	27
5	NJ	6

8.2. GROUP BY AND HAVING: List class types and count with at least 5 reservations.

```
SELECT      R_ClassType, Count(*)
FROM        RESERVATION
GROUP BY    R_ClassType
HAVING      Count(*) >= 5;
```



```
SELECT R_ClassType, Count(*)
FROM RESERVATION
GROUP BY R_ClassType
HAVING Count(*) >= 5;
```

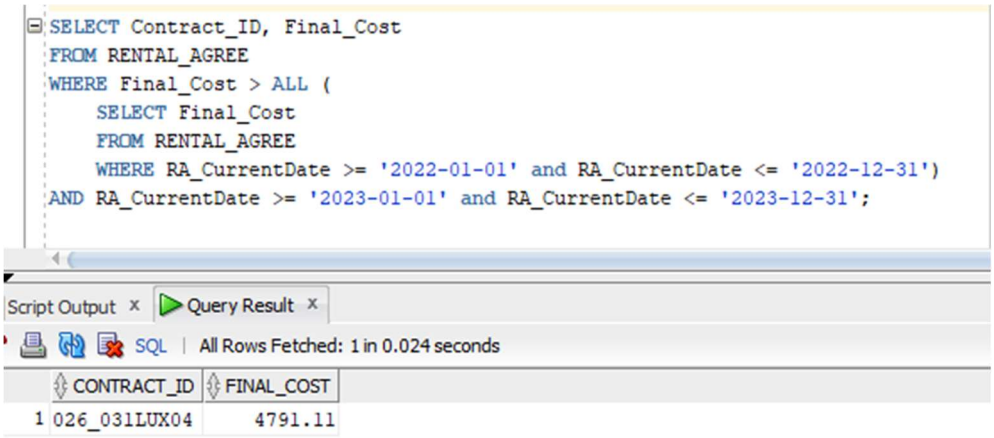
Script Output | Query Result

SQL | All Rows Fetched: 4 in 0.018 seconds

	R_CLASSTYPE	COUNT(*)
1	Sedan	6
2	SUV	6
3	Luxury	14
4	Electric	9

8.3. NESTED WITH ALL: List Contract_ID and Final_Cost of those rental agreements that fetched more money in 2023 compared to all agreements in 2022.

```
SELECT      Contract_ID, Final_Cost
FROM        RENTAL_AGREE
WHERE       Final_Cost > ALL (
        SELECT      Final_Cost
        FROM        RENTAL_AGREE
        WHERE       RA_CurrentDate >= '2022-01-01' and RA_CurrentDate <= '2022-12-31')
AND         RA_CurrentDate >= '2023-01-01' and RA_CurrentDate <= '2023-12-31';
```



```
SELECT Contract_ID, Final_Cost
FROM RENTAL_AGREE
WHERE Final_Cost > ALL (
    SELECT Final_Cost
    FROM RENTAL_AGREE
    WHERE RA_CurrentDate >= '2022-01-01' and RA_CurrentDate <= '2022-12-31')
AND RA_CurrentDate >= '2023-01-01' and RA_CurrentDate <= '2023-12-31';
```

Script Output | Query Result

SQL | All Rows Fetched: 1 in 0.024 seconds

	CONTRACT_ID	FINAL_COST
1	026_031LUX04	4791.11

8.4. NESTED WITH IN: List down the no show reservations, meaning that a customer has made a reservation and didn't pick up the car. Include customer name and address in the report.

```
SELECT      R_ID, C_Name, C_Address
FROM        RESERVATION
WHERE       R_ID NOT IN (
        SELECT      R_ID
        FROM        RENTAL_AGREE RA);
```

```
SELECT R_ID, C_Name, C_Address
FROM RESERVATION
WHERE R_ID NOT IN (
    SELECT R_ID
    FROM RENTAL_AGREE RA);
```

Script Output × Query Result ×

SQL | All Rows Fetched: 10 in 0.033 seconds

	R_ID	C_NAME	C_ADDRESS
1	007COM03	Caleigh Starkey	7876 Durham Rd, New York, NY 10023
2	013HYB02	Tyla Mclaren	235 Washington Ave, Brentwood, NY 11717
3	020HYB03	Nikko Xu	904 Summit Rd, Flushing, NY 11355
4	024MID01	Xion Wardell	1 Division Dr, Fresh Meadows, NY 11365
5	028SUV01	Hans Robins	80 W. Gainsway St, Brooklyn, NY 11229
6	032SUV03	Jarvis Jett	25 Mechanic Dr, Yonkers, NY 10701
7	036VAN02	Tamera Senn	309 Logan St, South Ozone Park, NY 11420
8	041ELE01	Starr Rey	61 Theatre Court, Flushing, NY 11355
9	045LUX01	Ruhi Tremblay	26 Virginia Dr, Astoria, NY 11103
10	050ELE01	Eleonora Brownfield	127 East Central Ave, Brooklyn, NY 11219