95 – 703: Database Management

Implementation Project

This project is to be completed in Oracle Database 21c Express by groups of two students. Pairing will be provided by the instructor. This document is divided into the following parts: description of the model (Part I), specific tasks to do (Part II), and what is required for submission (Part III). You have four weeks to complete the project. Submit your project no later than 9 a.m. on July 26, 2022.

Part I. Description of the model

A car rental company has several outlets (i.e., locations) with cars/vehicles that are rented for various periods of time. For each vehicle, we record its license plate number, make, model, year, last inspection date, the daily rate, etc. For the clients who rent vehicles/cars only basic information is recorded.

Each outlet has several employees working at the outlet (e.g., sales reps, mechanics, and administrative assistants). The information stored about the employees includes name, gender, date of birth, contact information, hire date, etc. Each employee is working at only one outlet. A few of the employees may supervise other employees (e.g., one sales rep would supervise other sales reps). For each supervised employee, we need to identify which other employee supervises them. Some employees may manage up to 3 outlets. Each outlet has only one manager responsible for the operation of the outlet.

For each rental agreement[1] (agreement with a client who rents a vehicle) we need to record the rental date, rental time, and the number of miles driven before a rental agreement is signed. When the rented vehicle is returned the date and time as well as the mileage (i.e., odometer reading after the vehicle is returned) is recorded. The rental agreement must also include the insurance type used.

When a rented vehicle is returned, it is checked by one of the employees (typically a mechanic on duty at the time) for any problems. When it is needed, the employee prepares a report describing the problems found with the vehicle. The fault report is created only when there are issues/problems with the returned vehicle. The fault report is very simple and includes only date, time, and comments (describing and evaluating the issues/problems). Once a vehicle has accumulated 5 fault reports, that vehicle is put out of service and is no longer available for rentals until a complete check is done (and all issues are resolved). We also need to link each fault report to individual rental agreement, in case a follow up is needed. The ERD and schema for the model are shown below.

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[1] The entity name is shortened to "RAGREEMENT" in the ERD and schema.

ER Diagram:
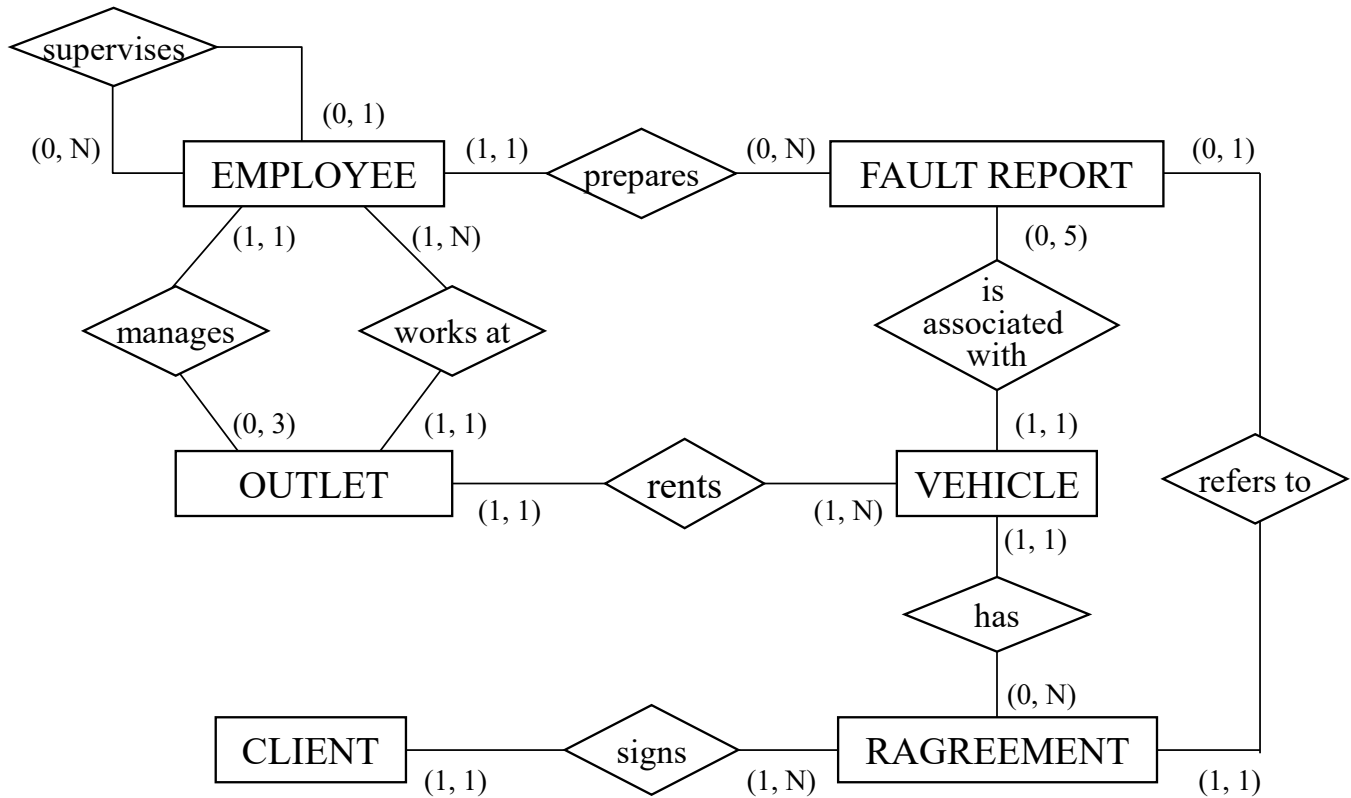
Schema:

EMPLOYEE (<u>EmpNo</u>, Fname, Lname, Position, Phone, Email, DOB, Gender, Salary, HireDate, OutNo$^@$, Super_No$^@$)

FAULTREPORT (<u>ReportNum</u>, DateChecked, Comments, EmpNo$^@$, LicenseNo$^@$, RentalNo$^@$) [2]

OUTLET (<u>outNo</u>, Street, City, State, ZipCode, Phone, ManagerNo$^@$)

VEHICLE (<u>LicenseNo</u>, Make, Model, Color, Year, NoDoors, Capacity, DailyRate, InspectionDate, outNo$^@$)

CLIENT (<u>clientNo,</u> FName, Lname, Phone, Email, Street, City, State, ZipCode)

RAGREEMENT (<u>RentalNo</u>, StartDate, ReturnDate, MileageBefore, MileageAfter, InsuranceType, ClientNo$^@$, LicenseNo$^@$) [3]

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[2] *DateChecked* attribute stores both the date and the time when the report was created.
[3] Both *StartDate & ReturnDate* attributes store both date and time information of each transaction.

Part II.

A. Create two separate SQL scripts for creating all necessary tables, data integrity constraints, and for inserting data into the tables to implement the database as defined above.

1. Script #1: Write all CREATE TABLE statements that have the necessary integrity constraints including primary keys, foreign keys, etc. Start the script with a set of "Drop Table" statements, that will allows you to clean up the database before creating it (very useful when you recreate the database using the script). Use the names of tables as well as the names of attributes exactly as provided in the conceptual model above. *All constraints, except one, must be created with "Create Table" statements and must be named using the convention discussed in class (lecture 10). Then, add one "Alter Table" statement with your last constraint.* Run the script to create your database. Your CREATE TABLE statements must also include the following:
   a. The *HireDate* should have a default value that is the current date.
   b. The age of the vehicle must be less than 10 years.
   c. Any phone number value must follow a specific format. You decide what format the phone number needs to follow and create an appropriate constraint to verify the format.
   d. The US Child Labor Law states that no one under the age of 14 is allowed to be hired.
   e. The company operates using a default domain name for all email addresses. All email addresses must conform to a validation rule to ensure that only the officially accepted domain name is used for all email addresses in the database, and
   f. Two more appropriate and useful check constraints of your choice (but not the "Not Null" or "Unique" constraints). Make sure that you clearly identify each of the two constraints.

2. Script #2: After the DB tables and all data integrity constraints are created, insert about ten rows of data into each table. Provide data that would allow you to test all queries as defined in section B below (each query must give you results). It may be required to add more than 10 rows in some tables in order to show that your queries work as intended. *Outlet* table could have few rows. Run the script to perform the task of populating the tables. *(Note: All constraints must be enabled and enforced – not deferred – before your "Insert" statements)*

3. After all tables are populated, list the complete content of each table. Format each table's contents to make sure it is readable.

B. Create SQL queries to answer the following questions

1. For each client from Pennsylvania (provide client ID and name), list rental ID, rental start date, duration (in hours) of each rental, and the cost of the rental. Sort the result by client's name and then by start date of the rental.

2. List employee (ID & Name) and the number of fault reports he/she has "prepared". Rank each employee based on the number of fault reports prepared. The highest number of fault reports should get highest rank. Include "0" for employees who did not create any fault reports.

3. For each outlet, calculate the number of rental agreements and the revenue generated from the rentals. Rank the outlets based on the revenue generated from the rentals. List only the top two outlets.

4. For the outlet with most rentals, list information about rentals (ID, Start Date, and Return Date) with the client ID and name on each rental. Also include the outlet street address.

5. For each client, list client ID and name, the number of rentals, average distance driven per rental, and the number of fault reports associated with the rentals. Replace any Null values with appropriate constant value.

6. We want to analyze data of the rentals for each "vehicle make" in order to develop strategies for future purchases of vehicles. Consider two different measures that would allow the manager to make the recommendations. Produce an appropriate list that includes all outlets and sort it by outlet number and vehicle make. Then, <u>write a paragraph</u> explaining how the measures are to be used to help making the right decisions regarding the future purchases at any outlet.

7. For each outlet managers, provide the manager's name, number of outlets he/she manages, total number of employees working at those outlets, and the total number of vehicles at those outlets.

8. Calculate each outlet contribution (in percentage points) to the overall revenue of the company for the 2nd quarter of this year. Provide ID, street address and city of the outlet, number of vehicles at the outlet, revenue at the outlet, and the percent score.

9. Use a pivot query to provide number of rental agreements signed in the 1st and 2nd quarter of current year. Last column should display the total # of rental in each outlet and as last row should display the total # of rental the 1st and 2nd quarter.

C. Query of your choice

Create a query (provide a description) that might be useful for the company's top management. Then formulate and execute a SQL query that would provide the answer. Write a memo explaining the business value of your analysis (the SQL query that answered your question and how the management could use your analysis). In the memo, include the question, the SQL query, results of the query, and your explanation. *Use the memo template available on the class website.*

Part III.

The project work must be the work of your group only. You cannot look at, access, or discuss any aspect of any other project. You also must not allow anyone outside of your group to look at your solutions. Both group members are responsible for ensuring the academic integrity of the work you submit. If you borrow any idea from the internet, then provide the URL of the source.

Create a title page that includes your names, email addresses, and the group number as it was assigned to your group. Clearly identify each part of your submitted project and each answer.

Submit hardcopy of the following:

1. Printout of the two separate SQL script files (*Script#1 & Script#2*) as you created them in Part II.A. as well as the content of your database tables.
   (Note: Do not print any "spool file" of executing your scripts)

2. The queries created in Part II.B. Include the SQL <u>query</u> statements <u>as you execute them</u> as well as the <u>results of executing the queries</u>. Make sure you appropriately format both the statements and results.

3. Memo created in Part II.C

Grading

Projects will be graded based on:

- <u>Correctness</u> of SQL statements based on requirements provided. Although there may be more than one way to approach each question, the SQL results must match the requirements as defined in each question.

- <u>Readability</u> of your project submission. Both SQL statements and results are to be well formatted and readable. No screenshots are allowed.

- <u>Punctuality</u>. The deadline for the submission is 9 a.m. on July 26.
  - Projects submitted on July 26 but later than 9 a.m. will receive a 10% penalty
  - Projects will not be accepted after July 26.

- <u>Grading Part II. C (the "*Query of your choice*")</u>
  You can have the best idea in the world, but, if you can't express it clearly, concisely and coherently, the CEO will likely ignore it.
  Therefore, your message will be graded for its clarity, brevity and coherence as well as its accuracy and use of Standard English grammar.

  You can best achieve those outcomes with plain language that is direct and simple that persuades the reader while making a professional statement and appearance. More than anything, you must understand the audience, the CEO, and his/her needs, interests, and expectations (the "business value").

  You must also understand that the best writers labor over their messages and often write many drafts. In this assignment you will write at least two drafts of your memo. When you submit a draft of your memo (due on July 19), it will be scored to a maximum of 7 points. After that draft is returned to you with comments for improvement, you will edit it with a chance to earn 3 more points on your rewrite (due with the rest of your project on July 26). Obviously, when you write your first submission well, you will have a better chance to score the most points (total of 10).