95 – 703 B: Database Management

Implementation Project

This project is to be completed in Oracle Database 11g 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 <u>four weeks</u> to complete the project. Submit hardcopy of your project no later than 3:00 p.m. on August 1.

Part I. Description of the model

A car rental company has several outlets (i.e., locations) from which clients pick up cars. Each outlet has a number of vehicles that may be rented for various periods of time. For each car/vehicle we record the car ID, year, model and the daily rate.

Each outlet has several employees working at the outlet including mechanics, sales reps and/or administrative assistants. We need to keep only some basic information about the employees. A few of the employees 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 serve as "area managers." Each outlet is managed by one area manager. The area managers may manage up to 3 outlets.

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

When a car is returned, it is checked by one of the employees (typically a mechanic on duty at the time) for any "faults". A fault report is created only when there are "issues" with the returned car. When needed, the employee prepares a fault report for the vehicle. The fault report is very simple and includes only date & time and comments.   Once a vehicle has received 5 fault reports, that vehicle is put out of service and no longer available for rentals. We also need to link the fault report to individual Rental Agreement, in case a follow up is needed. The ERD and schema for the model is shown below.

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

ER Diagram:
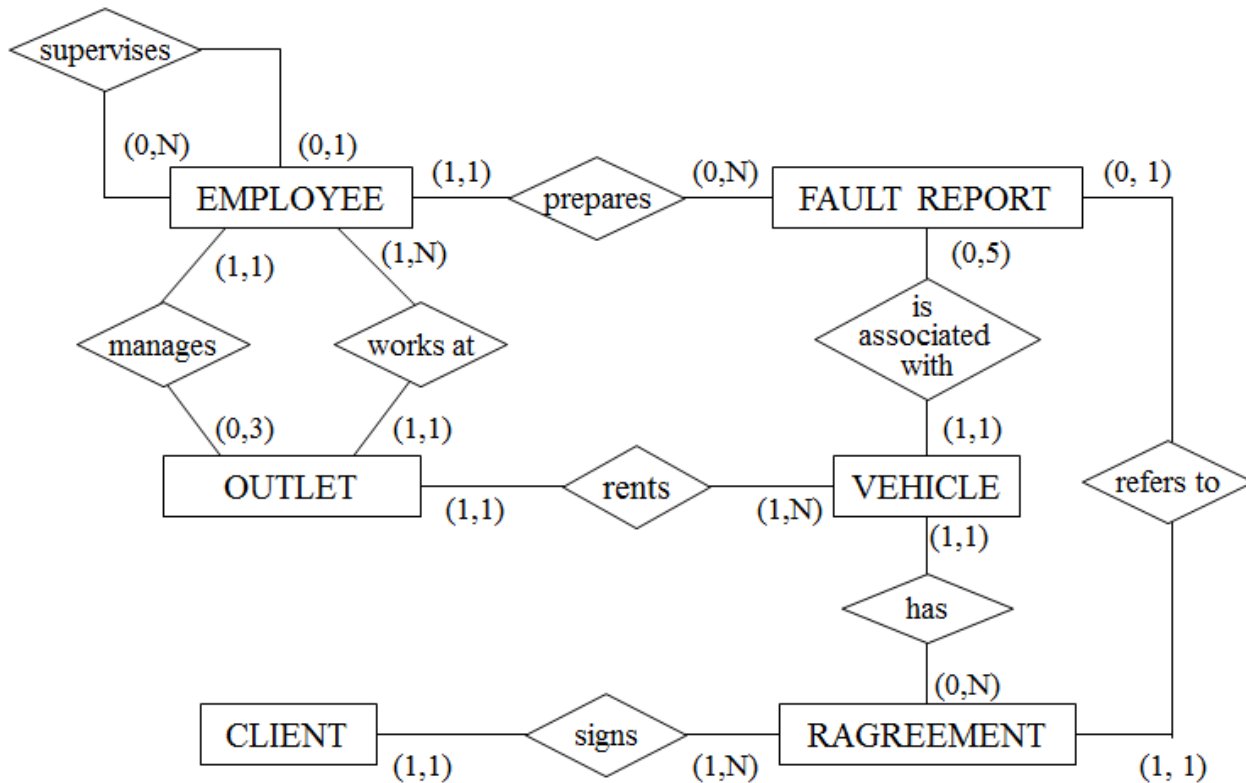
Schema:

EMPLOYEE (EmpNo, Fname, Lname, Position, Phone, Email, DOB, Gender, Salary, HireDate, OutNo$^@$, SupervisorNo$^@$)

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

OUTLET (outNo, Street, City, State, ZipCode, Phone, ManagerNo$^@$)

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

CLIENT (clientNo, ClientName, Street, City, State, ZipCode, WebAddress, Contact_FName, Contact_LName, Phone, Email)

RAGREEMENT (RentalNo, 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 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).* Run the script to create the DB objects and to create the missing constraint (as a last statement in your script). Your CREATE TABLE statements should also include constraints defined below:
    a. The US Child Labor Law states that no one under the age of 14 is allowed to be hired,
    b. 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 system, and
    c. Two appropriate <u>check constraints</u> (but not the *Not Null* constraints) of your choice. Make sure that you clearly identify them.

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 <u>must be enabled and enforced</u> – not deferred – before you populate your tables.)*

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 clients from *Pennsylvania*, list the duration (in hours) of each rental along with the ID and name of the client, and the cost of the rental. Sort the result by client's name.

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, find the average number of hours it takes for a fault report to be generated after the "damaged" car is returned to the rental agency. Include "0" for those outlets without any fault reports.

4. List clients who have rented vehicle(s) but who have never generated any fault report. List the ID and name as well as the contact information for those clients.

5. 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.

6. Generate a list of rentals (ID, Start Date, and Return Date) with the client's information (client's number and name) for the outlet with the most rentals. Also include the outlet street address.

7. For each client from *West Virginia*, list client ID and name, the number of rentals, average duration of a rental, and the number of fault reports associated with the rentals. Include "0s" for clients without any rentals.

8. A manager from one of the outlets wants to analyze data of the rentals for each "vehicle make" in his outlet in order to develop strategies for future purchases of vehicles and to share his findings with other outlets. 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, write a paragraph explaining how the measures are to be used to help making the right decisions regarding the operations of the outlets.

9. We need to review fault reports of cars rented in previous month. In addition to the details on each fault reports, also include information about the car on the fault report, as well as the name of employee who recorded the fault report.

10. 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.

11. List the number of transactions (number of rentals started & number of returns) in each of three periods a working day. Assume that outlets are open between 6am and 11pm and divide the day into the following three periods: morning (from 6 am to12 noon), afternoon (from 12 noon to 6pm), and evening (6pm to 11pm). As last two column of the results, provide: 1) total numbers of transactions that includes both the rental started and the returns, and 2) percentage of the transactions for the whole day.

12. We are interested in what types of clients we have. Based on the "web address" information, group the client by the type of client (".edu" indicates an educational institution, ".gov" a government agency, ".org" a non-for-profit organization, and ".com" a for-profit company) and provide how many clients we have of each type/category. If we do not have a web address, then the "type" should be '*Not Available'*. For any category that has no clients currently, display a "0".

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.*

Create a video, intended for the CEO, explaining the business value of your analysis (just as the memo). Explain, as you would in a virtual presentation, your findings and reasons why the CEO should accept your recommendation.

Video instructions:
1. Find a suitable location (non-distracting background or background which suits your message);
2. Use the best lighting (northern light is very flattering; overhead sunlight can be harsh and unflattering);
3. Use a microphone (or keep the recording device close to the speaker – and not outdoors);
4. Limit the number of people in the frame;
5. Use "jumpcuts" judiciously;
6. Use text on the screen to amplify your message; speak slowly and distinctly especially if you use English as a second language);
7. Load your video to *iMovie* or *Windows Movie Maker* and edit if needed.

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 (including projects from previous semesters). 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 query statements as you execute them as well as the results of executing the queries. Make sure you appropriately format both the statements and results.

Submit electronic version of the following by email to Janusz (*js1m@andrew.cmu.edu*) and Ed (*edbarr@cmu.edu*):
1. Word document of your Memo and
2. Your video in either *iMovie* or *Windows Movie Maker* format.

Grading

Projects will be graded based on the following criteria:

- <u>Correctness</u> of SQL statements and results based on requirements given in the assignment.
  - 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>Neatness</u> and readability of your SQL statements as well as results.

- <u>Punctuality</u>. The deadline for the submission is 3:00 p.m. on August 1.
  - Projects submitted on August 1 but later than 3:00 p.m. will receive a 25% penalty
  - Projects will not be accepted after August 1.

- <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 and 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").

  When you create a video, you must also understand the audience, in this case an executive audience, and you must accomplish these ends: you must attract their attention; you must show them some benefit; you must move them to action (in this case, approve your recommendation).

  You can attract their attention by using a statistic or engaging fact in the first seconds of your video. However, your first words will be wasted if you have a busy background or weak audio or weak lighting.

  Your video will be judged by these standards, as explained in "Query of your choice" above (and according to the evaluation documents uploaded on Canvas). When in doubt use this mantra: always answer every question an executive has BEFORE HE/SHE CAN ASK IT, and respect the reality that executives have little time and less patience. Give them the BLUF (i.e., the bottom line up front).