CPSC 304: Tutorial #1

Case Study on Entity-Relationship Diagrams and Conceptual Data Modeling

Due Date: One week after your tutorial

Submission Instructions

Submit your solutions using the Department of Computer Science's standard `handin` facility. You can write your solutions by hand and scan the pages or take pictures of them with your phone, or you can use a word processing package or other software package to typeset your solutions and produce a `.pdf` file. Limit your file size to 1 MB.

To submit: On an undergraduate machine, copy the file that contains your solution to the directory `~/cs304/tutorial_01_[YourTutorialSection]` (note that it will wind up in your home directory). You can create this directory using:

```
mkdir ~/cs304/tutorial_01_[YourTutorialSection]
```

Be sure to list your tutorial group members on your assignment or in a `README.txt` file, being sure to list all student names, IDs, and CPSC userids. Then, from your home directory, run:

```
handin cs304 tutorial_01_[YourTutorialSection]
```

Take a screen shot of your successful submission, in case any problems exist.

Only one group member should submit the assignment. Important: Group members: Verify with your group that the submission has actually taken place, and that it's on time.

Late submission policy: Tutorials are due a week after your tutorial. There are no exceptions.

A few notes:

- You'll probably have to read ahead in the textbook (Chapter 2) to complete this tutorial. You can wait until we've covered more content in class, but even then we might leave some details out. Your assignment is due before your next tutorial, so nothing is due during the week of Tutorial #1.

- As mentioned in class: for our tutorials (not the project), you'll work in groups of 3 in your tutorial section. All of your team members must be from the same tutorial. You can only work in a group of 2 if your TAs determine that we don't have enough students to fill all the groups with exactly 3 students. Your TA will tell you if you can work in a group of 2.

- The deliverable is an entity-relationship diagram. Don't convert anything to tables using SQL Data Definition Language—at least not for Tutorial #1. Use the same convention as

in the textbook, and in class. You will hand your work in electronically, via the `handin` facility. Convert it to PDF, and submit it electronically. Please limit your file size to 1 MB. Some groups may wish to do their whole diagram using a diagramming tool of some sort, and then convert it to PDF.

- As mentioned in class, students who are on the wait list are free to attend any tutorial, but if you are on the wait list, please leave the seats for the students who are actually registered in the tutorial section. We expect some movement in the course and the wait list—as people fine-tune their course selection and drop the odd course. Periodically check SSC to see when seats become available.

Specifications

The database system that you are to model in this project is for a car rental company called **SuperRent.** The main business of SuperRent is to rent cars and trucks to its customers. The company keeps a number of offices in a variety of cities and locations within each city. Each location maintains a number of cars and trucks. The car types include: Economy, Compact, Mid-size, Standard, Full-size, Premium, Luxury, SUV, and Van. Truck types include 24-foot, 15-foot, 12 foot, Box Trucks, and Cargo Vans. Each type has different features; different daily, weekly and hourly rates; different per-kilometre rates (charged for kilometers driven above a pre-defined limit); and different weekly, daily, and hourly insurance coverage packages.

SuperRent maintains a list of all its customers. When a customer first rents a vehicle, the company records the customer name, address, and phone number (with the area code). A customer is usually identified by their phone number. The company also maintains a list of the SuperRent Club members. To become a SuperRent Club member, a customer needs to fill in an application with their name and address and pay the annual fee determined by the company. When a customer first joins the club, she/he gets 500 points. After that, a club member gains 1 point for every $5 spent. A customer can exchange 1000 points for a one-day rental of a premium or lower-ranking car, or they can use 1500 points for a one-day rental of a luxury car, SUV, van or truck.

A customer can reserve a vehicle for specific days, can rent a vehicle, or return the vehicle that was rented. To make a reservation, a customer provides the location, the type of the vehicle, and the day and time for which the customer would like to pick up and return the vehicle. If there is a vehicle of the requested type available in that location, the system shows an estimation of the cost. The customer can then proceed and make a reservation or cancel it. To make a reservation, the customer provides their name and phone number, and the system prints a confirmation number. To cancel a reservation, a customer must provide either the confirmation number or their phone number and the dates.

To rent a vehicle, a customer provides the same information as that required for a reservation. If a customer has already made a reservation, they only need to provide the confirmation number or their phone number. The system gets the rest of the information from the reservation record. The customer needs to decide whether to buy insurance on the car. Insurance coverage is either for the entire period of the rental, or for none of the days (i.e., there is no partial insurance coverage). To

complete the rental agreement, a customer has to provide their driver's license number and credit card information consisting of the card number and expiry date. SuperRent accepts only American Express, MasterCard, and Visa.

When a customer returns a vehicle, the clerk enters the date, time, odometer reading, and whether the gas tank is full. The system calculates the charges by applying weekly rates to whole weeks, the daily rate to remaining days, and an hourly rate to additional hours. To pay their bill, customers can use their credit card or cash.

SuperRent maintains a fleet of fairly new cars. Every year the managers sell a number of used cars to customers. A car is flagged to be "used" and is eligible for sale, if its mileage exceeds 80,000 kilometres. Once a car is flagged, it is removed from the rental pool. The sale of used cars does not apply to trucks. Each used car is given an initial asking price of 50% of the original purchase price. A club member can use every 2,000 club points in exchange of $100 towards the purchase of a used car. The database also keeps track of the date the car was added to the used car list, the date the car was sold, the final sale price, whether club points were used in the purchase, and who the agent was who sold the car.

Additional Notes

The requirements stated on these pages are not expected to be complete. As you start analyzing these requirements you may notice that certain details are missing. In this case, you may make any reasonable assumptions about them, but if there is any uncertainty about some requirements, you should discuss it with your TAs.

Some of the details presented above, and most of those in the Appendix below, may not be necessary for your ER diagram. For example, the kinds and formats of reports do not have to be included, nor do we deal with calculations at the ER level, but you should verify that the data needed below by the reports (e.g., rental/sales information including points, kilometres, and certain dates) are captured in your model. The applications programmers can deal with the implementation of the reports, including the logic and calculations, and all that goes beyond what we need to do at the data modeling stage. Some of this background will help the data modeler to better understand the business, which often leads to a smarter design.

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Appendix

In addition to the transactions mentioned above the system must be able to generate a number of reports. At the end of each day, the company wants to produce the following reports:

- Daily Rentals: The report contains all the vehicles rented out during the day. The entries are grouped by branch, and within each branch, the entries are grouped by vehicle category. The report shows the number of vehicles rented from each category, the subtotal for each branch and the grand total for the day.
- Daily Rentals for Branch: This is the same as the Daily Rental report but it is for one specified branch.
- Daily Returns: The report contains all the vehicles returned during the day. The entries are grouped by branch, and within each branch, the entries are grouped by vehicle category. The report shows the number of vehicles rented from each category and the amount of money paid by the customers, the subtotals of the number of vehicles, the amount for each branch, and the grand totals for the day.
- Inventory of used cars for sale: The report shows all the vehicles that were sold during the day, all the vehicles that were added to the used car list during the day, and all the vehicles that have been on the used car list for longer than 3 months.

The system you design will be used by three types of users:

- **Customer:** can make reservations, can apply for the Club membership and check the points accumulated
- **Clerk**: processes all the customer services like renting a vehicle, returning a vehicle, etc.
- **Manager**: sells the used vehicles and sets all the rates and costs.

In addition to those defined above, there are a number of simple queries a clerk of the company should be able to ask. Clerks should be able to:

1. Show the vehicles of a specified category that are available in a given location for a given set of dates (usually given as from-date and to-date).
2. Show the vehicles in a specified location and category that are overdue.
3. Show the vehicles in a specified location and category that are for sale, and their sale prices.

If the category is not specified, vehicles in all categories are shown, grouped by category. If the branch is left out, vehicles from all branches are shown, grouped by branch. Finally, managers must be able to perform the following tasks:

1. Show the vehicles in a specified location and category that are older than a specified number of years. If the location or category is left out, all qualifying vehicles are shown grouped by category and/or location.
2. Sell a vehicle to a customer or dealer.
3. Add more vehicles.

When a user starts the system, the program asks the user for an id and a password. Then the system starts up the appropriate menu for the current type of user. A system administrator can access all the menus and can add and remove users and change their passwords at any time.