CECS 323 Term Project

Fall 2016

# **Project Description**

You are designing a database and proof of concept for Dave’s Automotive, a small auto repair shop that specializes in providing preventative maintenance that saves the customer in the end by staying ahead of the normal wear and tear on a vehicle.

Dave’s Automotive has three types of customers: **steady, premier,** and **prospective**.

They extend from customer, customer = parent. Arrow to customer that is not filled. IS-A relationship. Customer 0 to 1 the three types and the three types are one to one to the customer. Customer can be one of these types at a time, cannot be two at the same time (disjoint).

* The steady customers are those who have signed up for generated E-mail notifications to alert them when their automobile(s) are likely to be due for some routine maintenance. When a customer registers a vehicle with Dave’s we ask the customer for an estimate of how many miles a year they expect to put on that vehicle. Each time they bring that vehicle in for service; we note the mileage and update the estimated yearly mileage accordingly.

Each model and make of vehicle has a set of pre-defined maintenance intervals. Each of those maintenance intervals has a set of services that are called for at that time. For instance, the Toyota Camry may have a 60,000-mile maintenance interval that calls for an oil change, transmission oil and filter change, air cleaner change, rotation of the tires, and so forth. Another model or make may have a different suite of maintenance actions required at a slightly different mileage.

When Dave’s calculates that one or another of a customer’s vehicles is due for preventative maintenance, an E-mail is sent to them telling them the vehicle that is due for maintenance, the mileage that the maintenance is supposed to be done at, the time to expect for the maintenance to take, and the estimate of what that maintenance will cost. The steady customers will then reply to the E-mail indicating which days they would be willing to come in for that maintenance. They get another E-mail confirming the date and time of their appointment.

* The premier customers pay an annual fee in monthly installments for their preventative maintenance. The amount of the fee will be a function of the estimate of the number of miles that the customer will put on the vehicle each year, the model of the vehicle, and the make.

Dave’s assumes that the customer will have that vehicle with us for 5 years or more, so we calculate which maintenance intervals will come up during that 5 year time, the likely cost for the maintenance required at each of those maintenance intervals, and then amortize it over the 5 years so that the customer is essentially purchasing maintenance insurance.

If the customer sticks to the schedule and brings their vehicle within 2000 miles of the maintenance interval, and never gets into an accident during their time with Dave’s, we will never charge them over the set monthly fee for their maintenance, regardless of any unforeseen maintenance that comes up. To protect ourselves from out of control maintenance costs, Dave’s Automotive does not provide premier coverage for any vehicle with over 100,000 miles on it.

* The prospective customers are where the growth occurs. We provide a free oil change to our steady customers or $50 off their next monthly payment to our premier customers if they refer us to someone who is not currently a customer. When they make the referral, we get contact information on their friend/relative from the existing customer, and put it into our database. We also keep track of which of our steady customers made the referral.

On a periodic basis, we have specials that we have for first time customers, and either send out E-mail or automated phone calls to the prospective customers. We track the date on which these contacts have occurred. If a prospective customer does not become a steady or premier customer after three contacts, we flag that customer as a “dead prospect”. In this way, we do not start the whole process of trying to entice them in all over again.

A given customer can be either a **private individual** or a **corporation** of some sort.

* If they are a private individual, we only track one address for them, their mailing address.
* On the other hand, if they are a corporate entity, we can optionally track several addresses for them. Examples of the types of address that we might track for a given customer is a) mailing, b) billing, c) vehicle pickup, d) vehicle delivery.

Each time a customer comes in, one of our service technicians writes up the maintenance visit order. They capture the maintenance items for the maintenance visit, and make an assignment of a mechanic for each of the maintenance items in the maintenance visit. The mileage of the vehicle is logged at the time that it is brought in so that we can update our records of how much the rate at which mileage accumulates on the vehicle.

A service technician can also be a mechanic in certain cases. Oftentimes, those mechanics with evident organizational skills work part time as a service technician for some period to see how they do. If they work out well in that role, they become full time service technicians and stop being a mechanic. The chief incentive to the mechanic is that the pay is better for the service technician, and they do not get nearly as greasy.

Our mechanics are proud of their certifications. Each mechanic can have several certifications, and any number of our mechanics could hold a given certification. In addition, we track individual skills that the mechanics have so that we can better match them up to a particular maintenance item within a particular service visit. Each maintenance item requires one or more skills. For instance, a maintenance item might be “engine rebuild” which could have skills such as “hoist operation”, “head machining”, and “ring replacement”.

Each mechanic with a given skill is encouraged to mentor another mechanic in that skill. The other mechanic may already have that skill, in which case they are either brushing up on that skill or attempting to achieve greater mastery of that skill. Alternatively, a mechanic may not have a given skill and establish a mentoring relationship with another mechanic to achieve that skill. Either way, only a mechanic with a given skill can mentor another mechanic in that particular skill. When a mentoring relationship starts, we make a formal record of the start of the mentoring relationship. If a given mentee decides to stop the mentoring relationship, we capture that as well. A given mentor/mentee relationship between two mechanics could start and stop multiple times.

Each service visit has a set of maintenance items in it. A maintenance item could be something as simple as changing out the windshield wiper blades to changing the motor mounts, or replacing the struts on the vehicle. Each maintenance item has zero or more parts associated with it. Those parts have a price that depends upon the supplier that we get the part from for that particular execution of a maintenance item.

A maintenance **package** is a maintenance item composed of **other** maintenance items. The identifier for a maintenance package is the mileage, the make, and the model. A given service visit could be a combination of a maintenance package as well as any number of additional maintenance items, or it could just be a grab bag of maintenance items.

Each detail maintenance item will have a mechanic assigned to it. Since a maintenance package could be rather complex, we do not assign a single mechanic to the whole package, rather the assignment is done at the individual maintenance item level.

Any given service visit will only address the needs of a given vehicle. If a customer brings in more than vehicle at the same time, we create two separate maintenance visits, one for each vehicle.

The steady customers receive a customer loyalty point for every 10 dollars that they spend with us. The customer can use loyalty points to pay for several of the more common maintenance items such as “ignition tune up”, “oil change”, and “tire rotation”. Every time that a customer spends loyalty points, their loyalty point balance goes down, but they do not earn loyalty points for spending loyalty points.

In order to better manage the cost of the premier package, we track not only how much money comes in from a given premier customer but also the actual cost that they **would** have paid, had they just been steady customers. That way, we can tell whether we are charging them enough.

# **Denormalization**

Denormalization is a conscious, deliberate change of a design from 3rd normal form to some lower normal form in order to meet some particular objective. You will describe the denormalization used in part one of the project. If you did any denormalization in your design, please include a separate paragraph(s) stating what you did and why. If you did not do any denormalization, state that and why.

### **Output**

Output of the database must support the following features. You do not need to develop “pretty” printed or on-screen reports. You will run the views/queries in MySQL Workbench in the lab.

**Views**

Use the Create View statement to create the following views:

1. Customer\_v – for each customer, indicate his or her name as well as the customer type (prospect, steady or premier) as well as the number of years that customer has been with us.
2. Customer\_addresses\_v – for each customer, indicate whether they are an individual or a corporate account, and display all of the addresses that we are managing for that customer.
3. Mechanic\_mentor\_v – reports all of the mentor/mentee relationships at Dave’s, sorted by the name of the mentor, then the name of the mentee.
4. Premier\_profits\_v – On a year by year basis, show the premier customer’s outlay versus what they would have been charged for the services which they received had they merely been steady customers.
5. Prospective\_resurrection\_v – List all of the prospective customers who have had three or more contacts, and for whom the most recent contact was more than a year ago. They might be ripe for another attempt.

#### **Queries**

Write the SQL to perform the following queries. If it seems to you that it would make the queries easier to write and understand, please feel free to write additional views to facilitate your query writing. Never return just the ID of a given thing in your queries, always do any necessary joins so that you can display a proper name. Be sure that the sample data that you insert into your tables is adequate to return **some** data from each of these queries:

1. List the customers. For each customer, indicate which category he or she fall into, and his or her contact information.
2. For each service visit, list the total cost to the customer for that visit.
3. List the top three customers in terms of their net spending for the past two years, and the total that they have spent in that period.
4. Find all of the mechanics who have three or more skills.
5. Find all of the mechanics who have three or more skills **in common**.
6. For each maintenance package, list the total cost of the maintenance package, as well as a list of all of the maintenance items within that package.
7. Find all of those mechanics who have one or more maintenance items that they lacked one or more of the necessary skills.
8. List the customers, sorted by the number of loyalty points that they have, from largest to smallest.
9. The premier customers and the difference between what they have paid in the past year, versus the services that they actually used during that same time. List from the customers with the largest difference to the smallest.
10. Report on the steady customers based on the net profit that we have made from them over the past year, and the dollar amount of that profit, in order from the greatest to the least.
11. List the three services that we have performed the most in the last year and how many times they were performed.
12. List the three services that have brought in the most money in the last year along with that amount of money.
13. Find the mechanic who is mentoring the most other mechanics. List the skills that the mechanic is passing along to the other mechanics.
14. Find the three skills that have the fewest mechanics who have those skills.
15. List the employees who are both service technicians as well as mechanics.
16. Four additional queries that you make up yourselves. One query per person. Feel free to create additional views to support these queries if you so desire.

### **Deliverables**

Your work will be done in two parts with one submission of each part for each team. See the class schedule for due dates.

#### The first part, design, will consist of:

* Class diagram.
* English description of all classes and associations.
* If you did any denormalization in your design, please include a separate paragraph(s) stating what you did and why. If you did not do any denormalization, state that and why.

#### The second part, implementation, will include:

* A revised design, based on feedback from the first part. This includes class diagrams and English descriptions of classes and associations.
* English description of all attributes.
* The relation scheme, based on the design.
* DDL used to create all the tables and the DML used to insert the data
* Queries to produce the reports, as described above along with sample output for each of these queries.

# **Teams**

# This project will be done in teams of four people, whom you may self-select.

## **Content**

If you are unfamiliar with the automotive world, that need not be a problem. Please check out some service websites for some ideas about what typically goes into routine, preventative maintenance.

<http://eurosportautomotive.com/know-your-bmws-recommended-maintenance-schedule/>

<http://www.toyotaofsantabarbara.com/yaris-recommended-maintenance-oil-change.htm>