

Customer Database Management System in Retail Business

Sunah Kim Zhe Zhao Tae Woo Kim

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Abstract

Among many computing knowledge we learned in class, we found database development especially useful for managing data in our daily life, small business, and even for research. Particularly, we are interested in managing customer information in retail business, how the data help understand customer better, and how a company gets benefit from it. Thus, our team decided to build a database system for a imaginary retailer, Bow-Wow, using *Open Office Database Development*. We focused on efficiently structuring relationship between tables based on third normal form, making user friendly forms for data coding, generating queries and reports for building up marketing strategy.

1 Introduction

<Bow-Wow> is a company that sells items we need to raise a dog. They are specialized in dog product such as dog food, dog accessories, and apparels for dogs. They started as a small business and have displayed a rapid growth based on their strength in customer database management. Now, they are trying to focus more on customer relationship management to be a more friendly company for dog lovers. To be specific, We have basic data about customers and we would like to take advantage of this to make our business a profitable one. In other words, we not only want to maintain customer data but also want to derive meaningful information for marketing our shop and our product. We prepared tables, queries, forms, and reports for this purpose. What follows next is the explanations for these four.

2 Tables and Relationship

2.1 Tables

Based on third normal form, we made six different tables - Customer, Dog, Species, Sales, Sales:Item(link table), Item - as follows. Customer Table

- Customer Table

Names of customers are randomly made. Some of their names are taken after famous statisticians. Their addresses are centered at Iowa city since we assume our shop Bow-Wow is located at downtown area. For the street names and other address information, our team referred apartment rental website, bakersapartment.com.

- Dog Table

This table includes owner ID, name, age, and species of dogs. Species are written in abbreviated terms. Since one customer could own more than one dogs, customer and dog table has one to many relationship.

- Species Table

For the sake of convenience, we use abbreviation of species names. Species table also shows how big the species is. The size of species is necessary for many reasons. We need to know the ratio large, middle, and small sized dogs to make an order for the dog apparels.

- Item Table

To figure out what kind of goods we are selling, this item table is what one needs to look at. This table shows the name, price, manufacturer(brand), and the category of the items. For the category, we have apparel, foods, toys, and sports goods. All the information in this table is useful since it helps us categorize customers into several groups which in turn, allows us differentiated marketing strategy for different groups. We will cover issues on marketing in detail when in query section.

- Sales Table

Sales table shows the date when each sale has occurred and the customer id, the id of customer who made this purchase. The primary key of this table is receipt number which is generated every time a customer receive a receipt. The customer id is a foreign key. The relationship between customer and this table is one to many.

- Sales:Item Table

This is a linking table. In this table, we combined receipt number with item ID and item quantity. If we link this table with Sales:Item table, we can figure out who has purchased which item, when, and how much. This table actually has all the information about each purchased based on its relationship with other tables.

2.2 Relationship between tables

Basically, we used one-to-many and many-to-many relationship in our database. More specifically, Most of them are one-to-many relationship except for one, which is Sales table and Item table. To define a relationship between Sales and Items which definitely is many-to-many relationship we used link table named Sales:Items. Overall relationship between tables are as follows :

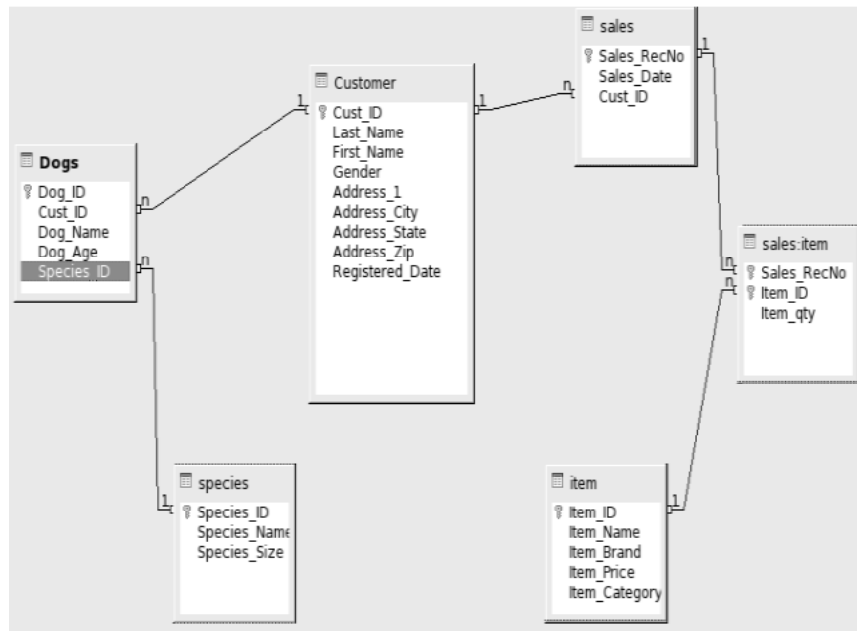


Figure 1: Relationship of tables of Bow-Wow

3 forms

Forms are mainly used in the shop, at the front desk. Using form, which has a clearer view of the records to type in data, will save a lot of effort and avoid the mistakes that may occur when typing new records directly into tables. Generally, after setting all the tables and their relationship, forms are what we mainly use to maintain data.

For our database, we generate three forms. The one showed in the picture below is the form named custom which is used to maintain all the data about customers and their dogs. On the upper part, it shows the information about customers such as their names and addresses, while the lower part displays dogs' information corresponding to this customer. If one customer has more than one dog, then the lower part will have multiple records. Similar idea is applied to other two forms which are used to type in information about sales. Using the first form, 'customer', we can easily update customer information and add new customers. If we type the customer ID in the small blank that is at the bottom, left of the customer form, it bring us to that customer's basic information and we can easily change the content here without having to open up tables every time. In case a customer comes into the shop for the refund of an item, we can open up the customer-Sales form and check the receipt number and purchase data.

What is even better with the forms is, we figured out how to type in new record with drag box. For example, for the information of the species_ID at customer form, instead of manually typing in the Species_ID each time, we could select corresponding ID name from the drag box which saves a lot of work.

Dog_ID	Cust_ID	Dog_Name	Dog_Age	Species_ID
D1	1	Aronq	11	CS

Figure 2: Example Form for coding customer and dog data

4 Queries

Since our tables satisfy third normal form, we need to make queries to see the data in a customized way. Not only that but also we can combine many tables and queries together and abstract useful data that we want to see using built-in functions such as sort, condition, function. In our database, we have created more than 10 queries and they could be categorized into three steps - simple queries which used combining only, basic calculation queries which used some functions and advanced queries which used condition, sort, functions.

4.1 Simple Queries

Simple queries is the basic one where we connected tables to see needed information at once. First 3 queries are of these kinds. To be more specific, we generate combination of sales and items (Comb_Sales_Item query) that linked four tables in a way one can see which customer have purchased which item by how much. This table enables us to watch each customer's purchase pattern and even enables advanced queries. Customer_Mailing query shows customer address information and their names which can be conveniently used for mailing promotion. Customer_Dog queries shows which customer owns which type of dogs.

4.2 Basic Calculation Queries

Using basic functions like grouping and summation, we generate several queries. One example is 'total sales Amount' vs type of 'Category, Customer, Date, and Zip', respectively. The other is 'total quantity sold' vs each type of 'Brand and Item'. These type of queries begins with 'Tot' and 'Qty' in our database. To be specific, four queries that begin with 'Tot' shows total dollar amount of sales that uses customer, item category, date, and zip code as grouping variables. This total amount is calculated by multiplying quantity of items and its price.

- Inference from *Basic Calculation Queries*
 - Tot_SalesAmt_category show real dollar amount of sales profit from each category. It shows which of our four categories of items are contributing the most to our profits. Apparel is selling most so far and this query indicates that dog food is not a profitable section of Bow-Wow business. We may need to investigate the reason and possibly do some advertising such as Bow-Wow beat the lowest price you can get from Whatever.com.
 - Tot_SalesAmt_customer shows the sum of each customer's purchase amount. As we can see, customer who has ID 1,3, and 29 have purchased more than \$500 amount of items and they could be segmented as VIPs.
 - Tot_SalesAmt_Date shows sales amount of each days. If we want to see if there is any trend in sales amount, we can sum up the sales for each month or seasons. If we link this table with item category, we can see which item has been beloved during summer seasons and then prepare for the next summer.
 - Tot_SalesAmt_Zip tells us where our customers are coming from. It seems that most customers are from Iowa city, North Liberty, and Tiffin.
 - Qty_sold_Item

and Qty_sold_Brand shows which brand and individual item is selling most respectively. It seems that dog's secret, toysryours, and northdogface is selling most so far. Fabulousdog, gorgeous, and sportstoy is selling most as individual items. By the way, these numbers are simply sum of the quantities of items, not the dollar amount.

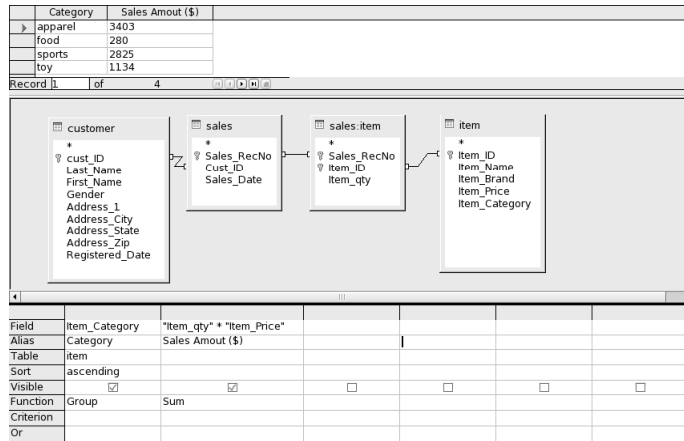


Figure 3: Example Query for Sales Amount by Category

4.3 More Advanced Queries

If first two types of queries provide us with more general information, these more advanced queries aimed at abstracting more specific information based on data from tables and existing queries. We used sort, function, condition and sometimes worked two steps to merge data. This type of query will be more useful in target-database-marketing since in real business, we would occasionally face with the limit of budget which force us to build up marketing strategy and promotion more effectively. Based on this idea, we made queries as follows:

- Sports Mania Coupon Mailing

In this query we aimed at promoting sports discount coupon for limited customers and decided to target customers who bought sports goods for dogs in our shop at least two times. We divided queries into two steps. The first step is extracting customer ID that meets above condition. We of course pay attention to remove any redundant customer ID in this process. To do that we used grouping function for customer ID. Second step is attaching address information to the our target customer -that is obtained from step one. As for the usage of this type of query, we can effectively advertise if Bow-Wow were to host a sports competition event, say 'obstacle race', then we need the addresses of customers only who are likely to join this event and this mailing query is an example that does it. We can apply this query if we slightly change factors such as type of product

category or quantity sold or include other terms and conditions that we want. As another example, Bow-Wow may organize some contests such Miss and Mr. Puppy Iowa which is a dog's beauty contest. There are certain customer group that purchase apparels and beauty items more than others. Since they are interested in making their dogs beautiful, events like Miss and Mr. Puppy Iowa may be appealing. This idea is basically same as sports competition but the customer group that this event is targeting is different.

Mailing_SpoMania_cust_List(sorting)

File Edit View Insert Tools Window Help

Field: cust_ID, Item_Category, Item_qty

Alias: cust_ID

Table: Comb_Sales_Item

Function: Group

Criterion: 'sports' >= 2

Field	cust_ID	Item_Category	Item_qty
Alias	cust_ID		
Table	Comb_Sales_Item	Comb_Sales_Item	Comb_Sales_Item
Function	Group		
Criterion		'sports'	>= 2

Figure 4: Example (step 1) Abstracting Target Customer ID for Sports Mania Mailing

Mailing_SpoMania_Final_List(address)

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cust_ID	First_Name	Last_Name	Address_1	Address_City	Address_State	Address_Zip
1	Tae Woo	Kim	337 Emerald st	Iowa City	Iowa	52246
5	Paul	Franklin	43 Sunset St	Iowa City	Iowa	52246
8	Jacques	Bernoulli	100 Hawk Ridg	Iowa City	Iowa	52246
9	Gerolamo	Cardana	226 S. Lucas	Iowa City	Iowa	52240
10	Rene	Descartes	451 Iris Court	Tiffin	Iowa	52340
11	Ronald	Fisher	1014 Oakcrest	Iowa City	Iowa	52240
12	Galleo	Galleo	125 Juniper Cox	North Liberty	Iowa	52317
13	Francis	Galton	902 N. Dodge	Iowa City	Iowa	52245
14	William	Gosset	2230 Westlake	North Liberty	Iowa	52317
15	John	Graunt	65 Thistle Ct	Iowa City	Iowa	52240
17	Abraham	de Mowre	906 N. Dodge	Iowa City	Iowa	52245
20	Karl	Pearson	100 1st Ave. N	Cedar Rapids	Iowa	52402

Record 11 of 15

Field: cust_ID, First_Name, Last_Name, Address_1, Address_City, Address_State, Address_Zip

Table: Mailing_SpoMania_Customer_Mailing

Function: Group

Criterion: cust_ID IN (SELECT cust_ID FROM Mailing_SpoMania_cust_List(sorting))

Figure 5: Example (step 2) Attaching Address Information to Target Customer for Sports Mania Mailing

- Redemption Mailing

Assume that our company wants to issue redemption mailing with voucher that is five percent proportional to purchase amount each customer made from July to September. To calculate the redemption amount we need combination of sales and item query.

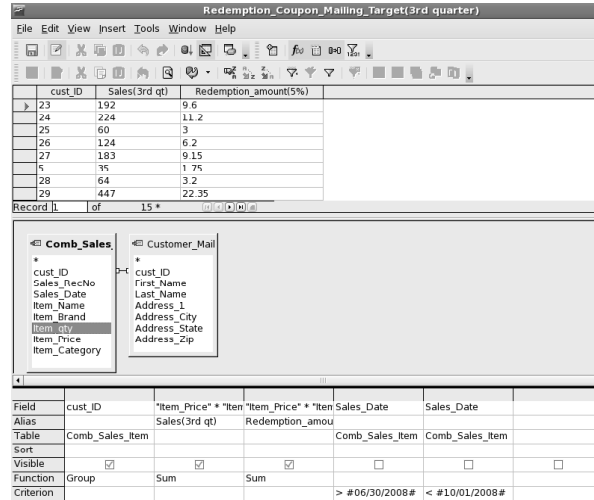


Figure 6: Example Advanced query using function and condition

I would like to mention that our query shows only a part of our ideas. For more possible example, we can regress purchase amount or visit frequency on the distance between customers' residence and their could have certain relationship. It is likely that customers who live closer to Bow-Wow come to the shop more often. We can use the street name and zip code to calculate the distance. This regression may bring us back some important marketing point. That is, if it is true that the purchase amount decrease as the distance increase and we want to have more customers living far away, we could send some coupons to draw them.

5 Reports

We generate three different reports in our database. Reports not only shows our data and queries as it is but also well manipulate and describe information effectively by using several chart and graph. Moreover, dynamic chart can be useful since it automatically reflect the changes of data in use if there is change in database. Mailing_Spomania_Final_List shows the addresses of customers to whom we need to send our coupons. This report is based on the Spo_Mania query that sorts out the customers who purchased more than or equal to 2 sports items. This reports shows the same result of the query in a user friendly way. The other 2 reports are more useful.

Sales_reg_report(789) shows the histogram of sales amount for three months, July, August, and September. One can also see the detailed data of each month. This report is based on the query Sales_reg_report(789). Pie chart is another way of summarizing the data. Qty_Sold_Brand shows top 8 brands summing up the rest as 'Others'. The type of reports we used here is a dynamic report and it update itself when the original data changes. The other type is called static and this does not allow updates.

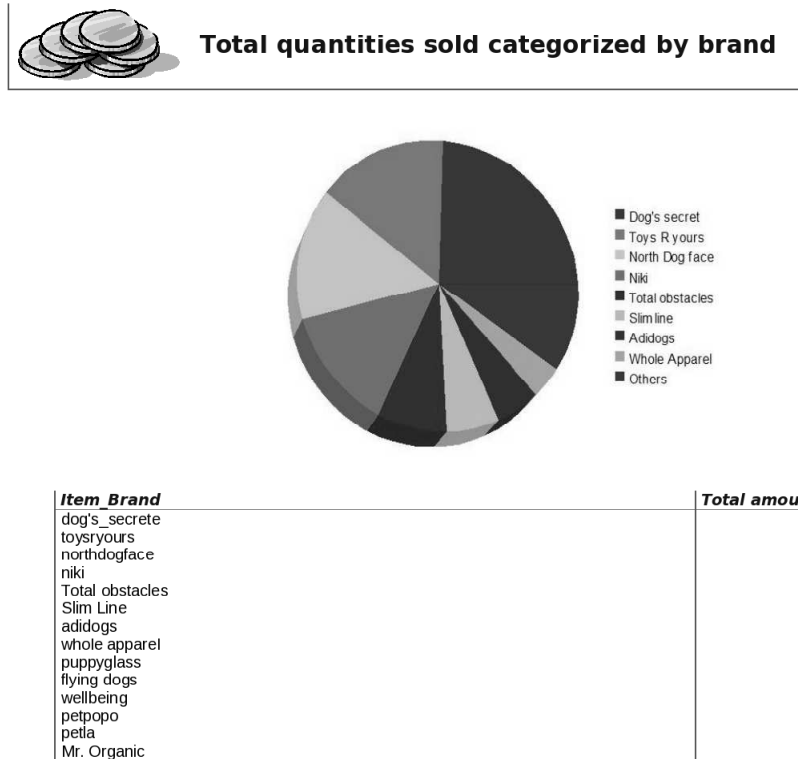


Figure 7: Example Reports for Total Quantities Sold categorized by Brand

6 Summary

As we expected, we found out that we can do a lot of things with database development. Let's summarize the steps from the beginning to the report. First of all, it is important to know what we are trying to do with the data. Otherwise one may spend resource on collecting data that will never be used. In this sense, one better begins with drawing a picture of final report and then think backward. In our case, we gathered data in the perspective marketing and the report is something that could be used when we discuss about Bow-Wow's marketing strategy . Next step is to type in or read in collected data into the tables that satisfy 3rd normal form and set up the relationship among the tables. Making correct relationship is important since the query is based on it. Query is, in a word, to select and combine the data from different tables based on different criterion. It is possible to manipulate numbers or characters using simple summary statistics such as sum and mean. Once we are done with the query, then you are ready to make the report. Report summarize the manipulated numbers in a way one can get the meaning at once. Also, with reports we could do some simple selecting and grouping procedures, but for our case, we generate reports based on the existing queries.