IS 475/675 Database Design & Implementation Project

What is the purpose of the project?

The two objectives of this project are to <mark>design a database</mark> to support the requested operations of the company described in this document and <mark>create a prototype</mark> to test the design. This project requires you to:

- Identify the data required to be stored for the application.

- Identify the entities, attributes, primary keys, relationships and foreign keys.

- Create a logical data model in third normal form.

- Create a sample prototype database.

- Write a series of queries to test the prototype and check the validity of the database design.

Project Structure

The application scenario used for the entire project is described in this document. The application scenario will not change for the two parts of the project – it will be the same and will be described only in this document. The scenario is an extension of a database that you designed for a previous homework assignment (HW#3).

The project is divided into two parts: (1) Database Design; and (2) Prototype Creation and Queries. The two parts of the project will be turned in and graded separately to help provide a milestone and ensure that the project will be completed by the end of the semester.

What are the deliverables from <u>part 1</u> of the project?

There is only one deliverable for this part of the project: A data model for the entire application system in third normal form.

The data model will be documented using a logical entity-relationship diagram (ERD). Copy the ERD into a Word or .pdf document – do not turn in a file that needs some other program to run. Upload the Word or .pdf document to WebCampus for grading. If you need to explain any assumptions, please include those in your document.

The ERD should follow the conventions that we have been using all semester. Use the crowsfoot notation and make sure that all relationships have both a maximum and minimum cardinality. Be sure that each entity has the entity name at the top of the box, the primary key attribute or attributes in the middle of the box, and the non-key attributes in the bottom of the box. Lines should separate each part of the entity box. The ERD should not have any M:N relationships. Each entity must have a primary key defined. A primary key may consist of one or more attributes. Include all required foreign keys and denote the foreign key(s) with the notation (FK) on the ERD.

<mark>Please make the diagram readable.</mark> Enclose your entities in boxes. If you create the diagram by hand, rather than with a computer tool, please use a straight-edge to make the entity boxes. Make your printing legible. Avoid crossing relationship lines.

You must include a verb phrase for each relationship.

What is the application?

Replica Toys designs, develops, manufactures, and markets sophisticated, expensive, automated toys for children. Replica Toys sells directly to the public, but most of their toy sales are made through distributors such as Amazon, Wayfair, World of Toys and independent toy stores. The company's toys are relatively expensive (the least expensive toy sold is priced at $250 and the most expensive toy sells for $25,000) and are also frequently sold through exclusive, specialized, independent toy stores. Replica Toys sells few toys when compared to other toy manufacturers because their market includes only those people who are looking for sophisticated, expensive, very high quality toys.

The company's first product line included a set of miniature ride-able motor vehicles. Each toy is a complex replica of an adult vehicle. Their ride-able toys include all-terrain vehicles, trains, trucks, luxury sedans, sports cars, and vintage automobiles. The product line includes approximately 35 unique ride-able vehicles at any one time. The model number indicates the general model of a toy and could be considered an identifier for a product model. For example, a "Chevy 4 door SUV" is model CSUV7. Each individual toy of model CSUV7 is uniquely identified by a serial number. Replica Toys will sell more than one model CSUV7, each with its own unique serial number.

Replica Toys wants to create a database to track post-sales information. This database will NOT be used to track customer orders. The database will be used by two different departments in the organization:

1) **Marketing Department**. The Marketing Department will use the database to answer questions about customer purchasing patterns and interests. To answer these questions, the Marketing Department wants to store customer registration information. The Marketing Department will use the registration data to better understand why customers elect to purchase toys from the company.

   In addition to storing registration data, the Marketing Department wants to store data about returns of toys (remember – this is all post-sales data). The Marketing Department will use data about customer returns to understand why customers elect to return toys back to the company. This database will **not be** used to process financial transactions for orders or returns – it will be used to capture marketing data about the reasons WHY a customer places an order or returns a product.

The Marketing Department will also use this database to track information gathered from the web about customer reactions to their products. They plan to scan the web frequently and download any reviews/comments about the toys that they find from other websites.

2) **Quality Control**. The Quality Control group within the Manufacturing Department will use the database to track problems with toys that have been sold. The Quality Control group wants to store problem reports, testing and resolution documents.

The company wants to consolidate all post-sales returns, registration, service and customer data in a single database. This database does not contain customer order data, but in the future it might link to the customer order database. This database does not contain inventory data, but in the future it might link to the inventory database. The purpose of this particular database, however, is to store post-sales data. It is NOT to store order data or inventory data beyond what is necessary to support the processes required by the Marketing Department and the Quality Control group.`

Registration Data

In order to keep track of customers and purchases, Replica Toys asks all customers to fill out the registration form shown on the next page as Figure 1. This is similar to the form you used in HW#3 to design a database for the same company.

Customers are usually compliant with the request to fill out the registration because Replica Toys offers free service for two years to all those who submit the registration form. Replica Toys also provides savings offers to current customers for future purchases, if those customers fill out the registration form. Replica Toys has many return customers – their customers are loyal and tend to buy toys from them many different times.

Registration forms will be filled out online, using the database you are designing as the place to store the data collected from customers. Registration forms are completed by the person who purchased the toy since the customer is the buyer of the toy, not the child who will be the user of the toy. Most toys are sold through distributors. The company anticipates using the serial number of a toy as the primary key because each toy can be uniquely identified by its serial number. Business rules about the registration data are provided below.

- A registration will contain only one answer to the question "Where did you first learn about Replica Toys?"

- A registration may contain multiple answers to the question "What features were you most interested in when buying the toy?" The Marketing Department anticipates that additional features may be added as they determine which features are most important to customers and identify additional features that might be of interest to customers.

- A registration will contain only one answer to the question "How are you related to the primary user of the toy?"

- Each toy has a unique serial number. It is possible that a toy (uniquely identified by a serial number) may be registered more than once. We want to keep track of the history of which customer registered a toy on what registration date.

- A serial number determines the model number of a toy. The model number determines the name and description of a given toy. The company keeps track of the name, description, and recommended price of each model (even though that information is not shown on the registration form in Figure 1), so that data should be in this database.

3

- A given registration can have only one gender checked.

- The company does not keep track of the name of the intended primary user, since that user is most likely a child. The age of the intended primary user is interesting to the Marketing Department because they want to know the ages at purchase of the recipients of each particular model. The "customer" is the person who purchased the toy.

Customer Information		Purchase Information	
First Name	Tyler	Model Number	JCSUV7
Last Name	Swanson	Serial Number	19029388-11
Address	7883 Cordova Ave.	Date of Purchase	11/04/2022
City	Rancho Cucamonga	Distributor	Claremont Toy World
State	CA	Price	485.99
Zip	91209	**Primary User of Toy**	
Email	tycar@gmail.com	Age	6
Primary Phone	714-232-1111	Will there be only one user?	**X** Yes ☐ No ☐ Don't know
Background Information about the Purchase			
Where did you first learn about toys from Replica Toys? (Check only one)		☐ Advertisement in print ☐ Advertisement on the web **X** Advertisement on TV ☐ Friend's recommendation ☐ In-store display ☐ Catalog ☐ Other	
What features were you most interested in when buying the toy? (Check all that apply)		**X** Type of toy (car, jeep, etc.) ☐ Size **X** Color **X** Speed **X** Quality of design ☐ Level of replication from original ☐ Safety features ☐ Cost ☐ Sound features ☐ Other	
How are you related to the primary user of the toy? (Check only one)		☐ Parent ☐ Grandparent **X** Aunt/Uncle ☐ Friend ☐ Other Relative ☐ Other	
Do you anticipate buying similar toys in the future? (Check only one)		☐ Yes ☐ No **X** Don't know	
Why did you buy this toy from Replica Toys?		My niece loves our SUV and I wanted her to drive one just like mine!	

Figure 1: Sample Registration Form

Return Data

Replica Toys has not kept track of return data in the past, but the Marketing Department wants to understand why people are returning toys. The Marketing Department wants to store data about returns made from toy buyers. They requested that their distributors ask their customers (people buying the toys) to provide an explanation when making a return. This data will be gathered from the cash register systems of the distributors and sent to the Marketing Department at Replica Toys. For those people buying toys directly online from Replica Toys, the data will be gathered from an online form. Return data that the Marketing Department wants to store will include: Serial Number, Date purchased, date returned, reason for return (they plan to have about 10 standard reasons why people would return the product, but may discover more reasons in the future), and a notes area where people can type in any comments they have about the returned item. Personnel in the Marketing Department anticipate they will be able to persuade their distributors to type in any comments that the customers made about the toy when returning the product. Since this system is not in place yet, they don't have a sample form to provide for you to understand the data required.

Review Data

The Marketing Department anticipates gathering data from available sources to capture customer reviews of their products. They plan to relate a review to a given model of a toy. The data that they will store for each review is: Model number, review date, review source (i.e. Yelp, Google), and review text. They plan to store the review text as just a large text field without attempting to categorize it in any way. Figure 2 provides sample data for the reviews.

Quality Control Data

One of the greatest concerns about the products sold by Replica Toys is that they be safe for children. The products are fairly complex and it is possible that a toy could harm a child if the design is flawed or if the implementation of the design is not correct. As a result, the company monitors the problems reported with toys very closely. If there are any problems with a toy, Replica Toys notifies customers and distributors directly.

To keep track of problems reported for a product, employees at the company fill out the problem report form shown in Figure 3. Whenever a customer or distributor calls in with a problem, an employee at Replica Toys fills out the form in Figure 3 with detailed information about the problem. There is a standard set of problems (problem types) used to fill out the problem description area of the form in Figure 3, but each problem reported is currently typed in as text by the employee filling out the form. Problems are related to a specific serial number, but a specific serial number may have more than one problem reported.

Problem reports can be initiated by a distributor, an employee of Replica Toys, or a customer. A problem report is initiated by only one person. The person who initiates a problem report could fill out multiple problem reports. Multiple problem reports could be filled out for a given toy (uniquely identified by a serial number).

A problem report may not be related to a registration. For example, a customer does not have to register a toy to call the company with a problem with a specific toy. While this post-sales system includes both Marketing and Quality Control data, they are only tangentially related to each other.

Once a problem report is filed, Replica Toys does testing and evaluates the validity of the complaint. Employees fill out reports for each test performed in relation to a problem report. An example of the Test form is provided in Figure 4.

More than one test form may be completed per problem report. A test form is not filled out unless initiated by a problem report; there must be a problem report stored in the database before a test form can be completed. It is possible that the recommended resolution of a test form is to perform another test. When that occurs and another test must be performed, the "test complete" question on the form is answered as "no"

Reviewer	Review Date/Time	Model Number	Review Source	Rating	Review
James Madison	9/10/2022 09:12 GMT	VBJAG	Yelp	5	This car is incredible. I own the "real" thing and this replica has great attention to detail in both the interior and exterior. My grandson is only 4 years old but is able to drive it easily up and down our ½ mile driveway!
Marta Madison	9/11/2022	VBJAG	Google	4.5	My husband bought this model for our grandson and I think it is an excellent replica of the original. The only difficulty is that the brakes are a little grabby which makes it stop with a real jerk.
Jenice Leathers	8/28/2022	SUVLUX	Amazon	4	I'd love to give this SUV a 5 star rating, but the paint seems to chip fairly easily. My great grandson drove the range rover into a wall (by accident, of course!) and the front bumper had a chip in the paint. The air bag and seat belt prevented any damage to my great grandson, but I think that the paint job should be able to handle hitting a wall!

Figure 2. Review Data

Date/Time of Report	11/08/2022 11:35AM	Report ID	760-22931
Model Number	JCSUV7	Serial Number	19029388-11
Returned?	Yes ☐ No ✖	Return Date	
Person Reporting Problem (Check only one)	✖ Customer ☐ Employee of Replica Toys ☐ Distributor ☐ User ☐ Other		
Complaint Made	☐ WebForm ☐ Phone ✖ Email ☐ Twitter ☐ Store		
First Name	Tyler		
Last Name	Swanson		
Address	7883 Cordova Ave.		
City	Rancho Cucamonga		
State	CA		
Zip	91209		
Phone Number	714-232-1111		
Email	tycar@gmail.com		
Type of Problem (Check only one)	☐ Inadequate finish – toy does not look good ☐ Inadequate operation – toy does not operate correctly ✖ Poor operation – toy tips over during use ☐ Inadequate operation quality – toy broke during use ☐ Poor operation quality – toy hurt user ☐ Other		
Description of Problem	When driving around corners, the Chevy Tahoe seems top heavy and tips over unexpectedly. Happens most often on uneven terrain.		
Injury	☐ Yes ✖ No		
Description of Injury			

Figure 3. Sample Problem Report Form

Problem Report ID	760-22931	Date and Time of Report	11/12/2022 8:30AM
Model Number	JCSUV7	Serial Number	N/A
EmployeeID	35002	Test Type	Operational
Test Description	Used computer simulation of vehicle with 40 pound rider 3 MPH; 5MPH; 10MPH; 15MPH test runs. Tried it on qualified uneven terrain including potholes. Tried it on unqualified terrain (sand).		
Test Results	Slight outside tilt; no tipping at any speed on qualified terrain. Tipping occurs when vehicle is used on 1 foot sand surface.		
Recommended Resolution	No problems with expected performance. Provide additional documentation to Marketing about intended operating environment for JCSUV7. Recommend inclusion of additional information in operating manual stating: don't operate on sand.		
Test complete?	Yes.		

Figure 4. Test Form

Managerial and Operational Questions

Two disparate groups (Marketing and Quality Control) each have different types of questions they hope to answer from information obtained from this database. Both groups have data from other databases in the organization – Marketing gets most of its data from the ordering database, while Quality Control uses the manufacturing database. But neither of those databases stores post-sales registration, return, survey, and service data. Here are samples of the questions that the two groups hope to answer from this database:

- How old is the average user for each of the different styles of vehicles?
- What is the preferred purchase by gender?
- What are the most important features to a grandparent purchasing a vehicle for a grandchild?
- How do grandparents hear about our toys?
- Which toy models are returned the most often?
- What reason is given for returns for those toy models returned the most often?
- Which user age group has the most returns?
- What is the relationship of the customer to the intended user for those toys returned the most often?
- What is the relationship to the primary user for our different models? In other words, do grandparents or parents buy the most SUVs? Which type of buyer buys the most sports cars?
- Which model has the most problem reports? Which model has the least problem reports?
- Who reports the most problems – distributors or customers?
- What is the gender and age group of the primary user with the most and least problem reports?
- What is the current status of a specific problem report?
- What tests did we run on a specific date?
- Are there any problem reports that have not had any tests run?
- Which problem reports are not complete (have not been issued a "yes" on the "test complete" question of a test form?
- What is the count of injury reports by model?
- What is the count of injury reports by model by age of primary user?
- What is the count of injury reports by model by location of buyer? Or by location of distributor?
- When did we receive the most current injury report for model CVR722? (or any other specific model)