**Database Concepts**

Seventh Edition

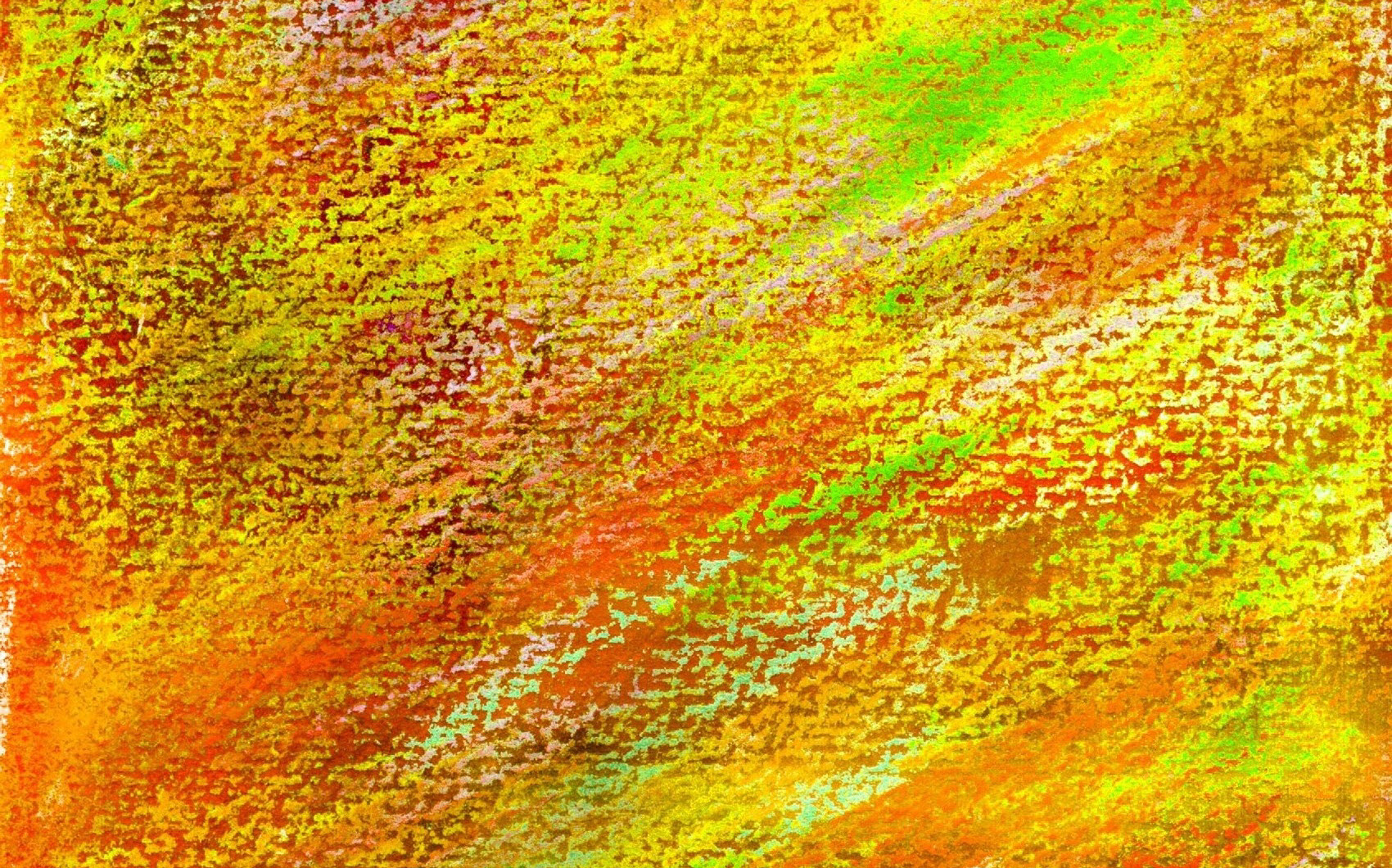
### David M. Kroenke • David J. Auer

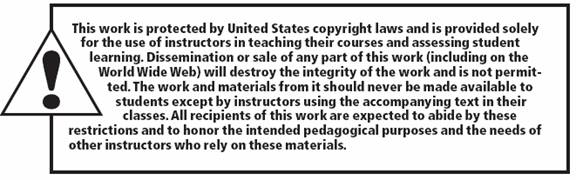
# Instructor’s Manual

**Prepared by David J. Auer**

CHAPTER ONE

GETTING STARTED





Instructor’s Manual to accompany:

*Database Concepts (Seventh Edition)*

**David M. Kroenke and David J. Auer**

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* CHAPTER OBJECTIVES
* Identify the purpose and scope of this book
* Know the potential problems with lists
* Understand the reasons for using a database
* Understand how using related tables helps you avoid the problems of using lists
* Know the components of a database system
* Learn the elements of a database
* Learn the purpose of a database management system (DBMS)
* Understand the functions of a database application
* Introduce nonrelational databases
* CHAPTER ERRATA
* There are no known errors at this time. Any errors that are discovered in the future will be reported and corrected in the Online DBC e07 Errata document, which will be available at [http://www.pearsonhighered.com/kroenke](http://www.pearsonhighered.com/kroenke/).
* THE ACCESS WORKBENCH

Solutions to the *Access Workbench* exercises may be found in *Solutions to all* Sections: *The Access Workbench*, which is a separate document within the Instructor’s Manual.

* TEACHING SUGGESTIONS
* The Art Course database discussed in Chapter One is a good database to use for an in-class demo of the concepts in this chapter. See the list, data, and database files supplied, and use the following material:
* Microsoft Access 2013:
* “Art Course List” in DBC-e07-Lists-And-Data.xlsx
* DBC-e07-Art-Course-Database-CH01.accdb
* Microsoft SQL Server 2014 Express Edition:
* DBC-e07-MSSQL-Art-Course-Database-Create-Tables.sql
* DBC-e07-MSSQL-Art-Course-Database-Insert-Data.sql
* DBC-e07-MSSQL-Art-Course-Database-SQL-Queries-CH01.sql
* NOTE: Create a database diagram for the database
* Oracle Database Express Edition 11*g* Release 2:
* DBC-e07-ODB-Art-Course-Database-Create-Tables.sql
* DBC-e07-ODB-Art-Course-Database-Insert-Data.sql
* DBC-e07-ODB-Art-Course-Database-SQL-Queries-CH01.sql
* Oracle MySQL 5.6:
* DBC-e07-MySQL-Art-Course-Database-Create-Tables.sql
* DBC-e07-MySQL-Art-Course-Database-Insert-Data.sql
* DBC-e07-MySQL-Art-Course-Database-SQL-Queries-CH01.sql
* Introduce the course by explaining that database processing is the heart of all applications today. The demand for knowledgeable people (both users and technicians) is high, but the supply is low. The knowledge gained in this course will be valuable at job-hunting time. Internet technology has tremendously amplified the need for database knowledge—that technology can be used inside organizations as well as outside for e-commerce applications.
* Many students wonder why we need a separate course for keeping track of lists. If you compare and contrast Figures 1-1 and 1-2, and especially if you consider the need to change data (while keeping the data rows consistent), this may become more clear. Also, add the problems of concurrent processing, and students should begin to understand why database processing is necessary (and important to their future).
* Another important idea that may be new to students is the fact that storing a relationship is just as important as storing a data item. The fact that a particular supplier can supply a particular part, or that an advisor is assigned to a particular student, is a “relationship fact” that needs to be recorded. Point out the relationship links in Figures 1-6.
* This chapter uses the term **theme** (an equivalent term is **topic**) to refer to the notion that a group of columns are related to one another. During class ask the students to take a credit card receipt out of their wallet and identify the “themes” / “topics” on that receipt. You can do the same with their grade report or class schedule. This is good practice for learning and doing normalization later.
* In Figure 1-10, your students may point out that if you delete a row from the ENROLLMENT table, you do lose the AmountPaid information. This is true, but we will assume that if an ENROLLMENT is deleted, the AmountPaid is refunded and irrelevant. A full accounting tracking of payments (receipts) and refunds (disbursements) is beyond the scope of this example!
* If your students are using Microsoft Access, or another personal DBMS product, be sure to point out that personal DBMS products combine the Database Application and the DBMS sections in Figure 1-15 as shown in Figure 1-23. Contrast these figures in class. Students need to understand that there is a difference between a database application and a DBMS. You can use Figure 1-26 to show the multiple people, roles, and skills involved in managing a large-scale database system
* As an aside, we find the term DBMS products easier to pronounce than DBMSs.
* If the students are coping well with this material, you can take an excursion into epistemology. Examine Figure 1-11 again. All of the text discussion makes the underlying assumption that the relationship from a project (ProjectName) to an owner (OwnerContact) is 1:1. What if it’s 1:N (many owners for a project)? What if it’s N:1 or N:M? All are possible.

Two questions arise:

* What do we do in these cases? (We’ll deal with this in Chapters 4 and 5.)
* How do we know which is true?

This second question leads to a whole series of next questions: Whom do we check with? Can we make our own assumptions? Should we ask a user? Which user? What if I ask the wrong user? What if the answer changes over time? Suppose, in frustration, I say, “I’m making a model of reality—not just of some user’s idea.” What does that mean? Doesn’t it mean I’m making a model of my own mental model—and isn’t that arrogant of me? What are we modeling?

* We believe that a database is a model of a user’s mental model and not of reality. But what are user’s models? Are they models of reality? Or just some shared hallucination about “what is out there—outside of our brains?” The instruction set of a computer determines what kinds of “thoughts” that computers can have. Doesn’t the instruction set of the human brain determine what kinds of “thoughts” we can have, or what kinds of models of reality we can have? So, there may be a lot more going on than we can model. Immanuel Kant had much to say on this topic. It’s been the focus of one thread of philosophy for centuries.
* If you choose to present these questions, you might want to parcel them out over several lectures. Maybe in the last five minutes (not the first five minutes or you’ll never get to the lecture). If you go too far in the first session, there’s a danger the students will just think you’re a nut (trust us on that one). You can also defer all of this discussion to the data modeling material in Chapter 4.
* ANSWERS TO REVIEW QUESTIONS

1. Why is the study of database technology important?

Databases are used everywhere: They are key components of e-commerce and other Web-based applications. They lay at the heart of organization-wide operational and decision support applications. Databases also are used by thousands of workgroups and millions of individuals.

1. What is the purpose of this book?

The purpose of this book is to teach you the essential database concepts, technology, and techniques that you will need to begin a career as a database developer.

1. Describe the purpose of a database.

The purpose of a database is to help people keep track of things.

1. What is a modification problem? What are the three possible types of modification problems?

A modification problem is a data corruption or loss that occurs when a table uses one row to store facts about two or more themes. In this case, a deletion of a row can remove facts about two or more themes, leading to a loss in data, or a data change must be made in multiple rows to maintain data consistency. Finally, unless creation of a new row is allowed based on only one theme, it may be impossible to store needed data.

Thus, the three possible modification problems are: (1) insert problems—missing data, (2) update problems—inconsistent data, and (3) delete problems—data loss.

1. Figure 1-30 shows a list that is used by a veterinary office. Describe three modification problems that are likely to occur when using this list.
   * Updating an owner’s name or other data must be done in (potentially) many rows
   * Possibly incorrect, inconsistent owner data across rows (changed in one row, but not in another)
   * No place to store owner (your customer!) data unless they have a pet
2. Name the two themes in the list in Figure 1-30.

OWNER and PET

1. What is an ID column?

An ID column is a column used to assign a unique identifying number to each row of a table.

1. Break the list in Figure 1-30 into two tables, each with data for a single theme. Assume that owners have a unique phone number but that pets have no unique column. Create an ID column for pets like the one created for customers and courses for the Art Course database tables in Figure 1-10.

**PET (PetID, PetName, PetType, PetBreed, PetDOB, *OwnerPhone*)**

**OWNER (OwnerLastName, OwnerFirstName, OwnerPhone, OwnerEmail)**

1. Show how the tables you created for question 1.8 solve the problems you described in question 1.5.
   * We have to change owner data just once for each owner.
   * We allow only one row per owner, so we can’t have inconsistent data.
   * We can add owner data, even if the owner has no pet.
2. What does SQL stand for, and what purpose does it serve?

SQL stands for **Structured Query Language**. It is used for combining, querying, and processing sets of tables and the data in those tables. For example, an SQL statement could be used to recombine the two tables created in question 1.8 into a table containing the data shown in Figure 1-30.

1. Another version of the list used by the veterinary office is shown in Figure 1-31. How many themes does this list have? What are they?

The list has three themes: PET, OWNER, SERVICE.

1. Break the list in Figure 1-31 into tables, each with a single theme. Create ID columns as you think necessary.

PET (PetID, PetName, PetType, PetBreed, PetDOB, *OwnerPhone*)

OWNER (OwnerLastName, OwnerFirstName, OwnerPhone, OwnerEmail)

SERVICE (ServiceID, Service, Date, Charge, *PetID*)

1. Show how the tables you created for question 1.12 solve the three problems of lists identified in this chapter.

See the answer for question 1.9 for the PET and OWNER Tables. For the SERVICE Table:

* + We can add/modify a Service for a particular date, pet, and indicate the charge amount
  + If we delete a Service, it does not remove owner or pet information

1. Describe in your own words and illustrate with tables how relationships are represented in a relational database.

Relationships are represented by storing the key values of one table, such as PetID or OwnerPhone, in a column in a second table to serve as a linking value. In the SERVICE table, for example, the value of PetID means that the service was performed for that particular pet, which links to the PET table.

1. Name the four components of a database system.

User, database application, DBMS, database

1. Define the term **database.**

A self-describing collection of related tables (or records), where **self-describing** means that the database contains a description of itself within itself.

1. Why do you think it is important for a database to be self-describing?

It is important for a database to be self-describing so that there is always a way to know the database’s structure and contents. Without the self-description, it would not be possible to know what’s in the database.

1. List the components of a database.

Components are: User data, metadata, indexes and other overhead data, application metadata.

1. Define the term **metadata,** and give some examples of metadata.

Metadata is data about the structure of the database. Examples are the names of tables, columns, and indexes.

1. Describe the use of an index.

An index is used to improve database performance. The concept of an index is similar to a traditional index at the back of a textbook.

1. Define the term **application metadata,** and give some examples of application metadata.

Application metadata are the data that describe application elements. Examples are reports and forms.

1. What is the purpose of a DBMS?

The purpose of a DBMS, which stands for **database management system,** is creating, processing, and administering databases.

1. List the specific functions of a DBMS.

As listed in Figure 1-18:

* Create databases
* Create tables
* Create supporting structures (e.g., indexes, etc.)
* Read database data
* Modify (insert, update, or delete) database data
* Maintain database structures
* Enforce rules
* Control concurrency
* Provide security
* Perform backup and recovery

1. Define the term **referential integrity constraint.** Give an example of a referential integrity constraint for the tables you created for question 1.8.

The term **referential integrity constraint** is a rule that before a possible key value of one table can be placed in a second table as a linking value, the value must exist in the first table before it is used in the second table.

OwnerPhone in PET must exist in OwnerPhone in OWNER.

1. Explain the difference between a DBMS and a database.

A DBMS is a program for defining, processing, and administering a database. A database is a file of data having the components listed in the answer for question 1.18.

1. List the functions of a database application.

As listed in Figure 1-19:

* Create and process forms
* Process user queries
* Create and process reports
* Execute application logic
* Control the application

1. Explain the differences between a personal database system and an enterprise-class database system.

The basic differences are size and complexity. Also, the application and the DBMS are often combined in a personal DBMS like Microsoft Access. Enterprise-class databases have concurrent users, may need to run 24/7, and may have many different applications and application types (as shown in Figure 1-25).

1. What is the advantage of hiding complexity from the user of a DBMS? What is the disadvantage?

Hiding complexity makes it easier for users to learn and use the product. But, the problem with hiding database technology (and with using lots of wizards to accomplish database design tasks) is that you never understand what is being done on your behalf.

1. Summarize the differences between the database systems in Figures 1-23 and 1-26.

The database system in Figure 1-23 is suited to one or a few users. The database system in Figure 1-26 is suited to many concurrent users, many different applications and application types, large databases, and may be distributed over different computers.

1. What is a NoSQL database? What are Web 2.0 applications, and why can’t these applications use a relational database?

A NoSQL database is a nonrelational database that focuses on applications that need to quickly create and store massive amounts of data. Web 2.0 applications are applications that allow the user to create and store data that would be subsequently displayed on a Web page.

* ANSWERS TO PROJECT QUESTIONS

The following spreadsheets form a set of named spreadsheets with the indicated column headings. Use these spreadsheets to answer exercises 1.31 through 1.33.

1. Name of Spreadsheet: EQUIPMENT

Column Headings:

(Number, Description, AcquisitionDate, AcquisitionPrice)

1. Name of Spreadsheet: COMPANY

Column Headings:

(Name, IndustryCode, Gross Sales, OfficerName, OfficerTitle)

1. Name of Spreadsheet: COMPANY

Column Headings:

(Name, IndustryCode, Gross Sales, NameOfPresident)

1. Name of Spreadsheet: COMPUTER

Column Headings:

(SerialNumber, Make, Model, DiskType, DiskCapacity)

1. Name of Spreadsheet: PERSON

Column Headings:

(Name, DateOfHire, DeptName, DeptManager, ProjectID, NumHours, ProjectManager)

1. For each of the spreadsheets provided, indicate the number of themes you think the spreadsheet includes and give an appropriate name for each theme. For some of them, the answer may depend on the assumptions you make. In these cases, state your assumptions.
2. One: EQUIPMENT.
3. Two: COMPANY, OFFICER.  
   Assume a company has more than one officer, or an officer has more than one company or both.
4. One: COMPANY.  
   Assume a company has only one president and a president is president of only one company.
5. One: COMPUTER, if you assume Make and Model do not determine DiskType and DiskCapacity.  
     
   Two: COMPUTER, and MAKE-MODEL, if you assume Make and Model do determine DiskType and DiskCapacity.
6. Four: PERSON, DEPARTMENT, PROJECT, and ASSIGNMENT  
   Assume an employee has more than one assignment to a project.
7. For any spreadsheet that have more than one theme, show at least one modification problem that will occur when inserting, updating, or deleting data.

For B: A company changing its Industry code may create inconsistencies (update problems).

For D: A new DiskType assigned to a Make, Model creates lack of data (insert problems).

For E: A project obtaining a new project manager may create inconsistencies (update problems).

1. For any spreadsheet that has more than one theme, break up the columns into tables such that each table has a single theme. Add ID columns if necessary, and add a linking column (or columns) to maintain the relationship between the themes.
2. One table:

EQUIPMENT(Number, Description, AcquisitionDate, AcquisitionPrice).

1. Two tables:

COMPANY(CompanyID, Name, IndustryCode, Gross Sales)

OFFICER (OfficerName, OfficerTitle, *CompanyID*)

1. One table:

COMPANY(CompanyID, Name, IndustryCode, Gross Sales)

1. One or Two tables:

COMPUTER (SerialNumber, Make, Model, DiskType, DiskCapacity)

***or***

COMPUTER (SerialNumber, *Make*, *Model*)

MAKE-MODEL (Make, Model, DiskType, DiskCapacity)

1. Four tables:

PERSON (PersonID, Name, DateOfHire, *DeptName*)

DEPARTMENT (DeptName, DeptManager)

PROJECT (ProjectID, ProjectManager)

ASSIGNMENT (*ProjectID*, *PersonID*, NumHours)

* ANSWERS TO SAN JUAN SAILBOAT CHARTERS CASE QUESTIONS

San Juan Sailboat Charters (SJSBC) is an agency that leases (charters) sailboats. SJSBC does not own the boats. Instead, SJSBC leases boats on behalf of boat owners who want to earn income from their boats when they are not using the boats themselves, and SJSBC charges the owners a fee for this service. SJSBC specializes in boats that can be used for multiday or weekly charters. The smallest sailboat available is 28 feet in length, and the largest is 51 feet in length.

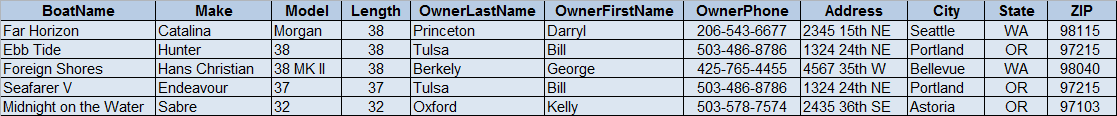
Each sailboat is fully equipped at the time it is leased. Most of the equipment is provided at the time of the charter. The majority of the equipment is provided by the owners, but some is provided by SJSBC. Some of the owner-provided equipment is attached to the boat, such as radios, compasses, depth indicators and other instrumentation, stoves, and refrigerators. Other owner-provided equipment is not physically attached to the boat, such as sails, lines, anchors, dinghies, life preservers, and equipment in the cabin (dishes, silverware, cooking utensils, bedding, and so on). SJSBC provides consumable supplies such as charts, navigation books, tide and current tables, soap, dish towels, toilet paper, and similar items. The consumable supplies are treated as equipment by SJSBC for tracking and accounting purposes.

Keeping track of equipment is an important part of SJSBC’s responsibilities. Much of the equipment is expensive, and those items not physically attached to the boat can be easily damaged, lost or stolen. SJSBC holds the customers responsible for all of the boat’s equipment during the period of their charter.

SJSBC likes to keep accurate records of its customers and charters, and customers are required to keep a log during each charter. Some itineraries and weather conditions are more dangerous than others, and the data from these logs provides information about the customer experience. This information is useful for marketing purposes, as well as for evaluating a customer’s ability to handle a particular boat and itinerary.

Sailboats need maintenance (two definitions of **boat** are: (1) “break out another thousand” and (2) “a hole in the water into which one pours money”). SJSBC is required by its contracts with the boat owners to keep accurate records of all maintenance activities and costs.

1. Create a sample list of owners and boats. Your list will be similar in structure to that in Figure 1-30, but it will concern owners and boats rather than owners and pets. Your list should include, at the minimum, owner name, phone, and billing address, as well as boat name, make, model, and length.



1. Describe modification problems that are likely to occur if SJSBC attempts to maintain the list in a spreadsheet.

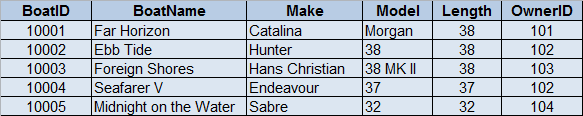
Note that owners may own more than one boat. For example, Bill Tulsa owns both Ebb Tide and Seafarer V. If the owner’s phone number changes, this will require changing multiple rows. If the change is made incorrectly, one row can disagree with another. Phone numbers could be entered inconsistently. There is no place to record the owner data if you have no boat owned by him or her.

1. Split the list into tables such that each has only one theme. Create appropriate ID columns. Use a linking column to represent the relationship between a boat and an owner. Demonstrate that the modification problems you identified in part B have been eliminated.

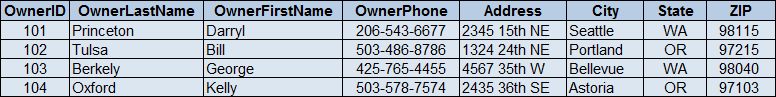
BOAT (BoatID, BoatName, Make, Model, Length, *OwnerID*)

OWNER (OwnerID, OwnerLastName, OwnerFirstName, OwnerPhone, Address, City, State, ZIP)

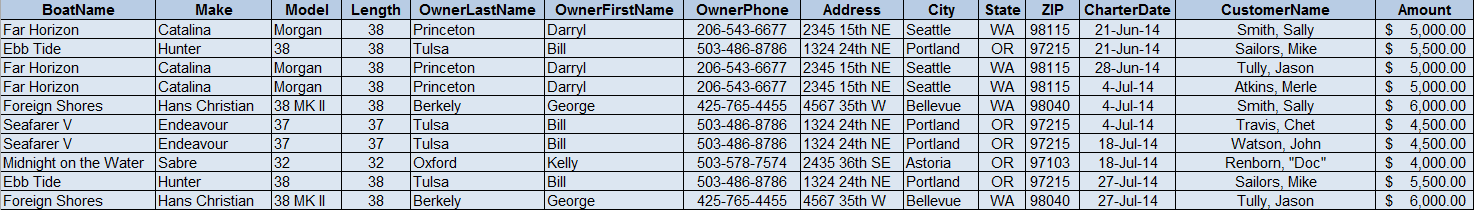
**BOAT:**



**OWNER:**



1. Create a sample list of owners, boats, and charters. Your list will be similar to that in Figure 1-31. Your list should include the data items from part A as well as the charter date, charter customer and the amount charged for each charter.



1. Illustrate modification problems that are likely to occur if SJSBC attempts to maintain the list from part D in a spreadsheet.

Same as the answer for part B, except it is even worse because it can involve charter items as well.

1. Split the list from part D into tables such that each has only one theme. Create appropriate ID columns. Use linking columns to represent relationships. Demonstrate that the modification problems you identified in part E have been eliminated.

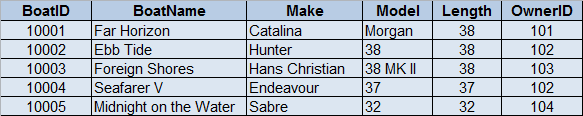
BOAT (BoatID, BoatName, Make, Model, Length, *OwnerID*)

OWNER (OwnerID, OwnerLastName, OwnerFirstName, OwnerPhone, Address, City, State, ZIP)

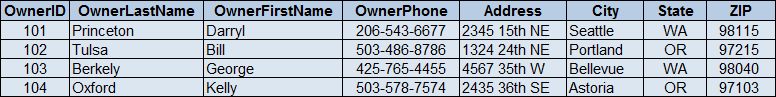
CUSTOMER (CustomerID, CustomerName)

CHARTER (CharterID, CharterDate, *BoatID, CustomerID*, Amount)

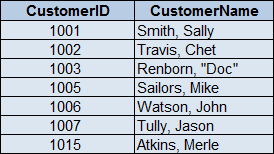
**BOAT:**



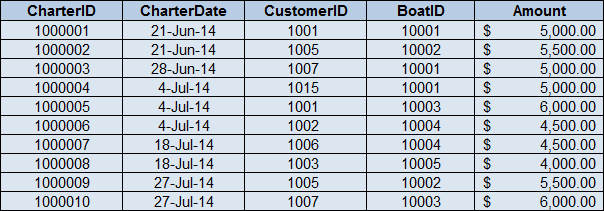
**OWNER:**



**CUSTOMER:**



**CHARTER:**



* ANSWERS TO GARDEN GLORY PROJECT QUESTIONS

Garden Glory is a partnership that provides gardening and yard maintenance services to individuals and organizations. Garden Glory is owned by two partners. They employ two office administrators and a number of full- and part-time gardeners. Garden Glory will provide one-time garden services, but it specializes in ongoing service and maintenance. Many of its customers have multiple buildings, apartments, and rental houses that require gardening and lawn maintenance services.

1. Create a sample list of owners and properties. Your list will be similar in structure to that in Figure 1-30, but it will concern owners and properties rather than owners and pets. Your list should include, at the minimum, owner name, phone, and billing address, as well as property name, type, and address.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **PropertyName** | **PropertyType** | **Address** | **OwnerName** | **OwnerPhone** | **BillingAddress** |
| **Jones Home** | **Residence** | **Elm St** | **E.J. Jones** | **223-1111** | **2nd Street** |
| **Eastlake Office** | **Office** | **Elm St** | **E.J. Jones** | **223-1111** | **2nd Street** |
| **Samish** | **Park** | **East Park** | **City** | **222-0030** | **City Hall** |
| **Westview** | **Park** | **West Park** | **City** | **222-0030** | **City Hall** |

See Figure 2-29 for additional data for some of the columns.

1. Describe modification problems that are likely to occur if Garden Glory attempts to maintain the list in a spreadsheet.

If the owner’s phone number changes, this will require changing multiple rows. If the change is made incorrectly one row can disagree with another. Phone numbers could be entered inconsistently (see phone for E.J. Jones, above). There is no place to record the owner if you have no property for him or her

1. Split the list into tables such that each has only one theme. Create appropriate ID columns. Use a linking column to represent the relationship between a property and an owner. Demonstrate that the modification problems you identified in part B have been eliminated.

**PROPERTY:**

|  |  |  |  |
| --- | --- | --- | --- |
| **PropertyName** | **PropertyType** | **Address** | **OwnerID** |
| **Jones Home** | **Residence** | **Elm St** | **100** |
| **Eastlake Office** | **Office** | **Elm St** | **100** |
| **Samish** | **Park** | **East Park** | **200** |
| **Westview** | **Park** | **West Park** | **200** |

**OWNER:**

|  |  |  |  |
| --- | --- | --- | --- |
| **OwnerID** | **OwnerName** | **OwnerPhone** | **BillingAddress** |
| **100** | **E.J. Jones** | **223-1111** | **2nd Street** |
| **200** | **City** | **222-0030** | **City Hall** |

1. Create a sample list of owners, properties, and services. Your list will be similar to that in Figure 1-31. Your list should include the data items from part A as well as the date, description, and amount charged for each service.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PropertyName** | **Type** | **Address** | **OwnerName** | **OwnerPhone** | **BillingAddress** | **Date** | **Desc** | **Charge** |
| **Jones Home** | **Residence** | **Elm St** | **E.J. Jones** | **223-1111** | **2nd Street** | **2/2/14** | **…** | **125.00** |
| **Eastlake Office** | **Office** | **Elm St** | **E.J. Jones** | **223-1111** | **2nd Street** | **2/7/14** | **…** | **78.44** |
| **Samish** | **Park** | **East Park** | **City** | **222-0030** | **City Hall** | **2/2/14** | **…** | **99.50** |
| **Westview** | **Park** | **West Park** | **City** | **222-0030** | **City Hall** | **3/7/14** | **…** | **224.99** |
| **Eastlake Office** | **Office** | **Elm St** | **E.J. Jones** | **223-1111** | **2nd Street** | **2/14/14** | **…** | **78.44** |
| **Eastlake Office** | **Office** | **Elm St** | **E.J. Jones** | **223-1111** | **2nd Street** | **2/22/14** | **…** | **100.00** |
| **Westview** | **Park** | **West Park** | **City** | **222-0030** | **City Hall** | **3/14/14** | **…** | **224.99** |

(Note: Description [Desc] data is omitted from above because there is no room to enter it. Assume some legitimate description has been entered.)

1. Illustrate modification problems that are likely to occur if Garden Glory attempts to maintain the list from part D in a spreadsheet.

Same as the answer for B, except it is even worse because it can involve service items as well.

1. Split the list from part D into tables such that each has only one theme. Create appropriate ID columns. Use linking columns to represent relationships. Demonstrate that the modification problems you identified in part E have been eliminated.

**OWNED\_PROPERTY (PropertyID, PropertyName, PropertyType, Address, *OwnerID*)**

**OWNER (OwnerID, OwnerName, OwnerPhone, BillingAddress)**

**PROPERTY\_SERVICE (ServiceID, Date, Description, Charge, *OwnerID*, *PropertyID*)**

* ANSWERS TO JAMES RIVER JEWELRY PROJECT QUESTIONS

**[**NOTE: The James River Jewelry Project Questions are available online in Appendix D, which can be downloaded from the textbook’s Web site: [www.pearsonhighered.com/kroenke](http://www.pearsonhighered.com/kroenke). The solutions for these questions will be included in the Instructor’s Manual for each chapter]

James River Jewelry is a small jewelry shop. While James River Jewelry does sell typical jewelry purchased form jewelry vendors, including such items as rings, necklaces, earrings, and watches, it specializes in hard-to-find Asian jewelry. Although some Asian jewelry is manufactured jewelry purchased from vendors in the same manner as the standard jewelry is obtained, many of the Asian jewelry pieces are often unique single items purchased directly from the artisan who created the piece (the term “manufactured” would be an inappropriate description of these pieces). It has a small but loyal clientele, and it wants to further increase customer loyalty by creating a frequent buyer program. In this program, after every 10 purchases, a customer will receive a credit equal to 50 percent of the sum of his or her 10 most recent purchases. This credit must be applied to the next (or “11th”) purchase.

1. Create a sample list of customers and purchases and a second list of customers and credits. Your lists should include customer data you think would be important to James River along with typical purchase data. Credit data should include the date of the credit, the total amount of the 10 purchases used as the basis of the credit, and the credit amount.

The best way for students to answer this is to create two spreadsheets with columns like the following:

**CustomerPurchase Spreadsheet:**

**(CustomerLastName, CustomerFirstName, Phone, Email, Street, City, State, Zip, PurchaseDate, InvoiceNumber, SubTotal)**

Note: Use SubTotal because tax is not part of credit, but that is beyond the scope of this exercise.

**CustomerCredit Spreadsheet:**

**(CustomerLastName, CustomerFirstName, Phone, Email, Street, City, State, Zip, CreditDate, TenPurchaseAmount, CreditAmount)**

1. Describe modification problems that are likely to occur if James River attempts to maintain the lists in a spreadsheet.

Lots of duplicated data—not just within a spreadsheet, but across the spreadsheets as well. Think of what happens when a customer changes email, for example. Other problems as described for Garden Glory, part B as well.

1. Split the lists into tables such that each has only a single theme. Create appropriate ID columns. Use one ID to represent the relationship between a purchase and a customer and use another ID to represent the relationship between a credit and a customer.

CUSTOMER (CustomerID, CustomerLastName, CustomerFirstName, Phone, Email, Street, City, State, Zip)

PURCHASE (InvoiceNumber, PurchaseDate, SubTotal, *CustomerID*)

CREDIT (CreditID, CreditDate, TenPurchaseAmount, CreditAmount, *CustomerID*)

1. Attempt to combine the two lists you created in part A into a single list. What problems occur as you try to do this? Look closely at Figure 1-31. An essential difference exists between a list of the three themes customer, purchase, and credit and a list of the three themes PetName, Owner, and Service in Figure 1-31. What do you think this difference is?

**CustomerPurchaseAndCredit Spreadsheet:**

**(CustomerLastName, CustomerFirstName, Phone, Email, Street, City, State, Zip, PurchaseDate, InvoiceNumber, SubTotal, CreditDate, TenPurchaseAmount, CreditAmount)**

This becomes a real mess!

Each line of credit corresponds to a group of ten purchase lines. You could append a credit line to each of the ten purchase lines that were used to compute the credit, but that seems misleading. In the Pet database, the PetName, Owner, Service combination says that a certain pet, owned by a certain owner, received a certain service.

In the James River Jewelry database, the Customer, Purchase, Credit combination seems to imply that the customer made a purchase and received the indicated credit, which is not true. The fundamental problem is that a credit relates to a group of purchase lines and there is no clear way to represent this. This is the difference between this data and the data in Figure 1-31. In Figure 1-31, there are three separate themes. Here we are looking at three parts of the same theme.

1. Change the tables from part C so that the purchase list has not only the ID of Customer but also the ID of Credit. Compare this arrangement to the tables in your answer to question 1.12. What is the essential difference between these two designs?

Assign each PURCHASE to a particular CREDIT by placing CreditID into PURCHASE. You would need to write application logic to ensure that no CREDIT has more than 10 invoices. Also Note: CreditAmount must be zero until there are 10 invoices.

CUSTOMER (CustomerID, CustomerLastName, CustomerFirstName, Phone, Email, Street, City, State, Zip)

PURCHASE (InvoiceNumber, PurchaseDate, SubTotal, *CustomerID*, *CreditID*)

CREDIT (CreditID, CreditDate, TenPurchaseAmount, CreditAmount)

For the pet application, an owner has potentially many pets, and a pet has potentially many services (a hierarchy, but that term is not used in the book).

For the jewelry store, a customer has potentially many purchases, and a customer has potentially many credits. A credit has from zero to 10 purchases and some business rules (a network, but that term is not used in the book).

The difference between this design and the design in Review Question 1-12 is that here we have one table, PURCHASE, with two foreign keys, while in the RQ 1-12 design, each table had at most one foreign key. In the RQ 1-12 design, the tables formed a chain, connected by the foreign keys. Here, all tables are related to PURCHASE.

* ANSWERS TO THE QUEEN ANNE CURIOSITY SHOP PROJECT QUESTIONS

The Queen Anne Curiosity Shop sells both antiques and current-production household items that complement or are useful with the antiques. For example, the store sells antique dining room tables and new tablecloths. The antiques are purchased from both individuals and wholesalers, and the new items are purchased from distributors. The store’s customers include individuals, owners of bed-and-breakfast operations, and local interior designers who work with both individuals and small businesses. The antiques are unique, although some multiple items, such as dining room chairs, may be available as a set (sets are never broken). The new items are not unique, and an item may be reordered if it is out of stock. New items are also available in various sizes and colors (for example, a particular style of tablecloth may be available in several sizes and in a variety of colors).

1. Create a sample list of purchased inventory items and vendors, and a second list of customers and sales. Your first list should include inventory data such as a description, manufacturer and model (if available), item cost, and vendor identification and contact data you think should be recorded. The second list should include customer data you think would be important to The Queen Anne Curiosity Shop, along with typical sales data.

The best way for students to answer this is to create two spreadsheets with columns as follows:

**PurchasedInventory Spreadsheet:**

**(ItemID, ItemDescription, Manufacturer, Model, ItemCost, VendorName, VendorPhone,**

**VendorEmail)**

**CustomerSales Spreadsheet:**

**(CustomerLastName, CustomerFirstName, Street, City, State, Zip, CustomerPhone, CustomerEmail, SaleDate, ItemID, RetailPrice, Tax, TotalSaleAmount)**

See Figures 2-33 and 2-34 for data for some of the columns in the spreadsheets. Other reasonable data needs to be created by the students.

1. Describe problems that are likely to occur when inserting, updating, and deleting data in these spreadsheets.

When inserting, updating, and deleting data, there will be a lot of duplicated data, so there will be a lot of opportunities for inconsistent data. Consider what happens when either a customer or vendor changes email, for example. Insert problems exist when we try to add a new vendor if no item has been purchased from the vendor. Deleting an inventory item can cause delete problems because we may lose vendor data as well.

There will be similar problems for the CustomerSales spreadsheet, plus there may be problems between spreadsheets if an item is deleted. The ItemID will be deleted, but what will we do with the sale data?

1. Attempt to combine the two lists you created in part A into a single list. What problems occur as you try to do this?

This will be a real mess! The first spreadsheet is supposed to hold inventory data, not sales data! Yet now each row of inventory data must be linked to a customer and a sale. This simply doesn’t make any sense!

**PurchasedInventory CustomerSales Spreadsheet:**

**(ItemID, ItemDescription, Manufacturer, Model, ItemCost, VendorName, VendorPhone,**

**VendorEmail, CustomerLastName, CustomerFirstName, Street, City, State, Zip, CustomerPhone, CustomerEmail, SaleDate, RetailPrice, Tax, TotalSaleAmount)**

Now, we will really have modification problems!

1. Split the spreadsheets you created in part A into tables such that each has only one theme. Create appropriate ID columns.

**ITEM (ItemID, ItemDescription, Manufacturer, Model, ItemCost, *VendorID*)**

**VENDOR (VendorID, VendorName, VendorPhone, VendorEmail)**

**CUSTOMER (CustomerID, CustomerLastName, CustomerFirstName, Street, City, State, Zip, CustomerPhone, CustomerEmail**

**SALE(SaleID, SaleDate, *CustomerID*, *ItemID*, RetailPrice, Tax, TotalSaleAmount)**

1. Explain how the tables in your answer to part D will eliminate the problems you identified in part B.

As each table deals with one theme, the modification problems are eliminated.

For example, changes to either a customer or vendor email address will be unique and without insert problems of possible data inconsistencies. Deleting an inventory item will no longer cause delete problems with Vendor or Sale (as long as the item has not been sold).

1. What is the relationship between the tables you created from the first spreadsheet and the tables you created from the second spreadsheet? If your set of tables does not already contain this relationship, how will you add it into your set of tables?

The tables created from the first spreadsheet deal with items in inventory and the vendors from which those items were obtained. VendorID is the linking field.

The tables created from the second spreadsheet deal with sales or items and the customers who bought the items. This relationship is reflected by the inclusion of ItemID in the SALE table, which is the link between the item in inventory and its sale to a customer.