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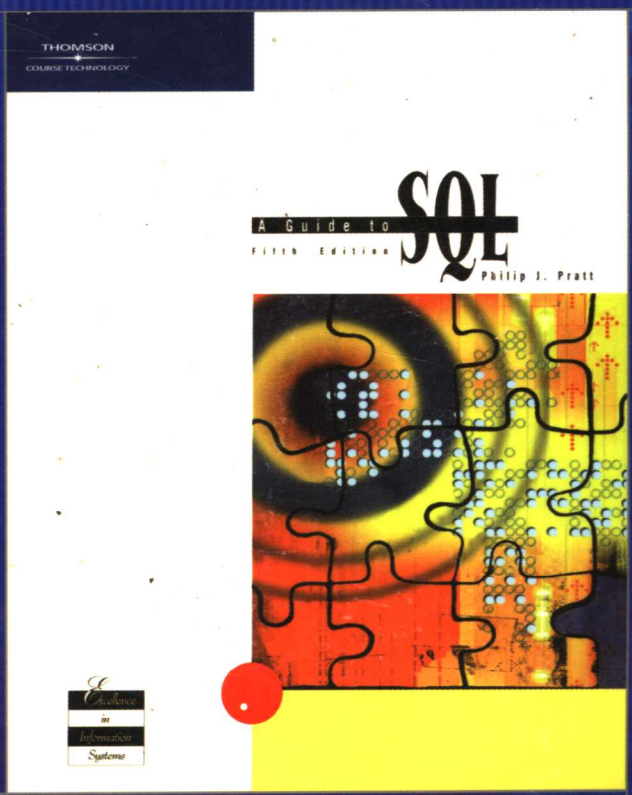
A Guide to SQL

5th Edition

Philip J. Pratt



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Philip J. Pratt

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PREFACE

SQL (Structured Query Language) is a popular computer language that is used by diverse groups such as home computer owners, owners of small businesses, end users in large organizations, and programmers. Although this book uses the SQL implementation in Oracle8 as a vehicle for teaching SQL, the chapter material, examples, and exercises in this book are designed to be completed using any SQL implementation.

A Guide to SQL, Fifth Edition is written for a wide range of teaching levels, including students taking introductory computer science classes to those students in advanced information systems classes. This textbook can be used for a stand-alone course on SQL or in conjunction with a database concepts textbook where students are required to learn SQL.

The chapters in this textbook should be covered in order. Students should complete the end-of-chapter exercises and the examples within the chapters for maximum learning. Because the content of Chapter 8 assumes that the reader has had instruction in or experience with at least one programming language, the instructor should determine whether students will understand the concepts. Students without a programming background will have difficulty understanding the topic of embedded SQL. Instructors can easily omit Chapter 8 from the textbook in situations where students are not comfortable with programming examples.

Distinguishing Features

Use of Examples

Each chapter contains multiple examples that use SQL to solve a problem. Following each example, students will read about the commands that are used to solve the stated problem, and then they will see the SQL commands used to arrive at the solution. For most students, learning though examples is the most effective way to master material. For this reason, instructors should encourage students to read the chapters at the computer and to input the commands shown in the figures.

Case Studies

One case study, using the Premiere Products database, is presented in all of the examples within the chapters, and also in the first set of exercises at the end of each chapter. Although the database is small in order to be manageable, the examples and exercises for the Premiere Products database simulate what a real business can accomplish using SQL commands. Using the same case study as examples within the chapter and in the end-of-chapter exercises ensures a high level of continuity to reinforce learning.

A different case study—the Henry Books database—is used in a second set of exercises at the end of each chapter. The second case study gives students a chance to venture out "on their own" without the direct guidance of examples from the text.

Question and Answer Sections

A special type of exercise, called a Q&A, is used within each chapter. These exercises force students to consider special issues and understand important questions before continuing with their study. The answer to each Q&A appears after the question. Students are encouraged to formulate their own answer before reading the answer provided in the textbook to ensure that they understand new material before proceeding.

Exercises

Each chapter concludes with two sets of exercises in which students use SQL commands to solve realistic problems using the Premiere Products and Henry Books databases. Unless indicated otherwise in the exercise, students should complete the exercises at the computer using SQL commands.

Reference Appendices

Two reference appendices are included at the end of this textbook. Appendix A is a SQL reference that describes the purpose and syntax for the major SQL commands. Students can use Appendix A to quickly identify how and when to use important commands. Appendix B includes a "How do I" reference, which lets students cross-reference the appropriate resource in Appendix A by searching for the answer to a question.

Answers to Odd-Numbered Exercises

Appendix C includes answers to the odd-numbered exercises in the book so students have a way of checking their progress while completing the end-of-chapter exercises.

Instructor Support

The Instructor's Manual to accompany *A Guide to SQL, Fifth Edition* contains detailed teaching information, answers to even-numbered end-of-chapter exercises, and test questions (and answers). Transparency masters are included for most of the figures in the text.

ORGANIZATION OF THE TEXTBOOK

Chapter 1: Introduction to Database Management

Chapter 1 introduces the concept of databases and database management systems using the Premiere Products and Henry Books databases as examples. Many Q&A exercises are provided in the chapter to ensure that students understand how to manipulate the database on paper before they begin working at the computer.

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Chapter 2: An Introduction to SQL

In Chapter 2, students will learn about important concepts and terminology associated with relational databases. They will create and run SQL commands to create tables, use data types, and add rows to tables. Chapter 2 also discusses the role and use of nulls.

Chapter 3: Single-Table Queries

Chapter 3 is the first of two chapters on using SQL commands to query a database. The queries in Chapter 3 all involve single tables. Included in this chapter are discussions of simple and compound conditions; computed columns; the SQL BETWEEN, LIKE, and IN operators; using SQL functions; nesting queries; grouping data; and retrieving columns with null values.

Chapter 4: Multiple-Table Queries

Chapter 4 completes the discussion of querying a database by demonstrating queries that join more than one table. Included in this chapter are discussions of the SQL IN and EXISTS operators, nested subqueries, using aliases, joining a table to itself, SQL set operations, and the use of the ALL and ANY operators.

Chapter 5: Updating Data

In Chapter 5, students learn how to use the SQL COMMIT, ROLLBACK, UPDATE, INSERT, and DELETE commands to update table data. Students also learn how to create a new table from an existing table and how to change the structure of a table.

Chapter 6: Database Administration

Chapter 6 covers the database administration features of SQL, including the use of views; granting and revoking database privileges to users; creating, dropping, and using an index; using and obtaining information from the system catalog; and using integrity constraints to control data entry.

Chapter 7: Reports

Chapter 7 teaches students how to create basic and complex reports based on data in a table or view. Students will learn how to concatenate data, create a view for a report, change report column headings and formats, and add report titles. Students also will include totals and subtotals in a report and group data. The topics of scripts and spooling also are discussed.

Chapter 8: Embedded SQL

Chapter 8 is an optional chapter for those students who have completed at least one programming course. This chapter covers embedding SQL commands into a procedural language such as COBOL. Although COBOL is used as a vehicle to illustrate the concepts in this chapter, the material applies equally well to any language that supports embedding.

Included in this chapter are discussions of the use of embedded SQL to insert new rows and change and delete existing rows. Also included is a discussion of how to retrieve single rows using embedded SQL commands and how to use cursors to retrieve multiple rows.

Appendix A: SQL Reference

Appendix A includes a command reference for the major SQL clauses and operators. Students can use Appendix A as a quick resource when constructing commands. Each command includes a short description, a table that shows the required and options clauses and operators, and an example and its results.

Appendix B: "How do I" Reference

Appendix B provides students with an opportunity to ask a question, such as "How do I delete rows?," and to identify the appropriate section in Appendix A to use to find the answer. Appendix B is extremely valuable when students know what they want to accomplish, but can't remember the exact SQL command they need.

Appendix C: Answers to Odd-Numbered Exercises

Answers to the odd-numbered exercises in all chapters appear in this appendix so students can make sure that they are completing the exercises correctly.

General Notes To The Student

Embedded Questions

Each chapter contains special questions to help you learn important concepts. Sometimes the purpose of these questions is to ensure that you understand some crucial material before you proceed. In other cases, the questions are designed to give you the chance to consider some special concept in advance of its actual presentation. In all cases, the answer to each question appears immediately after the question. You can simply read the question and its answer, however, you will receive maximum benefit from the text if you take the time to determine the answer to the question and then check your answer against the one given in the text before you proceed with your reading.

End-of-Chapter Material

The end-of-chapter material consists of a summary and exercises. The summary briefly describes the material covered in the chapter. Scan the summary and make sure all the concepts are familiar to you. Following the summary are two sets of exercises. The first set uses the same Premiere Products database that is used in the examples in the chapter. First work the exercises in this set to make sure that you understand how to use the commands presented in the chapter. Then complete the second set of exercises, using the Henry

Books database, and apply what you learned in the chapter to a database that is not as familiar to you. (The answers to the odd-numbered exercises in both sets of exercises appear in Appendix C so you can check your work.)

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CHAPTER 1

Introduction to Database Management

OBJECTIVES

- Understand the Premiere Products database, a database for a distributor of appliances, housewares, and sporting goods called Premiere Products.
- Understand the Henry Books database, a database for a chain of bookstores called Henry Books.

The Premiere Products Database

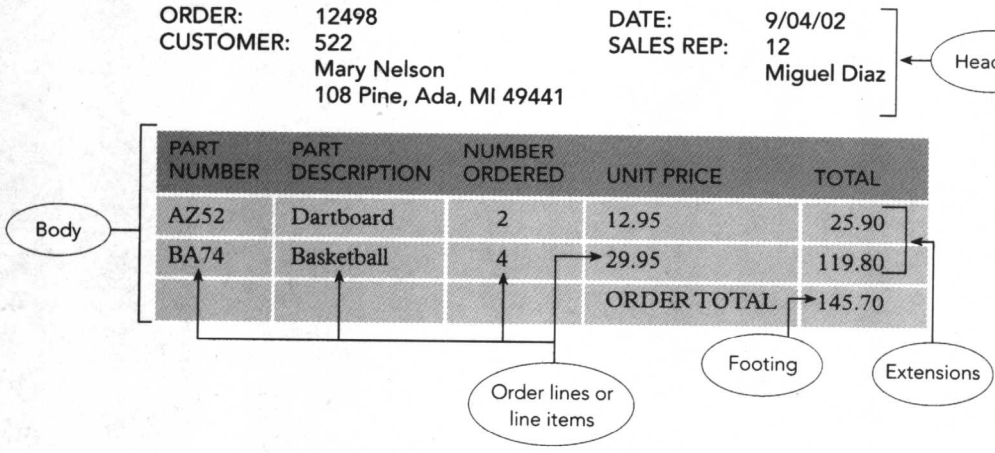
The management of Premiere Products, a distributor of appliances, housewares, and sporting goods, has determined that the company's recent growth means that it is no longer feasible to maintain customer, order, and inventory data using its manual systems. By placing the data on a computer with a full-featured database management system, management will be able to ensure that the data is current and more accurate than in the present manual system. Management also will be able to produce a variety of useful reports. In addition, management wants to be able to ask questions concerning the data in the database and obtain answers to these questions easily and quickly.

In deciding what data must be stored in the database, management has determined that Premiere Products must maintain the following information about its sales representatives (sales reps), customers, and parts inventory:

1. The number, last name, first name, address, total commission, and commission rate for each sales rep
2. The customer number, last name, first name, address, current balance, and credit limit for each customer, as well as the number of the sales rep who represents the customer
3. The part number, part description, number of units on hand, item class, number of the warehouse where the item is stored, and unit price for each part in inventory

Premiere Products also must store information about orders. Figure 1.1 shows a sample order.

FIGURE 1.1 Sample order



There are three components to the sample order:

1. The **heading** (top) of the order contains the order number; order date; the customer's number, name, and address; and the sales rep number and name.
2. The body of the order contains a number of **order lines**, sometimes called **line items**. Each order line contains a part number, a part description, the number of units of the ordered part, and the quoted price for the part. The order line also contains a total, usually called an **extension**, which is the product of the number ordered and the quoted price.
3. Finally, the **footing** (bottom) of the order contains the order total.

Premiere Products must also store the following items for each customer's order:

1. For each order: the order number, date the order was placed, and number of the customer who placed the order. The customer's name and address and the number of the sales rep who represents the customer are stored with the customer information. The name of the sales rep is stored with the sales rep information.
2. For each order line: the order number, part number, number of units ordered, and quoted price. Remember that the part description is stored with the information about parts. The product of the number of units ordered and the quoted price is not stored because it can be computed easily when needed.
3. The overall order total is not stored as part of the database. Instead, the total will be computed whenever an order is printed or displayed on the screen.

Figure 1.2 shows sample data for Premiere Products.

FIGURE 1.2 Sample data for Premiere Products

SALES_REP

SLSREP_NUMBER	LAST	FIRST	STREET	CITY	STATE	ZIP_CODE	TOTAL_COMMISSION	COMMISSION_RATE
03	Jones	Mary	123 Main	Grant	MI	49219	$2150.00	.05
06	Smith	William	102 Raymond	Ada	MI	49441	$4912.50	.07
12	Diaz	Miguel	419 Harper	Lansing	MI	49224	$2150.00	.05

FIGURE 1.2 Sample data for Premiere Products (continued)

CUSTOMER

CUSTOMER_ NUMBER	LAST	FIRST	STREET	CITY	STATE	ZIP_CODE	BALANCE	CREDIT_ LIMIT	SLSREP_ NUMBER
124	Adams	Sally	481 Oak	Lansing	MI	49224	$818.75	$1000	03
256	Samuels	Ann	215 Pete	Grant	MI	49219	$21.50	$1500	06
311	Charles	Don	48 College	Ira	MI	49034	$825.75	$1000	12
315	Daniels	Tom	914 Cherry	Kent	MI	48391	$770.75	$750	06
405	Williams	Al	519 Watson	Grant	MI	49219	$402.75	$1500	12
412	Adams	Sally	16 Elm	Lansing	MI	49224	$1817.50	$2000	03
522	Nelson	Mary	108 Pine	Ada	MI	49441	$98.75	$1500	12
567	Dinh	Tran	808 Ridge	Harper	MI	48421	$402.40	$750	06
587	Galvez	Mara	512 Pine	Ada	MI	49441	$114.60	$1000	06
622	Martin	Dan	419 Chip	Grant	MI	49219	$1045.75	$1000	03

ORDERS

ORDER_ NUMBER	ORDER_ DATE	CUSTOMER_ NUMBER
12489	9/02/02	124
12491	9/02/02	311
12494	9/04/02	315
12495	9/04/02	256
12498	9/05/02	522
12500	9/05/02	124
12504	9/05/02	522

ORDER_LINE

ORDER_ NUMBER	PART_ NUMBER	NUMBER_ ORDERED	QUOTED_ PRICE
12489	AX12	11	$21.95
12491	BT04	1	$149.99
12491	BZ66	1	$399.99
12494	CB03	4	$279.99
12495	CX11	2	$22.95
12498	AZ52	2	$12.95
12498	BA74	4	$24.95
12500	BT04	1	$149.99
12504	CZ81	2	$325.99

PART

PART_ NUMBER	PART_ DESCRIPTION	UNITS_ ON_HAND	ITEM_ CLASS	WAREHOUSE_ NUMBER	UNIT_ PRICE
AX12	Iron	104	HW	3	$24.95
AZ52	Dartboard	20	SG	2	$12.95
BA74	Basketball	40	SG	1	$29.95
BH22	Cornpopper	95	HW	3	$24.95
BT04	Gas Grill	11	AP	2	$149.99
BZ66	Washer	52	AP	3	$399.99
CA14	Griddle	78	HW	3	$39.99
CB03	Bike	44	SG	1	$299.99
CX11	Blender	112	HW	3	$22.95
CZ81	Treadmill	68	SG	2	$349.95

There are three sales representatives, who are identified by the numbers 03, 06, and 12. The name of sales rep number 03 is Mary Jones. Her street address is 123 Main. She lives in Grant, MI, and her zip code is 49219. Her total commission is $2,150.00, and her commission rate is 5% (.05).

Premiere Products has 10 customers who are identified with the numbers 124, 256, 311, 315, 405, 412, 522, 567, 587, and 622. The name of customer number 124 is Sally Adams. Her street address is 481 Oak. She lives in Lansing, MI, and her zip code is 49224. Her current balance is $818.75, and her credit limit is $1,000. The number 03 in the SLSREP_NUMBER column indicates that sales rep number 03 (Mary Jones) represents Sally.

Skipping down to the table named PART, there are 10 parts, which are identified by the part numbers AX12, AZ52, BA74, BH22, BT04, BZ66, CA14, CB03, CX11, and CZ81. Part AX12 is an iron and there are 104 units of this part on hand. Irons are in item class HW (housewares) and are stored in warehouse number 3. The price of an iron is $24.95. Other item classes are AP (appliances) and SG (sporting goods).

Moving back up to the table named ORDERS, there are seven orders, which are identified with the numbers 12489, 12491, 12494, 12495, 12498, 12500, and 12504. Order number 12489 was placed on September 2, 2002, by customer 124 (Sally Adams).

The table labeled ORDER_LINE might seem strange at first glance. Why do you need a separate table for the order lines? Could they be included in the ORDERS table? The answer is yes. The table labeled ORDERS could be structured as shown in Figure 1.3. Notice that this table contains the same orders as shown in Figure 1.2, with the same dates and customer numbers. In addition, each table row in Figure 1.3 contains all the order lines for a given order. Examining the fifth row, for example, you see that order 12498 has two order lines. One of these order lines is for two AZ52 parts at $12.95 each, and the other order line is for four BA74 parts at $24.95 each.

FIGURE 1.3
Sample table structure

ORDERS

ORDER_ NUMBER	ORDER_ DATE	CUSTOMER_ NUMBER	PART_ NUMBER	NUMBER_ ORDERED	QUOTED_ PRICE
12489	9/02/02	124	AX12	11	$21.95
12491	9/02/02	311	BT04 BZ66	1 1	$149.99 $399.99
12494	9/04/02	315	CB03	4	$279.99
12495	9/04/02	256	CX11	2	$22.95
12498	9/05/02	522	AZ52 BA74	2 4	$12.95 $24.95
12500	9/05/02	124	BT04	1	$149.99
12504	9/05/02	522	CZ81	2	$325.99

QUESTION How is the same information from Figure 1.3 represented in Figure 1.2?

ANSWER Examine the ORDER_LINE table shown in Figure 1.2 and note the sixth and seventh rows. The sixth row indicates there is an order line on order 12498 for two AZ52 parts at $12.95 each. The seventh row indicates there is an order line on order 12498 for four BA74 parts at $24.95 each. Thus, the same information that you find in Figure 1.3 is represented in Figure 1.2 in two separate rows rather than in one row.

It might seem more effective not to use two rows to represent the same information that can be represented in one row. There is a problem, however, with the arrangement shown in Figure 1.3—the table is more complicated. In Figure 1.2, there is a single entry at each location in the table. In Figure 1.3, some of the individual positions within the table contain multiple entries, thus making it difficult to track the information between columns. In the row for order number 12498, for example, it is crucial to know that the AZ52 corresponds to the 2 in the NUMBER_ORDERED column (not the 4), and that it corresponds to the $12.95 in the QUOTED_PRICE column (not the $24.95). In addition, having a more complex table means that there are practical issues to worry about, such as:

1. How much room do you allow for these multiple entries?
2. What if an order has more order lines than you have allowed room for?
3. Given a part, how do you determine which orders contain order lines for that part?

Certainly, none of these problems is unsolvable. These problems do add a level of complexity, however, that is not present in the arrangement shown in Figure 1.2. In the structure shown in Figure 1.2, there are no multiple entries to worry about, it doesn't matter how many order lines exist for any order, and finding all the orders that contain order lines for a given part is easy (just look for all order lines with the given part number in the PART_NUMBER column). In general, this simpler structure is preferable and that is why order lines appear in a separate table.

To test your understanding of the Premiere Products data, answer the following questions using the data shown in Figure 1.2.

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