Chapter 2

The Relational Model 1:
Introduction, QBE, and Relational Algebra

Solutions

Answers to Review Questions

Note: Answers to odd-numbered review questions are found in Appendix D of the textbook.

1. A relation is a two-dimensional table in which (1) the entries in the table are single-valued; (2) each column has a distinct name; (3) all of the values in a column are values of the same attribute; (4) the order of the columns is immaterial; (5) each row is distinct; and (6) the order of the rows is immaterial.

2. A relational database is a collection of relations.

3. An unnormalized relation is a structure that satisfies all the properties of a relation except the restriction that entries must be single-valued. It is not a relation.

4. In the relational model, an attribute is a property of an entity. Attribute is another term for a column in a table. It also is commonly called a field.

5. In the shorthand representation, each table is listed, and after each table, all the columns of the table are listed in parentheses. Primary keys are underlined. The shorthand representation for the Henry's Books database is as follows:

   ```
   Branch (BranchNum, BranchName, BranchLocation)
   Publisher (PublisherCode, PublisherName, City)
   Author (AuthorNum, AuthorLast, AuthorFirst)
   Book (BookCode, Title, PublisherCode, Type, Paperback)
   Wrote (BookCode, AuthorNum, SequenceNum)
   Copy (BookCode, BranchNum, CopyNum, Quality, Price)
   ```

6. To qualify a field name means to indicate the table to which it belongs by preceding the field name with the table name and a period. To qualify the Street field in the Customer table, you would enter Customer.Street.

7. The primary key is the column or collection of columns that uniquely identifies a given row. The primary key of the Branch table is BranchNum. The primary key of the Publisher table is PublisherCode. The primary key of the Author table is AuthorNum. The primary key of the Book table is BookCode. The primary key of the Wrote table is the concatenation (combination) of BookCode and AuthorNum. The primary key of the Copy table is the concatenation of BookCode, BranchNum, and CopyNum.

8. Include the field in the design grid and make sure the field's Show check box contains a check mark.

9. Enter the criteria in the Criteria row for the appropriate field name.

10. To combine criteria with AND, enter the conditions on the same Criteria row in the design grid. To combine criteria with OR, enter the conditions on different Criteria rows in the design grid.

11. Type the computation instead of a field name in the design grid. Alternatively, you can enter the computation in the Zoom dialog box.

12. To calculate functions, click the Totals button in the Show/Hide group on the Query Tools Design tab, and then add one of the following functions to the Total row for the column: Count, Sum, Avg (average), Max (largest value), Min (smallest value), StDev (standard deviation), Var (variance), First, and Last.

13.   Indicate the appropriate sort order (Ascending or Descending) in the Sort row of the design grid.

14.   When sorting on more than one field in an Access query, the sort key to the left in the design grid is the major key and the sort key to the right is the minor key. The data is sorted on the major key. Within those rows with the same value in the major key, the data is sorted by the minor key.

15.   Include the field lists from both tables in the query design. Provided the tables have matching fields, a join line will connect the tables. Include the desired fields from either table in the design grid.

16.   Use an update query when you want to make the same change to all rows satisfying some criteria.

17.   Use a delete query when you want to delete all rows satisfying some criteria.

18.   Use a make-table query to save the results of a query as a table.

19.   Relational algebra is a theoretical way of manipulating a relational database. Relational algebra includes operations that act on existing tables to produce new tables, similar to the way the operations of addition and subtraction act on numbers to produce new numbers in the mathematical algebra with which you are familiar.

20.   The SELECT command selects all rows satisfying some condition.

21.   The PROJECT command selects only the specified columns.

22.   The JOIN command combines tables on matching columns.

23.   The UNION command selects all rows that are in the first table, in the second table, or both.

24.   The two tables must be union compatible; that is, they must have the same number of columns and the columns must correspond.

25.   The INTERSECT command selects all rows that are in both tables.

26.   The SUBTRACT command selects all rows that are in the first table, but not in the second table.

27.   The PRODUCT command (mathematically called the Cartesian product) is the table obtained by concatenating every row in the first table with every row in the second table.

28.   When one table is divided by a second table, the DIVISION command produces a table containing all values in the first table that match all rows in the second table.

Answers to Premiere Products Exercises: QBE

The following answers indicate how to perform the specified task in Microsoft Access. The process for other database management systems would be different, although it should be similar. See the Instructor's Resource Kit on CD-ROM for a copy of the Premiere Products database that contains the solutions to these exercises. You also can access Instructor Resources via the Web at login.cengage.com.

1.   Add the Customer table to the Query Design window. Include the CustomerNum and CustomerName fields in the design grid. Do not include any criteria.

2.   Add the Part table to the Query Design window. Double-click the asterisk in the Part table field list to add all fields to the design grid. Do not enter any criteria.

3.   Add the Customer table to the Query Design window. Include the CustomerNum, CustomerName, and RepNum fields in the design grid. Enter 35 in the Criteria row for the RepNum column. Remove the check mark from the Show Check box in the RepNum column.

4.   Add the Customer table to the Query Design window. Place the CustomerNum, CustomerName, CreditLimit, and RepNum fields in the design grid. Enter 35 in Criteria row for the RepNum column and 10000 in the Criteria row for the CreditLimit column. Remove the check marks from the Show check boxes for the CreditLimit and RepNum columns.

5.   Add the Customer table to the Query Design window. Place the CustomerNum, CustomerName, CreditLimit, and RepNum fields in the design grid. Enter 35 in Criteria row for the RepNum column and 10000 in the Or row for the CreditLimit column. Remove the check marks from the Show check boxes for the CreditLimit and RepNum columns.

6.   Add the Customer table and the Orders table to the Query Design window.. Place the OrderNum, OrderDate, CustomerNum, and CustomerName columns in the design grid. Do not enter any criteria.

7.   Add the Customer table and the Rep table to the Query Design window.. Include the CustomerNum and CustomerName fields from the Customer table. Include the LastName and FirstName fields from the Rep table. Enter Perez in the Criteria row for the LastName column and Juan in the Criteria row for the FirstName column. Remove the check marks from the Show check boxes for the LastName and FirstName columns.

8.   Add the Customer table to the Query Design window. Place the CustomerNum and CreditLimit fields in the design grid. Include the Total row. Place the Count function in the Total row for the CustomerNum column. Select Where in the Total row for the CreditLimit column and enter 10000 in the Criteria row for the CreditLimit column.

9.   Add the Customer table to the Query Design window. Place the Balance and RepNum fields in the design grid. Include the Total row. In the Balance column, select the Sum function in the Total row. In the RepNum column, select Where in the Total row and enter 35 in the Criteria row.

10.   Add the Part table to the Query Design window. Place the PartNum, Description, and Class fields in the design grid. In the next column, enter the computation for the On-HandValue (OnHand * Price). Type HW in the Criteria row for the Class column, and remove the check mark from the Show check box in the Class column.

11.   Add the Part table to the Query Design window. Place all fields in the Part table in the design grid. Select Ascending in the Sort row for the Description column.

12.   Add the Part table to the Query Design window. Place all fields in the Part table in the design grid. Include the PartNum field a second time and remove the check mark from its Show check box. Select Ascending in the Sort row for the Class column. Select Ascending in the Sort row for the *second* PartNum column.

13.   Add the Part table to the Query Design window. Include the Total row. Place the Class and OnHand fields in the design grid. In the Class column, select the Group By function in the Total row. In the Total row for the OnHand column, select the Sum function.

14.   Add the Part table to the Query Design window. Place the PartNum, Description, Class, OnHand, Warehouse, and Price fields in the design grid. Enter SG in the Criteria row for the Class column and remove the check mark from the column's Show Check box. Change the query type to Make-Table query, and enter SportingGoods as the name of the table.

15.   Add the SportingGoods table to the Query Design window. Include the field list for the SportingGoods table in the query design and change the query type to Update query. Place the PartNum and Description fields in the design grid. Enter Fitness Gym in the Update To row for the Description column, and enter BV06 as the criterion for the PartNum column.

16.   Add the SportingGoods table to the Query Design window and change the query type to Delete query. Place the Price field in the design grid. Enter >1000 as the criterion for the Price column.

Answers to Premiere Products Exercises: Relational Algebra

1.
```
PROJECT Rep OVER (RepNum, LastName, FirstName) GIVING Answer
```

2.
```
SELECT Part WHERE PartNum = 'FD21' GIVING Answer
```

3.

```
JOIN Orders Customer WHERE Orders.CustomerNum = Customer.CustomerNum
     GIVING Temp1
PROJECT Temp1 OVER (OrderNum, OrderDate, CustomerNum, CustomerName)
     GIVING Answer
```
4.
```
JOIN Orders Customer WHERE Orders.CustomerNum = Customer.CustomerNum
     GIVING Temp1
JOIN Temp1 Rep WHERE Temp1.RepNum = Rep.RepNum GIVING Temp2
SELECT Temp2 WHERE Rep.LastName = 'Kaiser' GIVING Temp3
PROJECT Temp3 OVER (OrderNum, OrderDate, CustomerNum, CustomerName)
     GIVING Answer
```
5.
```
SELECT Orders WHERE OrderDate='10/20/2013' GIVING Temp1
PROJECT Temp1 OVER (OrderNum, OrderDate) GIVING Temp2
JOIN Orders Customer WHERE Orders.CustomerNum = Customer.CustomerNum
     GIVING Temp3
SELECT Temp3 WHERE RepNum = '20' GIVING Temp4
PROJECT Temp4 OVER (OrderNum, OrderDate) GIVING Temp5
UNION Temp2 WITH Temp5 GIVING Answer
```

6.
```
SELECT Orders WHERE OrderDate='10/20/2013' GIVING Temp1
PROJECT Temp1 OVER (OrderNum, OrderDate) GIVING Temp2
JOIN Orders Customer WHERE Orders.CustomerNum = Customer.CustomerNum
     GIVING Temp3
SELECT Temp3 WHERE RepNum = '20' GIVING Temp4
PROJECT Temp4 OVER (OrderNum, OrderDate) GIVING Temp5
INTERSECT Temp2 WITH Temp5 GIVING Answer
```

7.
```
SELECT Orders WHERE OrderDate='10/20/2013' GIVING Temp1
PROJECT Temp1 OVER (OrderNum, OrderDate) GIVING Temp2
JOIN Orders Customer WHERE Orders.CustomerNum = Customer.CustomerNum
     GIVING Temp3
SELECT Temp3 WHERE RepNum = '20' GIVING Temp4
PROJECT Temp4 OVER (OrderNum, OrderDate) GIVING Temp5
SUBTRACT Temp5 FROM Temp2 GIVING Answer
```

Answers to Henry Books Case

The following answers indicate how to perform the specified task in Microsoft Access. The process for other database management systems would be different, although it should be similar. See the Instructor's Resource Kit on CD-ROM for a copy of the Henry Books database that contains the solutions to these exercises. You also can access Instructor Resources via the Web at login.cengage.com.

1.   Add the Publisher table to the Query Design window. Include the PublisherName and City fields in the design grid. Remove the check mark from the Show check box in the City column. Type <>New York in the Criteria row for the City column.

2.   Add the Book table to the Query Design window. Include the Title and PublisherCode fields in the design grid. Type PE in the Criteria row for PublisherCode column. You also can join the Book and Publisher tables. Include the Title and PublisherName fields in the design grid and type Penguin USA in the Criteria row for the PublisherName column.

3.   Add the Book table to the Query Design window. Include the Title and Type fields in the design grid. Remove the check mark from the Show check box in the Type column. Type MYS in the Criteria row for the Type column.

4.   Add the Book table to the Query Design window. Include the Title, Type, and Paperback fields in the design grid. Remove the check mark from the Show check box in the Type column and the Paperback column. Type SFI in the Criteria row for the Type column. Type either True or Yes in the Criteria row for the Paperback column.

5.   Add the Book table to the Query Design window. Include the BookCode, Title, PublisherCode, and Type fields in the design grid. Remove the check mark from the Show check boxes in the PublisherCode and Type columns. Type PSY in the Criteria row for the Type column. Type JP in the Or row of the PublisherCode column.

6.   Add the Book table to the Query Design window. Include the Title, and Type fields in the design grid. Remove the check mark from the Show check box in the Type column. Type CMP in the Criteria row for the Type column. Type HIS in Or row for the Type column. Type SCI in the row below the Or row for the Type column.

7.   Add the Book table to the Query Design window. Include the Total row. Add the BookCode and PublisherCode fields to the design grid. Select the Count function in the Total row for the BookCode column. Select Where in the Total row for the PublisherCode column. Type ST in the Criteria row for the Publisher column. Type VB in the Or row for the PublisherCode column.

8.   Add the Book, Wrote, and Author tables to the Query Design window. Include the Title, AuthorLast, and AuthorFirst fields in the design grid. Remove the check mark from the Show check boxes for the AuthorLast and AuthorFirst columns. Type Francis in the Criteria row of the AuthorLast column and type Dick in the Criteria row of the AuthorFirst column.

9.   Add the Book, Wrote, and Author tables to the Query Design window. Include the Title, Type, AuthorLast, and AuthorFirst fields in the design grid. Remove the check mark from the Show check boxes for the Type, AuthorLast and AuthorFirst columns. Type Steinbeck in the Criteria row of the AuthorLast column, type John in the Criteria row of the AuthorFirst column, and FIC in the Criteria row of the Type column.

10.   Add the Author, Book, and Wrote tables to the Query Design window. Add the Title, PublisherCode, Type, AuthorLast, AuthorFirst, and Sequence fields to the design grid. Select Ascending as the Sort for the Title column and the Sequence column. Remove the check mark from the Show check box in the Sequence column.
Instructor Note: Delete the "with coauthors" in this exercise. Students should not limit result to only records with coauthors.

11.   Add the Copy table to the Query Design window. Include the Total row in the design grid. Add the CopyNum and Price fields to the design grid. Select the Count function in the Total row for the CopyNum column. Select Where in the Total row for the Price column. Type >20 and <25 in the Criteria row of the Price column.

12.   Add the Book and Copy tables to the Query Design window. Include the Title, BranchNum, CopyNum, Quality and Price fields in the design grid. Remove the check mark from the Show check box in the Title column and type The Stranger in the Criteria row for the Title column.

13.   Add the Branch, Book and Copy tables to the Query Design window. Include the Title, BranchName, CopyNum, Quality and Price fields in the design grid. Remove the check mark from the Show check box in the Title column and type Electric Light in the Criteria row for the Title column.

14.   Add the Book and Copy tables to the Query Design window. Include the Title, Quality, and Price fields in the design grid. Type >25 in the Criteria row for the Price column.

15.   Add the Branch, Book, Wrote, Author, and Copy tables to the Query Design window. Include the BranchName, Title, Quality, AuthorFirst, and AuthorLast fields in the design grid. Type Henry on the Hill in the Criteria row for the BranchName column and type Excellent in the Criteria row for the Quality column. Remove the check marks from the Show check boxes for the Branch Name and Quality columns.
(Instructor Note: There are 24 records in the result and all of the books have only one author.)

16.   Add the Book and Copy tables to the Query Design window. Include the BookCode, Title, BranchNum, CopyNum, Type, Quality, and Price columns in the design grid. Enter FIC in the Criteria row for the Type

column and remove the check mark from the column's Show Check box. Change the query type to Make-Table query, and enter FictionCopies as the name of the table.

17.   Add the FictionCopies table to the Query Design window. Include the BookCode, Title, and Quality fields in the design grid. Type Excellent in the Criteria row for the Quality column and remove the check mark from the columns' Show Check box. Enter the expression IncreasedPrice:1.1*[Price] in the first open column in the design grid.

18.   Add the FictionCopies table to the Query Design window and change the query type to Update query. Include the Price field in the design grid, enter 14.50 in the Update To row of the Price column, and enter 14.00 in the Criteria row for the Price column.

19.   Add the FictionCopies table to the Query Design window and change the query type to Delete query. Include the Quality field in the design grid and enter Poor in the Criteria row for the Quality column.

Answers to Alexamara Marina Group Case

The following answers indicate how to perform the specified task in Microsoft Access. The process for other database management systems would be different, although it should be similar. See the Instructor's Resource Kit on CD-ROM for a copy of the Alexamara database that contains the solutions to these exercises. You also can access Instructor Resources via the Web at login.cengage.com.

1.   Add the Owner table to the Query Design window. Include the OwnerNum, LastName, and FirstName fields in the design grid. Do not enter any criteria.

2.   Add the Marina table to the Query Design window. Double-click the asterisk in the Marina field list to add all fields to the design grid. Do not enter any criteria.

3.   Add the Owner table to the Query Design window. Include the LastName, FirstName, and City fields in the design grid. Remove the check mark from the Show check box for the City column. Enter Bowton in the Criteria row for the City column.

4.   Add the Owner table to the Query Design window. Include the LastName, FirstName, and City fields in the design grid. Remove the check mark from the Show check box for the City column. Enter <> Bowton in the Criteria row for the City column.

5.   Add the MarinaSlip table to the Query Design window. Include the MarinaNum, SlipNum, and Length fields in the design grid. Remove the check mark from the Show check box for the Length column. Enter <=30 in the Criteria row for the Length column.

6.   Add the MarinaSlip table to the Query Design window. Include the MarinaNum, SlipNum, and BoatType fields in the design grid. Remove the check mark from the Show check box for the BoatType column. Enter Dolphin 28 in the Criteria row for the BoatType column.

7.   Add the MarinaSlip table to the Query Design window. Include the SlipNum, MarinaNum, and BoatType fields in the design grid. Remove the check marks from the Show check boxes for the MarinaNum and BoatType column. Enter 1 in the Criteria row for the MarinaNum column. Enter Dolphin 28 in the Criteria row for the BoatType column.

8.   Add the MarinaSlip table to the Query Design window. Include the BoatName and Length fields in the design grid. Remove the check mark from the Show check box for the Length column. Enter >=25 AND <=30 in the Criteria row for the Length column.

9.   Add the MarinaSlip table to the Query Design window. Include the SlipNum, MarinaNum, and RentalFee fields in the design grid. Remove the check mark from the Show check boxes for the MarinaNum and RentalFee columns. Type 1 in the Criteria row for the MarinaNum column. Type <3000 in the Criteria row for the RentalFee column.

10.   Add the ServiceRequest table to the Query Design window. Include the SlipID, CategoryNum, and EstHours fields in the design grid. Enter the expression EstimatedCost:60*[EstHours] in the first open column in the design grid.

11.   Add the MarinaSlip table to the Query Design window. Include the MarinaNum, SlipNum, and BoatType fields in the design grid. Remove the check mark from the Show check box for the BoatType column. Enter Sprite 4000 in the Criteria row for the Type column. Type Sprite 3000 in the Or row for the Type column. Type Ray 4025 in the row below the Or row in the Type column.

12.   Add the MarinaSlip table to the Query Design window. Include the MarinaNum, SlipNum, and BoatName fields in the design grid. Select Ascending in the Sort row for the MarinaNum and BoatName columns.

13.   Add the MarinaSlip table to the Query Design window. Add the MarinaNum and BoatType fields in the design grid. Include the Total row. Select the Count function in the Total row for the MarinaNum column. Select Where in the Total row for the BoatType column. Enter Dolphin 25 in the Criteria row for the BoatType column.

14.   Add the MarinaSlip table to the Query Design window. Add the Length and RentalFee fields in the design grid. Include the Total row. Make sure the Group By operator is selected in the Total row for the Length column. Select the Sum function in the Total row for the RentalFee column.

15.   Add the MarinaSlip table and the Owner table to the Query Design window. Include the MarinaNum, SlipNum, and BoatName fields from the MarinaSlip table. Include the OwnerNum, FirstName, and LastName fields from the Owner table.

16.   Add the ServiceRequest table and the ServiceCategory table to the Query Design window. Include the SlipID, Description, and Status fields from the ServiceRequest table. Include the CategoryDescription field from the Category table and remove the check mark from the Show check box for the CategoryDescription column. Enter Routine engine maintenance in the Criteria row for the CategoryDescription column.

17.   Add the ServiceRequest, MarinaSlip, ServiceCategory, and Owner tables to the Query Design window. Include the SlipID field from the ServiceRequest table. Include the MarinaNum and SlipNum fields from the MarinaSlip table. Include the EstHours and SpentHours fields from the ServiceRequest table. Include the CategoryDescription field from the ServiceCategory table and remove the check mark from the Show check box for the CategoryDescription column. Type Routine engine maintenance in the Criteria row for the CategoryDescription column. Include the OwnerNum and LastName fields from the Owner table.

18.   Add the MarinaSlip table to the Query Design window. Include the MarinaNum, SlipNum, RentalFee, BoatName, OwnerNum, and Length columns in the design grid. Enter 40 in the Criteria rpw fpr the Length column. Remove the check mark from the Show check box for the Length column. Change the query type to Make-Table query, and enter LargeSlip as the name of the table.

19.   Add the LargeSlip table to the Query Design window and change the query type to Update query. Include the RentalFee field in the design grid, enter 3900 in the Update To row for the RentalFee column, and enter 3800 in the Criteria row for the RentalFee column.

20.   Add the LargeSlip table to the Query Design window and change the query type to Delete query. Include the RentalFee field in the design grid and enter 3600 in the Criteria row for the RentalFee column.