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 Colonial Adventure Tours database is as follows:

```
Trip (TripID, TripName, StartLocation, State, Distance, MaxGrpSize,
      Type, Season)
Guide (GuideNum, LastName, FirstName, Address, City, State,
       PostalCode, PhoneNum, HireDate)
Customer (CustomerNum, LastName, FirstName, Address, City, State,
          PostalCode, Phone)
Reservation (ReservationID, TripID, TripDate, NumPersons, TripPrice
             OtherFees, CustomerNum)
TripGuides (TripID, GuideNum)
```

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 Trip table is TripID. The primary key of the Guide table is GuideNum. The primary key of the Customer table is CustomerNum. The primary key of the Reservation table is ReservationID. The primary key of the TripGuides table is the concatenation (combination) of TripID and GuideNum.

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.

29.   [Critical Thinking] The Cartesian product of the Rep and Customer tables would have 48 rows (12 * 4).

30.   [Critical Thinking] No. You cannot use the PROJECT command with two tables. Also, you would eliminate one of the rep number columns needed to join the tables.

Answers to TAL Distributors Exercises: QBE

Note: 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. Data and solution files are available at www.cengage.com. Data files consist of copies of the TAL Distributors, Colonial Adventure Tours, and Solmaris Condominium Group databases that are usable in Access 2010 and Access 2013, and script files to create the tables and data in these databases in other systems, such as Oracle.

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 Item table to the Query Design window. Double-click the asterisk in the Item 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 15 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 15 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 15 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 Gradey in the Criteria row for the LastName column and Megan 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 15000 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 30 in the Criteria row.

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

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

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

13. Add the Item table to the Query Design window. Include the Total row. Place the Category and OnHand fields in the design grid. In the Category 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 Item table to the Query Design window. Place the ItemNum, Description, Category, OnHand, Storehouse, and Price fields in the design grid. Enter TOY in the Criteria row for the Category column and remove the check mark from the column's Show Check box. Change the query type to Make-Table query, and enter Toy as the name of the table.

15. Add the Toy table to the Query Design window. Include the field list for the Toy table in the query design and change the query type to Update query. Place the ItemNum and Description fields in the design grid. Enter Classic Train Set in the Update To row for the Description column, and enter DL51 as the criterion for the ItemNum column.

16. Add the Toy table to the Query Design window and change the query type to Delete query. Place the Price field in the design grid. Enter >120 as the criterion for the Price column.

17. [Critical Thinking] For query 11 you can use the asterisk to add all fields to the design grid. Then add the Item Description column again and remove the check mark from the column's Show Check box. Select Ascending in the Sort row for the Description column. You also can place all fields in the Item table in the design grid separately. Select Ascending in the Sort row for the Description column.

18.   [Critical Thinking] To achieve the correct results, include the Total row. Replace ItemNum with NumOrdered in the design grid. In the OrderNum column, select the Group By function in the Total row. In the Total row for the Num Ordered column, select the Sum function.

Answers to TAL Distributors Exercises: Relational Algebra

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

2.
```
SELECT Item WHERE ItemNum = 'FH24' 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 = 'Campos' GIVING Temp3
PROJECT Temp3 OVER (OrderNum, OrderDate, CustomerNum, CustomerName)
     GIVING Answer
```

5.
```
SELECT Orders WHERE OrderDate='10/15/2015' GIVING Temp1
PROJECT Temp1 OVER (OrderNum, OrderDate) GIVING Temp2
JOIN Orders Customer WHERE Orders.CustomerNum = Customer.CustomerNum
     GIVING Temp3
SELECT Temp3 WHERE RepNum = '30' GIVING Temp4
PROJECT Temp4 OVER (OrderNum, OrderDate) GIVING Temp5
UNION Temp2 WITH Temp5 GIVING Answer
```

6.
```
SELECT Orders WHERE OrderDate='10/15/2015' GIVING Temp1
PROJECT Temp1 OVER (OrderNum, OrderDate) GIVING Temp2
JOIN Orders Customer WHERE Orders.CustomerNum = Customer.CustomerNum
     GIVING Temp3
SELECT Temp3 WHERE RepNum = '45' GIVING Temp4
PROJECT Temp4 OVER (OrderNum, OrderDate) GIVING Temp5
INTERSECT Temp2 WITH Temp5 GIVING Answer
```

7.
```
SELECT Orders WHERE OrderDate='10/15/2015' GIVING Temp1
PROJECT Temp1 OVER (OrderNum, OrderDate) GIVING Temp2
JOIN Orders Customer WHERE Orders.CustomerNum = Customer.CustomerNum
     GIVING Temp3
SELECT Temp3 WHERE RepNum = '45' GIVING Temp4
PROJECT Temp4 OVER (OrderNum, OrderDate) GIVING Temp5
SUBTRACT Temp5 FROM Temp2 GIVING Answer
```

Answers to Colonial Adventure Tours

Note: 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. Data and solution files are available at

www.cengage.com. Data files consist of copies of the TAL Distributors, Colonial Adventure Tours, and Solmaris Condominium Group databases that are usable in Access 2010 and Access 2013, and script files to create the tables and data in these databases in other systems, such as Oracle.

1.   Add the Trip table to the Query Design window. Include the TripName and State fields in the design grid. Remove the check mark from the Show check box in the State column. Type <>NH in the Criteria row for the State column.

2.   Add the Trip table to the Query Design window. Include the TripName, StartLocation, and Type fields in the design grid. Type Biking in the Criteria row for Type column and remove the check mark from the Show check box in the column.

3.   Add the Trip table to the Query Design window. Include the TripName, Distance, and Type fields in the design grid. Remove the check mark from the Show check box in the Distance column and the Type column. Type >6 in the Criteria row for the Distance column and type Hiking in the Criteria row of the Type column.

4.   Add the Trip table to the Query Design window. Include the TripName, Type, and State fields in the design grid. Remove the check mark from the Show check box in the Type column and the State column. Type Paddling in the Criteria row for the Type column. Type VT in the Or row of the State column.

5.   Add the Trip table to the Query Design window. Add the Total row to the design grid. Include the TripID and Type fields in the design grid. Select the Count function in the Total row for the TripID column. Select Where in the Total row for the Type column. Type Hiking in the Criteria row of the Type column and type Biking in the Or row of the Type column.

6.   Add the Trip, Guide, and TripGuides tables to the Query Design window. TripName, Type, MaxGrpSize, and LastName fields in the design grid. Remove the check mark from the Show check box in the LastName column. Type Kiley in the Criteria row for the LastName column.

7.   Add the Trip table to the Query Design window. Include the TripName, State, and Season fields in the design grid. Add the TripName field to the design grid a second time. Type Summer in the Criteria row of the Season column. Remove check mark from the check box in the Season column and in the *second* TripName column. Select Ascending as the Sort for the State column and the *second* TripName column.

8.   Add the Trip, Guide, and TripGuides tables to the Query Design window. Include the TripName, Type, and LastName fields in the design grid. Remove the check mark from the Show check box for the Type column and the LastName column. Type Hiking in the Criteria row of the Type column and type Boyers in the Criteria row of the LastName column.

9.   Add the Trip table to the Query Design window. Add the Total row to the design grid. Include the State field and the TripID field in the design grid. Select Group By in the Total row for the State column. Select Count for the Total row of the TripID field.

10.   Add the Reservation table to the Query Design window. Add the Total row to the design grid. Include the ReservationID and TripPrice field in the design grid. Select the Count function in the Total row for the ReservationID column. Select Where in the Total row for the TripPrice column. Type >20 and <75 in the Criteria row of the TripPrice column

11.   Add the Reservation, Customer, and Trip tables to the Query Design window. Include the ReservationID, LastName, TripName, and NumPersons fields to the design grid. Remove the check mark from the Show check box for the NumPersons column. Type >4 in the Criteria row of the NumPersons column.

12.   Add the Guide, Trip, and TripGuides tables to the Query Design window. Include TripName, FirstName, LastName, and State fields in the design grid. Remove the check mark from the Show check box for the State column. Type NH in the Criteria row of the State column. Select Ascending as the Sort for the TripName column and the LastName column.

13.   Add the Customer and Reservation tables to the Query Design window. Include the ReservationID, CustomerNum, LastName, FirstName, and TripDate fields to the design grid. Remove the check mark from the Show check box for the TripDate column. Type >#6/30/2016 and <#8/1/2016# in the Criteria row of the TripDate column.

14.   Add the Reservation, Customer, and Trip tables to the Query Design window. Included the ReservationID, TripName, LastName, FirstName, and NumPersons fields to the design grid. Remove the check mark from the

Show check box for the NumPersons column. Type >4 in the NumPersons column. In the next column, enter the computation for the TotalPrice ((TripPrice+OtherFees) * NumPersons).

15.   Add the Reservation and Trips table to the Query Design window. Include all fields from the Reservation table in the design grid. Include the Type field from the Trip table. Enter Hiking 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 Hiking as the name of the table.
        Instructor Note: This question requires students to join the Trip and Reservation tables. The question in the text may confuse students.

16.   Add the Hiking table to the Query Design window and change the query type to Update query. Include the OtherFees field in the design grid, enter 5 in the Update To row of the OtherFees column, and enter 0 in the Criteria row for the OtherFees column.

17.   Add the Hiking table to the Query Design window and change the query type to Delete query. Include the TripDate field in the design grid and enter #6/12/2016# in the Criteria row for the TripDate column.

18.   [Critical Thinking] So many results were obtained because tables were not joined on a common field. You need to add the TripGuides table to the Query Design window. The TripGuides table joins the Trip table to the Guide table.

Answers to Solmaris Condominium Group Case

Note: 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. Data files consist of copies of the TAL Distributors, Colonial Adventure Tours, and Solmaris Condominium Group databases that are usable in Access 2010 and Access 2013, and script files to create the tables and data in these databases in other systems, such as Oracle.

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 Location table to the Query Design window. Double-click the asterisk in the Location 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 Lewiston 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 <> Lewiston in the Criteria row for the City column.

5.   Add the CondoUnit table to the Query Design window. Include the LocationNum, UnitNum, and SqrFt fields in the design grid. Remove the check mark from the Show check box for the SqrFt column. Enter <=1084 in the Criteria row for the SqrFt column.

6.   Add the CondoUnit table to the Query Design window. Include the LocationNum, UnitNum, and Bdrms fields in the design grid. Remove the check mark from the Show check box for the Bdrms column. Enter 3 in the Criteria row for the Bdrms column.

7.   Add the CondoUnit table to the Query Design window. Include the LocationNum, UnitNum, and Bdrms fields in the design grid. Remove the check mark from the Show check box for the Bdrms column and the LocationNum column. Enter 3 in the Criteria row for the Bdrms column. Enter 1 in the Criteria row for the LocationNum column.

8.   Add the CondoUnit table to the Query Design window. Include the LocationNum, UnitNum, and CondoFee fields in the design grid. Remove the check mark from the Show check box for the CondoFee column. Enter >=200 AND <=300 in the Criteria row for the CondoFee column or enter Between 200 and 300 in the Criteria row for the CondoFee column.
        Instructor Note: Either answer is correct.

9.   Add the CondoUnit table to the Query Design window. Include the LocationNum, UnitNum, and CondoFee fields in the design grid. Remove the check mark from the Show check box for the CondoFee column and the LocationNum

column. Type 2 in the Criteria row for the LocationNum column. Type <200 in the Criteria row for the CondoFee column.

10. Add the ServiceRequest table to the Query Design window. Include the CondoID, CategoryNum, and EstHours fields in the design grid. Enter the expression EstimatedCost:35*[EstHours] in the first open column in the design grid.

11. Add the Owner table to the Query Design window. Include the OwnerNum, LastName, and State fields in the design grid. Remove the check mark from the Show check box for the State column. Enter FL or GA or SC in the Criteria row for the State column.

12. Add the CondoUnit table to the Query Design window. Include the LocationNum, UnitNum, SqrFt, and CondoFee fields in the design grid. Select Ascending in the Sort row for the SqrFt and CondoFee columns.

13. Add the CondoUnit table to the Query Design window. Add the LocationNum, CondoID, and Bdrms fields in the design grid. Include the Total row. Make sure the Group By operator is selected in the Total row for the LocationNum column. Select the Count function in the Total row for the CondoID column. Select the Where function in the Total row from the Bdrms column. Enter 2 in the Criteria row for the Bdrms column.

14. Add the CondoUnit table to the Query Design window. Add the CondoFee field to the design grid. Include the Total row. Select the Sum function in the Total row for the CondoFee column.

15. Add the CondoUnit table and the Owner table to the Query Design window. Include the LocationNum and CondoNum fields from the CondoUnit 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 CondoID, 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 Painting in the Criteria row for the CategoryDescription column.

17. Add the ServiceRequest, CondoUnit, ServiceCategory, and Owner tables to the Query Design window. Include the CondoID field from the ServiceRequest table. Include the LocationNum and CondoNum fields from the CondoUnit 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 electrical systems in the Criteria row for the CategoryDescription column. Include the OwnerNum and LastName fields from the Owner table.

18. Add the CondoUnit table to the Query Design window. Include all fields in the CondoUnit table in the design grid. Enter >1500 in the Criteria row for the SqrFt column. Change the query type to Make-Table query, and enter LargeCondo as the name of the table.

19. Add the LargeCondo table to the Query Design window and change the query type to Update query. Include the CondolFee field in the design grid, enter 550 in the Update To row for the CondoFee column, and enter 300 in the Criteria row for the CondoFee column.

20. Add the LargeCondo table to the Query Design window and change the query type to Delete query. Include the CondoFee field in the design grid and enter 670 in the Criteria row for the CondoFee column.

21. [Critical Thinking] To modify the query in Exercise 7, add the SqrFt field to the design grid and enter >1200 in the Or row for the SqrFt column. Two additional records will be retrieved (5 records total).
Instructor Note: The question in the text should refer to Exercise 7 not Exercise 9.