Database Concepts

7th Edition

David M. Kroenke • David J. Auer

Online Appendix E

SQL Views, SQL/PSM and Importing Data

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Appendix Objectives

- To understand the reasons for using SQL views
- To use SQL statements to create and query SQL views
- To understand SQL/Persistent Stored Modules (SQL/PSM)
- To create and use SQL user-defined functions
- To import Microsoft Excel worksheet data into a database

What is the Purpose of this Appendix?

In Chapter 3, we discussed SQL in depth. We discussed two basic categories of SQL statements: data definition language (DDL) statements, which are used for creating tables, relationships, and other structures, and data manipulation language (DML) statements, which are used for querying and modifying data.

In this appendix, which should be studied immediately after Chapter 3, we:

- Describe and illustrate SQL views, which extend the DML capabilities of SQL.
- Describe and illustrate SQL Persistent Stored Modules (SQL/PSM), and create user-defined functions.
- Describe and use DBMS data import techniques to import Microsoft Excel worksheet data into a database.

Creating SQL Views

An **SQL view** is a virtual table that is constructed from other tables or views. A view has no data of its own but uses data stored in tables or other views. Views are created using SQL SELECT statements and then used in other SELECT statements as just another table. The only limitation on the SQL SELECT statements that create the views is that they cannot contain ORDER BY clauses.[1] If the results of a query using a view need to be sorted, the sort order must be provided by the SELECT statement that processes the view.

Does Not Work with Microsoft Access ANSI-89 SQL

Unfortunately, Microsoft Access does not support views. However, Access allows you to create a query, name it, and then save it, which is not supported in a standard SQL implementation. You can then process Access queries in the same ways that you process views in the following discussion.

Solution: Create Microsoft Access view–equivalent queries, as discussed in the "The Access Workbench" section at the end of this appendix.

We'll use the WPC database that we created in Chapter 3 as the example database for this discussion of views. You use the SQL **CREATE VIEW statement** to create view structures. The essential format of this statement is:

```
CREATE VIEW ViewName AS
   {SQL SELECT statement};
```

The following statement defines a view named EmployeePhoneView based on the EMPLOYEE table:

```
/* *** SQL-CREATE-VIEW-AppE-01 *** */
CREATE VIEW EmployeePhoneView AS
   SELECT   FirstName, LastName, Phone AS EmployeePhone
   FROM     EMPLOYEE;
```

Figure E-1 shows the view being created in the SQL Server Management Studio Express Edition, Figure E-2 shows the view being created in the Oracle SQL Developer, and Figure E-3 shows the view being created in the MySQL Workbench.

[1] This limitation appears in the SQL-92 standard. Some DBMSs modify this limitation in their implementation of SQL. For example, Oracle Database allows views to include ORDER BY, and SQL Server allows ORDER BY in very limited circumstances.

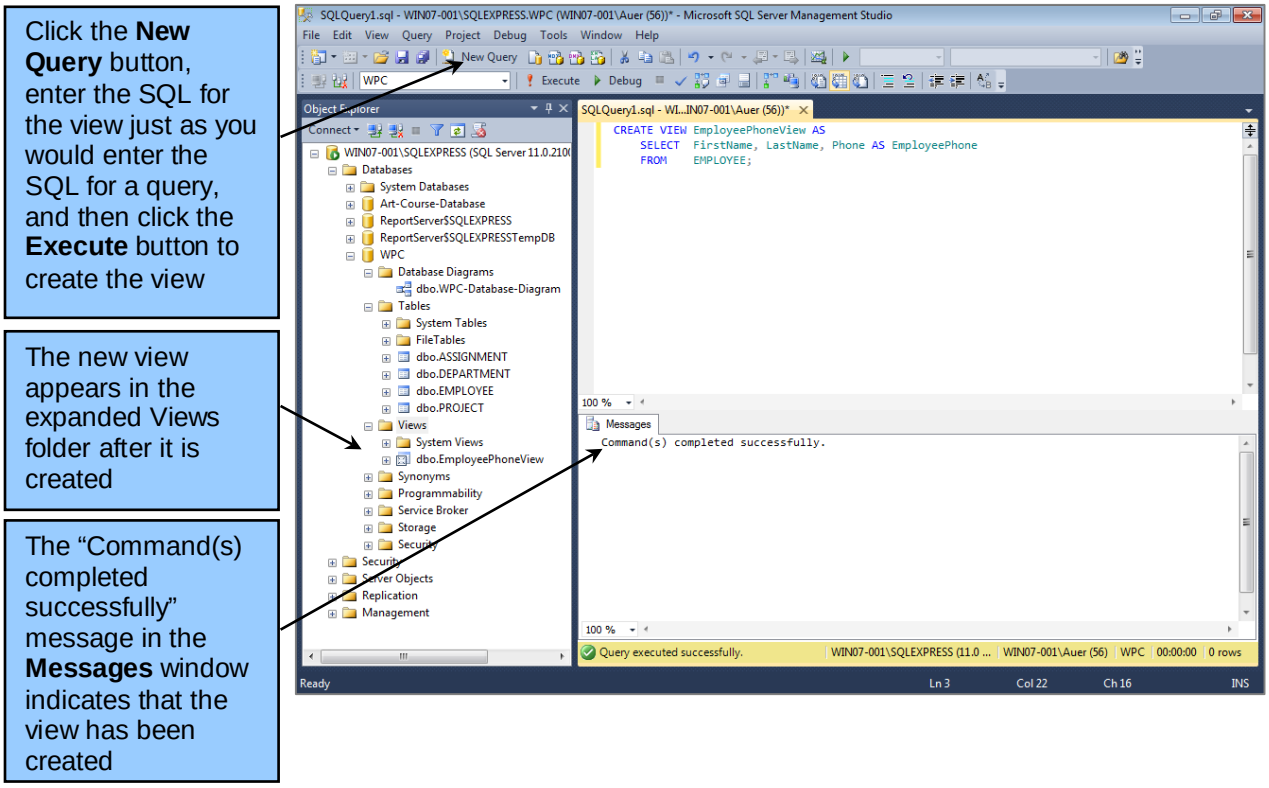


Figure E-1 — Creating a View in the Microsoft SQL Server Management Studio

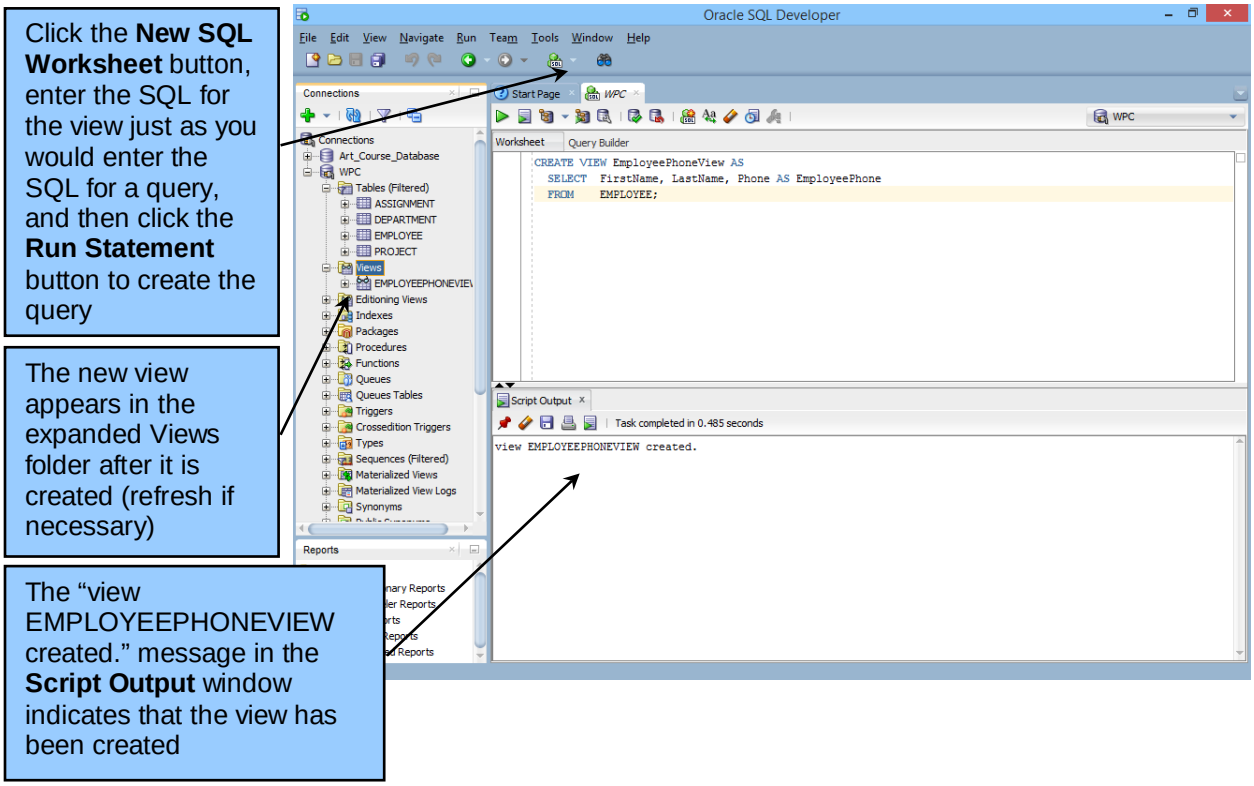


Figure E-2 — Creating a View in the Oracle SQL Developer

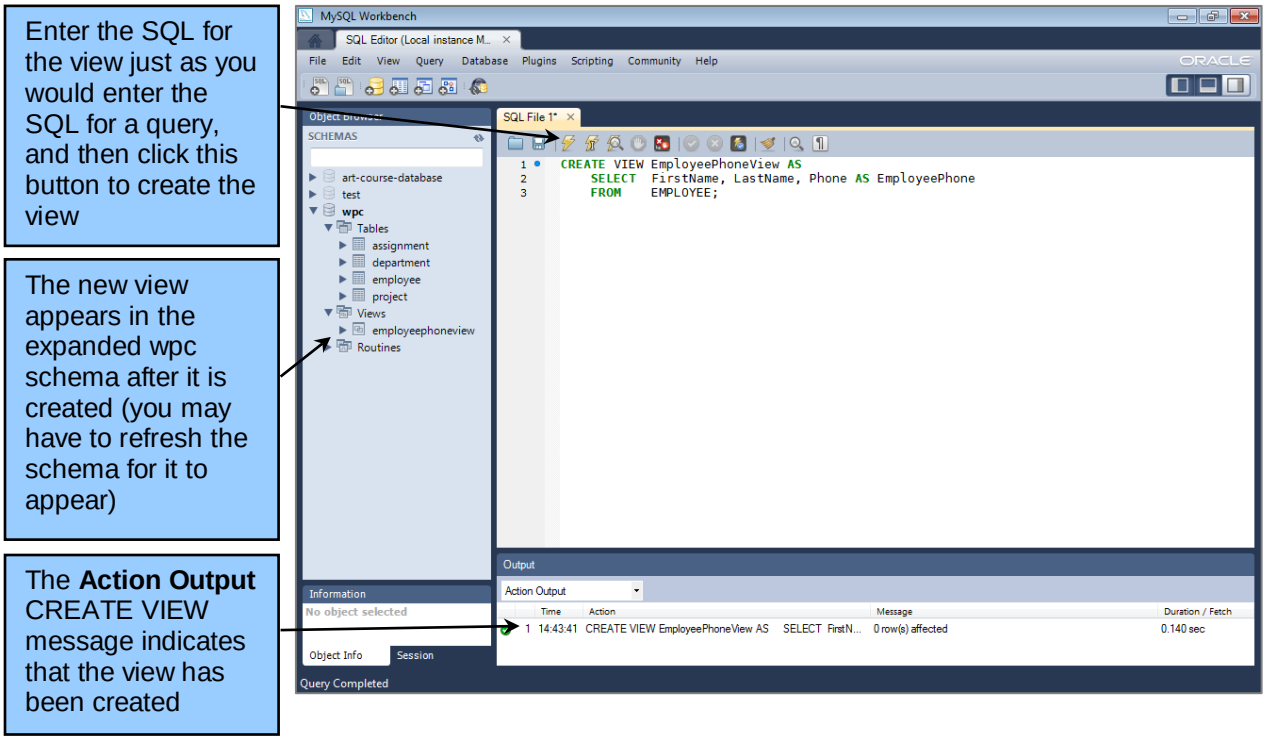


Figure E-3 — Creating a View in the MySQL Workbench

By The Way

SQL Server 2005, SQL Server 2008, SQL Server 2008 R2, SQL Server 2012, and most other DBMSs process the CREATE VIEW statements as written here without difficulty. However, SQL Server 2000 will not run such statements unless you *remove the semicolon* at the end of the CREATE VIEW statement. We have no idea why SQL Server 2000 works this way, but be aware of this peculiarity if you are using SQL Server 2000.

After we create the view, we can use it in the FROM clause of SELECT statements just as we would use a table. The following obtains a list of employee names and phone numbers, sorted first by employee last name and then by employee first name:

```
/* *** SQL-QUERY-AppE-01 *** */
SELECT      *
FROM        EmployeePhoneView
ORDER BY    LastName, FirstName;
```

Figure E-4 shows this SQL statement run in the SQL Server Management Studio, Figure E-5 shows it run in the Oracle SQL Developer, and Figure E-6 shows it run in the MySQL Workbench.

Click the **New Query** button, enter the SQL for the query that uses the view, and then click the **Execute** button to create the query

The query results appear in the Results window

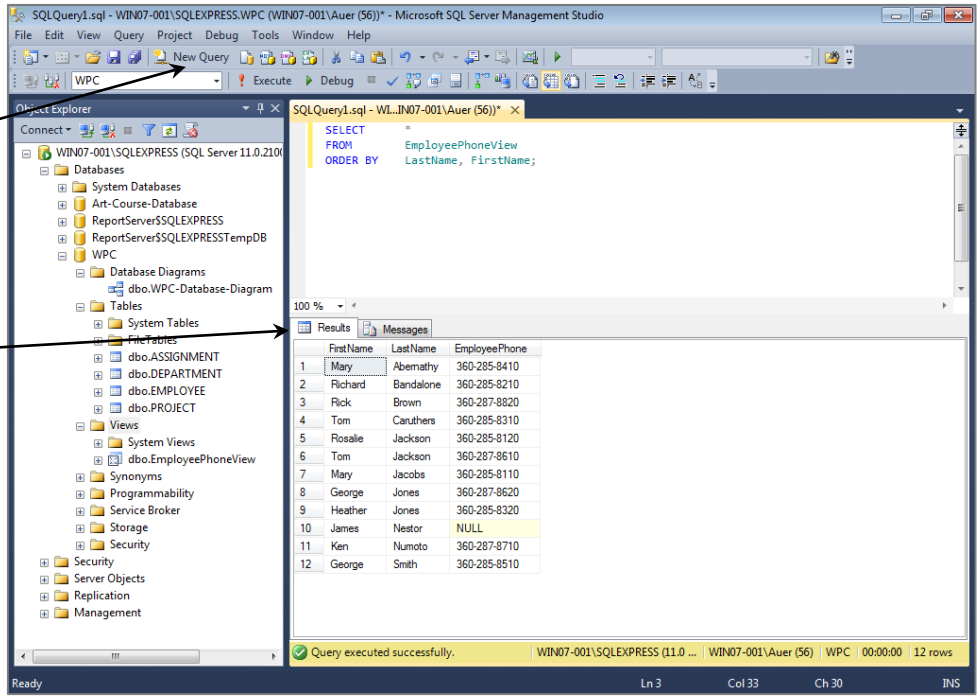


Figure E-4 — Using EmployeePhoneView in the Microsoft SQL Server Management Studio

Enter the SQL for the query that uses the view, and then click the **Run Statement** button to execute the query

The query results appear in the **Query Result** window

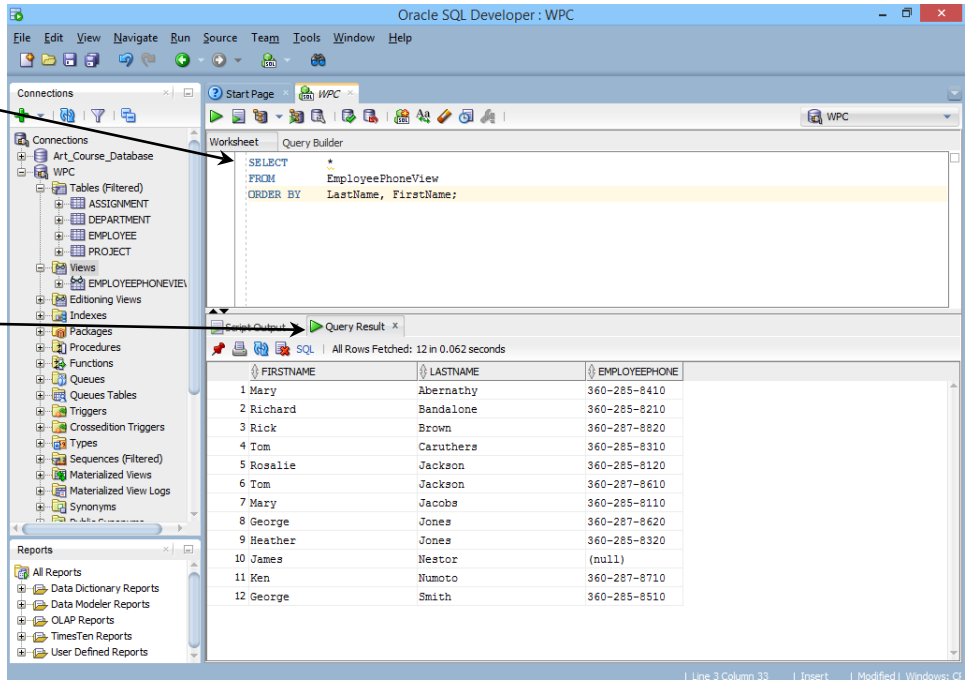


Figure E-5 — Using EmployeePhoneView in the Oracle SQL Developer

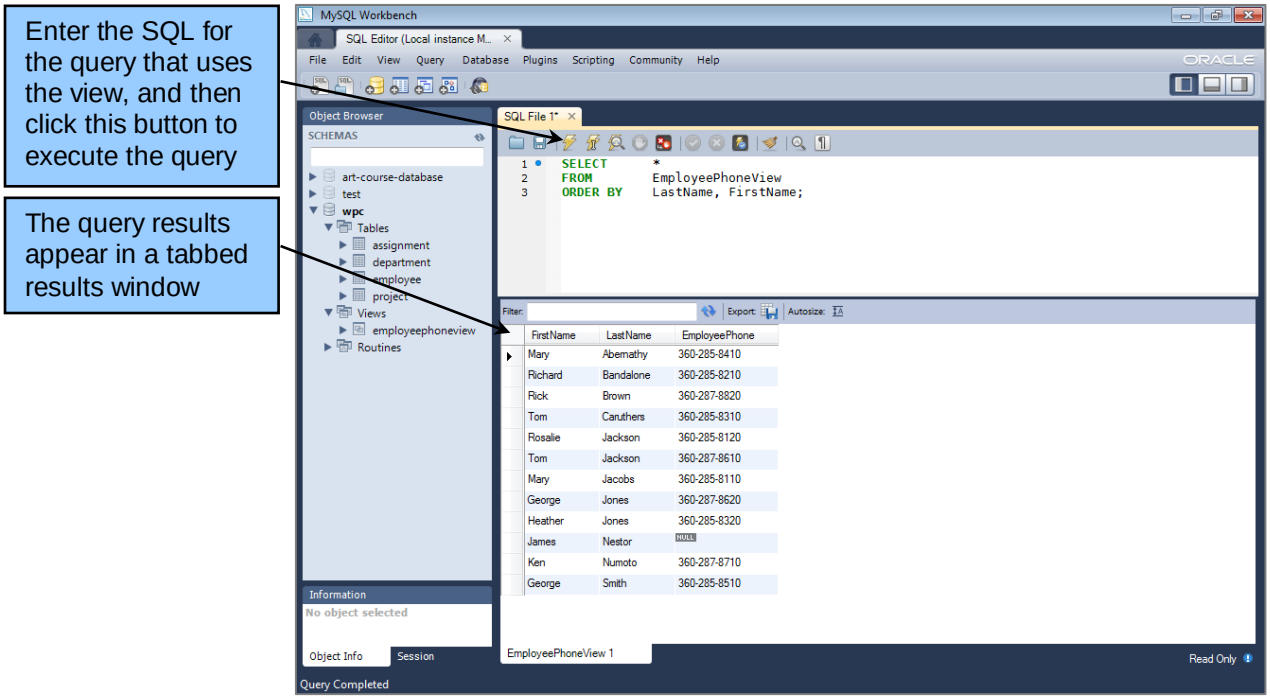


Figure E-6 — Using EmployeePhoneView in the MySQL Workbench

Note that the number of columns returned depends on the number of columns in the view, not on the number of columns in the underlying table. In this example, SELECT * produces just three columns because the view has just three columns. Also notice that the column Name in the EMPLOYEE table has been renamed EmployeePhone in the view, so the DBMS uses the label EmployeePhone when producing results.

By The Way

If you ever need to modify an SQL view you have created, use the **ALTER VIEW {ViewName} statement**. This works exactly the same as the CREATE VIEW {ViewName} AS statement except that it replaces the existing view definition with the new one. This statement is very useful when you are trying to fine-tune your view definitions.

If you ever want to delete a view, simply use the SQL **DROP VIEW {ViewName} statement**.

Using SQL Views

In general, SQL views are used to prepare data for use in an information system application, which may or may not be a Web-based application. While applications commonly use a Web interface (via a Web browser such as Microsoft Internet Explorer (IE), Google Chrome, or Mozilla Firefox), there are still many applications that run in their own application window.

In Appendix F — *Getting Started with Systems Analysis and Development*, we define **data** as recorded facts and numbers. Based on this definition, we can now define[2] **information** as:

- Knowledge derived from data.
- Data presented in a meaningful context.
- Data processed by summing, ordering, averaging, grouping, comparing or other similar operations.

In general, application programmers prefer that the work of transforming *database data* into the *information* that will be used in and presented by the application be done by the DBMS itself. SQL views are the main DBMS tool for this work. The basic principle is that all *summing, averaging, grouping, comparing and similar operations* should be done in SQL views, and that it is the final result as it appears in the SQL view that is passed to the application program for use. This is illustrated in Figure E-7.

For a specific example, let's consider a Web page that we'll build in Chapter 7's section of "The Access Workbench." We are building a Customer Relations Management (CRM) Web application for Wallingford Motors (WM). As shown in Figure E-8, one part of the Web CRM application displays a report named *The Wallingford Motors CRM Customer Contacts List*, which shows all contacts between WM salespeople (identified by NickName) and customers (identified by LastName and FirstName). This report is based on a view named *viewCustomerContacts*, which combines data from the both the CUSTOMER table and the CONTACT table in the WM database. This example clearly illustrates the principle of combining and processing data into a view that becomes the basis of the data sent to the Web application for display in a Web page.

Figure E-9 lists some of the specific uses for views.[3] They can hide columns or rows. They also can be used to display the results of computed columns, to hide complicated SQL syntax, and to layer the use of built-in functions to create results that are not possible with a single SQL statement. We will give examples of each of these uses.

[2] These definitions are from David M. Kroenke's books *Using MIS* (6th Ed.) (Upper Saddle River, NJ: Prentice-Hall, 2014) and *Experiencing MIS* (4th Ed.) (Upper Saddle River: Prentice-Hall, 2012). See these books for a full discussion of these definitions, as well as a discussion of a fourth definition, "a difference that makes a difference."

[3] Additional uses of SQL views are discussed in David M. Kroenke and David J. Auer, *Database Processing: Fundamentals, Design, and Implementation*, 13th edition (Upper Saddle River, NJ: Prentice Hall, 2014), Chapter 7.

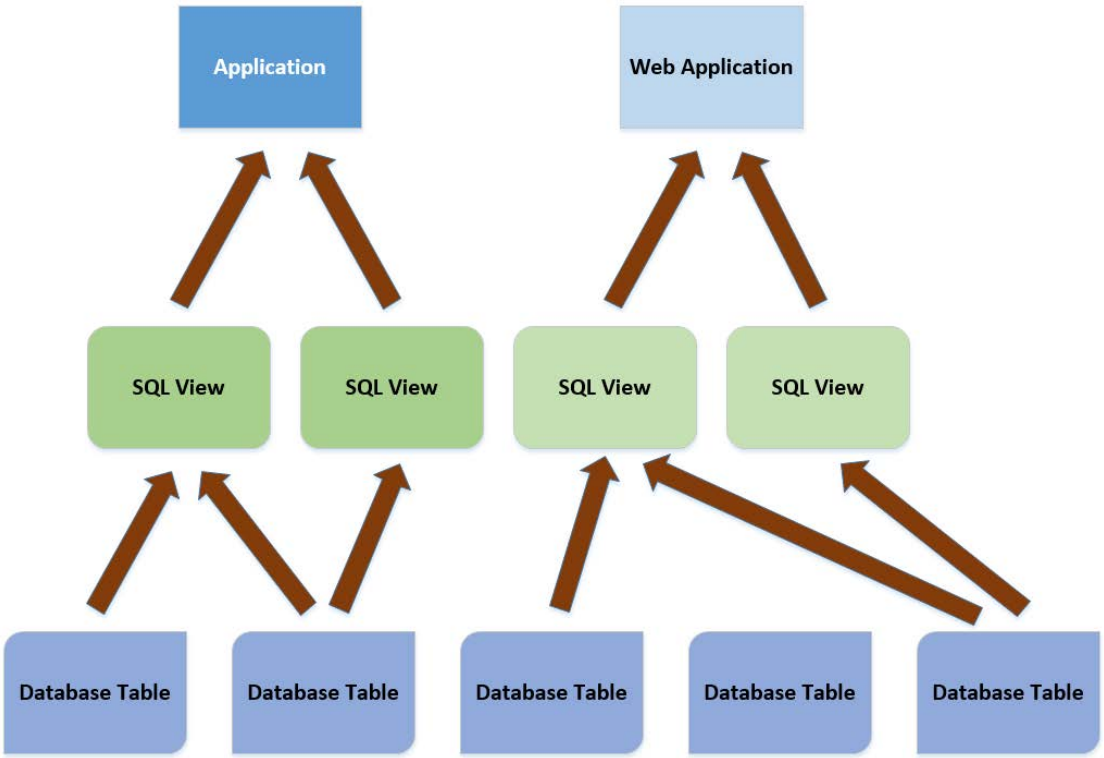


Figure E-7 — SQL Views as the Basis For Application Reports

Using Views to Hide Columns or Rows

Views can be used to hide columns to simplify results or to prevent the display of sensitive data. For example, suppose the users at WPC want a simplified list of departments that has just the department names and phone numbers. One use for such a view would be to populate a Web page. The following statement defines a view, BasicDepartmentDataView, that will produce that list:

```
/* *** SQL-CREATE-VIEW-AppE-02 *** */
CREATE VIEW BasicDepartmentDataView AS
   SELECT      DepartmentName, Phone AS DepartmentPhone
   FROM        DEPARTMENT;
```

The following SELECT statement obtains a list of department names and phone numbers sorted by the DepartmentName:

```
/* *** SQL-QUERY-AppE-02 *** */
SELECT      *
FROM        BasicDepartmentDataView
ORDER BY    DepartmentName;
```

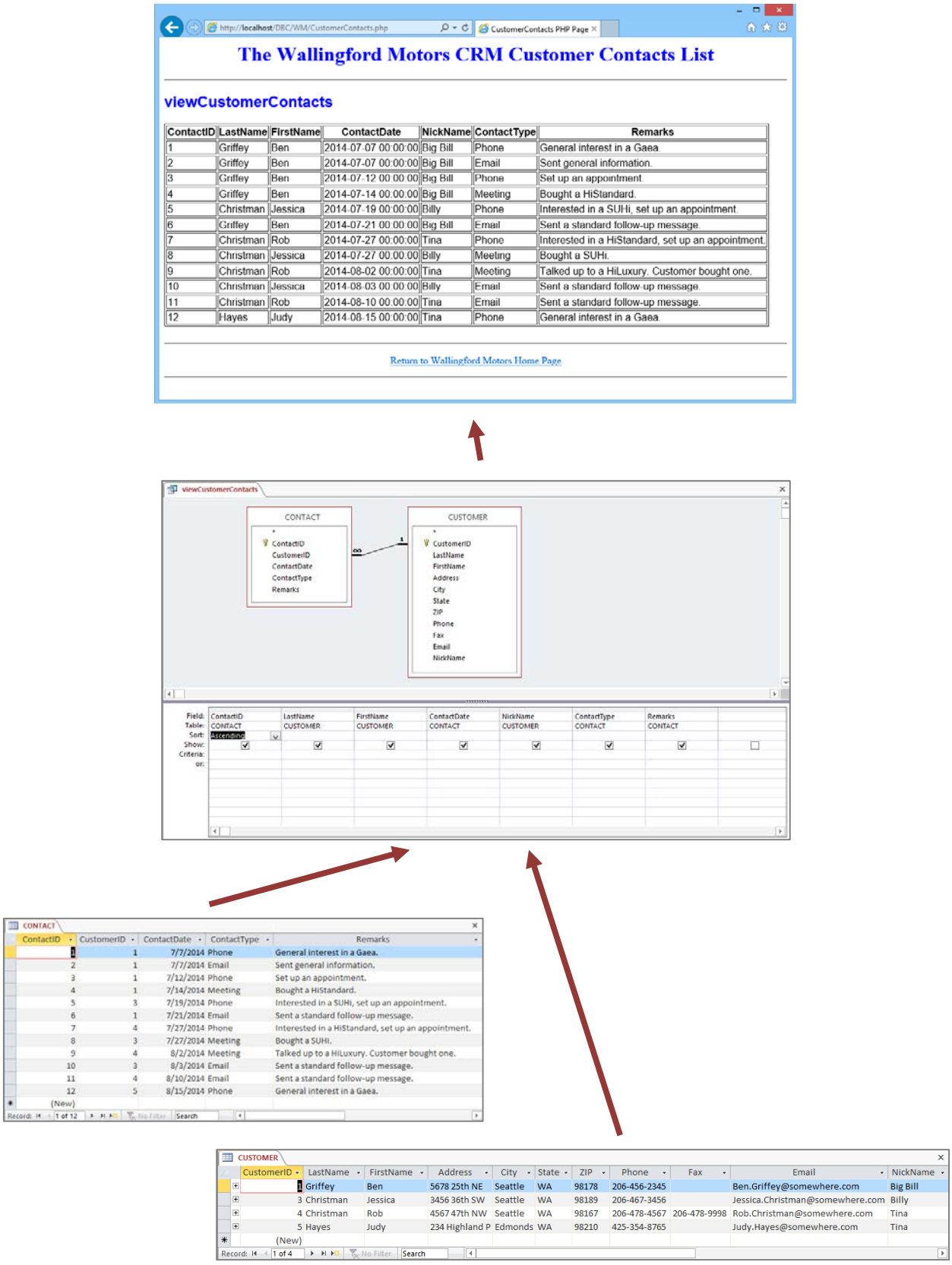


Figure E-8 — The Wallingford Motors CRM Web Application Customer Contacts List

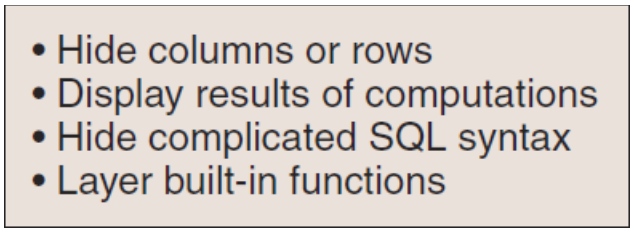


Figure E-9 — Some Uses for SQL Views

The results of a SELECT sorted by DepartmentName on this view are:

	DepartmentName	DepartmentPhone
1	Accounting	360-285-8300
2	Administration	360-285-8100
3	Finance	360-285-8400
4	Human Resources	360-285-8500
5	InfoSystems	360-287-8800
6	Legal	360-285-8200
7	Marketing	360-287-8700
8	Production	360-287-8600

Views can also hide rows by providing a WHERE clause in the view definition. The next SQL statement defines a view of WPC projects in the marketing department:

```
/* *** SQL-CREATE-VIEW-AppE-03 *** */
CREATE VIEW MarketingDepartmentProjectView AS
   SELECT      ProjectID, ProjectName, MaxHours,
               StartDate, EndDate
   FROM        PROJECT
   WHERE       Department = 'Marketing';
```

The following SELECT statement obtains a list of projects managed by the marketing department, sorted by the ProjectID number:

```
/* *** SQL-QUERY-AppE-03 *** */
SELECT      *
FROM        MarketingDepartmentProjectView
ORDER BY    ProjectID;
```

The results of a SELECT sorted by ProjectID on this view are:

	ProjectID	ProjectName	MaxHours	StartDate	EndDate
1	1000	2014 Q3 Product Plan	135.00	2014-05-10	2014-06-15
2	1300	2014 Q4 Product Plan	150.00	2014-08-10	2014-09-15

As desired, only the marketing department projects are shown in this view. This limitation is not obvious from the results because Department is not included in the view. This characteristic can be good or bad, depending on the use of the view. It is good if this view is used in a setting in which only marketing department projects matter; it is bad if the view indicates that these projects are the only WPC projects currently underway.

Using Views to Display Results of Computed Columns

Another use of views is to show the results of computed columns without requiring the user to enter the computation expression. For example, the following view allows the user to compare the maximum hours allocated for each WPC project to the total hours worked to date on the project:

```
/* *** SQL-CREATE-VIEW-AppE-04 *** */
CREATE VIEW ProjectHoursToDateView AS
   SELECT      PROJECT.ProjectID,
               ProjectName,
               MaxHours AS ProjectMaxHours,
               SUM(HoursWorked) AS ProjectHoursWorkedToDate
   FROM        PROJECT, ASSIGNMENT
   WHERE       PROJECT.ProjectID = ASSIGNMENT.ProjectID
   GROUP BY    PROJECT.ProjectID;
```

By The Way

Both SQL Server and Oracle Database require that any column specified in the SELECT phrase be used in either an SQL built-in function or the GROUP BY phrase. The previous SQL statement is correct SQL-92 syntax and will run in MySQL as written. However, SQL Server and Oracle Database require you to write:

```
/* *** SQL-CREATE-VIEW-AppE-04-MSSQL *** */
CREATE VIEW ProjectHoursToDateView AS
   SELECT      PROJECT.ProjectID,
               ProjectName,
               MaxHours AS ProjectMaxHours,
               SUM(HoursWorked) AS ProjectHoursWorkedToDate
   FROM        PROJECT, ASSIGNMENT
   WHERE       PROJECT.ProjectID = ASSIGNMENT.ProjectID
   GROUP BY    PROJECT.ProjectID, ProjectName, MaxHours;
```

Note the use of the extra column names in the GROUP BY clause. These are necessary to create the view but have no practical effect on the results.

When the view user enters:

```
/* *** SQL-QUERY-AppE-04 *** */
SELECT      *
FROM        ProjectHoursToDateView
ORDER BY    ProjectID;
```

these results are displayed:

	ProjectID	ProjectName	ProjectMaxHours	ProjectHoursWorkedToDate
1	1000	2014 Q3 Product Plan	135.00	160.00
2	1100	2014 Q3 Portfolio Analysis	120.00	85.00
3	1200	2014 Q3 Tax Preparation	145.00	130.00
4	1300	2014 Q4 Product Plan	150.00	165.00
5	1400	2014 Q4 Portfolio Analysis	140.00	52.50

Placing computations in views has two major advantages. First, it saves users from having to know or remember how to write an expression to get the results they want. Second, it ensures consistent results. If developers who use a computation write their own SQL expressions, they may write the expression differently and obtain inconsistent results.

Using Views to Hide Complicated SQL Syntax

Another use of views is to hide complicated SQL syntax. By using views, developers do not need to enter complex SQL statements when they want particular results. Also, such views allow developers who do not know how to write complicated SQL statements to enjoy the benefits of such statements. This use of views also ensures consistency.

Suppose that WPC users need to know which employees are assigned to which projects and how many hours each employee has worked on each project. To display these interests, two joins are necessary: one to join EMPLOYEE to ASSIGNMENT and another to join that result to PROJECT. You saw the SQL statement to do this in Chapter 3:

```
/* *** SQL-QUERY-CH03-49 *** */
SELECT      ProjectName, FirstName, LastName, HoursWorked
FROM        EMPLOYEE AS E JOIN ASSIGNMENT AS A
      ON    E.EmployeeNumber = A.EmployeeNumber
            JOIN PROJECT AS P
                  ON    A.ProjectID = P.ProjectID
ORDER BY    P.ProjectID, A.EmployeeNumber;
```

Now we need to make it into a view named EmployeeProjectHoursWorkedView. Remember that we cannot include the ORDER BY clause in the view. If we want to sort the output, we'll need to do this when we use the view:

```
/* *** SQL-CREATE-VIEW-AppE-05 *** */
CREATE VIEW EmployeeProjectHoursWorkedView AS
   SELECT      ProjectName, FirstName, LastName, HoursWorked
   FROM        EMPLOYEE AS E JOIN ASSIGNMENT AS A
         ON    E.EmployeeNumber = A.EmployeeNumber
               JOIN PROJECT AS P
                     ON    A.ProjectID = P.ProjectID;
```

This is a complicated SQL statement to write, but after the view is created the results of this statement can be obtained with a simple SELECT statement. When the user uses:

```
/* *** SQL-QUERY-AppE-05 *** */
SELECT   *
FROM     EmployeeProjectHoursWorkedView;
```

these results will be displayed:

	ProjectName	FirstName	LastName	HoursWorked
1	2014 Q3 Product Plan	Mary	Jacobs	30.00
2	2014 Q3 Product Plan	Tom	Jackson	75.00
3	2014 Q3 Product Plan	Ken	Numoto	55.00
4	2014 Q3 Portfolio Analysis	Tom	Caruthers	40.00
5	2014 Q3 Portfolio Analysis	Mary	Abernathy	45.00
6	2014 Q3 Tax Preparation	Mary	Jacobs	25.00
7	2014 Q3 Tax Preparation	Rosalie	Jackson	20.00
8	2014 Q3 Tax Preparation	Tom	Caruthers	45.00
9	2014 Q3 Tax Preparation	Heather	Jones	40.00
10	2014 Q4 Product Plan	Mary	Jacobs	35.00
11	2014 Q4 Product Plan	Tom	Jackson	80.00
12	2014 Q4 Product Plan	Ken	Numoto	50.00
13	2014 Q4 Portfolio Analysis	Tom	Caruthers	15.00
14	2014 Q4 Portfolio Analysis	Heather	Jones	10.00
15	2014 Q4 Portfolio Analysis	Mary	Abernathy	27.50

Clearly, using the view is much simpler than constructing the join syntax. Even developers who know SQL well will appreciate having a simpler view with which to work.

Layering Computations and Built-in Functions

Recall from Chapter 3 that you cannot use a computation or a built-in function as part of a WHERE clause. You can, however, construct a view that computes a variable and then write an SQL statement on that view that uses the computed variable in a WHERE clause. To understand this, consider the ProjectHoursToDateView definition created previously as SQL-CREATE-VIEW-AppE-04 (and remember that it needs to be modified for SQL Server and Oracle Database as noted in the ***By The Way*** on page E-13):

```
/* *** SQL-CREATE-VIEW-AppE-04 *** */
CREATE VIEW ProjectHoursToDateView AS
   SELECT      PROJECT.ProjectID,
               ProjectName,
               MaxHours AS ProjectMaxHours,
               SUM(HoursWorked) AS ProjectHoursWorkedToDate
   FROM        PROJECT, ASSIGNMENT
   WHERE       PROJECT.ProjectID = ASSIGNMENT.ProjectID
   GROUP BY    PROJECT.ProjectID;
```

The view definition contains the maximum allocated hours for each project and the total hours actually worked on the project to date as ProjectHoursWorkedToDate. Now we can use ProjectHoursWorkedToDate in both an additional calculation and the WHERE clause, as follows:

```
/* *** SQL-QUERY-AppE-06 *** */
SELECT      ProjectID, ProjectName, ProjectMaxHours,
            ProjectHoursWorkedToDate
FROM        ProjectHoursToDateView
WHERE       ProjectHoursWorkedToDate > ProjectMaxHours
ORDER BY    ProjectID;
```

Here, we are using the result of a computation in a WHERE clause, something that is not allowed in a single SQL statement. This allows users to determine which projects have exceeded the number of hours allocated to them by producing the result:

	ProjectID	ProjectName	ProjectMaxHours	ProjectHoursWorkedToDate
1	1000	2014 Q3 Product Plan	135.00	160.00
2	1300	2014 Q4 Product Plan	150.00	165.00

Such layering can be continued over many levels. We can turn this SELECT statement into another view named ProjectsOverAllocatedMaxHoursView (again without the ORDER BY clause):

```
/* *** SQL-CREATE-VIEW-AppE-06 *** */
CREATE VIEW ProjectsOverAllocatedMaxHoursView AS
   SELECT      ProjectID, ProjectName, ProjectMaxHours,
               ProjectHoursWorkedToDate
   FROM        ProjectHoursToDateView
   WHERE       ProjectHoursWorkedToDate > ProjectMaxHours;
```

Now we can use ProjectsOverAllocatedMaxHoursView in a further calculation—this time to find the number of hours by which each project has overrun its allocated hours:

```
/* *** SQL-QUERY-AppE-07 *** */
SELECT   ProjectID, ProjectName, ProjectMaxHours,
         ProjectHoursWorkedToDate,
         (ProjectHoursWorkedToDate - ProjectMaxHours)
               AS HoursOverMaxAllocated
FROM     ProjectsOverAllocatedMaxHoursView
ORDER BY ProjectID;
```

Here are the results:

	ProjectID	ProjectName	ProjectMaxHours	ProjectHoursWorkedToDate	HoursOverMaxAllocated
1	1000	2014 Q3 Product Plan	135.00	160.00	25.00
2	1300	2014 Q4 Product Plan	150.00	165.00	15.00

SQL views are very useful tools for database developers (who will define the views) and application programmers (who will use the views in applications).

SQL/Persistent Stored Modules (SQL/PSM)

Each DBMS product has its own variant or extension of SQL, including features that allow SQL to function similarly to a procedural programming language. The ANSI/ISO standard refers to these as **SQL/Persistent Stored Modules (SQL/PSM)**. Microsoft SQL Server calls its version of SQL *Transact-SQL (T-SQL)*, and Oracle Database calls its version of SQL *Procedural Language/SQL (PL/SQL)*. The MySQL variant also includes SQL/PSM components, but it has no special name and is just called *SQL* in the MySQL documentation.

SQL/PSM provides the program variables and cursor functionality. It also includes control-of-flow language such as BEGIN…END blocks, IF…THEN…ELSE logic structures, and LOOPs, as well as the ability to provide usable output to users.

The most important feature of SQL/PSM, however, is that it allows the code that implements these features in a database to be contained in that database. Thus the name: *Persistent*—the code remains available for use over time—*Stored*—the code is stored for reuse in the database—*Modules*—the code is

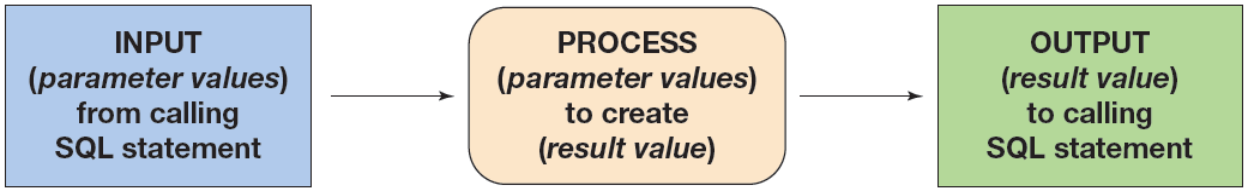


Figure E-10 — User-Defined Functions Logical Process Flow

written as a collection of user-defined units or modules. The SQL code can be written as one of three module types: user-defined functions, triggers, and stored procedures.

SQL/PSM User-Defined Functions

A **user-defined function** (also known as a *stored function*) is a stored set of SQL statements that:

- is *called by name* from another SQL statement (or another module),
- may have *input parameters* passed to it by the calling SQL statement (or module), and
- *returns an output value* to the SQL statement that called the function (or module).

The logical process flow of a user-defined function is illustrated in Figure E-10. SQL/PSM user-defined functions are very similar to the SQL built-in functions (COUNT, SUM, AVE, MAX, and MIN) that we discussed and used in Chapter 3, except that, as the name implies, we create them ourselves to perform specific tasks that we need to do.

A common problem is needing a name in the format *FirstName LastName* (including the space!) in a report when the database stores the basic data in two fields named *FirstName* and *LastName*. Using the data in the WPC database, we could, of course, simply include the code to do this in an SQL statement using a concatenation operator:

```
/* *** SQL-Query-AppE-08 *** */
SELECT      RTRIM(FirstName)+' '+RTRIM(LastName) AS EmployeeName,
            Department, Phone, Email
FROM        EMPLOYEE
ORDER BY    EmployeeName;
```

This produces the desired results, but at the expense of working out some cumbersome coding:

	EmployeeName	Department	Phone	Email
1	George Jones	Production	360-287-8620	George.Jones@WPC.com
2	George Smith	Human Resources	360-285-8510	George.Smith@WPC.com
3	Heather Jones	Accounting	360-285-8320	Heather.Jones@WPC.com
4	James Nestor	InfoSystems	NULL	James.Nestor@WPC.com
5	Ken Numoto	Marketing	360-287-8710	Ken.Numoto@WPC.com
6	Mary Abernathy	Finance	360-285-8410	Mary.Abernathy@WPC.com
7	Mary Jacobs	Administration	360-285-8110	Mary.Jacobs@WPC.com
8	Richard Bandalone	Legal	360-285-8210	Richard.Bandalone@WPC.com
9	Rick Brown	InfoSystems	360-287-8820	Rick.Brown@WPC.com
10	Rosalie Jackson	Administration	360-285-8120	Rosalie.Jackson@WPC.com
11	Tom Caruthers	Accounting	360-285-8310	Tom.Caruthers@WPC.com
12	Tom Jackson	Production	360-287-8610	Tom.Jackson@WPC.com

By The Way

SQL-Query-AppE-08 is written for SQL Server 2014 using SQL Server T-SQL. As usual, SQL syntax varies from DBMS to DBMS. Oracle Database Express Edition 11g Release 2 uses a double vertical bar [||] as the concatenation operator, and SQL-Query-AppE-08 is written for Oracle Database as:

```
/* *** SQL-Query-AppE-08-Oracle-Database *** */
SELECT      RTRIM(FirstName)||' '||RTRIM(LastName) AS EmployeeName,
            Department, Phone, Email
FROM        EMPLOYEE
ORDER BY    EmployeeName;
```

MySQL 5.6 uses the concatenation string function CONCAT() as the concatenation operator, and SQL-Query-AppE-08 is written for MySQL 5.6 as:

```
/* *** SQL-Query-AppE-08-MySQL *** */
SELECT      CONCAT(RTRIM(FirstName),' ',RTRIM(LastName))
               AS EmployeeName,
            Department, Phone, Email
FROM        EMPLOYEE
ORDER BY    EmployeeName;
```

The alternative is to create a user-defined function to store this code. Not only does this make it easier to use, but it also makes it available for use in other SQL statements. Figure E-12 shows a user-defined function written in T-SQL for use with Microsoft SQL Server 2014, and the SQL code for the function uses, as we would expect, specific syntax requirements for Microsoft SQL Server's T-SQL 2014:

```
CREATE FUNCTION dbo.FirstNameFirst

-- These are the input parameters
      (
      @FirstName          CHAR(25),
      @LastName           CHAR(25)
      )

RETURNS VARCHAR(60)
AS
BEGIN
      -- This is the variable that will hold the value to be returned
      DECLARE @FullName VARCHAR(60)

      -- SQL statements to concatenate the names in the proper order
      SELECT @FullName = RTRIM(@FirstName) + ' ' + RTRIM(@LastName);

      -- Return the concatenated name
      RETURN @FullName
END
```

Figure E-12 — User-Defined Function Code to Concatenate FirstName and LastName

- The function is created and stored in the database by using the T-SQL CREATE FUNCTION statement.
- The function name starts with *dbo*, which is a Microsoft SQL Server *schema* name

This use of a schema name preended to a database object nampe is common in Microsoft SQL Server.

- The variable names of both the input parameters and the returned output value start with @.
- The concatenation syntax is T-SQL syntax.

Now that we have created and stored the user-defined function, we can use it in SQL-Query-AppE-09:

```
/* *** SQL-Query-AppE-09 *** */
SELECT      dbo.FirstNameFirst(FirstName, LastName) AS EmployeeName,
            Department, Phone, Email
FROM        EMPLOYEE
ORDER BY    EmployeeName;
```

Note that we supply the parameters to the function in the order it expects them: first name, then last name. The advantage of having a user-defined function is that we can now use it whenever we need to without having to re-create the code. Now we have a query using our function that produces the results we want, which of course are identical to the results for SQL-Query-AppE-08 above:

	EmployeeName	Department	Phone	Email
1	George Jones	Production	360-287-8620	George.Jones@WPC.com
2	George Smith	Human Resources	360-285-8510	George.Smith@WPC.com
3	Heather Jones	Accounting	360-285-8320	Heather.Jones@WPC.com
4	James Nestor	InfoSystems	NULL	James.Nestor@WPC.com
5	Ken Numoto	Marketing	360-287-8710	Ken.Numoto@WPC.com
6	Mary Abernathy	Finance	360-285-8410	Mary.Abernathy@WPC.com
7	Mary Jacobs	Administration	360-285-8110	Mary.Jacobs@WPC.com
8	Richard Bandalone	Legal	360-285-8210	Richard.Bandalone@WPC.com
9	Rick Brown	InfoSystems	360-287-8820	Rick.Brown@WPC.com
10	Rosalie Jackson	Administration	360-285-8120	Rosalie.Jackson@WPC.com
11	Tom Caruthers	Accounting	360-285-8310	Tom.Caruthers@WPC.com
12	Tom Jackson	Production	360-287-8610	Tom.Jackson@WPC.com

By The Way

The user-defined function FirstNameFirst is written for SQL Server 2014 using SQL Server T-SQL. As usual, SQL syntax varies from DBMS to DBMS. The Oracle Database Express Edition 11g Release 2 version is written as:

```
CREATE OR REPLACE FUNCTION FirstNameFirst
    -- These are the input parameters
       (
        varFirstName    IN Char,
        varLastName     IN Char
       )
    -- This is the variable that will hold the returned value
    RETURN          Varchar
    IS varFullName  Varchar(60);

BEGIN

    -- SQL statements to concatenate the names in the proper order
    varFullName := (RTRIM(varFirstName)||' '||RTRIM(varLastName));
    -- Return the concatenated name
    RETURN varFullName;

END;
/
```

The MySQL 5.6 version is written as:

```
DELIMITER //

CREATE FUNCTION FirstNameFirst
-- These are the input parameters
       (
        varFirstName    Char(25),
        varLastName     Char(25)
       )
RETURNS Varchar(60) DETERMINISTIC
BEGIN
   -- This is the variable that will hold the value to be returned
   DECLARE   varFullName  Varchar(60);
   -- SQL statements to concatenate the names in the proper order
   SET varFullName = CONCAT(varFirstName, ' ', varLastName);
   -- Return the concatenated name
   RETURN varFullName;

END
//

DELIMITER ;
```

SQL/PSM Triggers

A **trigger** is a stored program that is executed by the DBMS whenever a specified event occurs. Triggers for Oracle Database are written in Java or in Oracle's PL/SQL. SQL Server triggers are written in Microsoft .NET Common Language Runtime (CLR) languages, such as Visual Basic .NET, or Microsoft's T-SQL. MySQL triggers are written in MySQL's variant of SQL. In this chapter, we will discuss triggers in a generic manner without considering the particulars of those languages.

A trigger is attached to a table or a view. A table or a view may have many triggers, but a trigger is associated with just one table or view. A trigger is automatically invoked by an SQL DML INSERT, UPDATE, or DELETE request on the table or view to which it is attached. Figure E-13 summarizes the triggers available for SQL Server 2014, Oracle Database Express Edition 11*g* Release 2, and MySQL 5.6.

Oracle Database Express Edition 11*g* Release 2 supports three kinds of triggers: BEFORE, INSTEAD OF, and AFTER. As you would expect, BEFORE triggers are executed before the DBMS processes the insert, update, or delete request. INSTEAD OF triggers are executed in place of any DBMS processing of the insert, update, or delete request. AFTER triggers are executed after the insert, update, or delete request has been processed. All together, nine trigger types are possible: BEFORE (INSERT, UPDATE, DELETE); INSTEAD OF (INSERT, UPDATE, DELETE); and AFTER (INSERT, UPDATE, DELETE).

Trigger Type / DML Action	BEFORE	INSTEAD OF	AFTER
INSERT	Oracle Database MySQL	Oracle Database SQL Server	Oracle Database SQL Server MySQL
UPDATE	Oracle Database MySQL	Oracle Database SQL Server	Oracle Database SQL Server MySQL
DELETE	Oracle Database MySQL	Oracle Database SQL Server	Oracle Database SQL Server MySQL

Figure E-13 — Summary of SQL Triggers by DBMS Product

Since SQL Server 2005, SQL Server supports DDL triggers (triggers on such SQL DDL statements as CREATE, ALTER, and DROP) as well as DML triggers. We will only deal with the DML triggers here, which for SQL Server 2014 are INSTEAD OF and AFTER triggers on INSERT, UPDATE, and DELETE. (Microsoft includes the FOR keyword, but this is a synonym for AFTER in Microsoft syntax.) Thus, we have six possible trigger types for use in SQL Server 2014.

MySQL 5.6 supports only BEFORE and AFTER triggers, thus it supports only six trigger types. Other DBMS products support triggers differently. See the documentation of your product to determine which trigger types it supports.

When a trigger is invoked, the DBMS makes the data involved in the requested action available to the trigger code. For an insert, the DBMS will supply the values of columns for the row that is being inserted. For deletions, the DBMS will supply the values of columns for the row that is being deleted. For updates, it will supply both the old and the new values. The way in which this is done depends on the DBMS product.

While a full discussion of triggers is beyond the scope of this book, we will note that triggers have many uses, and four common uses for triggers are

- Providing default values
- Enforcing data constraints
- Updating SQL views
- Performing referential integrity actions

For more information about SQL triggers and how to use them, see David M. Kroenke and David J. Auer, *Database Processing: Fundamentals, Design, and Implementation*, 13th Edition (Upper Saddle River, NJ: Pearson, 2014).

Triggers Versus Stored Procedures
Trigger
Module of code that is called by the DBMS when INSERT, UPDATE, or DELETE commands are issued.
Assigned to a table or view.
Depending on the DBMS, may have more than one trigger per table or view.
Triggers may issue INSERT, UPDATE, and DELETE commands and thereby may cause the invocation of other triggers.
Stored Procedure
Module of code that is called by a user or database administrator.
Assigned to a database, but not to a table or a view.
Can issue INSERT, UPDATE, DELETE, and MERGE commands.
Used for repetitive administration tasks or as part of an application.

Figure E-14 — Triggers Versus Stored Procedures

SQL/PSM Stored Procedures

A **stored procedure** is, like a function or trigger, a program that is stored within the database. In Oracle Database, stored procedures can be written in PL/SQL or in Java. With SQL Server 2014, stored procedures are written in T-SQL or a .NET CLR language, such as Visual Basic.NET, C#.NET, or C++.NET. With MySQL, stored procedures are written in MySQL's variant of SQL.

Stored procedures can receive input parameters and return results. They differ from functions in that they are not required to return a result. And unlike triggers, which are attached to a given table or view, stored procedures are attached to the database. They can be executed by any process using the database that has permission to use the procedure. Differences between triggers and stored procedures are summarized in Figure E-14.

Stored procedures are used for many purposes. Although database administrators use them to perform common administration tasks, their primary use is within database applications. They can be invoked from application programs written in languages such as COBOL, C, Java, C#, or C++. They also can be invoked from Web pages using VBScript, JavaScript, or PHP. Ad hoc users can run them from DBMS management products such as SQL*Plus or SQL Developer in Oracle Database, SQL Server Management Studio in SQL Server, or the MySQL Workbench in MySQL.

Advantages of Stored Procedures

While a full discussion of stored procedures is beyond the scope of this book, we will note that there are many advantages of using stored procedures. These are listed in Figure E-15.

Unlike application code, stored procedures are never distributed to client computers. They always reside in the database and are processed by the DBMS on the database server. Thus, they are more secure than distributed application code, and they also reduce network traffic. Increasingly, stored procedures are the preferred mode of processing application logic over the Internet or corporate intranets. Another advantage of stored procedures is that their SQL statements can be optimized by the DBMS compiler.

When application logic is placed in a stored procedure, many different application programmers can use that code. This sharing results not only in less work, but also in standardized processing. Further, the developers best suited for database work can create the stored procedures while other developers, say, those who specialize in Web-tier programming, can do other work. Because of these advantages, it is likely that stored procedures will see increased use in the future.

For more information about SQL stored procedures and how to use them, see David M. Kroenke and David J. Auer, *Database Processing: Fundamentals, Design, and Implementation*, 13th Edition (Upper Saddle River, NJ: Pearson, 2014).

Figure E-15 — Advantages of Stored Procedures

Advantages of Stored Procedures
Greater security.
Decreased network traffic.
SQL can be optimized.
Code sharing.
Less work.
Standardized processing.
Specialization among developers.

Importing Microsoft Excel Data into a Database Table

When developing a database to support an application, it is very common to find that some (if not all) of the data needed in the database exists as data in user **worksheets** (also called **spreadsheets**). A typical example of this is a Microsoft Excel 2013 worksheet that a user has been maintaining, and which must now be converted to data stored in the database.

If we are really lucky, the worksheet will already be organized like a database table, with appropriate column labels and unique data in each row. And if we are *really, really lucky*, there will be one or more columns that can be used as the primary key in the new database table. In that case, we can easily import the data into the database. More likely, we will have to modify the worksheet, and organize and clean up the data in it before we can import the data. In essence, we are following a procedure that we will encounter again in Chapter 8 in our discussion of data warehouses known as **extract, transform and load (ETL)**.

As an example, let's consider the problem of computers owned by WPC. WPC needs to track these computers (asset inventory) and who they are currently and have been assigned to for use. The properly designed tables (COMPUTER and COMPUTER_ASSIGNMENT) to handle this problem are shown in the Chapter 03 Access Workbench Exercises as Figures 3-23 and 3-25. The data for the tables is shown in Figures 3-24 and 3-26.

Unfortunately, that is not the way we will probably encounter the data. More likely we'll find it stored in a worksheet such as the Microsoft Excel 2013 worksheet shown in Figure E-16.

This worksheet breaks our basic rule of one theme per table—it combines computer inventory and computer assignment data into the same worksheet. Worse, the computer assignments are handled by using multiple assignment and date columns.

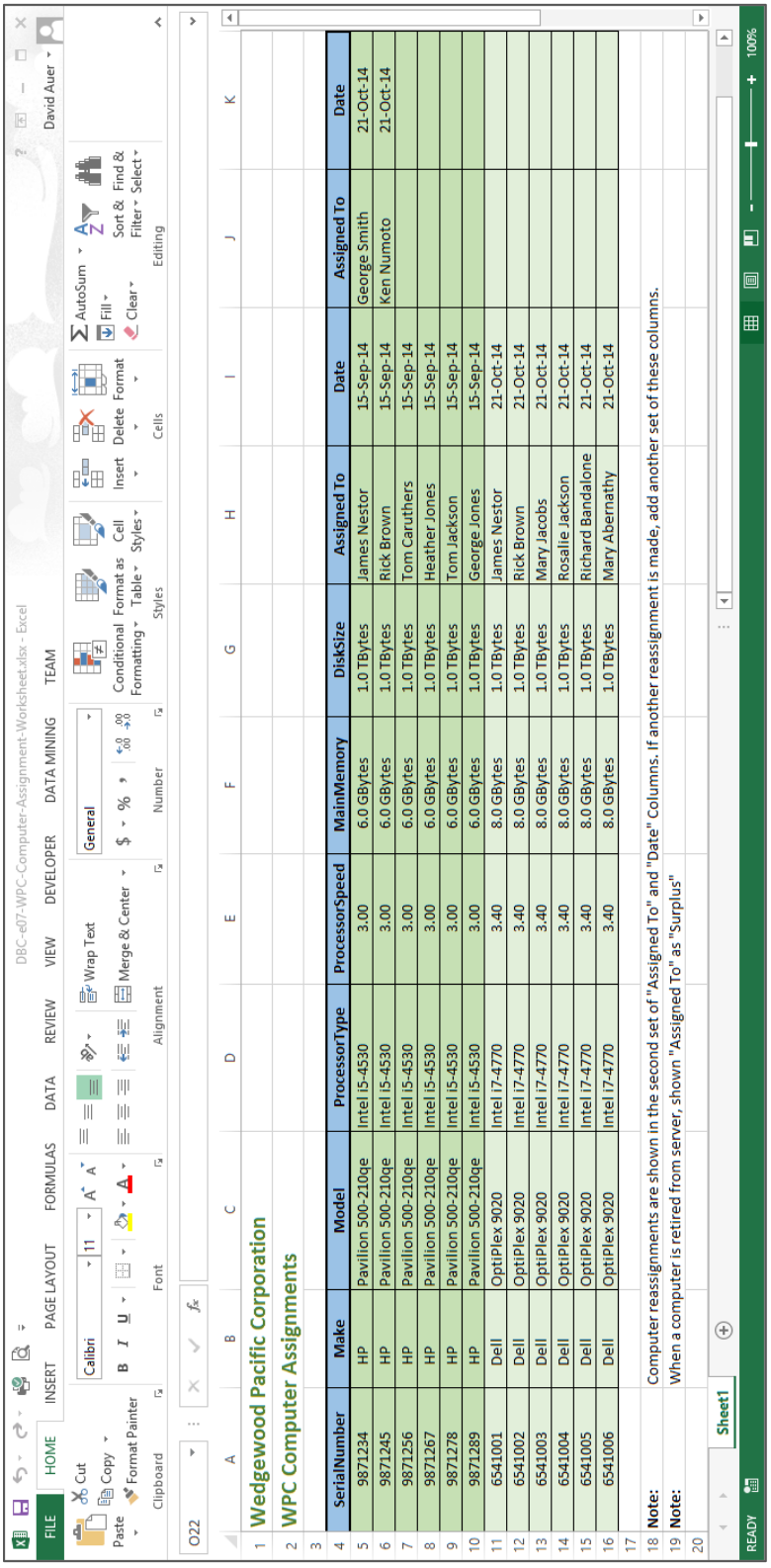
This is an example of what is called the **multivalue, multicolumn problem**, which occurs when multiple columns are used in a spreadsheet or database table to record repetitions of the same data. A good example is EMPLOYEE phone number data, where we might find a columns for HomePhone, CellPhone, and BusinessPhone. This may seem reasonable until we have to add yet *another* phone number, perhaps DepartmentPhone or SpousesPhone.

What we are dealing with here is a **multivalued dependency**, where the determinant determines multiple values instead of just one:

$$\text{EmployeeID} \rightarrow\!\!\!\!\rightarrow \text{PhoneNumber}$$

A detailed solution to this problem is beyond the scope of this book, but the basic answer to is to put the EmployeeID and PhoneNumber data into their own table (Note that as stated in Chapter 2, this is 4NF).[4]

[4] For more information about multivalued dependencies and the multivalue, multicolumn problem, see David Kroenke and David Auer, *Database Processing: Fundamentals, Design, and Implementation, 13th Edition*. (Upper Saddle River, NJ, 2014: Pearson Higher Education.



Wedgewood Pacific Corporation

WPC Computer Assignments

SerialNumber	Make	Model	ProcessorType	ProcessorSpeed	MainMemory	DiskSize	Assigned To	Date	Assigned To	Date
9871234	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	James Nestor	15-Sep-14	George Smith	21-Oct-14
9871245	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	Rick Brown	15-Sep-14	Ken Numoto	21-Oct-14
9871256	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	Tom Caruthers	15-Sep-14		
9871267	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	Heather Jones	15-Sep-14		
9871278	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	Tom Jackson	15-Sep-14		
9871289	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	George Jones	15-Sep-14		
6541001	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	James Nestor	21-Oct-14		
6541002	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	Rick Brown	21-Oct-14		
6541003	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	Mary Jacobs	21-Oct-14		
6541004	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	Rosalie Jackson	21-Oct-14		
6541005	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	Richard Bandalone	21-Oct-14		
6541006	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	Mary Abernathy	21-Oct-14		

Note: Computer reassignments are shown in the second set of "Assigned To" and "Date" Columns. If another reassignment is made, add another set of these columns.

Note: When a computer is retired from server, shown "Assigned To" as "Surplus"

Figure E-16 — WPC Computer Assignments in a Microsoft Excel 2013 Worksheet

In our current situation, it is obvious that we must *extract* the data we need from the worksheet for two database tables – COMPUTER and COMPUTER_ASSIGNMENT, *transform* each set of data into a correctly structured and formatted worksheet, and then *load* (import) the data from the worksheet into the database.

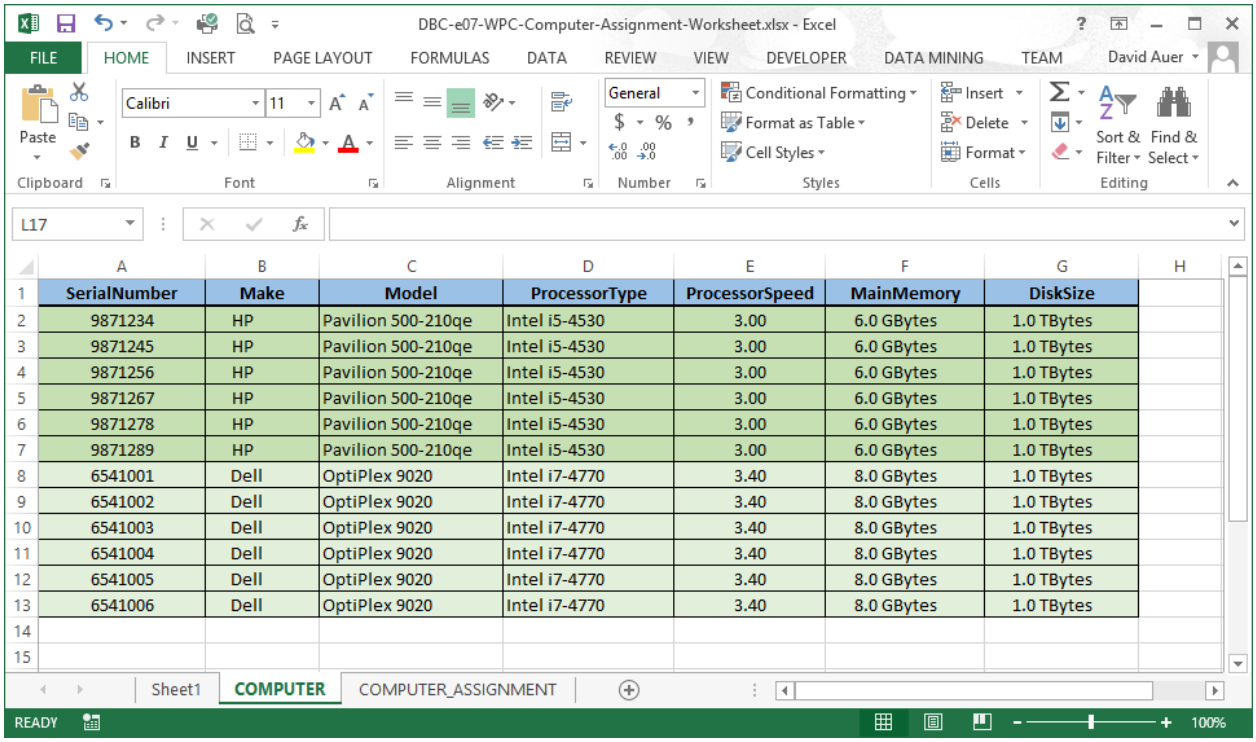
We can do this by:

- Creating two new worksheets named COMPUTER and COMPUTER_ASSIGNMENT, and copying the data into them, then
- Modifying the structure and data in each worksheet so that it is correct for importing into the database,
- Importing the data from each worksheet into the database

After the data is imported into two database tables, we will then have to use SQL ALTER TABLE statements to create primary keys, foreign keys and any other needed constraints.

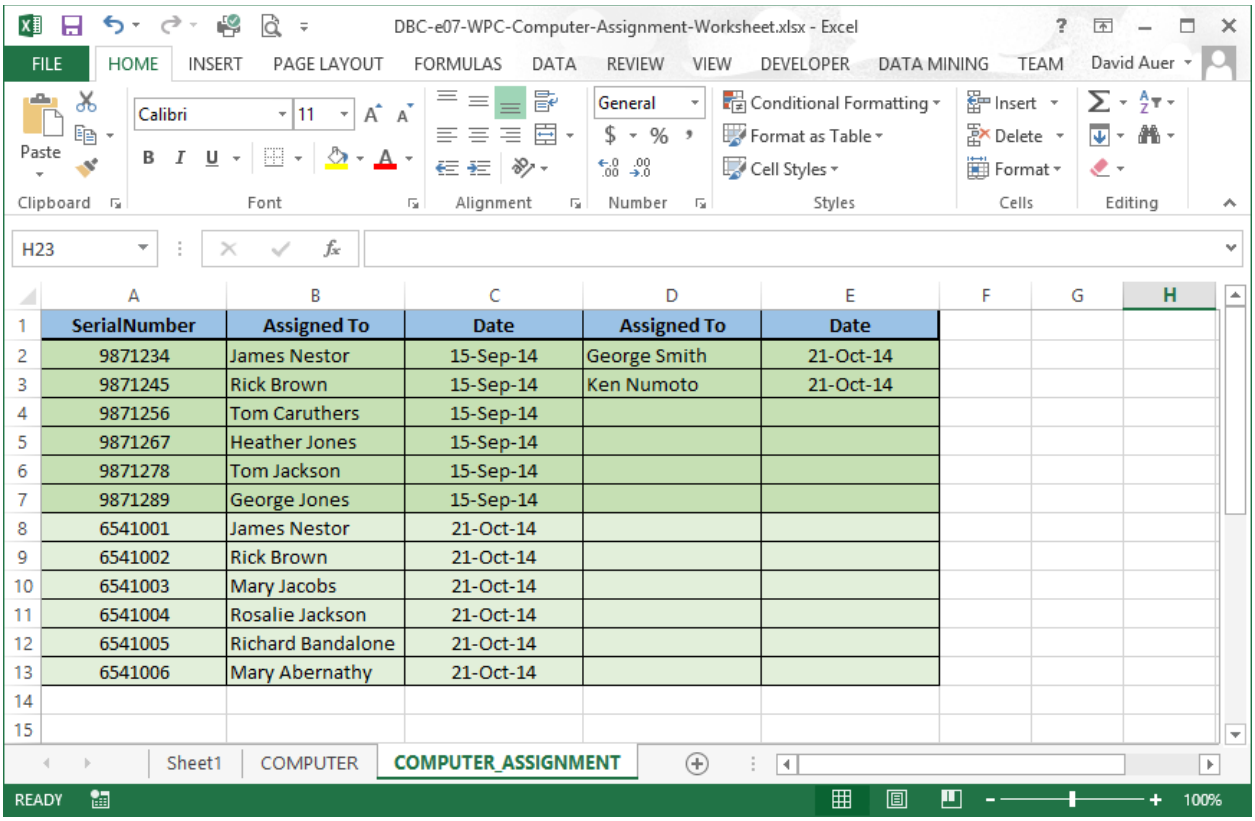
Preparing the Microsoft Excel Data for Import into a Database Table

Figure E-17 shows the COMPUTER worksheet after it has been cleaned up. All extraneous rows and columns have been deleted, and only the computer data (with appropriate column headers) remains. This worksheet now looks like a database table, which is a good indication that the data import should work properly.



	A	B	C	D	E	F	G	H
1	SerialNumber	Make	Model	ProcessorType	ProcessorSpeed	MainMemory	DiskSize	
2	9871234	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	
3	9871245	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	
4	9871256	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	
5	9871267	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	
6	9871278	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	
7	9871289	HP	Pavilion 500-210qe	Intel i5-4530	3.00	6.0 GBytes	1.0 TBytes	
8	6541001	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	
9	6541002	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	
10	6541003	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	
11	6541004	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	
12	6541005	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	
13	6541006	Dell	OptiPlex 9020	Intel i7-4770	3.40	8.0 GBytes	1.0 TBytes	
14								
15								

Figure E-17 — The WPC COMPUTER Worksheet



	A	B	C	D	E	F	G	H
1	SerialNumber	Assigned To	Date	Assigned To	Date			
2	9871234	James Nestor	15-Sep-14	George Smith	21-Oct-14			
3	9871245	Rick Brown	15-Sep-14	Ken Numoto	21-Oct-14			
4	9871256	Tom Caruthers	15-Sep-14					
5	9871267	Heather Jones	15-Sep-14					
6	9871278	Tom Jackson	15-Sep-14					
7	9871289	George Jones	15-Sep-14					
8	6541001	James Nestor	21-Oct-14					
9	6541002	Rick Brown	21-Oct-14					
10	6541003	Mary Jacobs	21-Oct-14					
11	6541004	Rosalie Jackson	21-Oct-14					
12	6541005	Richard Bandalone	21-Oct-14					
13	6541006	Mary Abernathy	21-Oct-14					
14								
15								

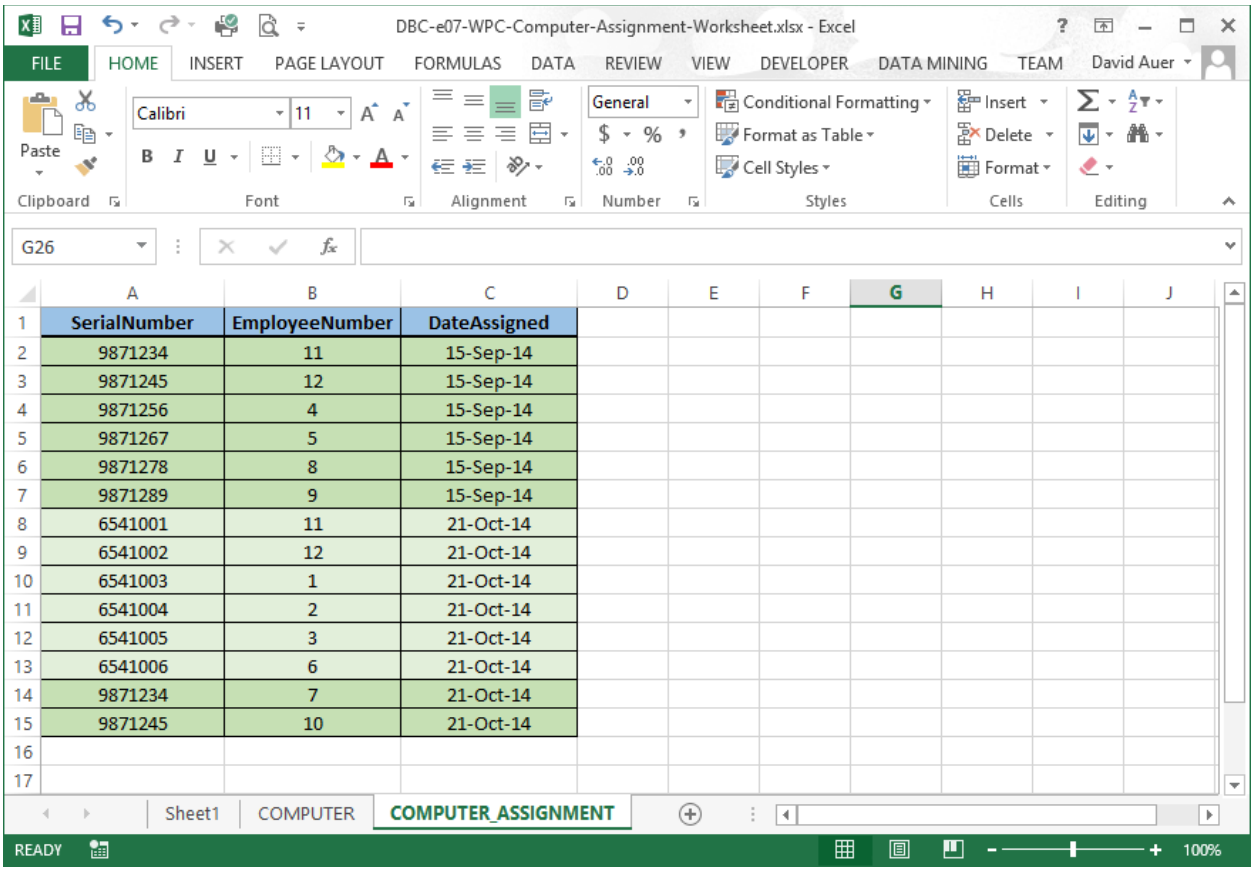
Figure E-18 — The WPC COMPUTER_ASSIGNMENT Worksheet – First Attempt

Figure E-18 shows the COMPUTER_ASSIGNMENT worksheet after our first attempt at restricting it. There are still some obvious problems here. First of all, in the WPC database we identify employees by their *EmployeeNumber*, not by their name. Second, we still have multiple Assigned To and Date columns. Therefore, we need to (1) substitute *EmployeeNumber* for *Assigned To*, and (2) combine the Assigned to and Date columns. We can determine EmployeeNumber (a surrogate key) by using an SQL query in the WPC database:

```
/* *** SQL-Query-AppE-10 *** */
SELECT      *
FROM        EMPLOYEE
```

This query gives us:

	EmployeeNumber	FirstName	LastName	Department	Phone	Email
1	1	Mary	Jacobs	Administration	360-285-8110	Mary.Jacobs@WPC.com
2	2	Rosalie	Jackson	Administration	360-285-8120	Rosalie.Jackson@WPC.com
3	3	Richard	Bandalone	Legal	360-285-8210	Richard.Bandalone@WPC.com
4	4	Tom	Caruthers	Accounting	360-285-8310	Tom.Caruthers@WPC.com
5	5	Heather	Jones	Accounting	360-285-8320	Heather.Jones@WPC.com
6	6	Mary	Abernathy	Finance	360-285-8410	Mary.Abernathy@WPC.com
7	7	George	Smith	Human Resources	360-285-8510	George.Smith@WPC.com
8	8	Tom	Jackson	Production	360-287-8610	Tom.Jackson@WPC.com
9	9	George	Jones	Production	360-287-8620	George.Jones@WPC.com
10	10	Ken	Numoto	Marketing	360-287-8710	Ken.Numoto@WPC.com
11	11	James	Nestor	InfoSystems	NULL	James.Nestor@WPC.com
12	12	Rick	Brown	InfoSystems	360-287-8820	Rick.Brown@WPC.com



	A	B	C	D	E	F	G	H	I	J
1	SerialNumber	EmployeeNumber	DateAssigned							
2	9871234	11	15-Sep-14							
3	9871245	12	15-Sep-14							
4	9871256	4	15-Sep-14							
5	9871267	5	15-Sep-14							
6	9871278	8	15-Sep-14							
7	9871289	9	15-Sep-14							
8	6541001	11	21-Oct-14							
9	6541002	12	21-Oct-14							
10	6541003	1	21-Oct-14							
11	6541004	2	21-Oct-14							
12	6541005	3	21-Oct-14							
13	6541006	6	21-Oct-14							
14	9871234	7	21-Oct-14							
15	9871245	10	21-Oct-14							
16										
17										

Figure E-19 — The WPC COMPUTER_ASSIGNMENT Worksheet – Second Attempt

Using this data, we can rework the COMPUTER_ASSIGNMENT worksheet as shown in Figure E-19, which also includes a renamed *Date* column which is now *DateAssigned.* We have also renamed the AssignedTo column to EmployeeNumber and transformed each row, which represented a single computer, into multiple rows, one per assignment of that computer—that effectively combines the AssignedTo and Date columns; it also transforms the data into first normal form.

Admittedly this is a small example, and given a larger data set a different strategy would be needed. For our purposes here, however, this method will work.

We will now look at how to import a table into SQL Server 2014, Oracle Database Express Edition 11*g* Release 2, and MySQL 5.6. We will use the COMPUTER table. The COMPUTER table column characteristics as stated in Figure 3-23 are shown below in Figure E-20. Note that we will need two CHECK constraints on this table, and that neither of these can be done in the data import—we will have to use SQL ALTER TABLE statements to implement these constraints after the table is created and the data is imported.

Database Column Characteristics for the COMPUTER Table

Column Name	Type	Key	Required	Remarks
SerialNumber	Number	Primary Key	Yes	Long Integer
Make	Text (12)	No	Yes	Must be "Dell" or "Gateway" or "HP" or "Other"
Model	Text (24)	No	Yes	
ProcessorType	Text (24)	No	No	
ProcessorSpeed	Number	No	Yes	Double [3,2], Between 1.0 and 4.0
MainMemory	Text (15)	No	Yes	
DiskSize	Text (15)	No	Yes	

Figure E-20 — Database Column Characteristics for the COMPUTER Table

Importing the Microsoft Excel Data into an SQL Server 2014 Database Table

Because Microsoft creates both Microsoft Excel 2013 and Microsoft SQL Server 2014, we would expect that importing data from Microsoft Excel into SQL Server would be simple and problem free. Unfortunately, in our experience, the **SQL Server Import and Export Wizard**, which is the tool we use for data import, has some glitches.

First, apparently the SQL Server Import and Export Wizard is only programmed to work with Microsoft Excel workbooks thorough Microsoft Excel 2007. Since we are using Microsoft Excel 2013, we have to download and install the **Microsoft Access Database Engine 2010 Redistributable** from http://www.microsoft.com/en-us/download/confirmation.aspx?id=13255. There are both 32-bit and 64-bit versions—install both if you are running a 64-bit version of Office. If you don't install this software, you will get an error message during the Wizard, and it will not complete its tasks.[5]

Second, the Wizard does not handle data types or NULL/NOT NULL constraints smoothly. We cannot modify the Wizard-detected data types or NULL/NOT NULL setting into the data types we want in the database—if we try, the Wizard generates an error message and will not complete its tasks.

Third, the Wizard does not allow a primary key to be set on the imported table, and it imports a set of blank rows (all NULL values) in addition to the actual data (this is only possible because no primary key has been set.

[5] This statement is true on Windows 8.1 Update 1 running Microsoft Office 2013 and Microsoft SQL Server 2014 Express Edition with all updates and patches installed as of July 7th, 2014. Hopefully Microsoft will update the SQL Server Import and Export Wizard and its supporting software in the near future.

Our solution to this is to:

- Use the SQL Server Import and Export Wizard to import the data into a temporary table as created by the Wizard, then
- Use an SQL CREATE TABLE statement to create the actual table we want in the database, then
- Use an SQL INSERT statement to copy the data from the temporary table to the actual table, then
- Delete the temporary table from the database.

Note that in these steps we will use a new variant of the SQL INSERT statement, a **bulk INSERT statement**. We use this form of the SQL INSERT statement when we want to copy a lot of data from one table to another, and copying from a temporary table to a final table is a great place to use this statement. In this case, given the name of the temporary table will be *COMPUTER$*, the SQL Statement will be:

```
/* *** SQL-INSERT-AppE-01 *** */
INSERT INTO dbo.COMPUTER
      (SerialNumber, Make, Model, ProcessorType,
       ProcessorSpeed, MainMemory, DiskSize)
      SELECT   SerialNumber, Make, Model, ProcessorType,
               ProcessorSpeed, MainMemory, DiskSize
      FROM     COMPUTER$
      WHERE    SerialNumber IS NOT NULL;
```

Note the use of the embedded SQL SELECT statement where we would expect to find a VALUES clause. Here are the actual steps:

1. In the Microsoft SQL Server Management Studio, expand the **WPC** database.
2. Right-click on the WPC database object to display a short-cut menu, and in the short-cut menu click on the **Tasks** command to display the Tasks menu, as shown in Figure E-21.
3. In the Task menu, click the **Import Data** command shown in Figure E-21 to launch the SQL Server Import and Export Wizard as shown in Figure E-22.
4. On the *Welcome to SQL Server Import and Export Wizard* page shown in Figure E-22, click the **Next** button to display the Choose a Data Source page as shown in Figure E-23.
5. On the *Choose a Data Source* page shown in Figure E-23, select **Microsoft Excel** as the data source.
6. On the *Choose a Data Source* page shown in Figure E-23, browse to the location of the Microsoft Excel file, select the most current version of **Microsoft Excel** listed in the Excel version drop-down list (currently *Microsoft Excel 2007*), and make sure the check box for *First row has column names* is checked, as shown in Figure E-23.
7. Click the **Next** button to display the *Choose a Destination* page as shown in Figure E-24, and select **SQL Server Native Client 11** as the destination. The WPC database values are automatically supplied and there is nothing to change.
8. Click the **Next** button to display the *Specify Table Copy or Query* page as shown in Figure E-25.

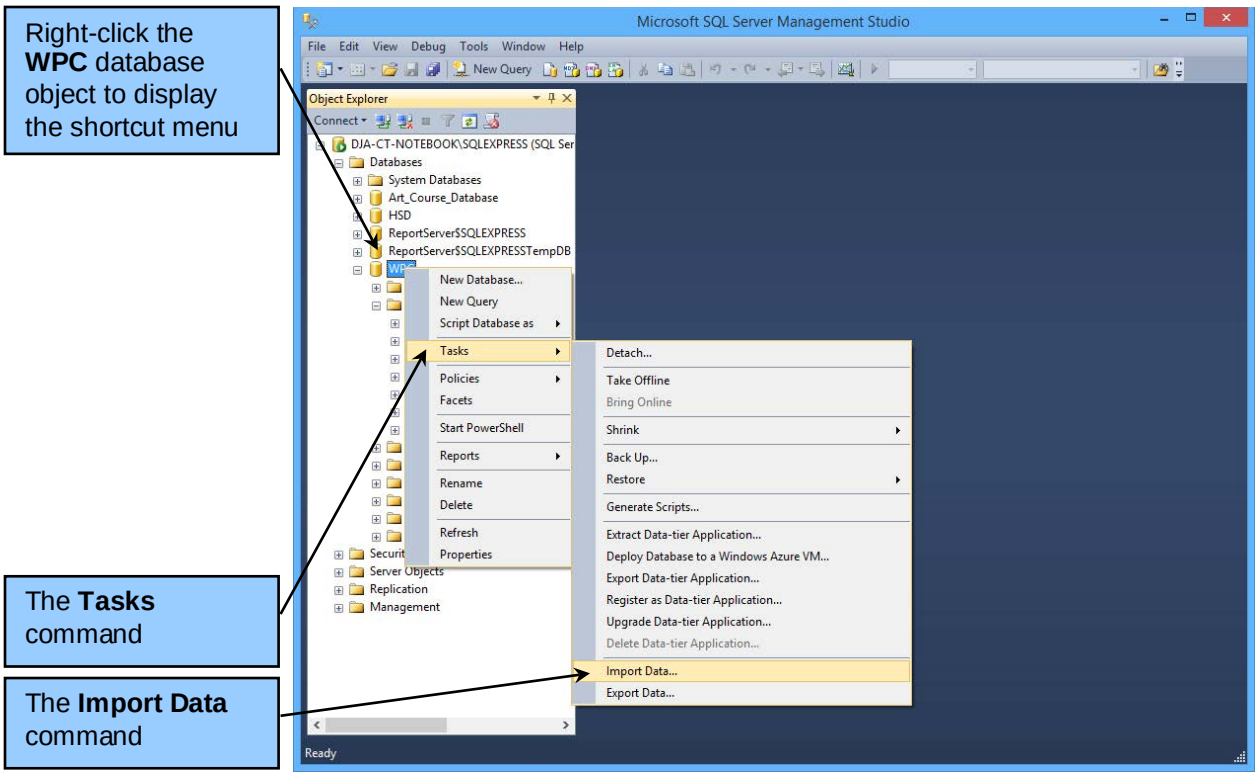


Figure E-21 — Launching the Microsoft SQL Server Import and Export Wizard

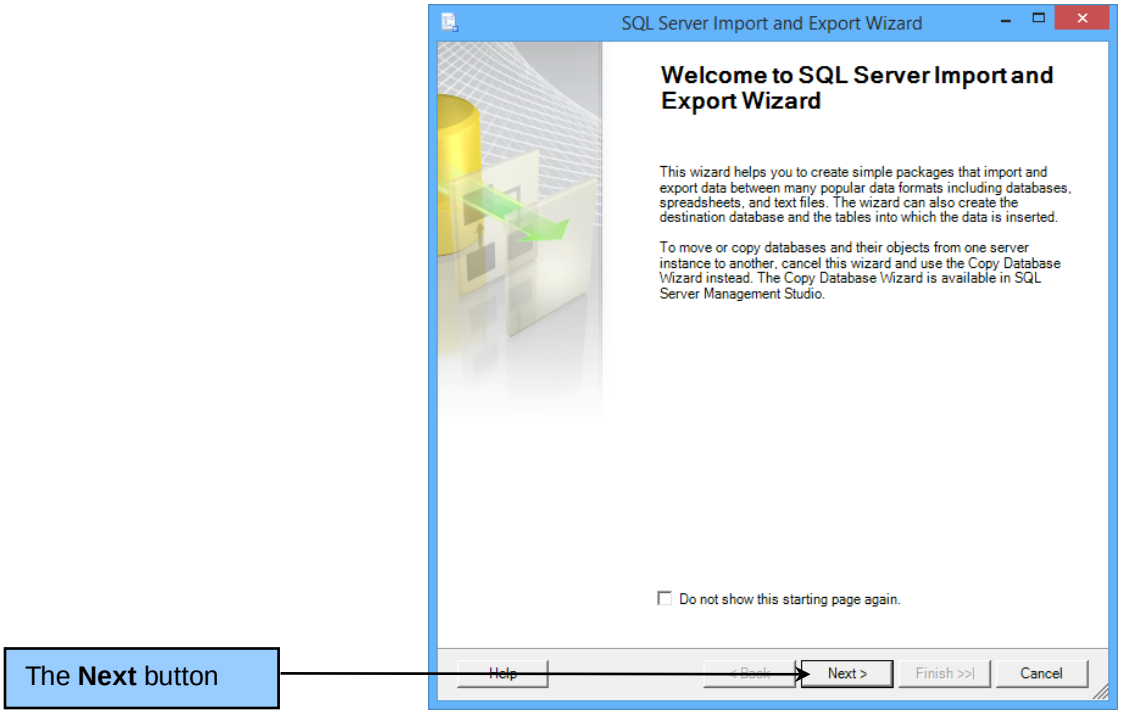


Figure E-22 — The Microsoft SQL Server Import and Export Wizard

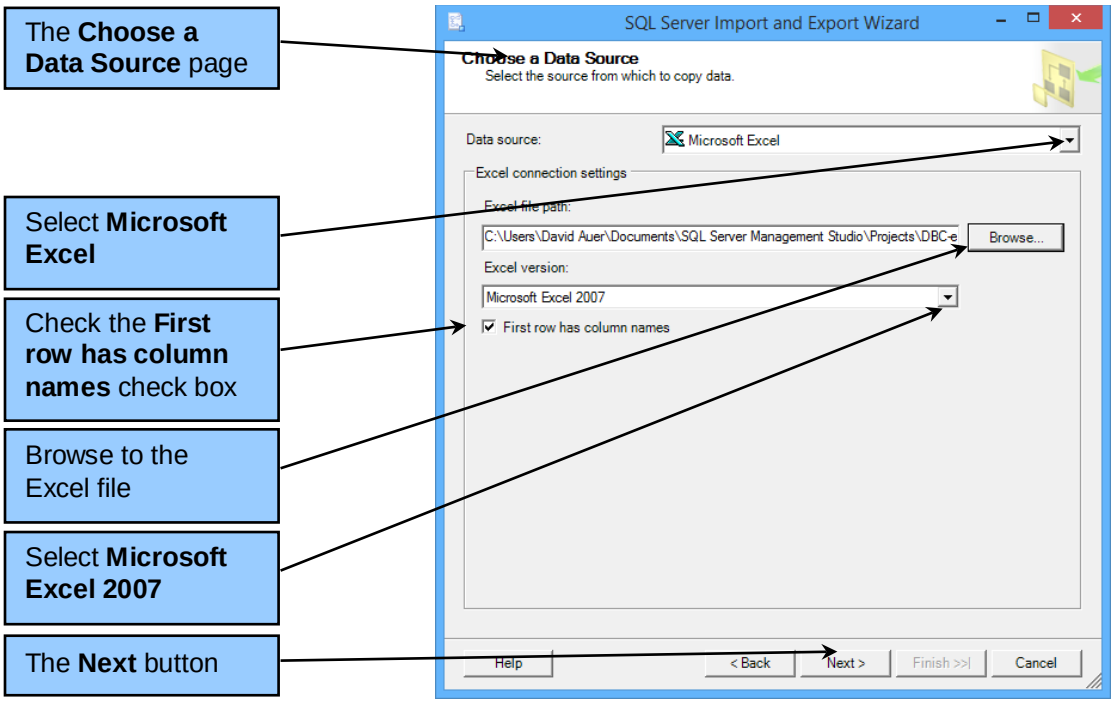


Figure E-23 — The Choose a Data Source Page

9. Click the **Next** button to display the *Select Source Tables and Views* page as shown in Figure E-26, and check the **'COMPUTER$'** check box in the *Source* column. The table name *[dbo].[COMPUTER$]* is generated and displayed in the *Destination* column. This is the name we will use for the temporary table in the WPC database.
10. Click the **Edit Mappings** button to display the *Column Mappings* dialog box shown in Figure E-27. This dialog box shows the column names, data types and NULL/NOT NULL settings that will be used to create the COMPUTER$ table during the import.

    - **Note:** We should be able to edit these values, but if we do we are likely to generate errors during the import process. Therefore, we leave them alone, and leave the temporary COMPUTER$ table as created by the Wizard.

    - **Note:** You may want to try some other imports where you do edit these values, in order to understand what you can and cannot successfully edit. When in doubt, leave it alone!

11. Click the **OK** button to return to the *Select Source Tables and Views* page, and then click the **Next** button.
12. The *Run Package* page is displayed as shown in Figure E-28. Click the **Next** button to display the *Complete the Wizard* page as shown in Figure E-29, and then click the **Finish** button.
13. The SQL Server Import and Export Wizard runs the actual import, and then displays the *The Execution was successful* page as shown in Figure E-30. Note that there are no errors in the process. Click the Close button to close the Wizard.

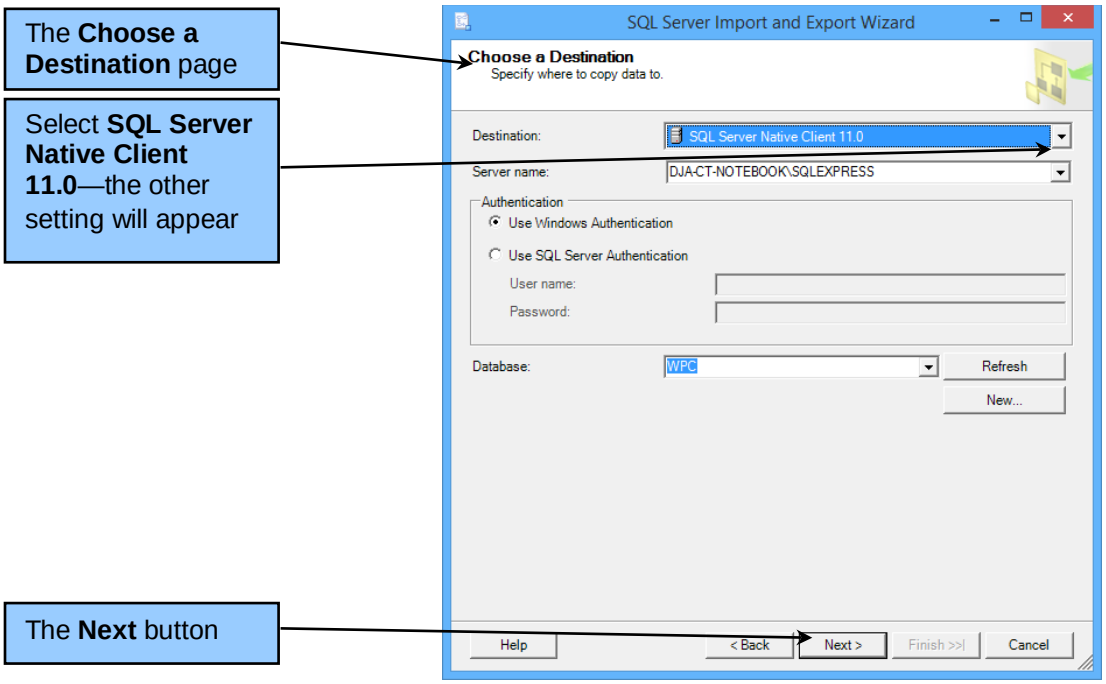


Figure E-24 — The Choose a Destination Page

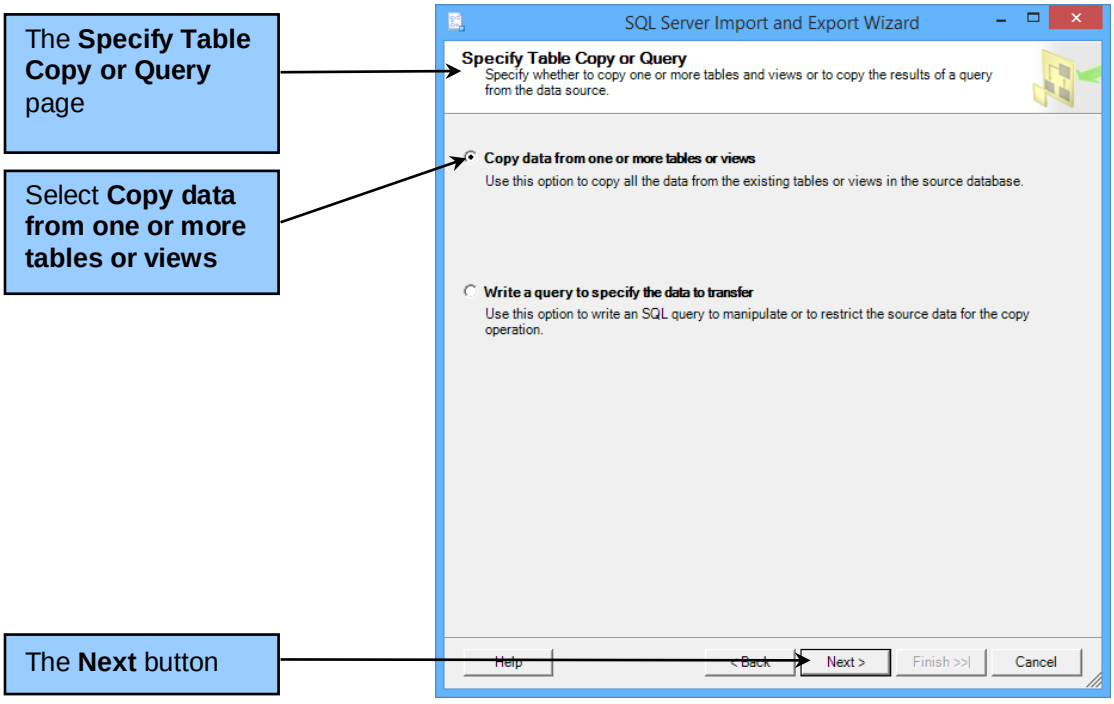


Figure E-25 — The Specify Table Copy or Query Page

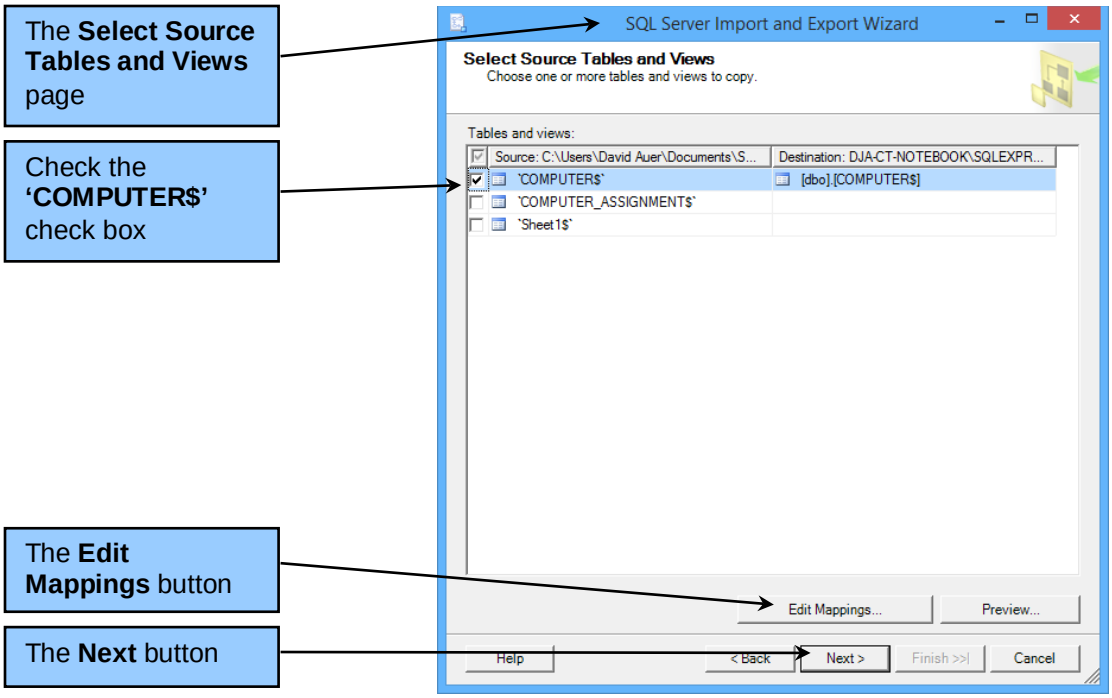


Figure E-26 — The Select Source Tables and Views Page

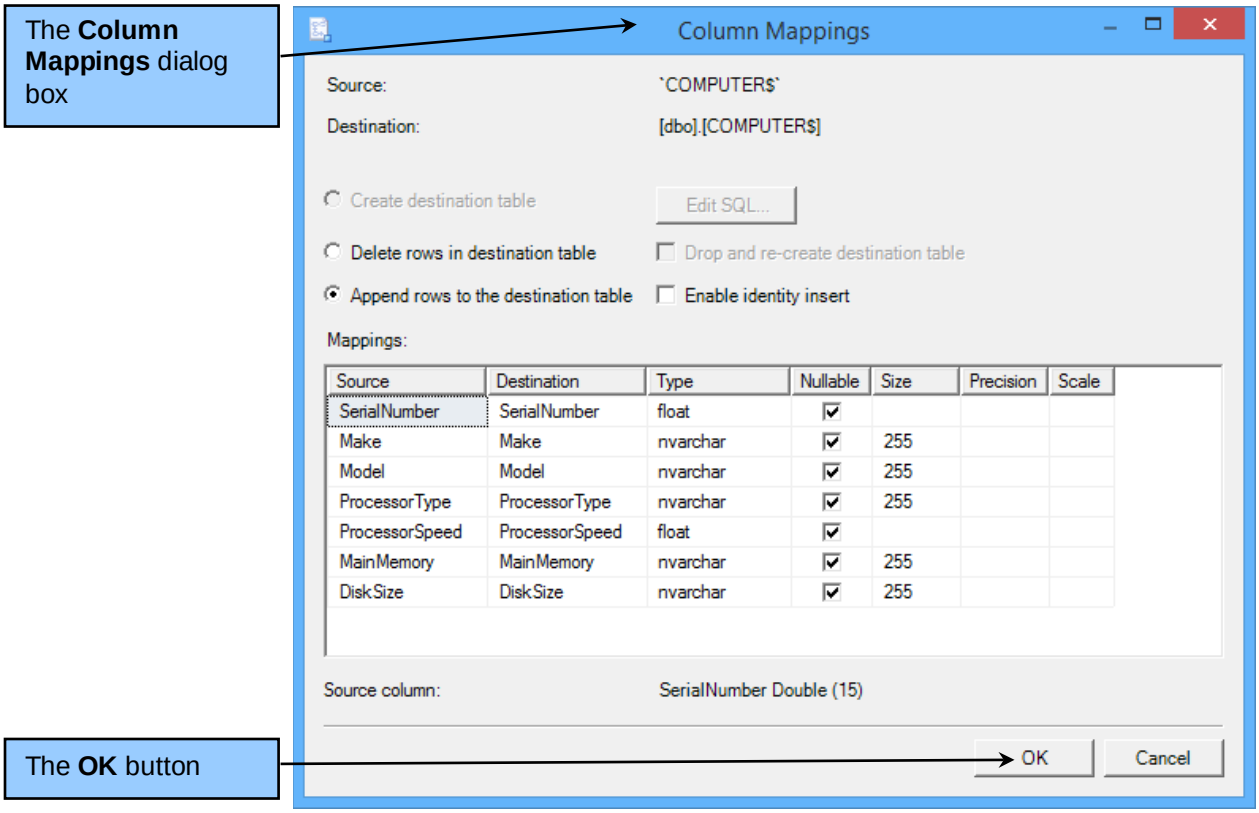


Figure E-27 — The Column Mappings Dialog Box

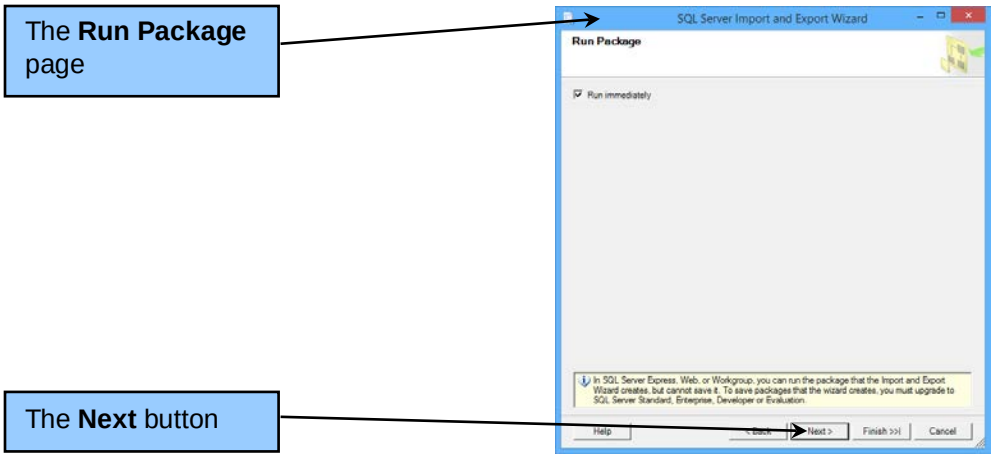


Figure E-28 — The Run Package Page

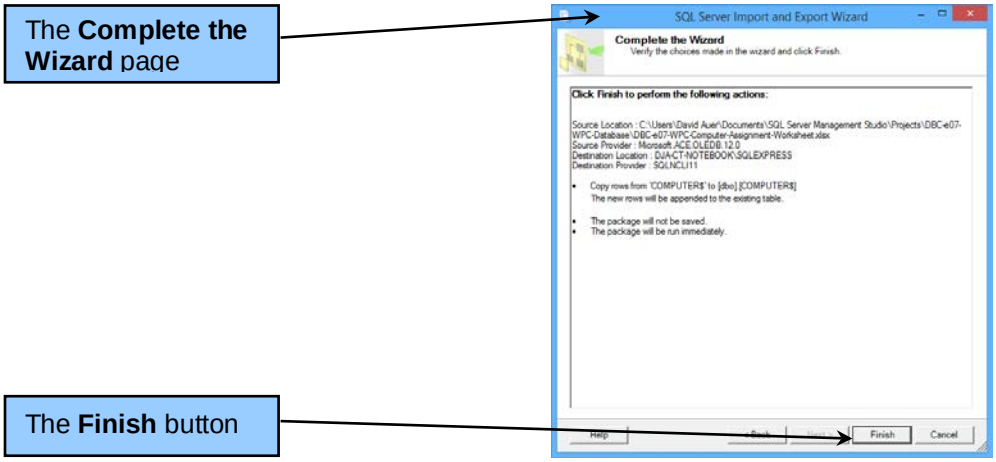


Figure E-29 — The Complete the Wizard Page

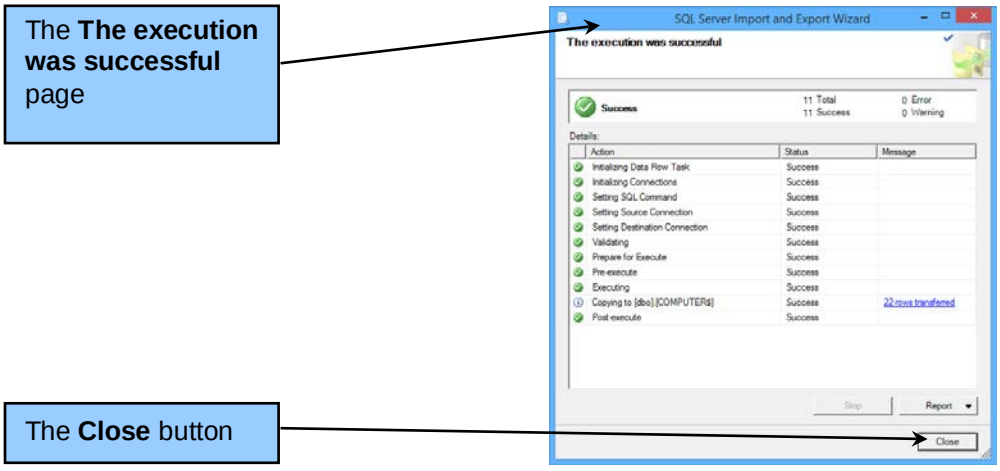


Figure E-30 — The Execution was Successful Page

14. In SQL Server Management Studio, refresh the **WPC** database. In Object Explorer, expand the **WPC** database, then expand the **Tables** object, then expand the **dbo.COMPUTER$** object, and finally expand the **Columns** object.

15. Open a New Query window, and run SQL-Query-AppE-11:

```
/* *** SQL-Query-AppE-11 *** */
SELECT    *
FROM      COMPUTER$;
```

16. The results of SQL-Query-AppE-11 are shown in Figure E-31. Note that the SQL Server Import and Export Wizard inserted an additional ten rows of blank data. This was only possible because no primary key was set, and SerialNumber was allowed to be NULL during the import process.

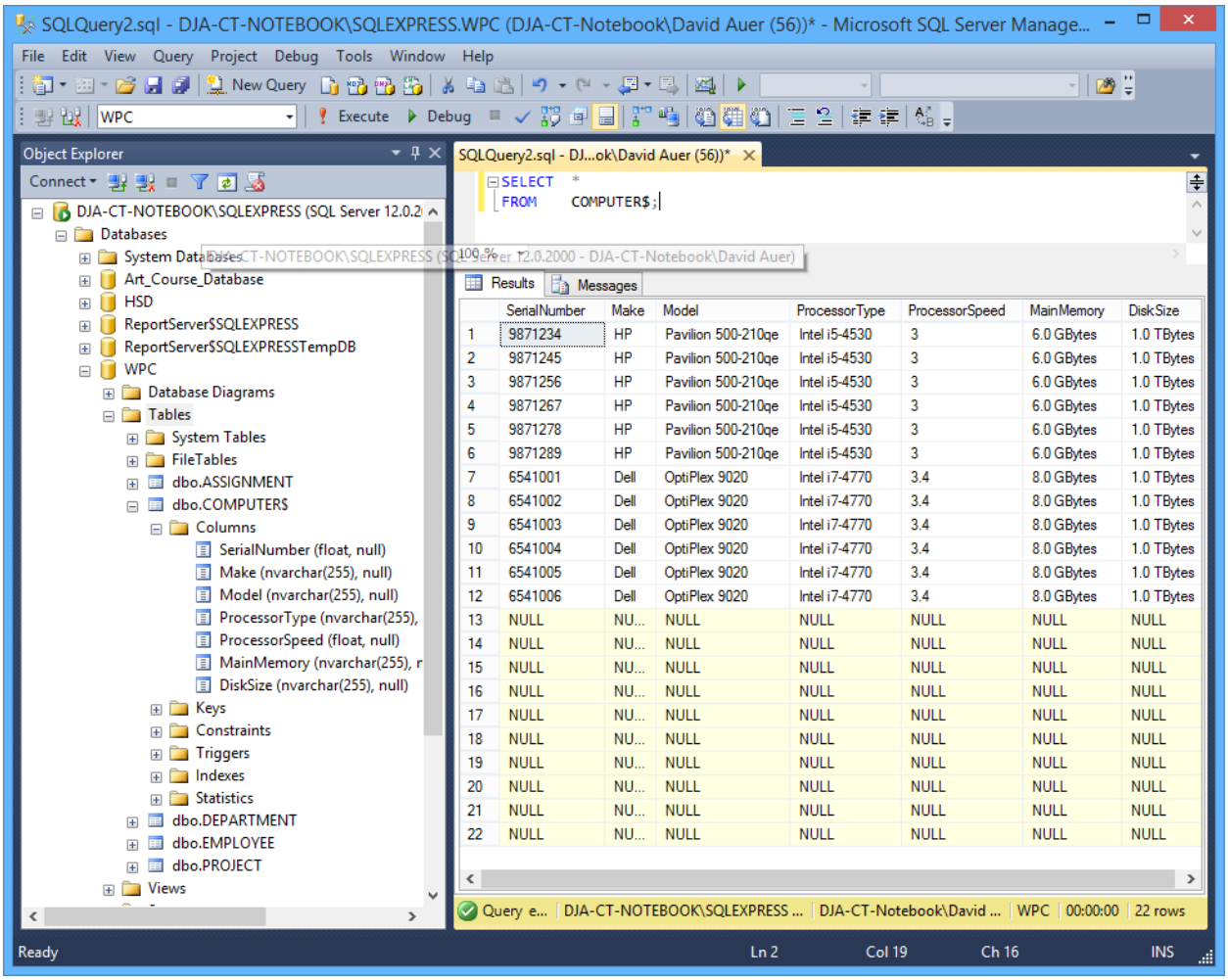


Figure E-31 — The SQL-Query-AppE-11 Query and Results

17. Now we have to create the final COMPUTER table in the WPC database. In the Microsoft SQL Server Management Studio, write the SQL CREATE TABLE statement for the COMPUTER table based on the data in Figure E-20. Note that in this case we can use the necessary CHECK CONSTRAINT statements as part of the CREATE TABLE statement, and will not need to add them later. This will be the SQL-CREATE-TABLE-AppE-01:

```
/* *** SQL-CREATE-TABLE-AppE-01 *** */

CREATE  TABLE COMPUTER(
   SerialNumber      Int             NOT NULL,
   Make              Char(12)        NOT NULL,
   Model             Char(24)        NOT NULL,
   ProcessorType     Char(24)        NULL,
   ProcessorSpeed    Numeric(3,2)    NOT NULL,
   MainMemory        Char(15)        NOT NULL,
   DiskSize          Char(15)        NOT NULL,
   CONSTRAINT     COMPUTER_PK        PRIMARY KEY(SerialNumber),
   CONSTRAINT     MAKE_CHECK         CHECK
                        (Make IN ('Dell', 'Gateway', 'HP', 'Other')),
   CONSTRAINT     SPEED_CHECK        CHECK
                        (ProcessorSpeed BETWEEN 1.0 AND 4.0)
);
```

18. Run the SQL-CREATE-TABLE-AppE-01 statement. The results are shown in Figure E-32.

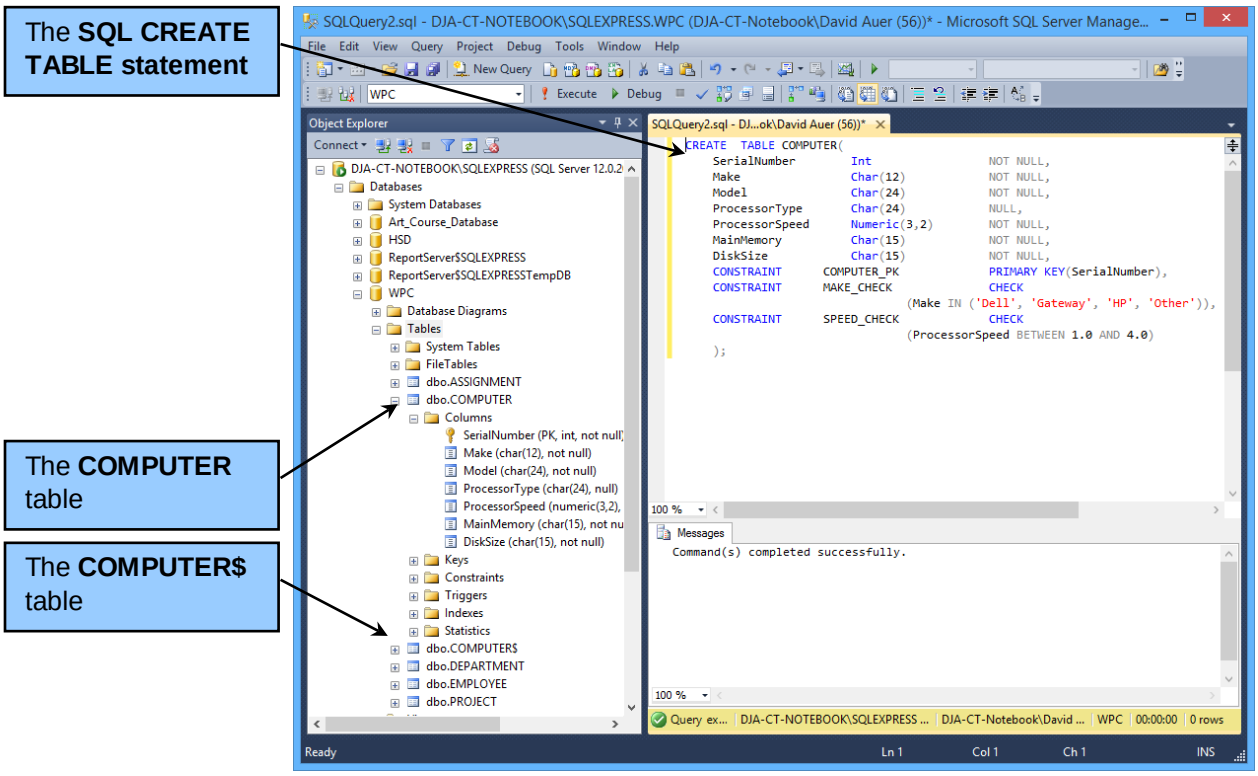


Figure E-32 — The SQL-CREATE-TABLE-AppE-01 Statement and Results

19. To copy the imported data from the temporary COMPUTER$ table to the final COMPUTER table, use the SQL bulk INSERT statement SQL-INSERT-AppE-1:

```
/* *** SQL-INSERT-AppE-01 *** */
INSERT INTO dbo.COMPUTER
      (SerialNumber, Make, Model, ProcessorType,
       ProcessorSpeed, MainMemory, DiskSize)
      SELECT   SerialNumber, Make, Model, ProcessorType,
               ProcessorSpeed, MainMemory, DiskSize
      FROM     COMPUTER$
      WHERE    SerialNumber IS NOT NULL;
```

20. After running the SQL-INSERT-AppE-01 statement, run SQL-Query-AppE-12:

```
/* *** SQL-Query-AppE-12 *** */
SELECT   *
FROM     COMPUTER;
```

21. The results for SQL-Query-AppE-12 are shown in Figure E-33. Note that we now have the correct twelve rows of data.

22. Drop the temporary COMPUTER$ table (be sure you drop the right table!) using SQL-DROP-TABLE-AppE-01:

```
/* *** SQL-DROP-TABLE-AppE-01 *** */
DROP TABLE COMPUTER$;
```

Because we were able to put all needed constraints, including PRIMARY KEY and the CHECK constraints, into the SQL CREATE TABLE statement, the COMPUTER table does not require any modifications and is ready to use.

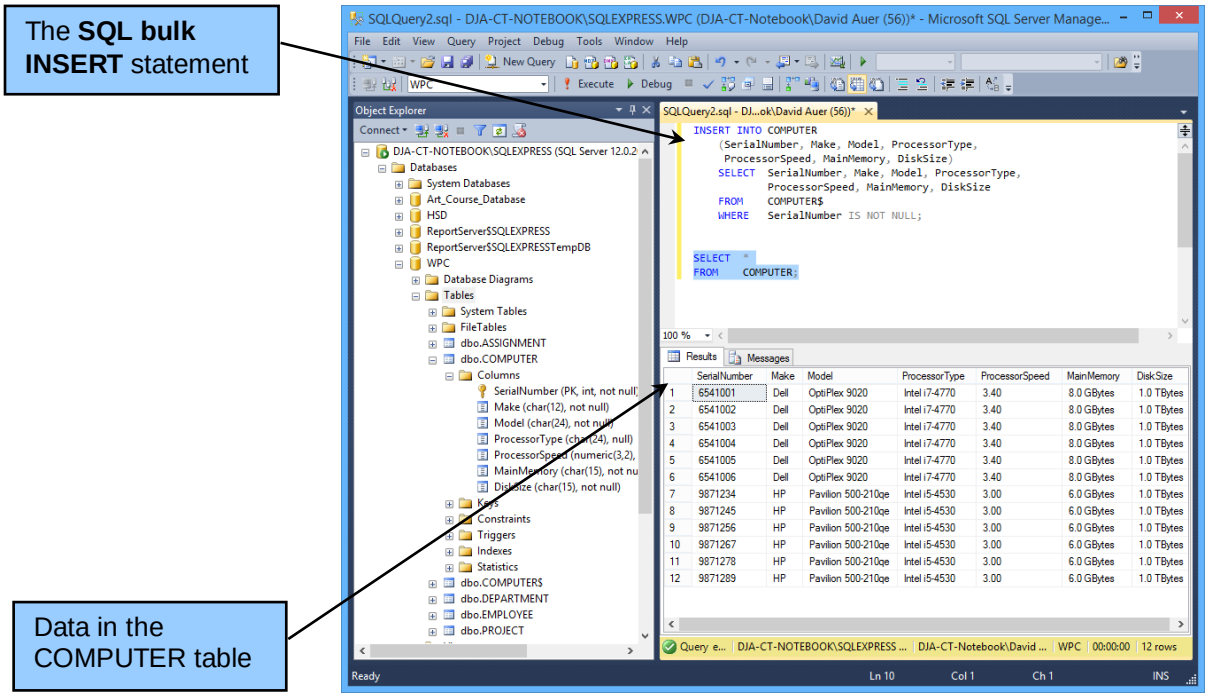


Figure E-33 — The Final COMPUTER Table and Data

Importing the Microsoft Excel Data into an Oracle Database Express Edition 11g Release 2 Database Table

Oracle Database Express Edition 11g Release 2 provides two ways of importing Microsoft Excel data via SQL Developer:

- Create the table first using an SQL CREATE TABLE statement, and then import the data.
- Create the table while importing the data.

We will use the second method.

1. In Oracle SQL Developer, expand the **WPC** database.
2. Right-click on the Tables (Filtered) WPC database object to display a short-cut menu, and in the short-cut menu click on the **Import Data** command, as shown in Figure E-34.
3. Click the **Import Data** command shown in Figure E-34. The Open dialog box is displayed, as shown in Figure E-35. Browser to the Excel workbook as shown in Figure E-35, and then click the **Open** button.
4. The *Data Import Wizard – Step 1 of 5* dialog box is displayed, initially looking as shown in Figure E-36.
5. In the *Data Import Wizard – Step 1 of 5* dialog box, check the **Header** checkbox, select the **excel 2003+ (xlsx)** format and the **COMPUTER** worksheet, so that the dialog box appears as shown in Figure E-37.

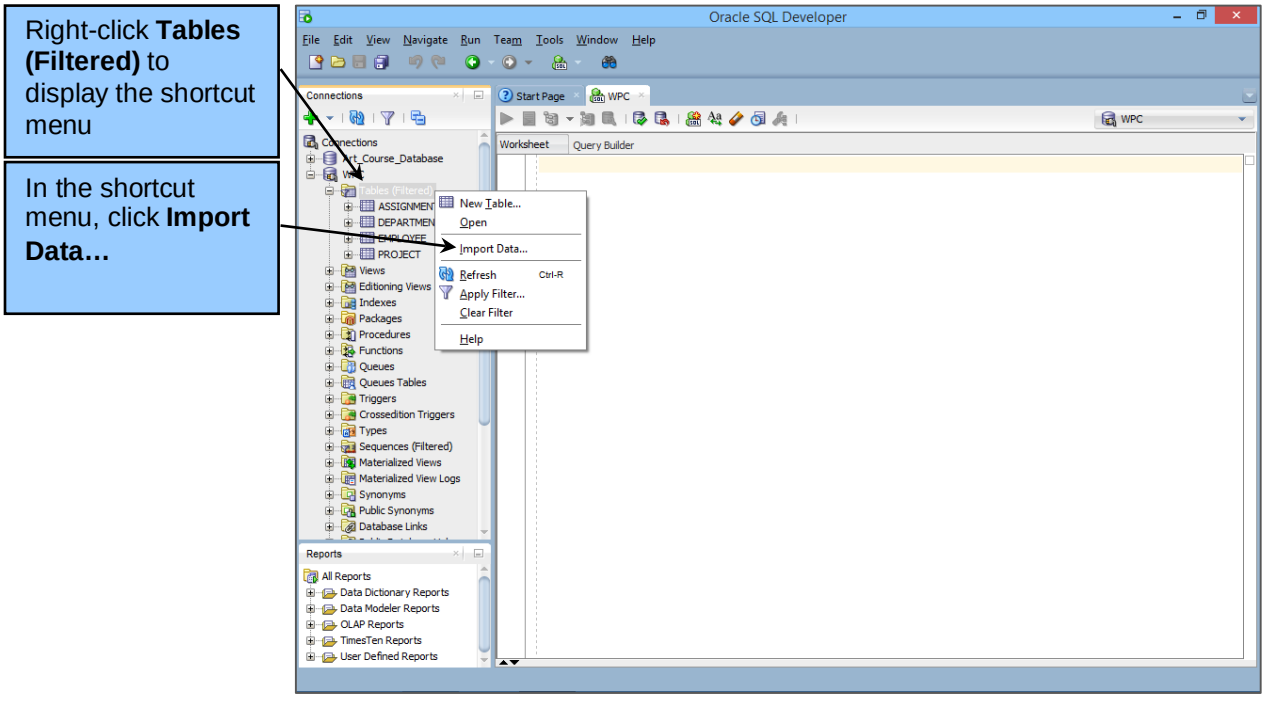


Figure E-34 — The Import Data Command

The **Open** dialog box

Browse to the Microsoft Excel file and select it

The **Open** button

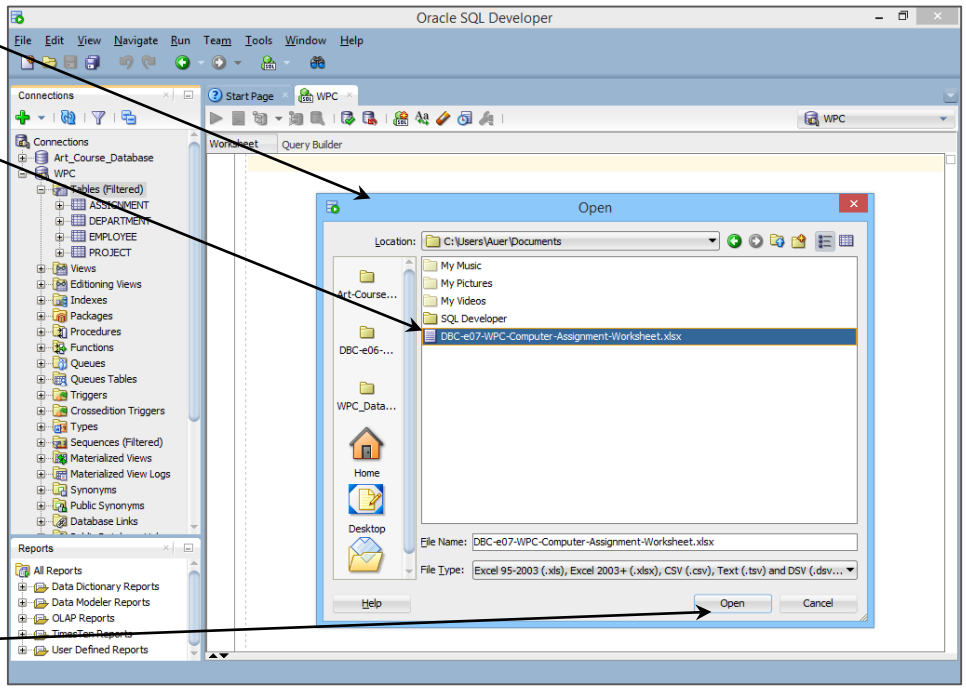


Figure E-35 — The Open Dialog Box

Data Import Wizard – Step 1 of 5 dialog box

These are the original settings, and need to be edited.

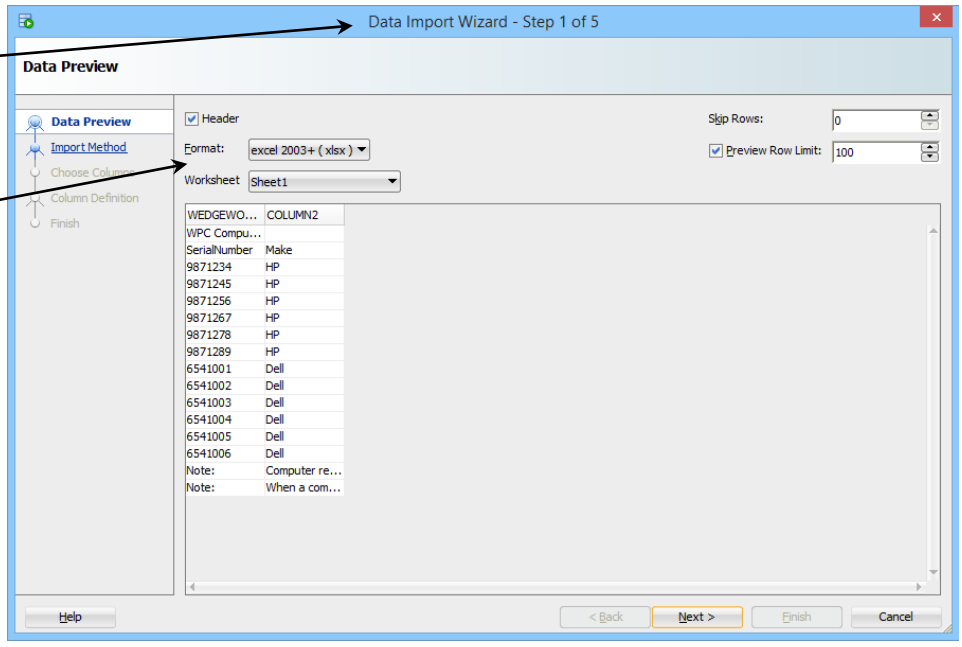


Figure E-36 — The Data Import Wizard – Step 1 of 5 Dialog Box – Original Settings

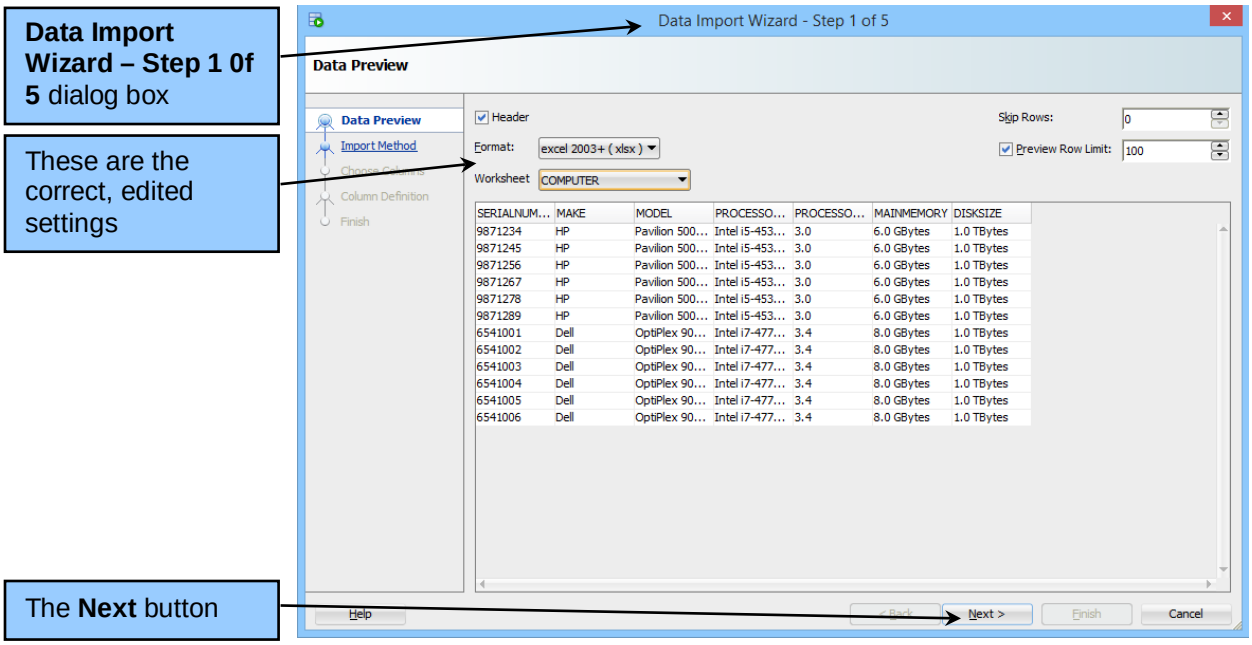


Figure E-37 — The Data Import Wizard – Step 1 of 5 Dialog Box – Edited Settings

6. Click the **Next** button. The *Data Import Wizard – Step 2 of 5* dialog box is displayed. Type in the Table Name COMPUTER, so that the dialog box appears as shown in Figure E-38.
7. Click the **Next** button. The *Data Import Wizard – Step 3 of 5* dialog box is displayed. This step allows us to choose which worksheet columns to import. Note that all are currently selected, and that is what we want, so no changes are necessary.
8. Click the **Next** button. The *Data Import Wizard – Step 4 of 5* dialog box is displayed, as shown in Figure E-39. This step allows us to define column characteristics for the COMPUTER table. Note that in Figure E-39, the SerialNumber column characteristics do not match the ones specified in Figure E-20.
9. Figure E-40 shows the SerialNumber column characteristics edited to match Figure E-20 as much as possible. Note that we cannot designate this column as the primary key.
10. Edit the rest of the column characteristics to match Figure E-20 (Use CHAR instead of VARCHAR2). Figure E-41 shows the edits for the ProcessorSpeed column.
11. When you have completed editing the column characteristics, click the **Next** button to display the *Data Import Wizard – Step 5 of 5* dialog box. This dialog box does not require us to take any action.
12. Click the **Finish** button. The Import Data dialog box is displayed to shown that the import is complete, as shown in Figure E-42.
13. Click the Import Data dialog box OK button to close the dialog box and end the import process.

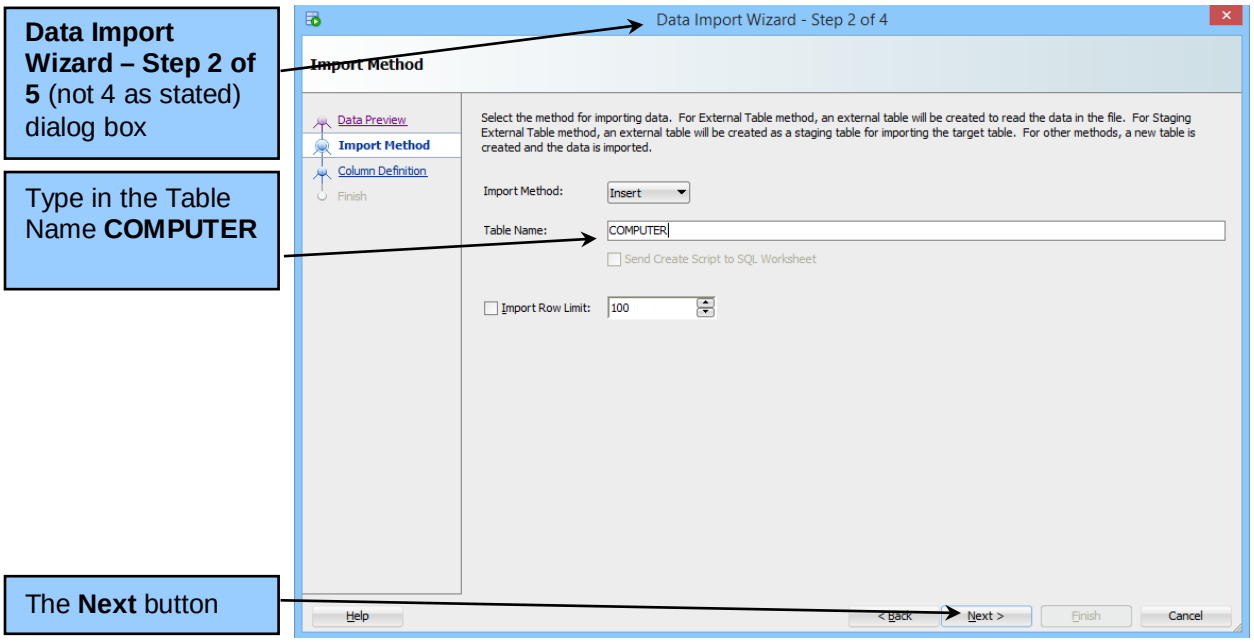


Figure E-38 — The Data Import Wizard – Step 2 of 5 Dialog Box – Edited Settings

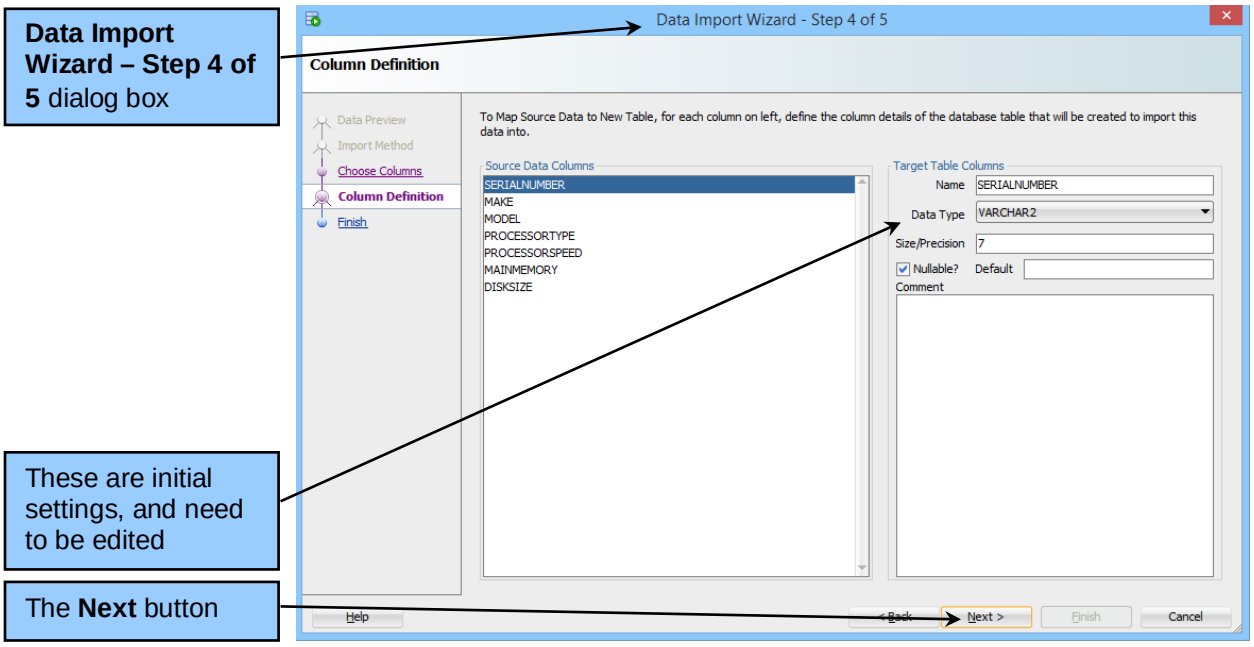


Figure E-39 — The Data Import Wizard – Step 4 of 5 Dialog Box – SerialNumber Initial Settings

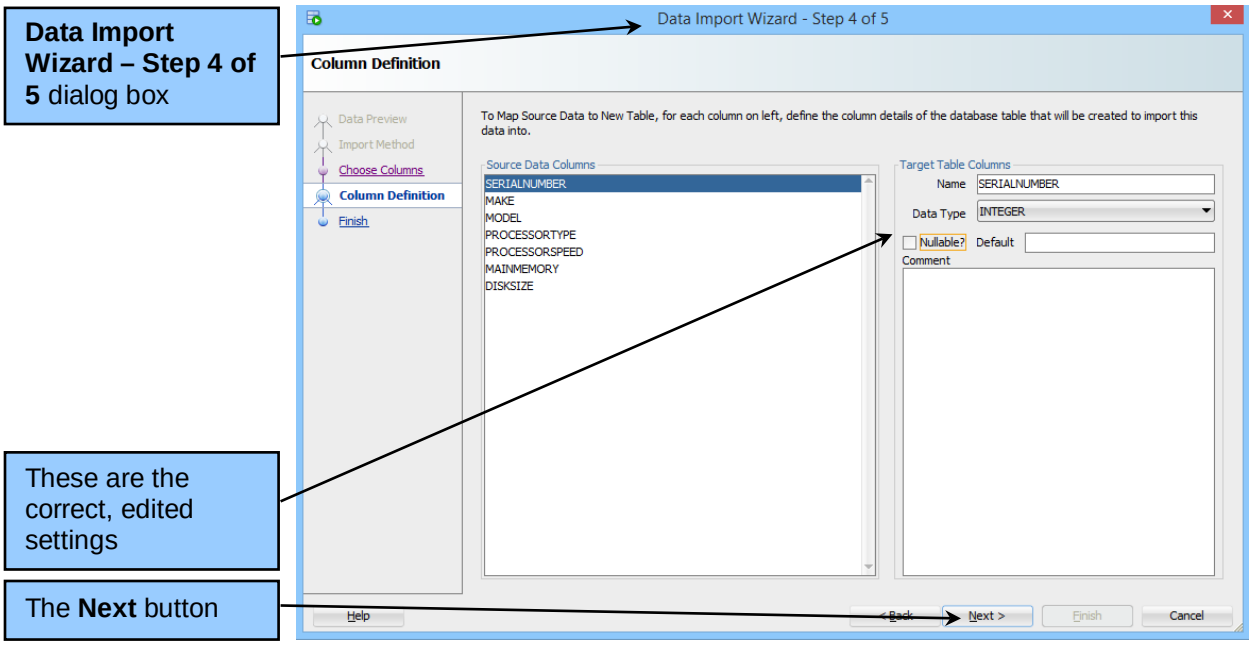


Figure E-40 — The Data Import Wizard – Step 4 of 5 Dialog Box – SerialNumber Edited Settings

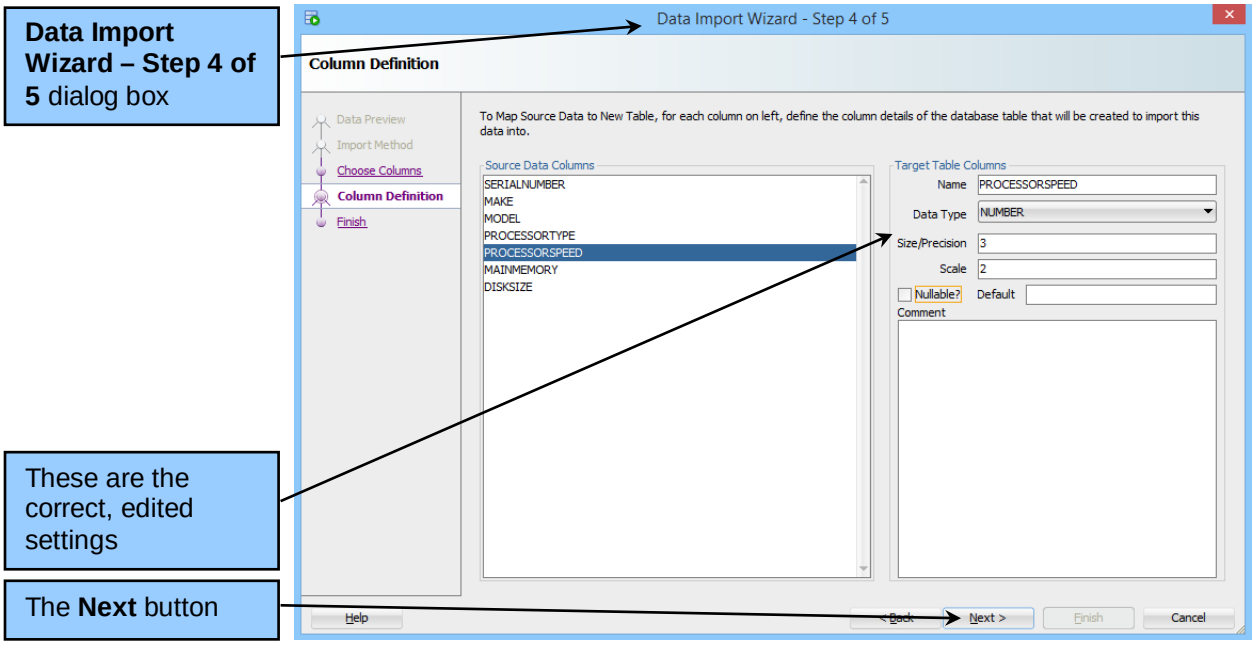


Figure E-41 — The Data Import Wizard – Step 4 of 5 Dialog Box – ProcessorSpeed Edited Settings

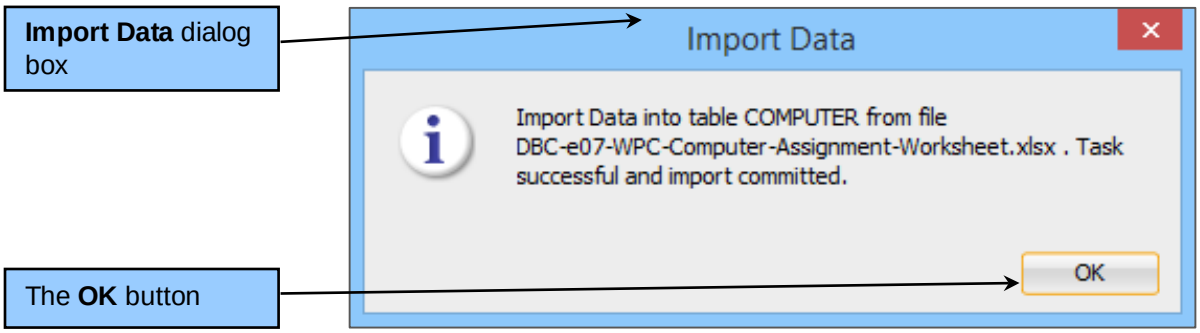


Figure E-42 — The Import Data Dialog Box

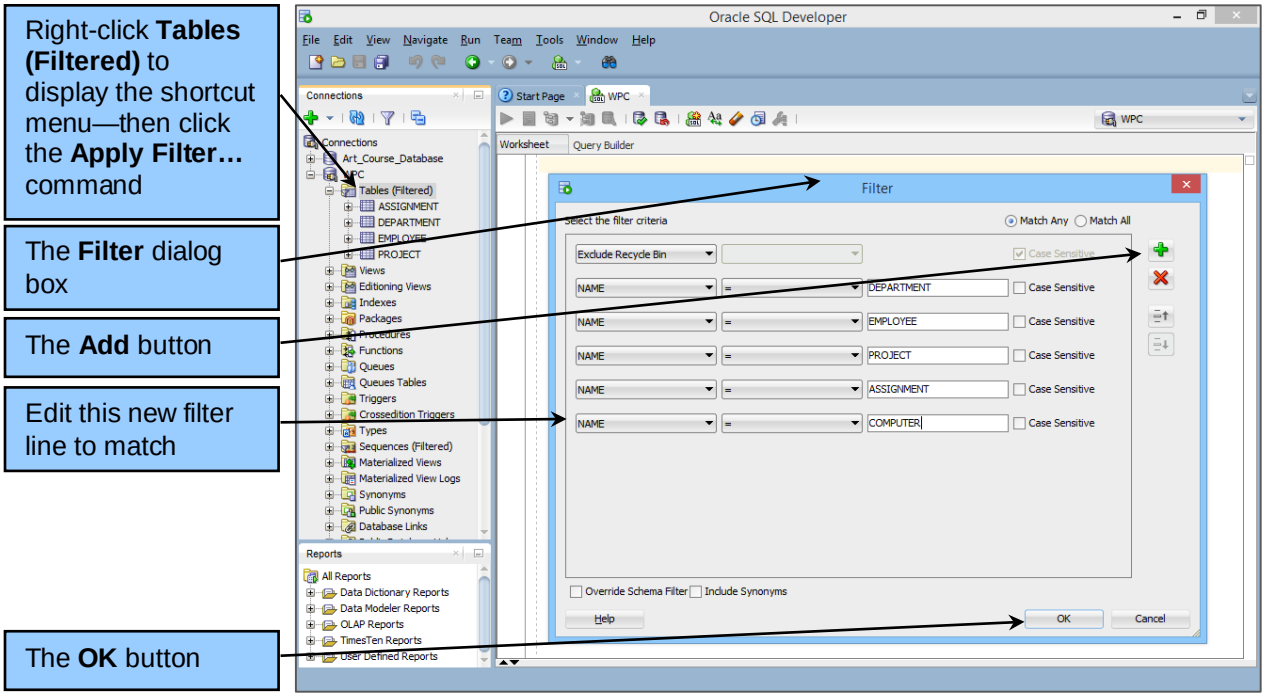


Figure E-43 — The Filter Dialog Box – Adding the COMPUTER Table

14. Right-Click the **Tables (Filtered)** WPC database object, and click the **Apply Filter…** command. In the Filter dialog box, add in the COMPUTER table by NAME and equals (=) to add the COMPUTER table to the list of visible database tables, as shown in Figure E-43.
15. Click the **OK** button on the Filter dialog box. The COMPUTER table now appears in the Tables (filtered) objects, as shown in Figure E-44 (where the COMPUTER table object itself has been expanded to shown the columns).

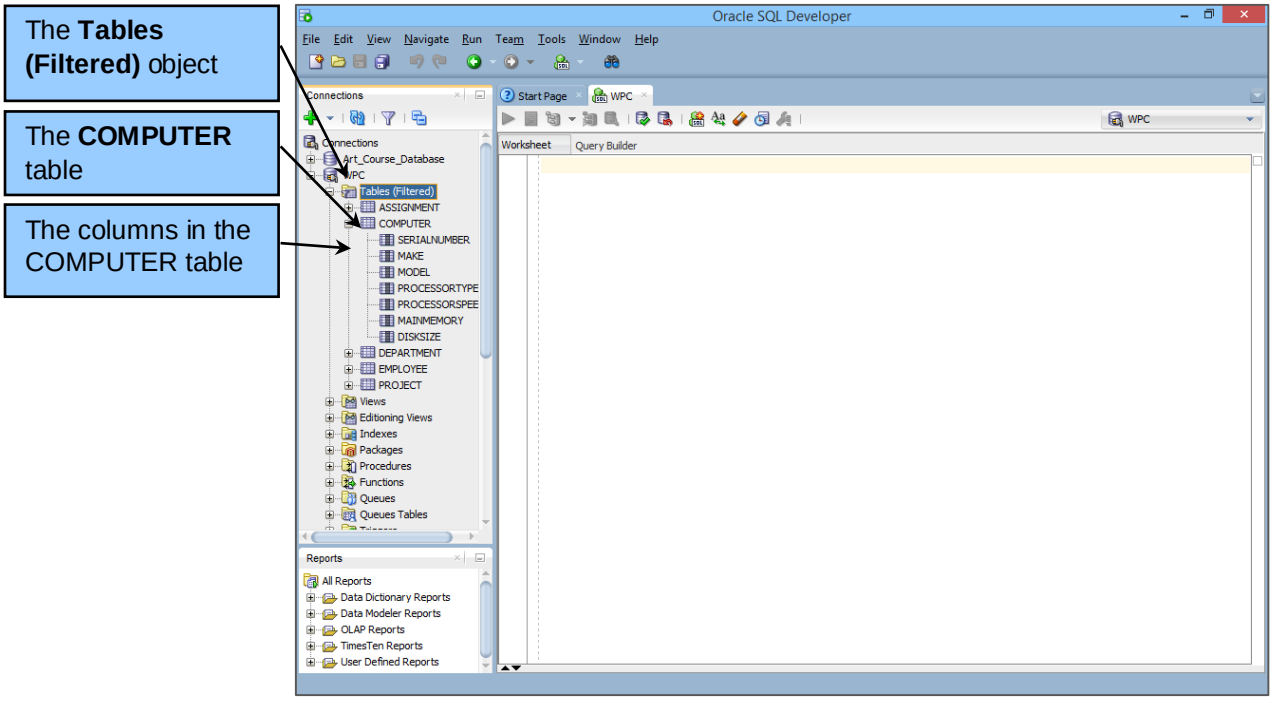


Figure E-44 — The COMPUTER Table in the Tables (Filtered) Object

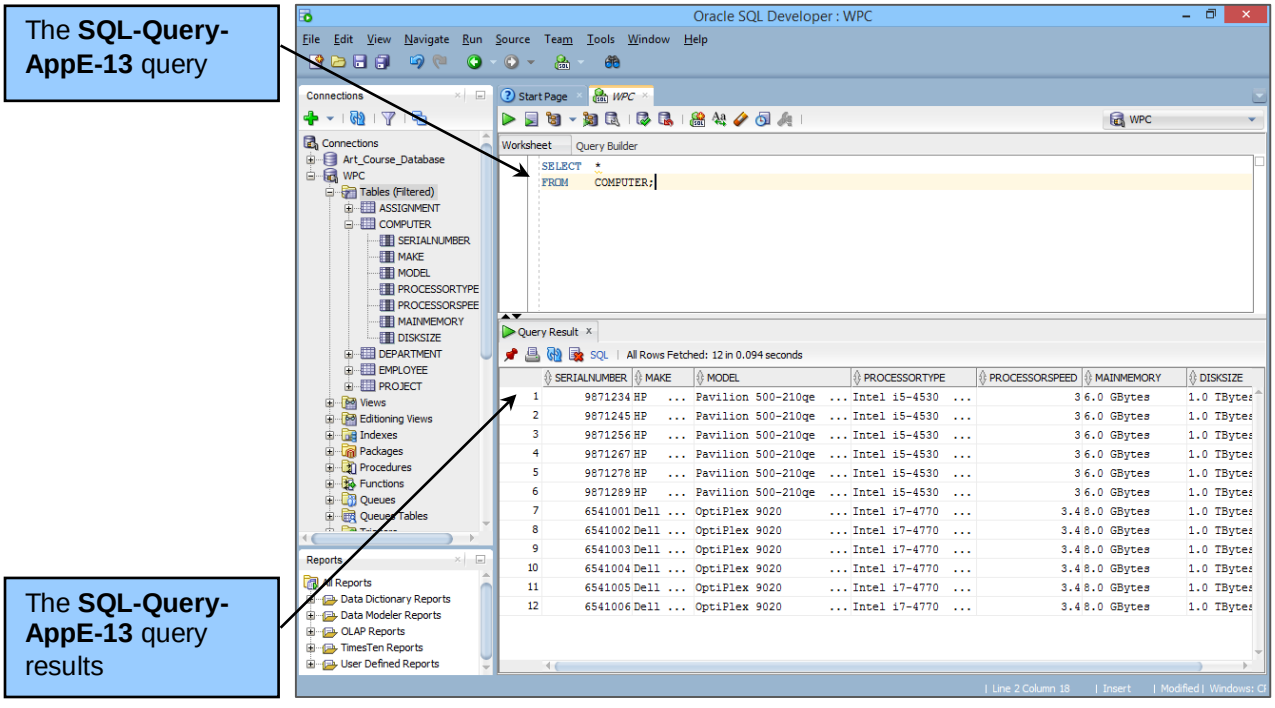


Figure E-45 — SQL-Query-AppE-13 Results

16. In the WPC SQL query window, and run SQL-Query-AppE-13:

```
/* *** SQL-Query-AppE-13 *** */
SELECT   *
FROM     COMPUTER;
```

17. The results of SQL-Query-AppE-13 are shown in Figure E-45. Note that the all columns and data are correct.
18. To set the COMPUTER table primary key, in the WPC SQL query window write the SQL-ALTER-TABLE-AppE-01 statement:

```
/* *** SQL-ALTER-TABLE-AppE-01 *** */
ALTER  TABLE COMPUTER
   ADD CONSTRAINT COMPUTER_PK PRIMARY KEY(SerialNumber);
```

19. To set the CHECK CONSTRAINT for the computer make, in the WPC SQL query window write the SQL-ALTER-TABLE-AppE-02 statement:

```
/* *** SQL-ALTER-TABLE-AppE-02 *** */
ALTER  TABLE COMPUTER
   Add CONSTRAINT MAKE_CHECK CHECK
            (Make IN ('Dell', 'Gateway', 'HP', 'Other'));
```

20. To set the CHECK CONSTRAINT for the computer processor speed, in the WPC SQL query window write the SQL-ALTER-TABLE-AppE-03 statement:

```
/* *** SQL-ALTER-TABLE-AppE-03 *** */
ALTER  TABLE COMPUTER
   Add CONSTRAINT SPEED_CHECK CHECK
            (ProcessorSpeed BETWEEN 1.0 AND 4.0);
```

21. The combined results for SQL-ALTER-TABLE-AppE-01, SQL-ALTER-TABLE-AppE-02, and SQL-ALTER-TABLE-AppE-03 are shown in Figure E-46.
22. The COMPUTER table has now been added to the WPC database.

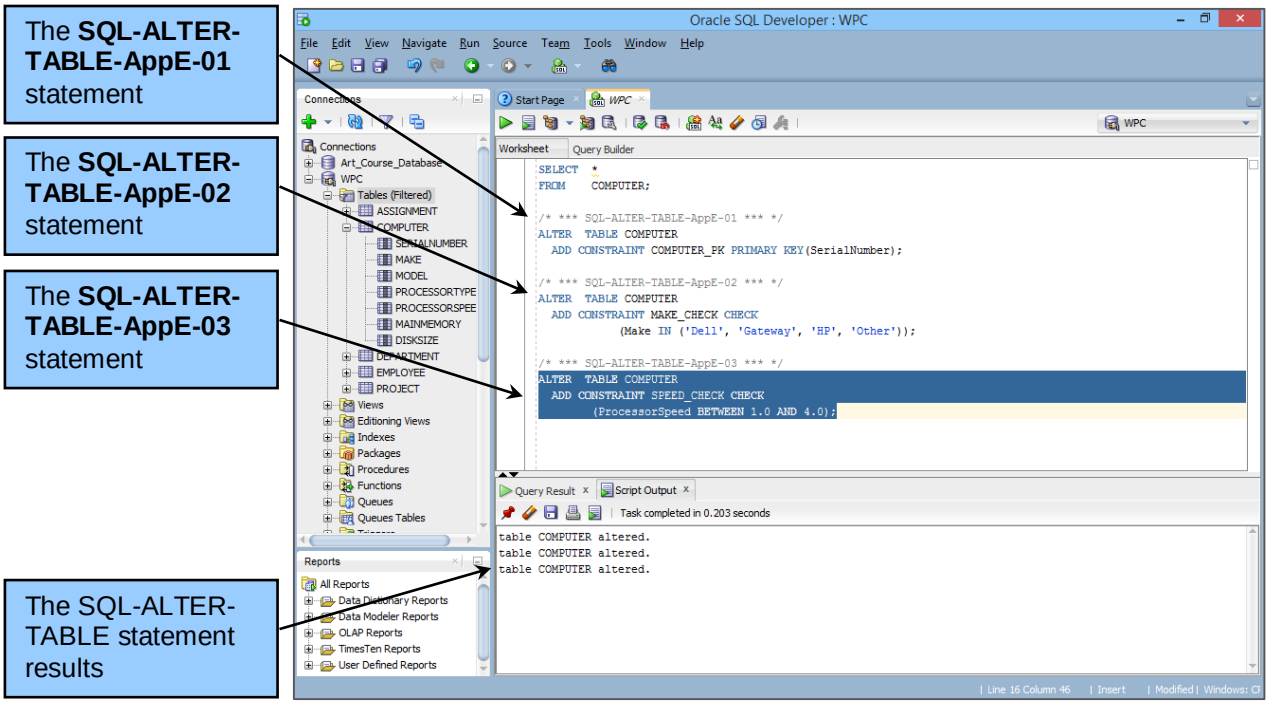


Figure E-46 — SQL-ALTER-TABLE Statement Results

Importing the Microsoft Excel Data into a MySQL 5.6 Database Table

For MySQL, we will create the COMPTUER Table using the **MySQL for Excel Add-In**. Install this utility using the MySQL Installer, and when Microsoft Excel is launched, it will then appear on the DATA tab in the Microsoft Excel 2013 ribbon. The MySQL for Excel Add-In does a good job of letting use create a new table, set a primary key and specify most column characteristics. It does not, however, let us set CHECK constraints as specified in Figure E-20, so we will have to use SQL ALTER TABLE statements to add those. However, MySQL does not support some common SQL ALTER TABLE features, so we will have to use MySQL specific syntax (see: http://dev.mysql.com/doc/refman/5.6/en/alter-table.html).

1. Open the COMPUTER worksheet in Microsoft Excel 2013, and click the DATA tab in the Ribbon. The MySQL for Excel button is displayed, as shown in Figure E-47. Click the MySQL for Excel button to launch the MySQL for Excel pane, as shown in Figure E-48.
2. Open a MySQL connection by double-clicking **Local instance MySQL56**, and logging into the MySQL 5.6 server.

3. As shown in Figure E-49, filter the database schemas shown to find the wpc schema, then click the wpc schema name to select it, and then click the **Next** button.
4. In Microsoft Excel, select (highlight) the entire COMPUTER table range!
5. As shown in Figure E-50, click the **Export Excel Data to New Table** command. The Export Data dialog box is displayed, as shown in figure E-51, labeled with the name of the selected Microsoft Excel sheet and the selected range (COMPUTER [A1:G13]).
6. Complete the new COMPUTER table specifications to match Figure E-20 – note that you can adjust data types and NULL/NOT NULL (shown as "Allow Empty") for each column as shown in Figure E-52. Although Figure E-20 shows Text data types which would normally be CHAR data types, we will use the selected MySQL VARCHAR data type for text columns, but adjust the number of characters to match Figure E-20.
7. The complete *Export Data – COMPUTER [A1:G13]* dialog box is shown in Figure E-53.
8. Click the **Export Data** button. The new table is created and populated, as shown in the Success dialog box seen in Figure E-54.

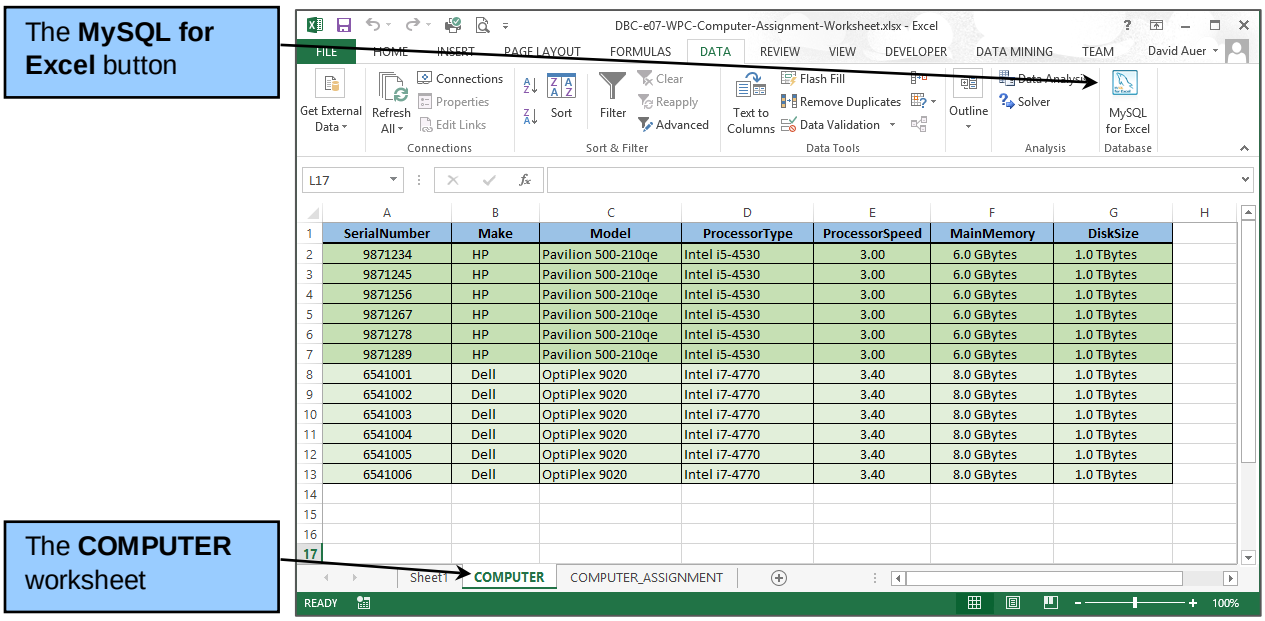


Figure E-47 — The MySQL for Excel button

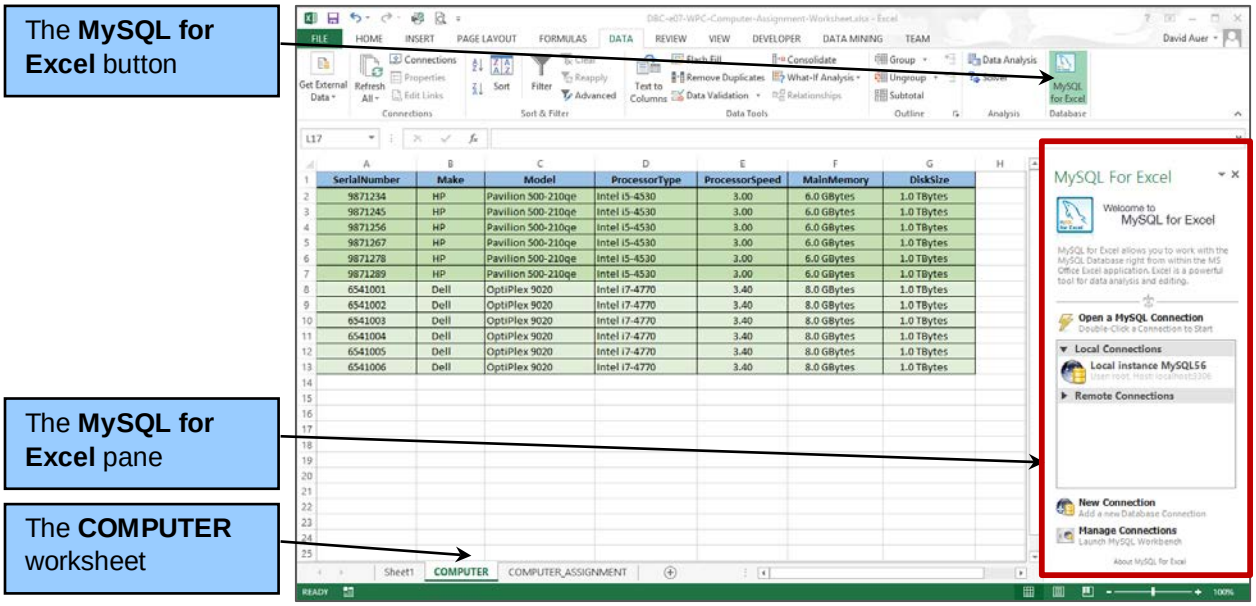


Figure E-48 — The MySQL for Excel Pane

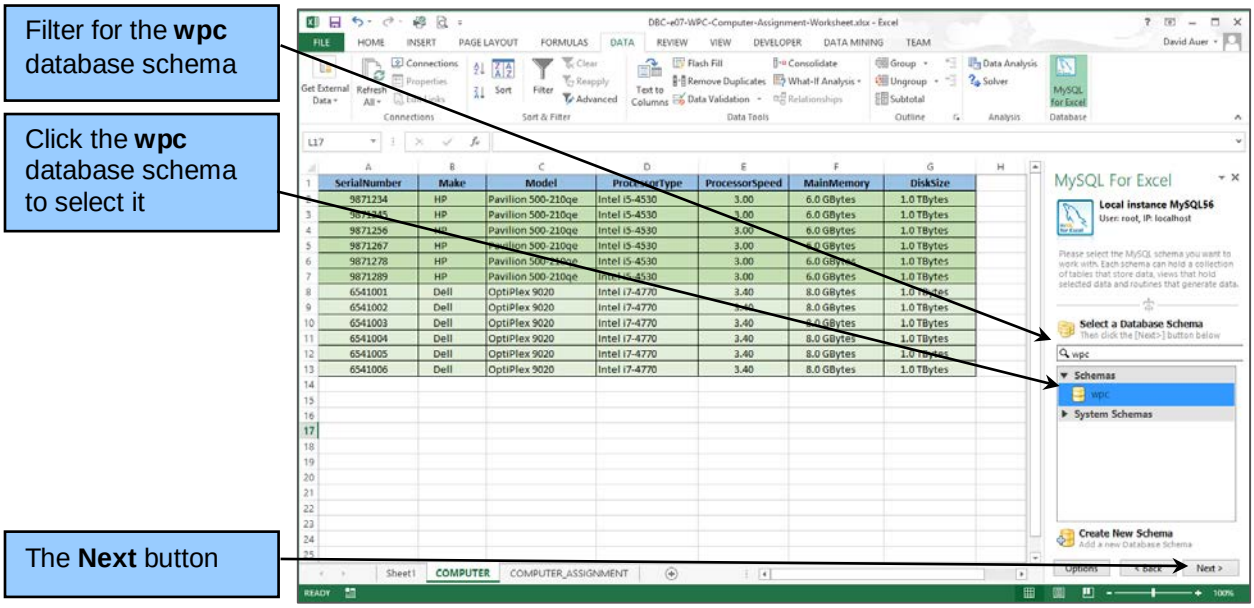


Figure E-49 — Selecting the wpc Database Schema

9. In the Success dialog box, click the **OK** button.
10. In the Microsoft Excel *MySQL For Excel* pane, click the **Close** button to close MySQL for Excel.
11. Save the Microsoft Excel workbook. If a dialog box appears warning about macro features that cannot be saved, ignore it and click the **Yes** button.
12. Close the Microsoft Excel workbook.

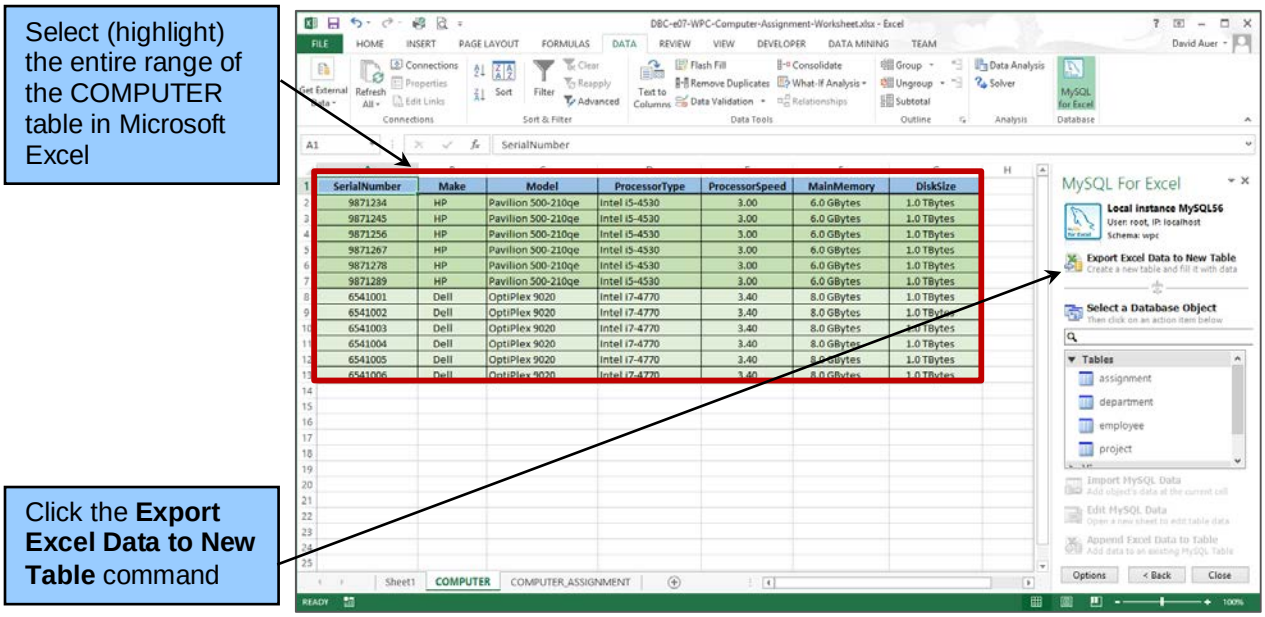


Figure E-50 — The MySQL for Excel Pane

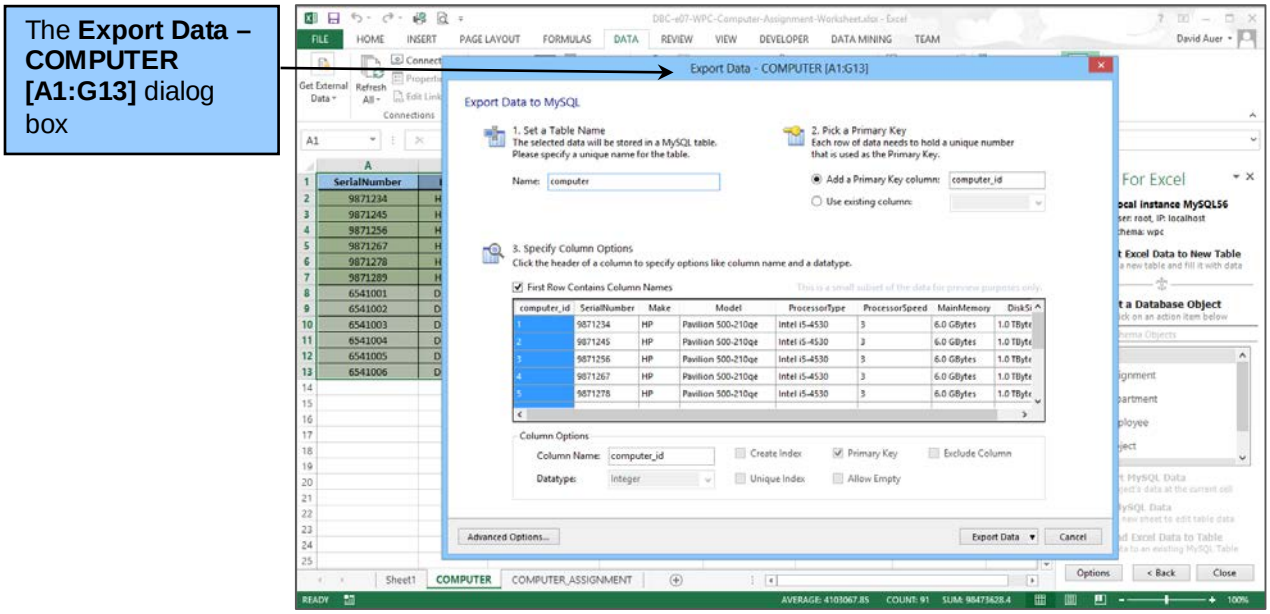


Figure E-51 — The Export Data – COMPUTER [A1:G13] Dialog Box

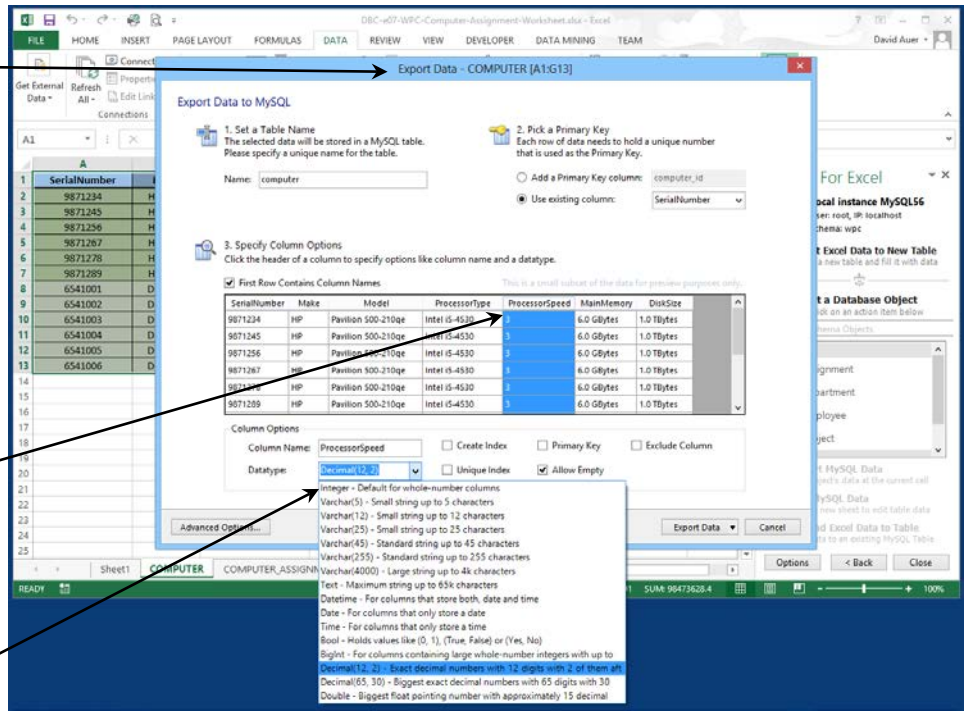


Figure E-52 — Editing the COMPUTER Table Specifications

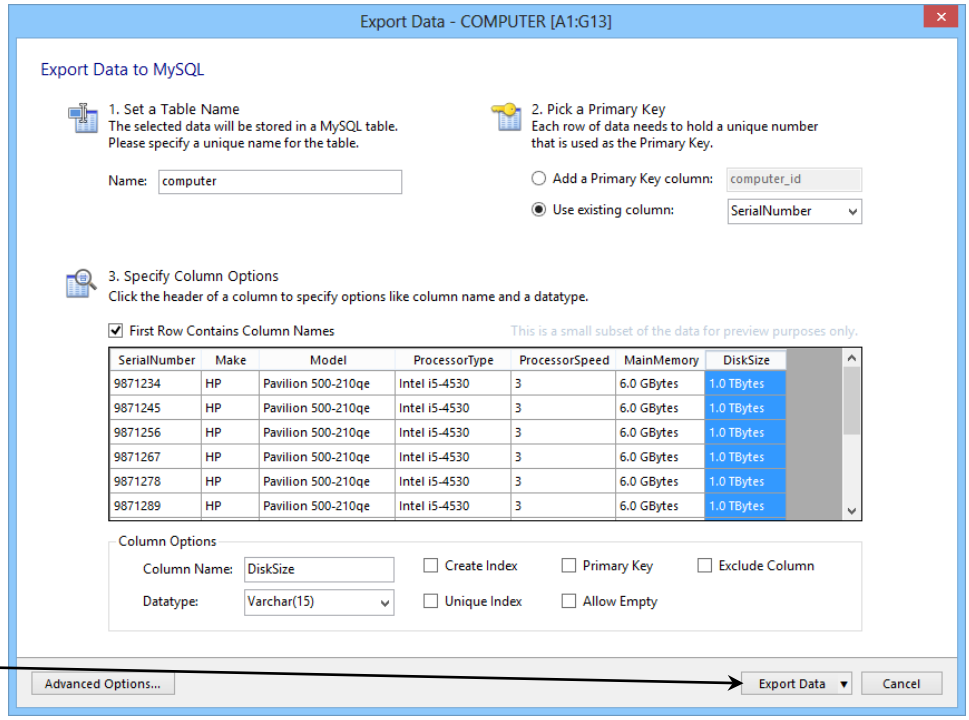


Figure E-53 — Final COMPUTER Table Specifications

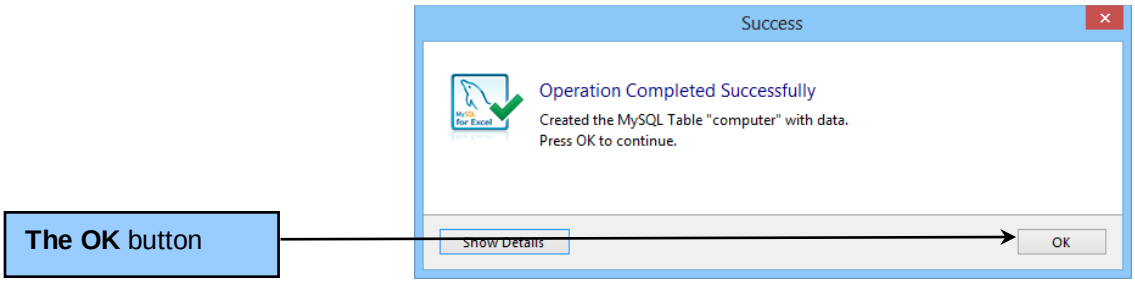


Figure E-54 — the Success Dialog Box

13. Open MySQL Workbench, and refresh the **wpc** schema. Expand the Tables object and the *computer* table object Columns.
14. We need to inspect the structure of the new *computer* table. Right-click the **computer table object**, click **Table Inspector**, and then click the **Columns** tab. The column characteristics for the *computer* table are displayed as shown in Figure E-55. The only problem with the table as created in MySQL 5.6 is that the *DiskSize* column should be NOT NULL. We can run an SQL ALTER TABLE command to fix that—otherwise everything is correct.
15. We need to check the data in the new *computer* table. Right-click the **computer table object**, and then click the **Select Rows – Limit 1000** command. The data in the computer table is displayed, as shown in Figure E-56. All the data is correct.

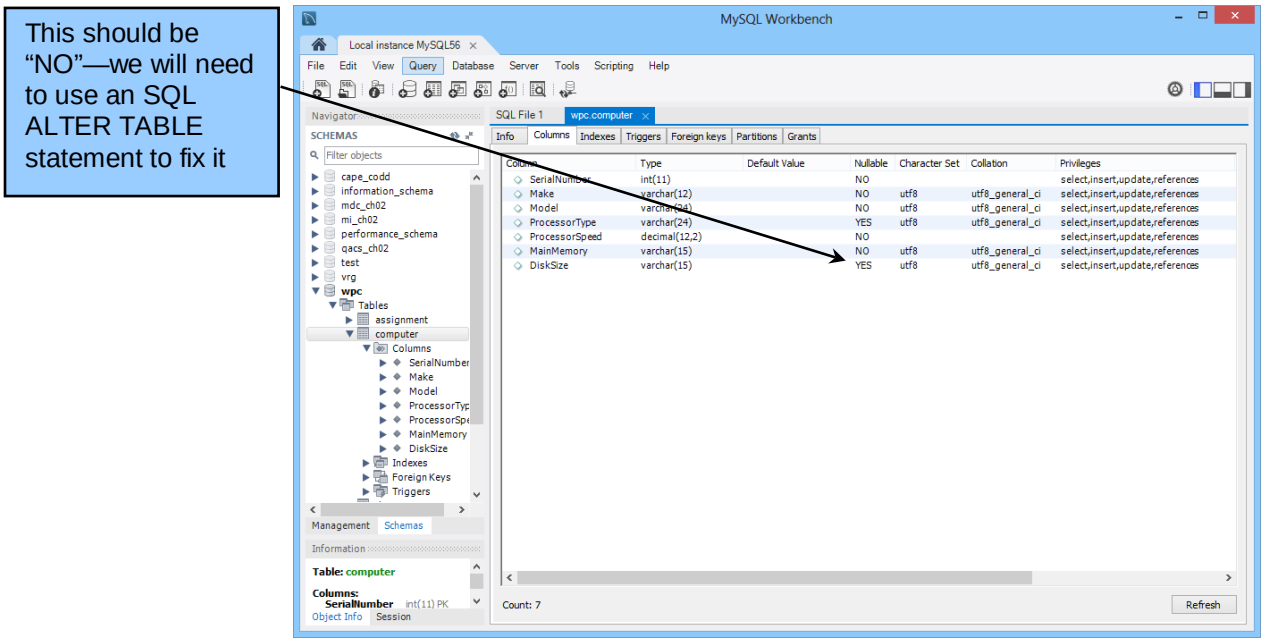


Figure E-55 — The computer Table Characteristics

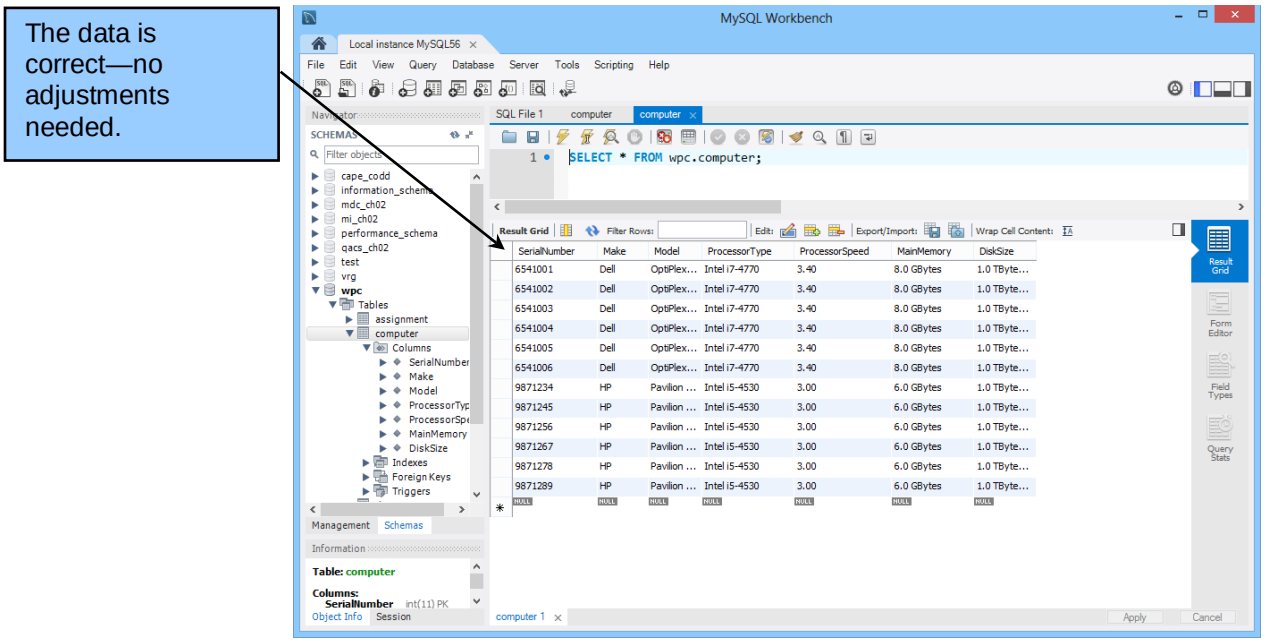


Figure E-56 — The computer Table Data

16. Now we need to modify the computer table to match the COMPUTER column characteristics in Figure E-20. Specifically, we need to fix the NULL/NOT NULL setting of DiskSize, and we need to add the two CHECK CONSTRAINTS.

17. To set the NULL/NOT NULL status of DiskSize requires the use of a syntax particular to MYSQL. In the WPC SQL query window write the SQL-ALTER-TABLE-AppE-04 statement:

```
/* *** SQL-ALTER-TABLE-AppE-04 *** */

ALTER  TABLE COMPUTER
   CHANGE COLUMN DiskSize  DiskSize VARCHAR(15) NOT NULL;
```

18. To set the CHECK CONSTRAINT for the computer make, in the WPC SQL query window write the SQL-ALTER-TABLE-AppE-05 statement:

```
/* *** SQL-ALTER-TABLE-AppE-05 *** */

ALTER  TABLE COMPUTER
   ADD CONSTRAINT MAKE_CHECK CHECK
            (Make IN ('Dell', 'Gateway', 'HP', 'Other'));
```

19. To set the CHECK CONSTRAINT for the computer processor speed, in the WPC SQL query window write the SQL-ALTER-TABLE-AppE-06 statement:

```
/* *** SQL-ALTER-TABLE-AppE-06 *** */

ALTER  TABLE COMPUTER
   ADD CONSTRAINT SPEED_CHECK CHECK
            (ProcessorSpeed BETWEEN 1.0 AND 4.0);
```

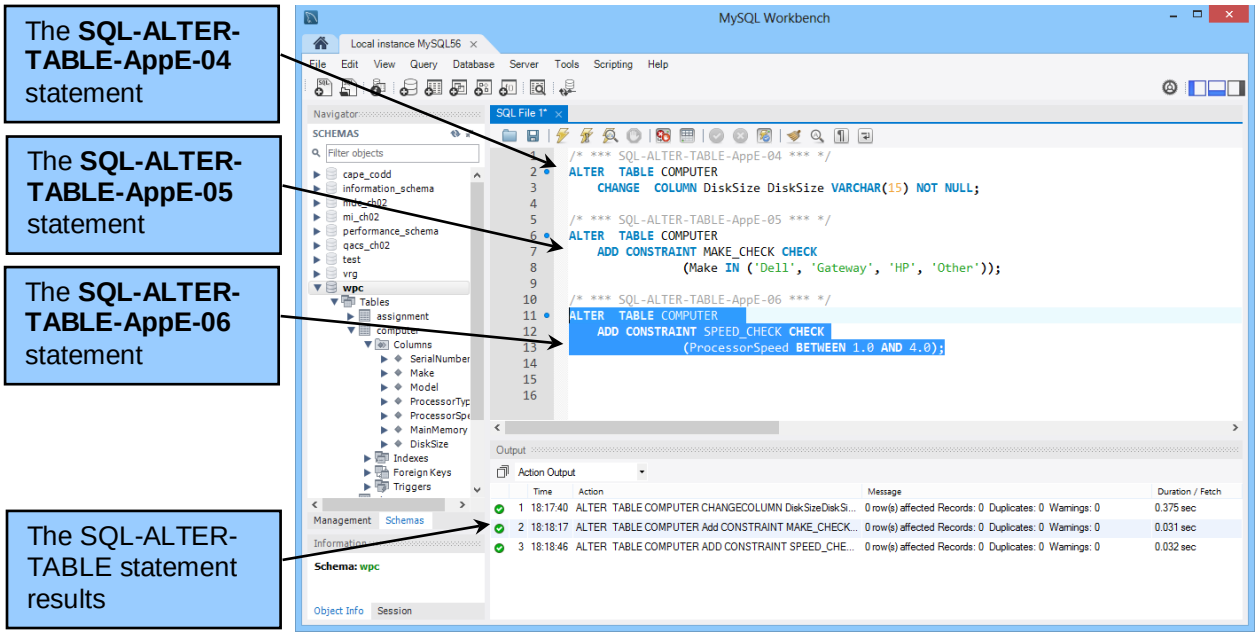


Figure E-57 — The SQL ALTER TABLE Statements in MySQL Workbench

20. The combined results for SQL-ALTER-TABLE-AppE-04, SQL-ALTER-TABLE-AppE-05, and SQL-ALTER-TABLE-AppE-06 are shown in Figure E-57.
21. The COMPUTER table has now been added to the WPC database.
22. Close MySQL Workbench.

THE ACCESS WORKBENCH

Section E

Working with Views and Microsoft Excel Data in Microsoft Access

In Chapter 3's section of "The Access Workbench," you learned to work with Microsoft Access SQL and QBE. In this section, you'll learn how to create the Access equivalent of SQL views.

We'll continue to use the WMCRM database we have been using. At this point, we have created and populated (which means we've inserted the data into) the CUSTOMER, CONTACT, and SALESPERSON tables and have set the referential integrity constraints between them.

Working with SQL Views in Microsoft Access

Although a view is a virtual table, it can also be represented as a stored query. Although most DBMSs do not allow queries to be saved in a database, Access does. Access allows us to run queries against tables or against saved queries. This gives us a way to implement a **Microsoft Access equivalent of an SQL view**: We simply save the SELECT query that would be used to create the SQL view and use it as we would an SQL view in other queries.

Here is an SQL CREATE VIEW statement that would be used to list customer data from the WMCRM database if we were creating a standard SQL view:

```
/* *** SQL-CREATE-VIEW-AWAppE-01 *** */
CREATE VIEW CustomerPhoneView AS
   SELECT   FirstName, LastName, Phone AS CustomerPhone
   FROM     CUSTOMER;
```

Since we cannot create SQL Views *directly as SQL Views* in Access, we instead create a query—using either Access SQL or QBE—based on the SELECT portion of this statement:

```
/* *** SQL-QUERY-AWAppE-01 *** */
SELECT      FirstName, LastName, Phone AS CustomerPhone
FROM        CUSTOMER
```

After we create the query, we save it using a query name that indicates that *this query is intended to be used as an SQL view*. We can use the naming convention of putting the word *view* at the beginning of any such query name. Thus, we can name this query viewCustomerPhone.

Creating an Access Query as a View Equivalent

1. Start Microsoft Access 2013.
2. Click the **File** command tab to display the File menu and then click the **WMCRM.accdb** database filename in the quick access list to open the database.
3. Click the **Create** command tab to display the Create command groups.
4. Click the **Query Design** button.
5. The Query1 tabbed document window is displayed in Design view, along with the Show Table dialog box.
6. Using either the SQL or QBE technique of creating queries, as described in Chapter 3's section of "The Access Workbench," create the query:

```
SELECT   FirstName, LastName, Phone AS CustomerPhone
FROM     CUSTOMER;
```

- **NOTE:** As shown in Figure AW-E-1, to create the equivalent of **`Phone AS CustomerPhone`**, enter the *alias name* followed by a *colon [:]*, and followed by the *column name* that is being aliased.

7. To save the query, click the **Save** button on the Quick Access Toolbar. The Save As dialog box appears.
8. Type in the query name **viewCustomerPhone** and then click the **OK** button. The query is saved, the document window is renamed with the query name, and a newly created viewCustomerPhone query object appears in the Queries section of the Navigation Pane, as shown in Figure AW-E-1. Note that Figure AW-E-1 shows the query created in Access QBE.
9. Close the viewCustomerPhone window by clicking the document window's **Close** button.
10. If Access displays a dialog box that asks whether you want to save changes to the design of query viewCustomerPhone, click the **Yes** button.

Now we can use the viewCustomerPhone query just as we would any other SQL view (or Access saved query). For example, we can implement the following SQL statement:

```
/* *** SQL-QUERY-AWAppE-01 *** */
SELECT      FirstName, LastName, CustomerPhone
FROM        viewCustomerPhone
ORDER BY    LastName;
```

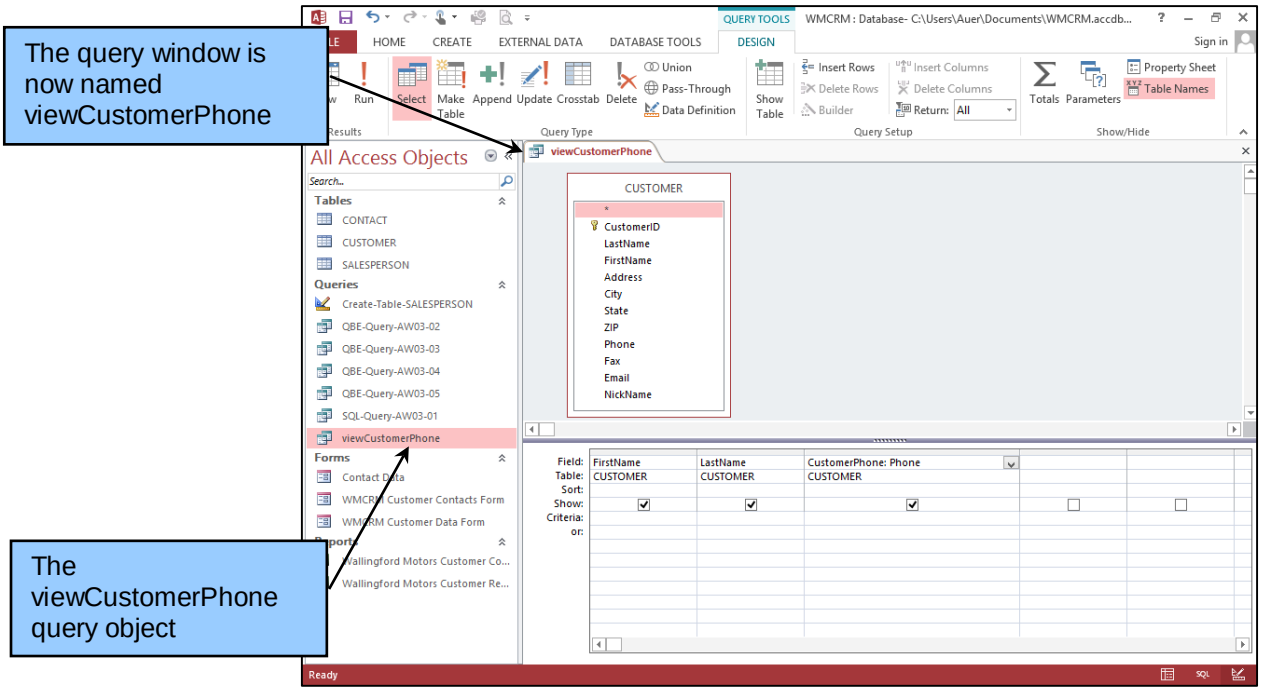


Figure AW-E-1 — The viewCustomerPhone Query in the Queries Pane

We'll use Access QBE in this example.

Using an Access Query in Another Access Query

1. Click the **Create** command tab to display the Create command groups.
2. Click the **Query Design** button.
3. The Query1 tabbed document window is displayed in Design view, along with the Show Table dialog box.
4. In the Show Table dialog box, click the **Queries** tab to select it. The list of all saved queries appears, as shown in Figure AW-E-2.
5. Click **viewCustomerPhone** to select the viewCustomerPhone query. Click the **Add** button to add the viewCustomerPhone query to the new query.
6. Click the **Close** button to close the Show Table dialog box.
7. From the viewCustomerPhone query, click and drag the **LastName**, **FirstName**, and **EmployeePhone** column names to the first three field columns in the lower pane.
8. In the field column for LastName, set the Sort setting to **Ascending**. The completed QBE query looks as shown in Figure AW-E-3. If necessary, resize the table object and the Field columns so that complete labels are displayed.

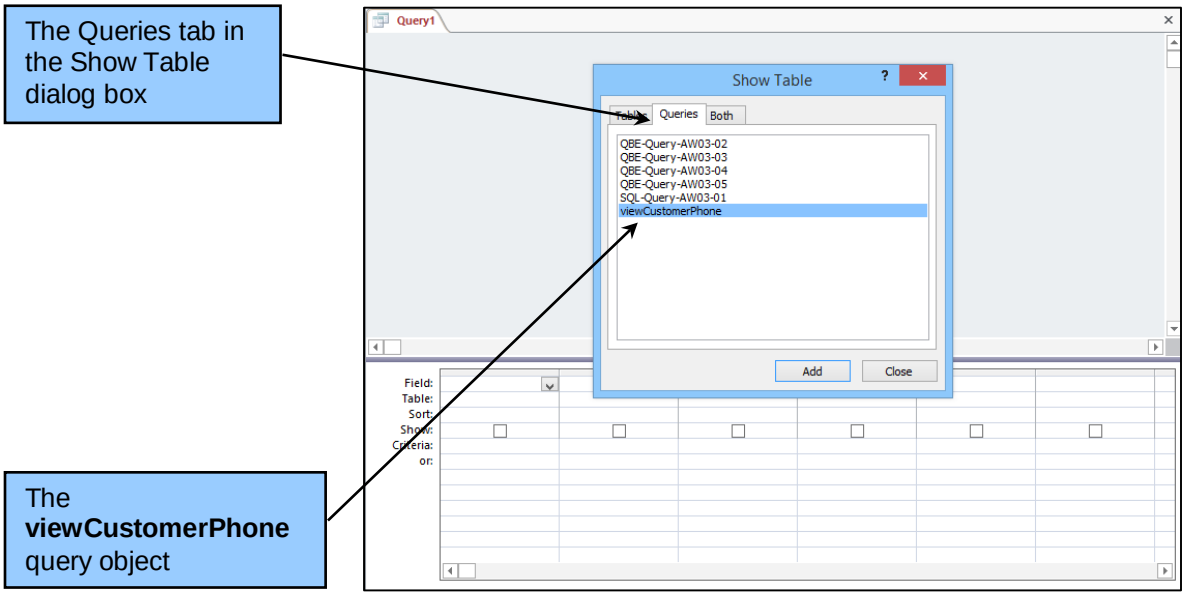


Figure AW-E-2 — Queries Displayed in the Show Table Dialog Box

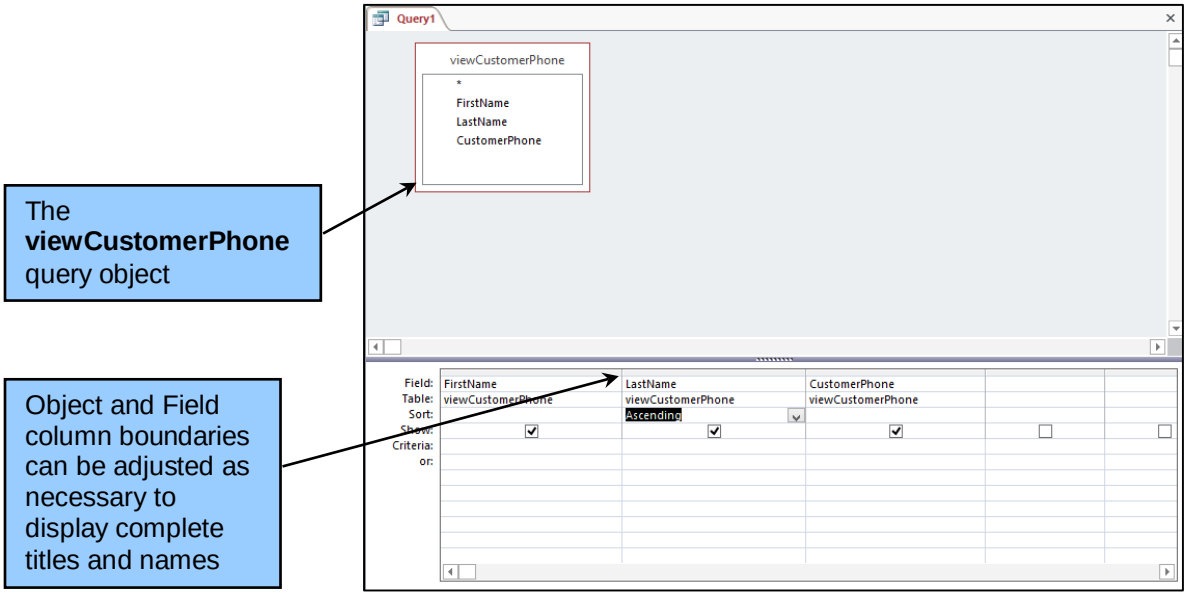


Figure AW-E-3 — The Completed Query

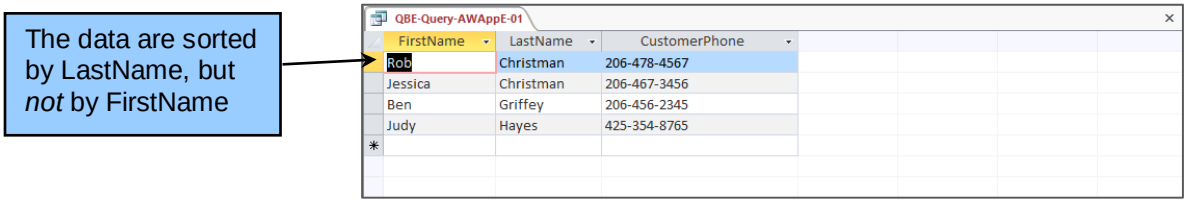


Figure AW-E-4 — The Query Results

9. Save the query as **QBEQuery-AWAppE-01**.

10. Click the **Run** button on the Design command tab. The query results appear as shown in Figure AW-E-4.

11. Close the QBEQuery-AWAppE-01 query window.

Now we can use the equivalent of SQL views in Access by using one query as the source for additional queries. That completes the work we'll do in this section of "The Access Workbench," so we can close the database and Access.

Working with SQL/PSM in Microsoft Access

Microsoft Access 2013 does not implement SQL/PSM as such. Corresponding capabilities can be found in Microsoft Access Visual Basic for Applications (VBA), but that topic is beyond the scope of this book.

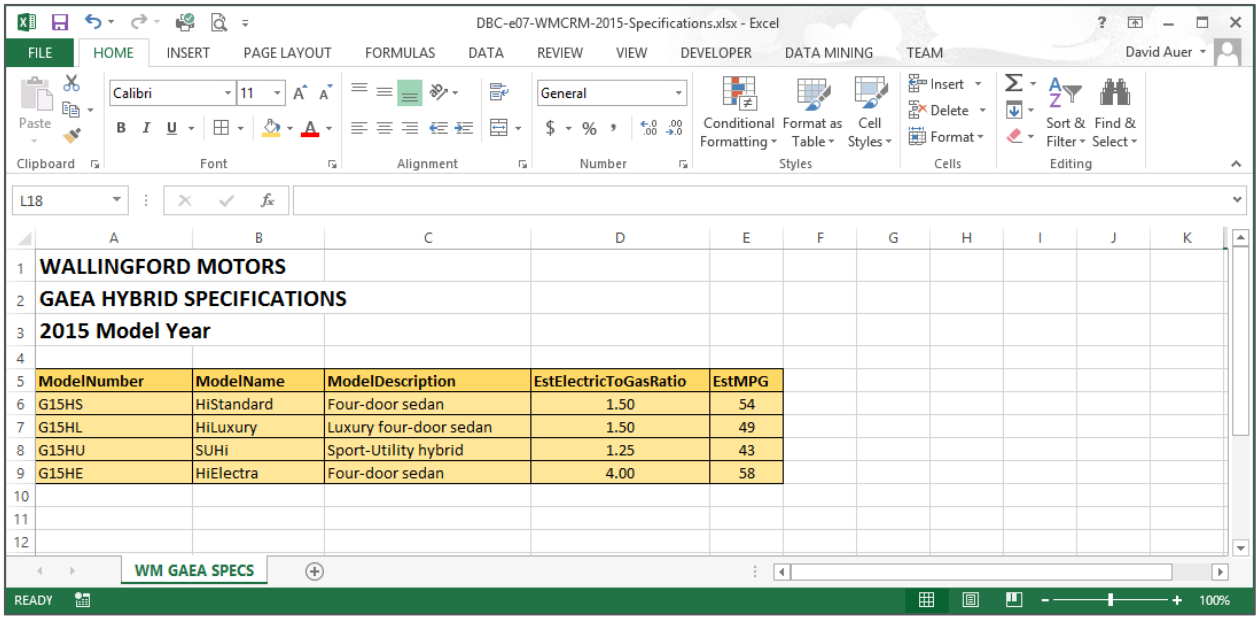


Figure AW-E-5 — The Wallingford Motors Gaea Specifications Workbook

Importing Microsoft Excel Data into in Microsoft Access

To illustrate importing Microsoft Excel data into Microsoft Access, we'll need a Microsoft Excel worksheet. Fortunately, the sales force at Wallingford Motors have been keeping details about Gaea model specifications in just such a worksheet, as shown in Figure AW-E-5.

As discussed in the text, this worksheet is problematic because it contains more that just the column names and data we will want to import. Therefoer, we create an edited version as shown in Figure AW-E-6. Now we need to import this data into Microsoft Access 2013.

Importing a Microsoft Excel Worksheet into Microsoft Access

1. Click the **EXTERNAL DATA** command tab to display the EXTERNAL DATA command groups.
2. As shown in Figure AW-E-7, click the **Excel** button to display the Get External Data – Excel Worksheet dialog box.
3. Browse to the **DBC-e07-WMCRM-2015-Specificiations.xlsx Microsoft Excel 2013** workbook, as shown in Figure AW-E-8. Leave the **Import the source data into a new table in the current database** radio button selected.
4. Click the **OK** button.
5. The Import Spreadsheet Wizard is launched. On the first page, select the **SPECIFICATIONS_2015** worksheet as shown in Figure AW-E-9.
6. Click the **Next** button.

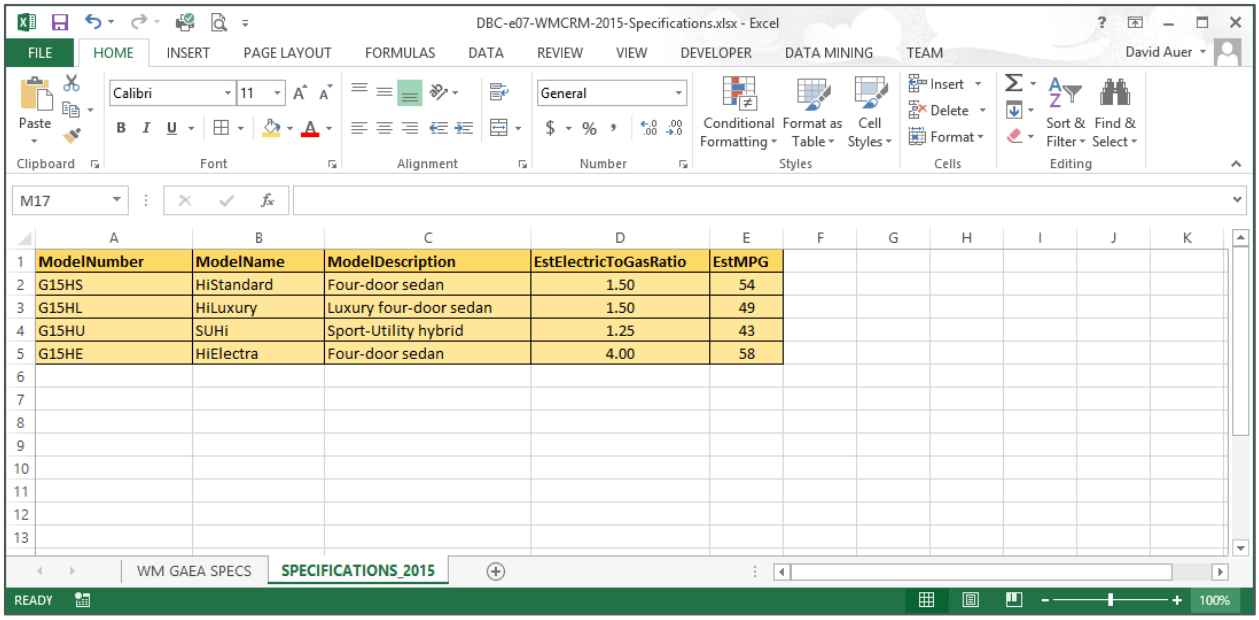


Figure AW-E-6 — The Revised Wallingford Motors Gaea Specifications Worksheet

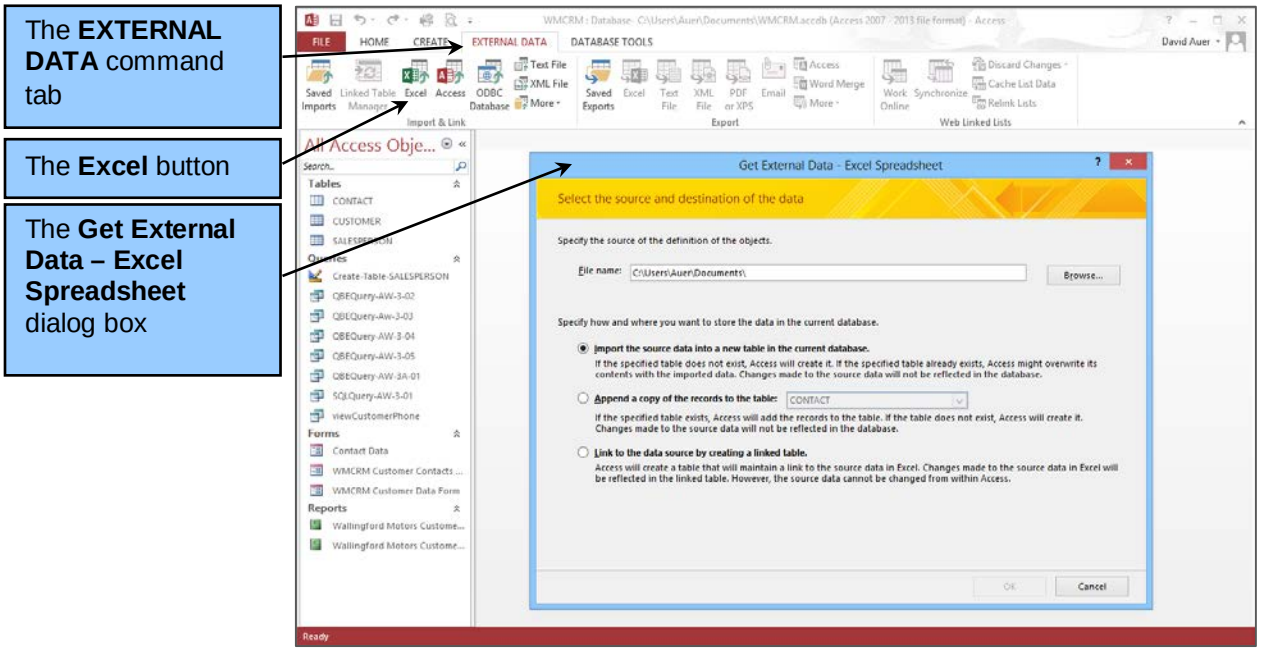


Figure AW-E-7 — The Get External Data – Excel Spreadsheet Dialog Box

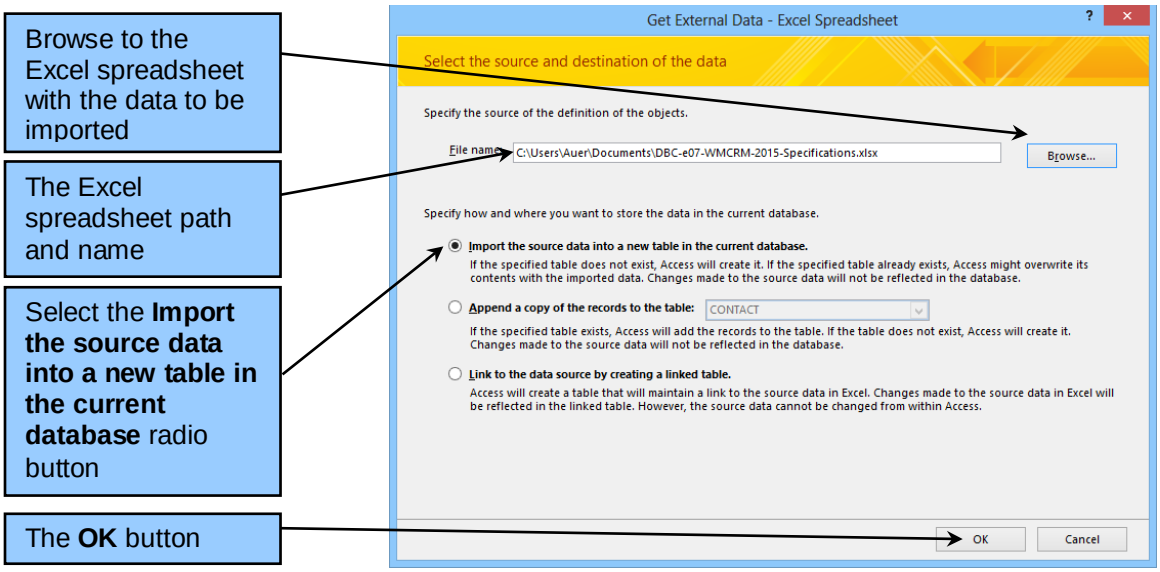


Figure AW-E-8 — The Get External Data – Excel Spreadsheet Dialog Box Completed

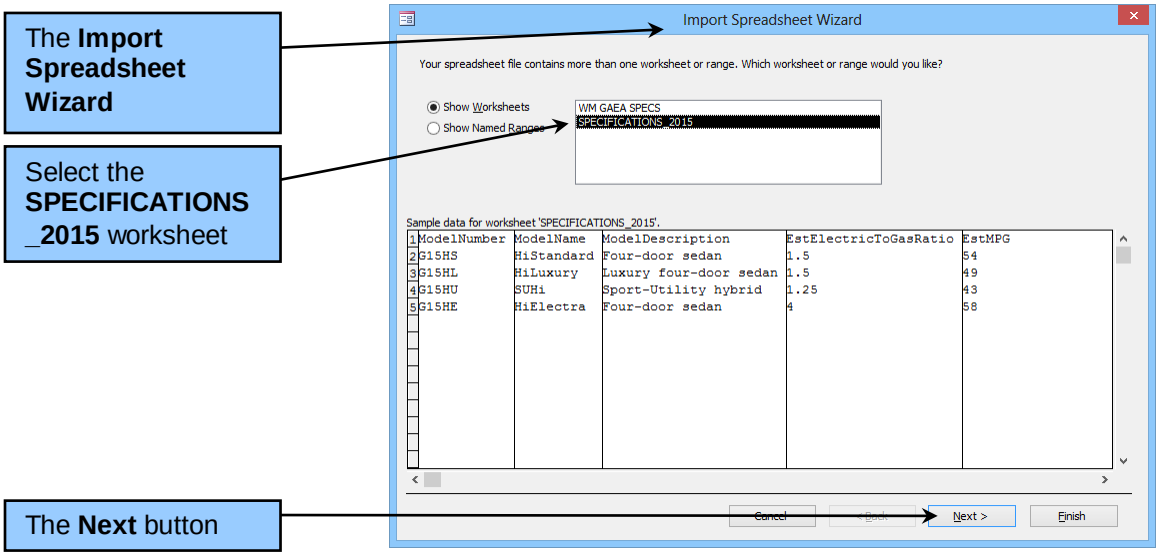


Figure AW-E-9 — The Import Spreadsheet Wizard Dialog Box

7. On the next page of the Import Spreadsheet Wizard, make sure the **First Row Contains Column Headings** checkbox is checked, as shown in Figure AW-E-10.

8. Click the **Next** button.

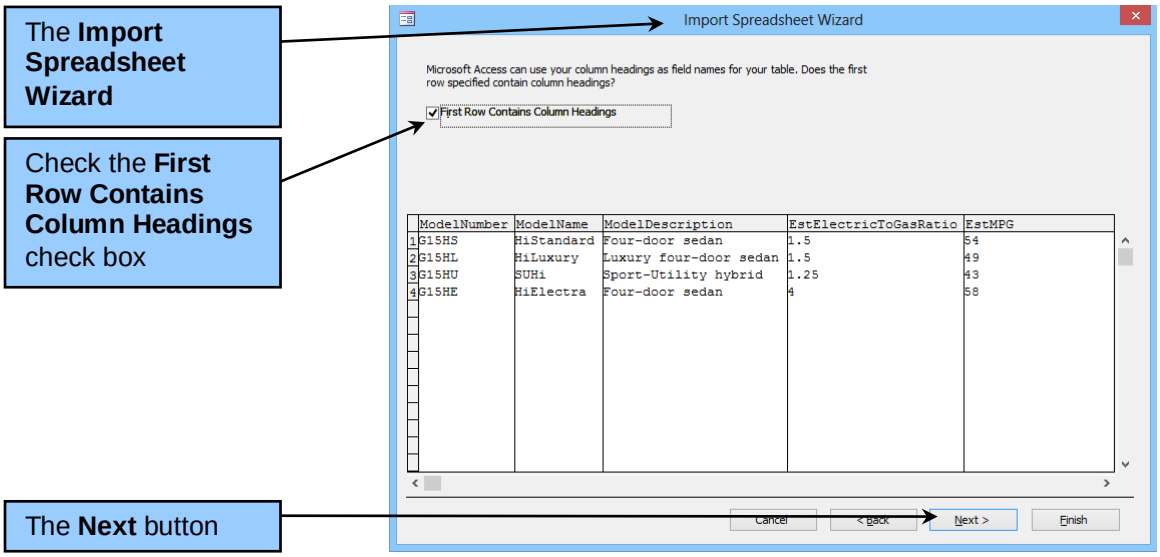


Figure AW-E-10— The First Row Contains Column Headings Check Box

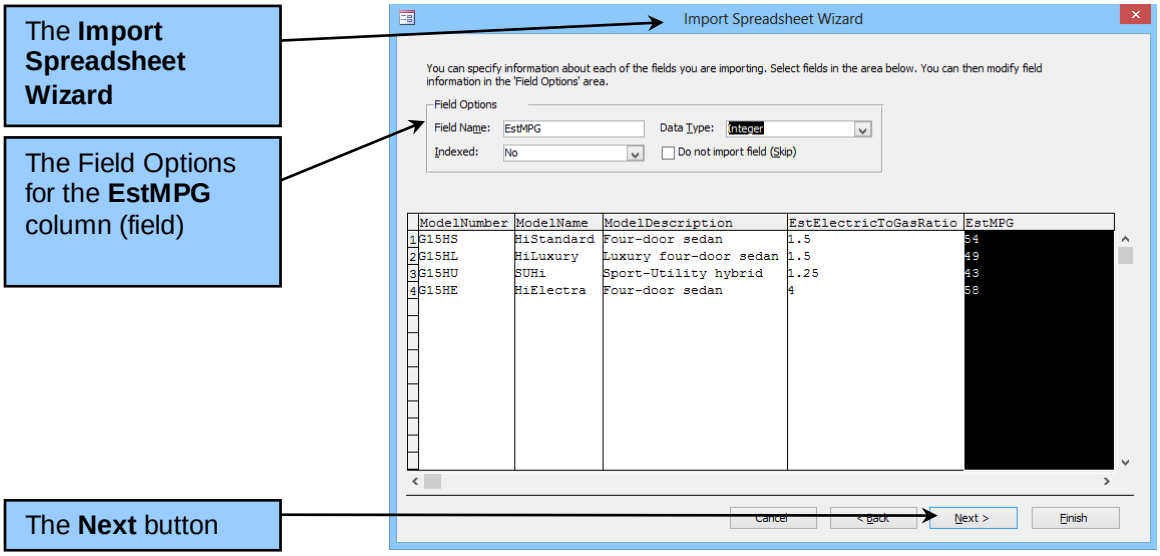


Figure AW-E-11— The Field Options for the EstMPG Column (Field)

9. On the next page of the Import Spreadsheet Wizard, we are given a chance to review column (called field here) characteristics. For each field, we can set Field Name, DataType and whether to index each column. We do not need to index. ModelNumber, ModelName and ModelDescription will be Short Text, EstElectricToGasRatio will be Single, and EstMPG will be Integer. Figure AW-E-11 shows the settings for the EstMPG field.

10. Click the **Next** button.

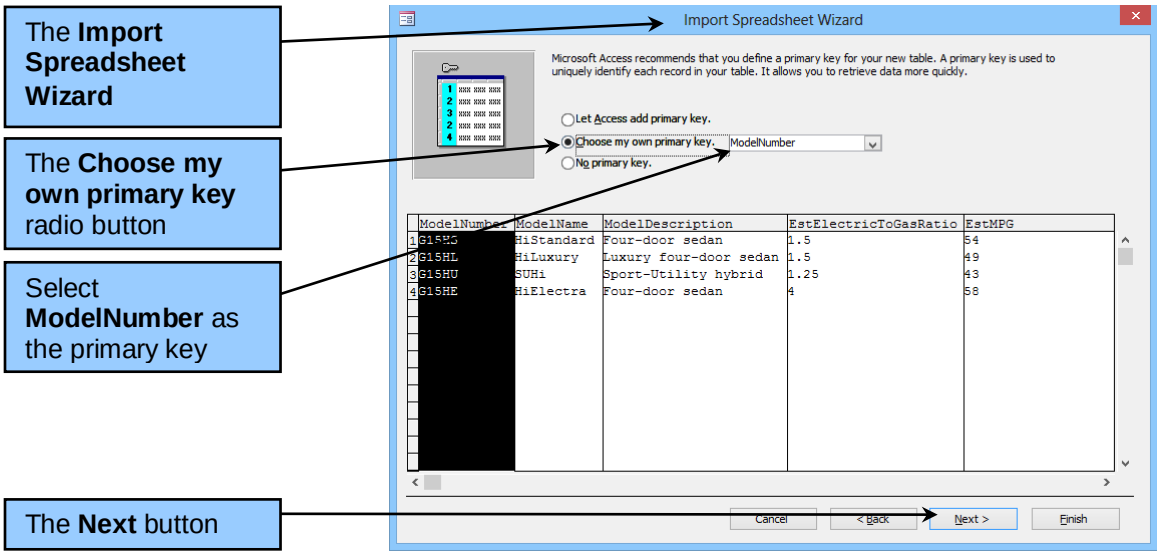


Figure AW-E-12— The Choose Primary Key Window

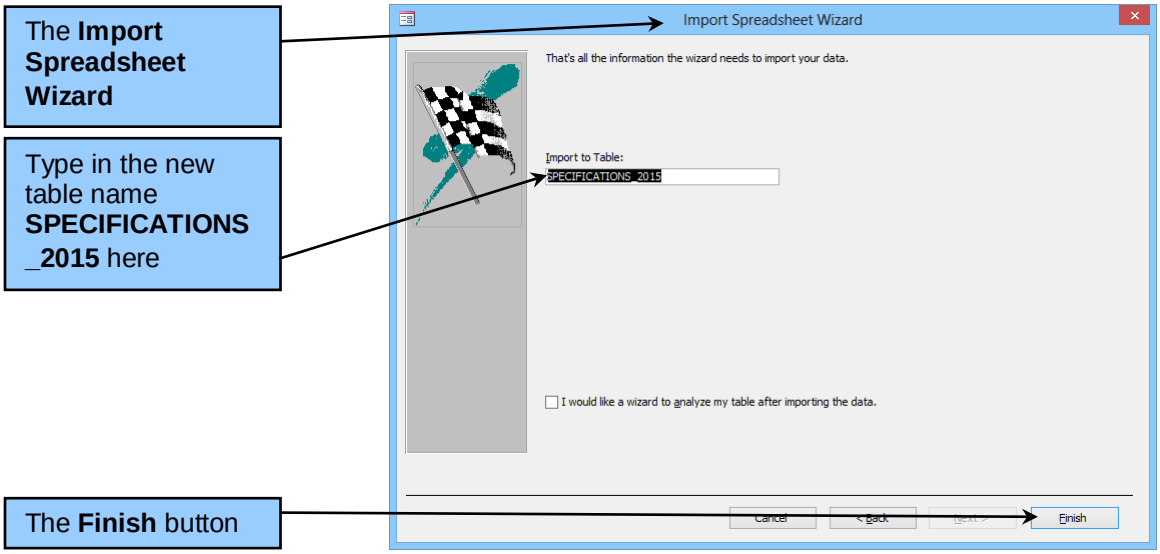


Figure AW-E-13— Entering the New Table Name

11. On the next page we are given a chance to set a primary key. We will choose our own, and it will be ModelNumber, as shown in Figure AW-E-12.

12. Click the **Next** button.

13. On the next page we are given a chance to set a table name. The default is the Worksheet name, and, as shown if Figure AW-E-13, here it is SPECIFICATIONS_2015, which is what we want the table to be named. No changes are required here.

14. Click the **Finish** button.

15. The table and data are imported, and we are given a chance to save the import steps. There is no need to do this so click the **Close** button to end the Wizard.

16. The imported SPECIFICATIONS_2015 table is shown in Datasheet View in Figure AW-E-14.

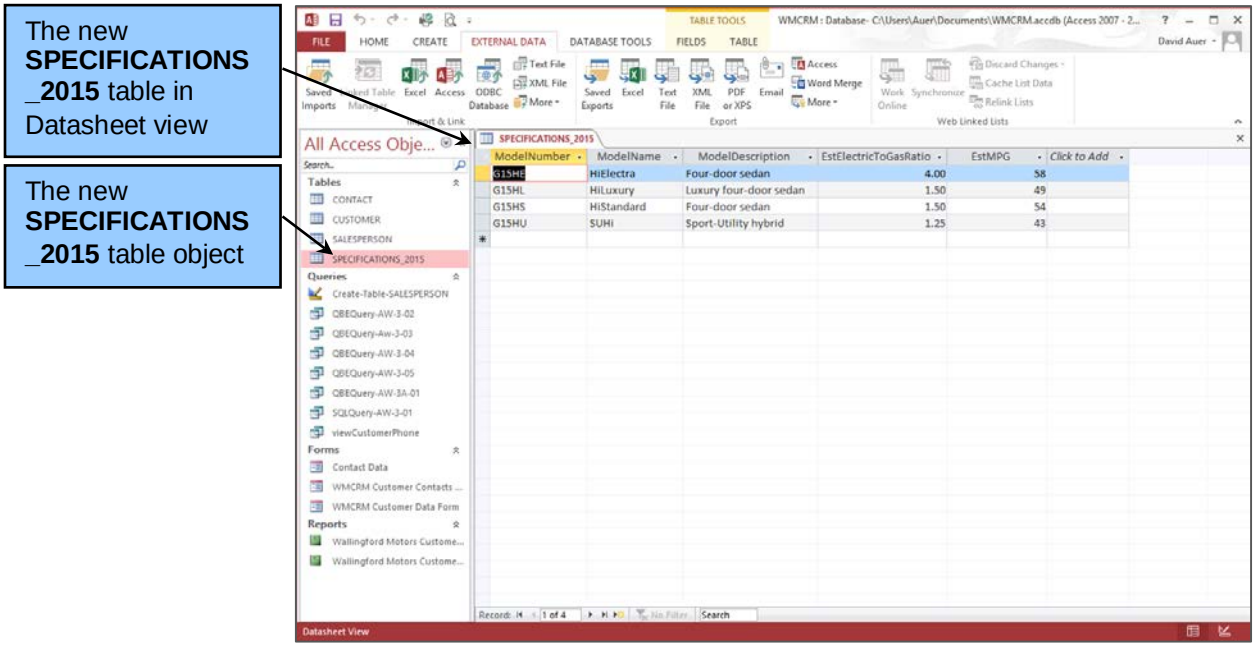


Figure AW-E-14 — The SPECIFICATIONS_2015 Table – Datasheet View

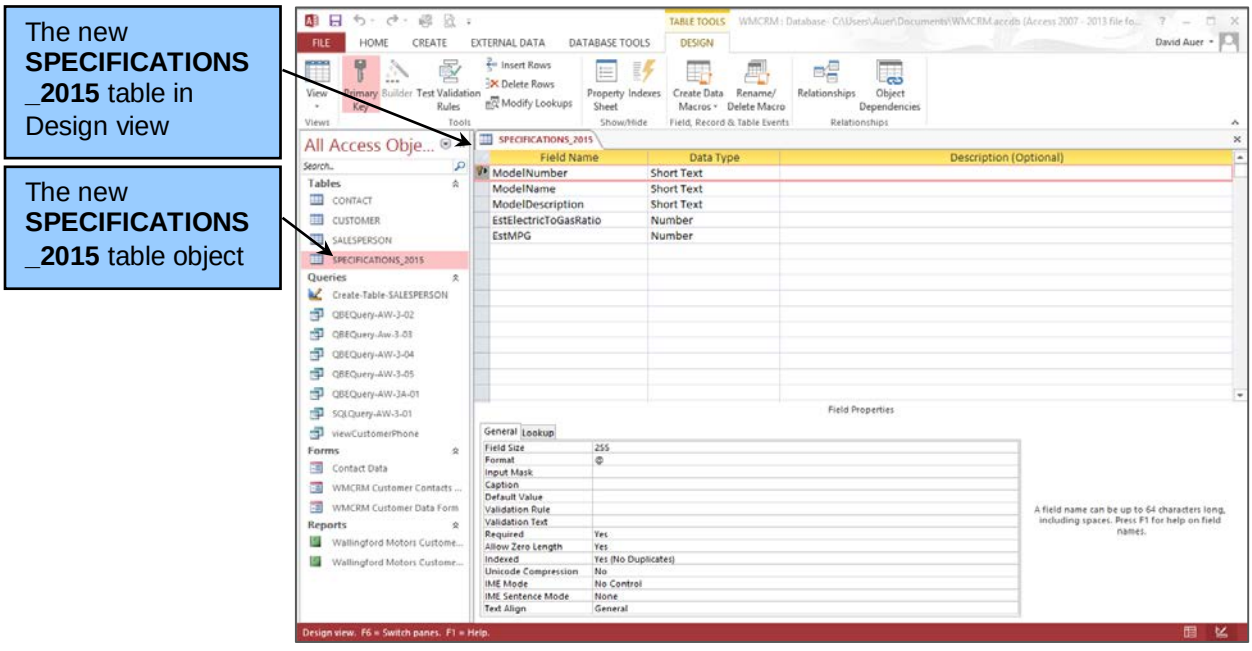


Figure AW-E-15 — The SPECIFICATIONS_2015 Table – Design View

17. Figure AW-E-15 shows the table in Design View. Note that the ModelNumber Short text Field size is 255. We may want to edit that and other field characteristics. For example, we need to set NULL/NOT NULL setting on all fields—this was not done during the import.

Although there is still some editing to do, we have successfully imported a Microsoft Excel 2013 worksheet in Microsoft Access 2013.

Closing the WMCRM Database and Exiting Access

1. To close the WMCRM database and exit Access, click the **Close** button in the upper-right corner of the Microsoft Access window.

Summary

An SQL view is a virtual table that is constructed from other tables and views. An SQL SELECT statement is used as part of a CREATE VIEW *ViewName* statement to define a view. However, view definitions cannot include ORDER BY clauses. Once defined, view names are used in SELECT statements the same way table names are used.

There are several uses for views. Views are used (a) to hide columns or rows, (b) to show the results of computed columns, (c) to hide complicated SQL syntax, and (d) to layer computations and built-in functions.

SQL/PSM is the portion of the SQL standard that provides for storing reusable modules of program code within a database. SQL/PSM specifies that SQL statements will be embedded in user-defined functions, triggers, and stored procedures in a database. It also specifies SQL variables, cursors, control-of flow statements, and output procedures.

A trigger is a stored program that is executed by the DBMS whenever a specified event occurs on a specified table or view. In Oracle Database, triggers can be written in Java or in a proprietary Oracle language called PL/SQL. In SQL Server, triggers can be written in a propriety SQL Server language called TRANSACT-SQL, or T-SQL. With MySQL, triggers can be written in MySQL's variant of SQL.

Possible triggers are BEFORE, INSTEAD OF, and AFTER. Each type of trigger can be declared for insert, update, and delete actions, so nine types of triggers are possible. Oracle Database supports all nine trigger types, SQL Server supports only INSTEAD OF and AFTER triggers, and MySQL supports the BEFORE and AFTER triggers.

A stored procedure is a program that is stored within the database and compiled when used. Stored procedures can receive input parameters and return results. Unlike triggers, their scope is database-wide; they can be used by any process that has permission to run the stored procedure. Stored procedures can be called from programs written in the same languages used for triggers. They also can be called from DBMS SQL utilities. The advantages of using stored procedures are summarized in Figure E-15.

SQL Server, Oracle Database, MySQL and Microsoft Access have tools for importing spreadsheet data.

Key Terms

bulk INSERT statement	**SQL ALTER VIEW {ViewName} statement**
Data	**SQL CREATE VIEW {ViewName} statement**
extract, transform and load (ETL)	**SQL DROP VIEW {ViewName} statement**
Information	**SQL/Persistent Stored Modules (SQL/PSM)**
Microsoft Access Database Engine 2010 Redistributable	**SQL Server Import and Export Wizard**
multivalue, multicolumn problem	**SQL view**
multivalued dependency	**Stored procedure**
MySQL for Excel Add-In	**trigger**
Spreadsheet	**user-defined function**
worksheet	

Review Questions

E.1 What is an SQL view? What purposes do views serve?

E.2 What SQL statements are used to create SQL views?

E.3 What is the limitation on SELECT statements used in SQL views?

E.4 How are views handled in Microsoft Access?

Use the following tables for your answers to questions E.5 through E.21:

PET_OWNER (OwnerID, OwnerLastName, OwnerFirstName, Phone, Email)

PET_3 (PetID, PetName, PetType, PetBreed, PetDOB, PetWeight, *OwnerID*)

These are the same tables that are used in the review questions for Chapter 3, and data for these tables are shown in below in Figures 3-18 and 3-20. For each SQL statement you write, show the results based on these data. If possible, run the statements you write in the questions that follow in an actual DBMS, as appropriate, to obtain your results.

FIGURE 3-18

PET_OWNER Data

OwnerID	OwnerLastName	OwnerFirstName	OwnerPhone	OwnerEmail
1	Downs	Marsha	555-537-8765	Marsha.Downs@somewhere.com
2	James	Richard	555-537-7654	Richard.James@somewhere.com
3	Frier	Liz	555-537-6543	Liz.Frier@somewhere.com
4	Trent	Miles		Miles.Trent@somewhere.com

FIGURE 3-20

PET_3 Data

PetID	PetName	PetType	PetBreed	PetDOB	PetWeight	OwnerID
1	King	Dog	Std. Poodle	27-Feb-11	25.5	1
2	Teddy	Cat	Cashmere	01-Feb-12	10.5	2
3	Fido	Dog	Std. Poodle	17-Jul-10	28.5	1
4	AJ	Dog	Collie Mix	05-May-11	20.0	3
5	Cedro	Cat	Unknown	06-Jun-09	9.5	2
6	Wooley	Cat	Unknown		9.5	2
7	Buster	Dog	Border Collie	11-Dec-08	25.0	4

E.5 Code an SQL statement to create a view named OwnerPhoneView that shows OwnerLastName, OwnerFirstName, and OwnerPhone.

E.6 Code an SQL statement that displays the data in OwnerPhoneView, sorted alphabetically by OwnerLastName.

E.7 Code an SQL statement to create a view named DogBreedView that shows PetID, PetName, PetBreed, and PetDOB for dogs.

E.8 Code an SQL statement that displays the data in DogBreedView, sorted alphabetically by PetName.

E.9 Code an SQL statement to create a view named CatBreedView that shows PetID, PetName, PetBreed, and DOB for cats.

E.10 Code an SQL statement that displays the data in CatBreedView, sorted alphabetically by PetName.

E.11 Code an SQL statement to create a view named PetOwnerView that shows PetID, PetName, PetType, OwnerID, OwnerLastName, OwnerFirstName, OwnerPhone, and OwnerEmail.

E.12 Code an SQL statement that displays the data in PetOwnerView, sorted alphabetically by OwnerLastName and PetName.

E.13 Code an SQL statement to create a view named OwnerPetView that shows OwnerID, OwnerLastName, OwnerFirstName, PetID, PetName, PetType, PetBreed, and PetDOB.

E.14 Code an SQL statement that displays the data in OwnerPetView, sorted alphabetically by OwnerLastName and PetName.

E.15 Code an SQL statement to create a view named PetCountView that shows each type (that is, dog or cat) and the number of each type (that is, how many dogs and how many cats) in the database.

E.16 Code an SQL statement that displays the data in PetCountView, sorted alphabetically by PetType.

E.17 Code an SQL statement to create a view named DogBreedCountView that shows each breed of dog and the number of each breed in the database.

E.18 Code an SQL statement that displays the data in DogBreedCountView, sorted alphabetically by PetBreed.

E.19 Write a user-defined function named LastNameFirst that concatenates the OwnerLastName and OwnerFirstName into a single value named OwnerName, and displays, in order, the OwnerFirstName and OwnerLastName with a single space between them (***hint***: *Downs* and *Marsha* would be combined to read *Marsha Downs*).

E.20 Code an SQL statement to create a view named PetOwnerLastNameFirstView that shows PetID, Name, Type, OwnerID, LastName and FirstName concatenated using the LastNameFirst user-defined function and displayed as PetOwnerName, Phone, and Email.

E.21 Code an SQL statement that displays the data in PetOwnerLastNameFirstView, sorted alphabetically by OwnerName and PetName.

Exercises

If you haven't created the Art Course database described in Chapter 3, create it now (by completing exercises 3.52 and 3.53). Use the Art Course database to answer exercises E.22 through E.32.

E.22 Code an SQL statement to create a view named CourseView that shows unique course names and fees.

E.23 Code an SQL statement that displays the data in CourseView, sorted alphabetically by Course.

E.24 Code an SQL statement to create a view named CourseEnrollmentView that shows CourseNumber, Course, CourseDate, CustomerNumber, CustomerLastName, CustomerFirstName, and Phone.

E.25 Code an SQL statement that displays the data in CourseEnrollmentView for the Advanced Pastels course starting 10/01/15. Sort the data alphabetically by CustomerLastName.

E.26 Code an SQL statement that displays the data in CourseEnrollmentView for the Beginning Oils course starting 10/15/15. Sort the data alphabetically by CustomerLastName.

E.27 Code an SQL statement to create a view named CourseFeeOwedView that shows CourseNumber, Course, CourseDate, CustomerNumber, CustomerLastName, CustomerFirstName, Phone, Fee, AmountPaid, and the calculated column (Fee – AmountPaid), renamed as AmountOwed.

E.28 Code an SQL statement that displays the data in CourseFeeOwedView, sorted alphabetically by CustomerLastName.

E.29 Code an SQL statement that displays the data in CourseFeeOwedView, sorted alphabetically by CustomerLastName for any customer who still owes money for a course fee.

E.30 Write a user-defined function named LastNameFirst that concatenates the CustomerLastName and CustomerFirstName into a single value named CustomerName, and displays, in order, the CustomerLastName, a comma, a space, and the CustomerOwnerFirstName (***hint***: *Johnson* and *Ariel* would be combined to read *Johnson, Ariel*).

E.31 Code an SQL statement to create a view named CourseEnrollmentLastNameFirstView that shows CourseNumber, Course, CourseDate, CustomerNumber, CustomerLastName and CustomerFirstName concatenated using the LastNameFirst user-defined function and displayed as CustomerName, and Phone.

E.32 Code an SQL statement that displays the data in CourseEnrollmentLastNameFirstView, sorted alphabetically by CustomerName and CourseNumber.

Access Workbench Key Terms

Microsoft Access equivalent of an SQL view

Access Workbench Exercises

In the "Access Workbench Exercises" sections for Chapters 1, 2, and 3, you created a database for Wedgewood Pacific Corporation (WPC) of Seattle, Washington. In this set of exercises, you will use that database, as completed in Chapter 3's section of "The Access Workbench Exercises," to create and use Microsoft Access queries as SQL view equivalents, and to practice importing data from an Excel spreadsheet..

AW.E.1 Using Access QBE or SQL, create and run view-equivalent queries to complete the questions that follow. Save each query using the query name format *viewViewQueryName*, where *ViewQueryName* is the name specified in the question.

A. Create an Access view–equivalent query named Computer that shows Make, Model, SerialNumber, ProcessorType, ProcessorSpeed, MainMemory, and DiskSize.

B. Create an Access view–equivalent query named EmployeeComputer that uses viewComputer for part A to show EMPLOYEE.EmployeeNumber, LastName, FirstName, and the data about the computer assigned to that employee, including Make, Model, SerialNumber, ProcessorType, ProcessorSpeed, MainMemory, and DiskSize.

AW.E.2 Use Access QBE to create and run the queries that follow. Save each query using the query name format QBEQuery-AW-E-1-##, where ## is replaced by the letter designator of the question. For example, the first query will be saved as QBEQuery-AW-E-1-A.

A. Create an Access QBE query to display the data in viewComputer, sorted alphabetically by Make and Model and then numerically by SerialNumber.

B. Create an Access QBE query to display the data in viewEmployeeComputer. Sort the results alphabetically by LastName, FirstName, Make, and Model and then numerically by SerialNumber.

AW.E.3 The COMPUTER and COMPUTER_ASSIGNMENT table have already been created in the Microsoft Access version of the WPC database as part of the Chapter 3 exercises, so we must use alternate names.

A. Using the table names COMPUTER_2 and COMPUTER_ASSIGNMENT_2, import the data from the DBC-e07-WPC-Computer-Assignment-Worksheet.xlsx file into the WPC database.

B. Modify the COMPUTER_2 and COMPUTER_ASSIGNMENT_2 table structures as needed to match the table column characteristics shown in Figures 3-23 and 3-25.

C. Create the needed relationships between COMPUTER_2, COMPUTER_ASSIGNMENT_2 and EMPLOYEE.

D. Complete exercises AW.E.1 and AW.E.2 using COMPUTER_2 and COMPUTER_ASSIGNMENT_2.

Heather Sweeney Designs Case Questions

These questions are based on Chapter 3's Heather Sweeney Designs case questions. Base your answers to the questions that follow on the HSD database, as described there. If possible, run your SQL statements in an actual DBMS to validate your work.

A Write a user-defined function named LastNameFirst that concatenates the customer's LastName and FirstName into a single value named CustomerName, and displays, in order, the CustomerLastName, a comma, a space, and the CustomerOwnerFirstName (***hint***: *Jacobs* and *Nancy* would be combined to read *Jacobs, Nancy*).

B. Create the following SQL views:

1. Create an SQL view named CustomerSeminarView that shows CUSTOMER.CustomerID, LastName, FirstName, EmailAddress, City, State, ZIP, SeminarDate, Location, and SeminarTitle.
2. Create an SQL view named CustomerLastNameFirstSeminarView that shows CUSTOMER.CustomerID, then LastName and FirstName concatenated using the LastNameFirst user-defined function and displayed as CustomerName, EmailAddress, City, State, ZIP, SeminarDate, Location, and SeminarTitle.
3. Create an SQL view named CustomerProductView that shows CustomerID, LastName, FirstName, EmailAddress, INVOICE.InvoiceNumber, InvoiceDate, PRODUCT.ProductNumber, and Description.
4. Create an SQL view named CustomerLastNameFirstProductView that shows CustomerID, then LastName and FirstName concatenated using the LastNameFirst user-defined function and displayed as CustomerName, EmailAddress, INVOICE.InvoiceNumber, InvoiceDate, PRODUCT.ProductNumber, and Description.

C. Create and run the following SQL queries:

1. Create an SQL statement to run CustomerSeminarView, with the results sorted alphabetically by State, City, and ZIP (in that order) in descending order.
2. Create an SQL statement to run CustomerLastNameFirstSeminarView, with the results sorted alphabetically by State, City, and ZIP (in that order) in descending order.
3. Create an SQL statement to run CustomerSeminarView, with the results sorted alphabetically by Location, SeminarDate, and SeminarTitle (in that order) in ascending order.
4. Create an SQL statement to run CustomerLastNameFirstSeminarView, with the results sorted alphabetically by Location, SeminarDate, and SeminarTitle (in that order) in ascending order.
5. Create an SQL statement to run CustomerProductView, with the results sorted alphabetically by LastName, FirstName, InvoiceNumber, and ProductNumber in ascending order.
6. Create an SQL statement to run CustomerLastNameFirstProductView, with the results sorted alphabetically by CustomerName, InvoiceNumber, and ProductNumber in ascending order.

Garden Glory Project Questions

These questions are based on Chapter 3's Garden Glory project questions. Base your answers to the questions that follow on the Garden Glory database, as described there. If possible, run your SQL statements in an actual DBMS to validate your work.

A Write a user-defined function named LastNameFirst that concatenates the employee's LastName and FirstName into a single value named FullName, and displays, in order, the LastName, a comma, a space, and the FirstName (***hint***: *Smith* and *Steve* would be combined to read *Steve, Smith*).

B. Create the following SQL views:

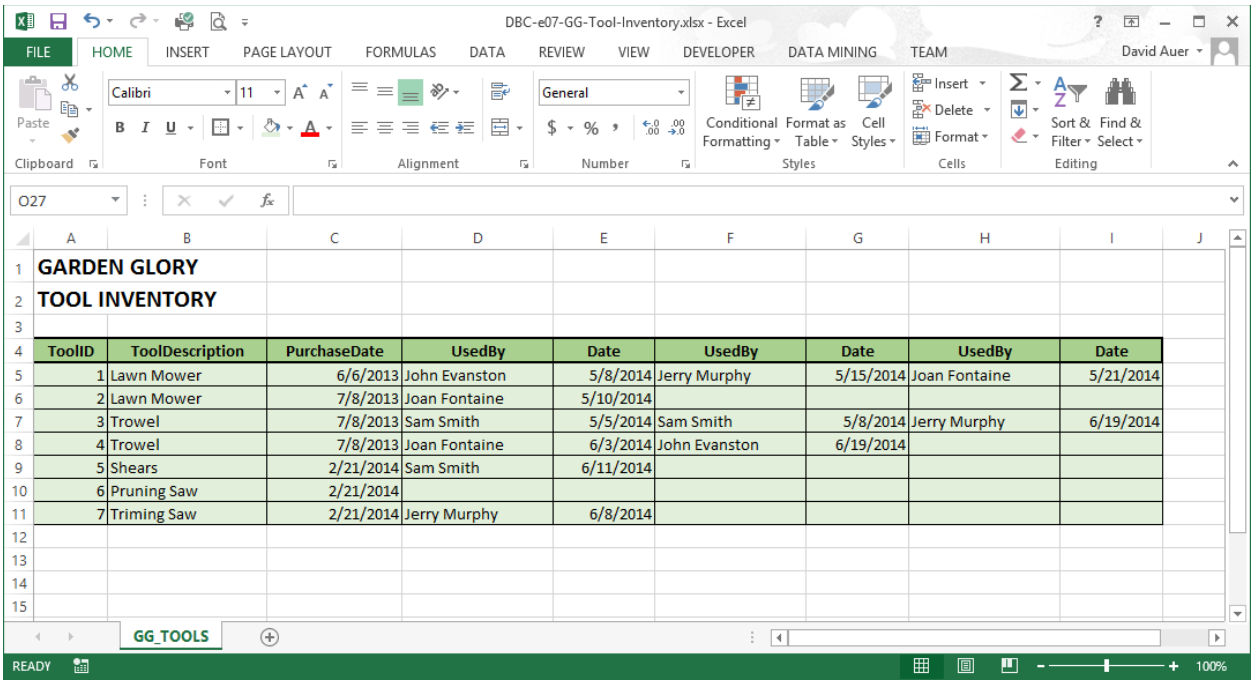
1. Create an SQL view named OwnerPropertyView that shows OWNER.OwnerID, OwnerName, Type, PropertyID, PropertyName, Street, City, State, and Zip.
2. Create an SQL view named PropertyServiceView that shows PROPERTY.PropertyID, PropertyName, Street, City, State, Zip, Date, FirstName, LastName, and HoursWorked.
3. Create an SQL view named PropertyServiceLastNameFirstView that shows PROPERTY.PropertyID, PropertyName, Street, City, State, Zip, Date, then LastName and FirstName concatenated using the LastNameFirst user-defined function and displayed as EmployeeName, and HoursWorked.

C. Create (and run) the following SQL queries:

1. Create an SQL statement to run OwnerPropertyView, with the results sorted alphabetically by OwnerName.
2. Create an SQL statement to run PropertyServiceView, with the results sorted alphabetically by Zip, State, and City.
3. Create an SQL statement to run PropertyServiceLastNamefirstView, with the results sorted alphabetically by Zip, State, and City.

D. Garden Glory staff keep a record of tool inventory and who uses those tools in a Microsoft Excel worksheet, as shown in Figure E-58.

1. Duplicate Figure E-58 in a worksheet (or spreadsheet) in an appropriate tool (such as Microsoft Excel or Apache OpenOffice Calc).
2. Import the data into one or more new tables in the GG database. You must determine all tables characteristics needed (primary key, foreign keys, data types, etc.)
3. Link this (these) new table (tables) as appropriate to the GG_SERVICE table in the GG database.



	A	B	C	D	E	F	G	H	I	J
1	GARDEN GLORY									
2	TOOL INVENTORY									
3										
4	ToolID	ToolDescription	PurchaseDate	UsedBy	Date	UsedBy	Date	UsedBy	Date	
5	1	Lawn Mower	6/6/2013	John Evanston	5/8/2014	Jerry Murphy	5/15/2014	Joan Fontaine	5/21/2014	
6	2	Lawn Mower	7/8/2013	Joan Fontaine	5/10/2014					
7	3	Trowel	7/8/2013	Sam Smith	5/5/2014	Sam Smith	5/8/2014	Jerry Murphy	6/19/2014	
8	4	Trowel	7/8/2013	Joan Fontaine	6/3/2014	John Evanston	6/19/2014			
9	5	Shears	2/21/2014	Sam Smith	6/11/2014					
10	6	Pruning Saw	2/21/2014							
11	7	Triming Saw	2/21/2014	Jerry Murphy	6/8/2014					
12										
13										
14										
15										

Figure E-58 — The Garden Glory Tool Inventory Worksheet

James River Jewelry Project Questions

The James River Jewelry project question are available in online Appendix D, which can be downloaded from the textbook's Web site: www.pearsonhighered.com/kroenke.

The Queen Anne Curiosity Shop Project Questions

These questions are based on Chapter 3's Queen Anne Curiosity Shop project questions. Base your answers to the questions that follow on the Queen Anne Curiosity Shop project database, as described there. If possible, run your SQL statements in an actual DBMS to validate your work.

A Write a user-defined function named LastNameFirst that concatenates the employee's LastName and FirstName into a single value named FullName, and displays, in order, the LastName, a comma, a space, and the FirstName (***hint***: *Smith* and *Steve* would be combined to read *Smith, Steve*).

B. Create the following SQL view statements:

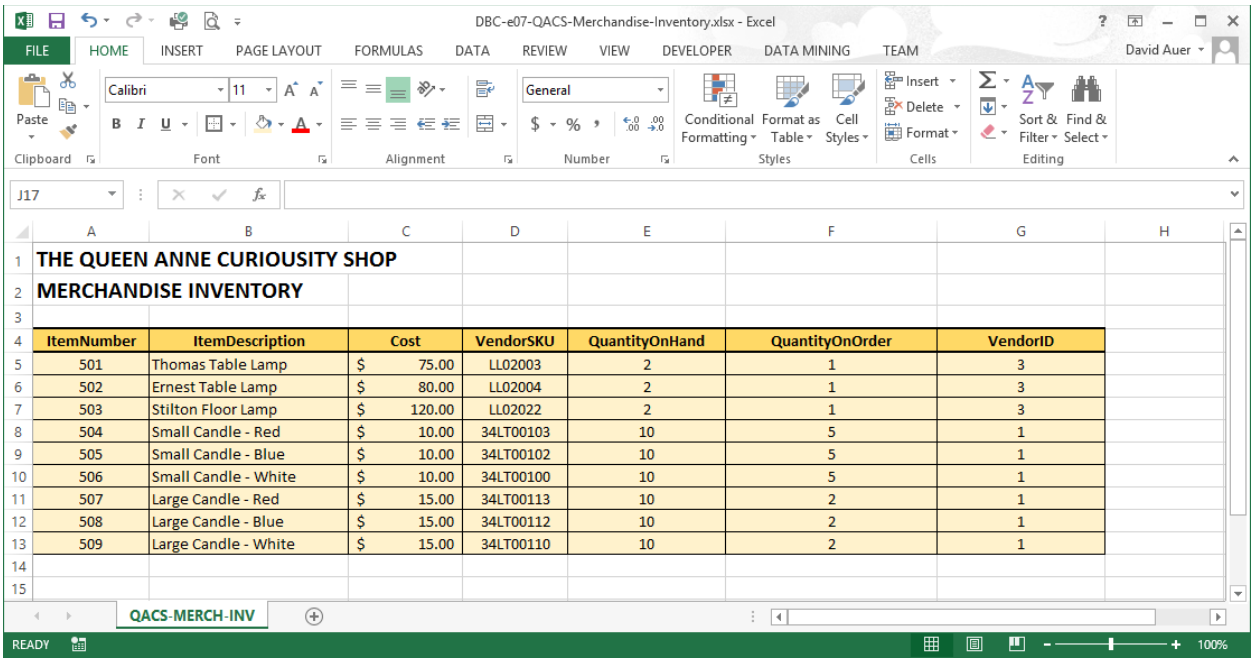
1. Create an SQL view named BasicCustomerView that shows each customer's CustomerID, LastName, FirstName, Phone, and Email.
2. Create an SQL view named BasicCustomerLastNameFirstView that shows each customer's CustomerID, then LastName and FirstName concatenated using the LastNameFirst user-defined function and displayed as CutomerName, Phone, and Email.
3. Create an SQL view named SaleItemItemView that shows SaleID, SaleItemID, SALE_ITEM.ItemID, SaleDate, ItemDescription, ItemCost, ITEM.ItemPrice as ListItemPrice, and SALE_ITEM.ItemPrice as ActualItemPrice.

C. Create (and run) the following SQL queries:

1. Create an SQL statement to run BasicCustomerView, with the results sorted alphabetically by LastName and FirstName.
2. Create an SQL statement to run BasicCustomerFirstNameFirstView, with the results sorted alphabetically by CustomerName.
3. Create an SQL statement to run SaleItemItemView, with the results sorted by SaleID and SaleItemID.
4. Create an SQL query that uses SaleItemItemView to calculate and display the sum of SALE_ITEM.ItemPrice (which is relabeled as ActualItemPrice) as TotalPretaxRetailSales.

D. The Queen Anne Curiosity Shop owners and staff have decided to sell standardized items that can be stocked and reordered as necessary. So far, they have kept their records for these items in a Microsoft Excel worksheet, as shown in Figure E-59. They have decided to integrate this data into the QACS database

1. Duplicate Figure E-59 in a worksheet (or spreadsheet) in an appropriate tool (such as Microsoft Excel or Apache OpenOffice Calc).
2. Import the data into one or more new tables in the QACS database. You must determine all table characteristics needed (primary key, foreign keys, data types, etc.)
3. Link this (these) new table (tables) to the VENDOR table only in the QACS database.



ItemNumber	ItemDescription	Cost	VendorSKU	QuantityOnHand	QuantityOnOrder	VendorID
501	Thomas Table Lamp	$ 75.00	LL02003	2	1	3
502	Ernest Table Lamp	$ 80.00	LL02004	2	1	3
503	Stilton Floor Lamp	$ 120.00	LL02022	2	1	3
504	Small Candle - Red	$ 10.00	34LT00103	10	5	1
505	Small Candle - Blue	$ 10.00	34LT00102	10	5	1
506	Small Candle - White	$ 10.00	34LT00100	10	5	1
507	Large Candle - Red	$ 15.00	34LT00113	10	2	1
508	Large Candle - Blue	$ 15.00	34LT00112	10	2	1
509	Large Candle - White	$ 15.00	34LT00110	10	2	1

Figure E-59 — The Queen Anne Curiosity Shop Standard Merchandise Inventory Worksheet