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Introduction

In the beginning there was the idea....The proposal to write about every single Microsoft Excel function with interesting and comprehensible examples came from Helmut Reinke—and everyone on the team agreed. "Yes, this is what Excel users need—a comprehensive reference book with all of the functions." That was eight years ago, and the enthusiasm hasn’t diminished.

At the beginning of this year, the idea to translate our reference book into English arose. And what could we say? There they were again: the same enthusiasm as in 2007, and along with it the tremendous task of translation. But we have persevered, and now we are really proud and happy to present to you the first edition of our function book in English. Since we wrote the German edition, a couple of small Excel revolutions took place: A few years ago, Excel 2007 was launched with many new properties and possibilities. For a year and a half now, we also have had Excel 2010 at our disposal, which includes even more new possibilities. We will address them partially in this book.

We hope that you, dear reader, will welcome this concept, and that this reference work will give you many ideas and support you when needed.

Who This Book Is For

Functions are the most powerful tools in Excel. Our goal is to give readers an understanding of every single function with the aid of plausible examples so that everyone can be capable of realizing the inexhaustible possibilities.

So this book is aimed at everyone who is interested in working with Excel—whether you are a beginner or a power user and whether you are using Excel privately or for business. We want to make readers with little experience familiar with the functions so that they will find meaningful scenarios for using them. But we also want to address the reader who is more familiar with Excel, and so we provide several scenarios to help that reader move to the next level of knowledge.

Do you want to calculate the probability of winning the lottery? Do you have to provide a meaningful report of your company’s annual sales? No problem. Let’s get started.

Assumptions About You

We make a basic assumption that you are generally experienced in working with Microsoft Office and know a few Excel basics. We do not spend time explaining the user interface of Excel and the buttons on the ribbon.
If you are an experienced Excel user, you can just skim over Chapter 1, “Solving Problems with Functions,” and Chapter 2, “Using Functions and PowerPivot.” If you are not so experienced, we hope to give you an idea of the general possibilities offered by Excel. We hope that the many pages you have in front of you will be helpful to you. Use them to your advantage, and if you like the book, please don’t keep your opinion to yourself. Write to us and let us know what you like about it, and especially what we should improve.

We promise that we will be here for you if you have questions or are running into problems. You can write to us at: info@mindbusiness.de.

### How This Book Is Organized

All the functions have been tested in Microsoft Office Excel 2000 through Excel 2010. With the exception of characteristics specific to Excel 2007 and Excel 2010, most descriptions can even be used with Excel 97. Where necessary, we added comments regarding the particularities of the different versions.

The book is divided into four sections.

#### Introducing Formulas and Functions in Excel

The first section contains Chapters 1 through 4. They describe working with Excel, provide a general introduction to using Excel 2010, and give you a first look at formulas and functions. For beginners and experts alike, we have outlined the use of formulas and table functions with all the important notes, instructions, tips, and tricks.

Because we consider the Excel 2010 PowerPivot add-in quite extraordinary, we have introduced it briefly in this section. It has relatively little to do with spreadsheet functions, but we still wanted to acquaint you with it.

#### Creating Your Own Solutions in Excel

Chapter 5, “Functions in Special Operations,” and Chapter 6, “Custom Functions,” show that you can do a lot more with most functions than just use them in a worksheet. You can create and program your own functions.

Chapter 5 provides examples for using special functions in names and conditional formatting, as well as for validity and data checks. We hope you will find many ideas and clues for your own Excel solutions here.
Chapter 6 introduces you to programming in Excel. You can create any custom functions in Excel and then use them just like the built-in functions.

**Functions**

Chapters 7 through 17 provide the descriptions of the main Excel functions:

- Chapter 7, “Date and Time Functions”
- Chapter 8, “Text and Data Functions”
- Chapter 9, “Logical Functions”
- Chapter 10, “Lookup and Reference Functions”
- Chapter 11, “Information Functions”
- Chapter 12, “Statistical Functions”
- Chapter 13, “Database Functions”
- Chapter 14, “Cube Functions” (new in Excel 2007)
- Chapter 15, “Financial Functions”
- Chapter 16, “Mathematical and Trigonometry Functions”
- Chapter 17, “Engineering Functions”

**Appendices**

This book includes three appendices: Appendix A and Appendix B list the functions alphabetically and categorically (respectively), and Appendix C explains what is new in Excel 2007 and Excel 2010.

And now we wish you lots of success for your work with Microsoft Excel!
Features and Conventions Used in This Book

This book uses special text and design conventions to make it easier for you to find the information you need.

Text Conventions

<table>
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<td>Abbreviated commands for navigating the ribbon</td>
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<td>Plus sign (+) in text</td>
<td>Keyboard shortcuts are indicated by a plus sign (+) separating key names. For example, Ctrl+Alt+Delete means that you press the Ctrl, Alt, and Delete keys at the same time.</td>
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Design Conventions

INSIDE OUT

An example of an “Inside Out” heading

These are the book’s signature tips. In these tips, you get the straight scoop on what’s going on with the software—inside information about why a feature works the way it does. You’ll also find handy workarounds to deal with software problems.

Sidebar

Sidebars provide helpful hints, timesaving tricks, or alternative procedures related to the task being discussed.

See Also Cross-references point you to locations in the book that offer additional information about the topic being discussed.
CAUTION

Cautions identify potential problems that you should look out for when you’re completing a task or that you must address before you can complete a task.

Note

Notes offer additional information related to the task being discussed.

Certain parts of the text are specially marked to draw your attention to important comments. We have used the following categories:

<table>
<thead>
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<th>Category</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>Note</td>
<td>Additional information about this topic that’s worth knowing</td>
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<tr>
<td>Important</td>
<td>Makes you aware of facts you must know and keep in mind</td>
</tr>
<tr>
<td>Tip</td>
<td>Tips and tricks regarding the current context</td>
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</table>

Your Companion eBook

The eBook edition of this book allows you to:

- Search the full text
- Print
- Copy and paste

To download your eBook, please see the instruction page at the back of this book.

Using the Sample Files

You’ll find the sample files that are used in this book at:

http://www.microsoftpressstore.com/title/9780735658028

Important

The Microsoft Excel 2010 software is not available from this website. You should purchase and install that software before using this book.
Microsoft offers special updates and file converters for opening an Excel 2007 and Excel 2010 workbook in a previous Excel versions (97–2003). If the converters are not installed with the Office update, you might be prompted to install them when opening an Excel 2007 or Excel 2010 workbook.

After you install the updates and the converter, you can open Excel 2007 and Excel 2010 workbooks. You can edit and save the workbooks. However, the new features and formats of Excel 2007 and Excel 2010 are not displayed in previous Excel versions. You will find detailed information at the following Microsoft website: http://office.microsoft.com/en-us/excel/HA100775611031.aspx

You should also read the information that is provided for the sample files in each chapter.

The following table lists the names of the sample files that are used in the book. Because some users who are working with older Excel versions (Excel 2000 through Excel 2003) might not be able to open the new file formats of Excel 2007 and Excel 2010 (.xlsx, .xlsm, and so on), the sample files are provided in both formats: .xls (Excel 97 through Excel 2003) and .xlsx (Excel 2007 and Excel 2010).

### Important

When you open a sample file in Excel and then close Excel, you can save the file in the same format or in a different format. By default, Excel offers the standard format again. However, if you choose the standard format (*.xlsx), Excel will display a message box that contains the information that you are going to save your work as a macro-free workbook. You should click No and save your work in a macro-enabled file type (*.xlsm).
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### Acknowledgments

In this introduction we would like to thank our editors Kenyon Brown and Thomas Braun-Wiesholler at O'Reilly Media and Kathy Krause at Online Training Solutions, Inc. (OTSI) for their inspiration, patience, and effort. The first edition of this book we published eight years ago in German for Microsoft Excel users in Germany, Austria, and Switzerland. Now we are proud to present you with our book translated into English. It was a great experience to transfer all of the chapters and sample files to readers in the United States and all over the world. Sometimes it was easy because we could remove the German-specific and European-specific topics. Other times it was challenging to find the U.S. analogy for some topics and samples. None of us is a native speaker, but with the great teamwork of the O'Reilly translators and editors, we learned a lot.
We have tried to bring you substantiated descriptions, practical examples, and solutions in all chapters, and to present the wide range of material without errors. Whether we have succeeded in fulfilling our own requirements is up to you to decide. We are realists and know that a book like this can always be improved in spite of all our efforts. We are therefore looking forward to receiving your critiques, suggestions, and notes.

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This chapter introduces Microsoft Excel and its functions. There are more practical examples with detailed function descriptions in Chapters 7 to 17 of this book.

First you will become familiar with Excel 2010, because there have been some notable changes since Excel 2007. Even if you are already using Excel 2010, you should be able to find some interesting points and suggestions.

**Introducing the New Functions in Excel 2010**

Microsoft Excel 2010 includes several new functions, many of which are introduced in the following Profit Margin example. Calculating a profit margin is important for price calculations and for planning operating results. By calculating the profit margin, you can build a decision-oriented cost accounting system.

**Scenario and Goals**

The Contoso, Ltd. company wants to evaluate and analyze its profit margins, focusing on overall percentages and variances. After you complete this example, you should be able to perform the following actions in Excel:

- Automatically fill in a month series and create your own fill styles
- Enter formulas
- Work with tables and style sheets
In this section, you will learn how to effectively work with Excel 2010 and explore the new possibilities.

Creating the Month Data Series

To quickly create a list of all months of the year, perform the following steps:

1. Select File/New and click Create to open an empty Excel workbook.

2. Enter the following text in columns A2 through E2 (see Figure 1-1):

   - **Month** (A2)
   - **Purchase** (B2)
   - **Sales** (C2)
   - **Profit margin** (D2)

   ![Figure 1-1](image)

   **Figure 1-1** Naming the table columns.
3. To enter the names of the months, you will use the fill feature. Start by entering **January** in cell A3.

4. Select cell A3 and point to the small square in the lower-right corner of the selected cell, the fill handle (see Figure 1-2). The mouse pointer changes to a black crosshair pointer.

   ![Figure 1-2](image)

   **Figure 1-2** The fill handle for extending the data series.

5. Drag the crosshairs into cell A14. While you drag the crosshairs down, you will see the names of the months in the preview (see Figure 1-3).

   ![Figure 1-3](image)

   **Figure 1-3** The months are added by using the fill handle.

6. Release the mouse button in cell A14 to display all months from January through December (see Figure 1-4).
Figure 1-4 The names of the months are automatically filled in.

Creating an Individual Data Series

This feature can be used to fill rows or columns; it works for weekdays, months, and dates. To fill a number series, fill in the first two numbers in the sequence manually, select the two completed cells, and then drag the fill handle. The function can also be useful if you want to create your own data or AutoFill series. For example, if you don’t want to enter a list of sales managers over and over again, you can define your own AutoFill list:

1. Click the last sheet tab at the bottom of the workbook, which is the one with the new sheet symbol, to open a new sheet. Alternatively, you can press the Ctrl+F11 key combination.

2. Enter Sales manager in a free cell.

3. Enter the names of the sales managers in the cells below the Sales manager title (see Figure 1-5).

Figure 1-5 Creating a custom data series.
4. Select the range containing the names.

5. Click the File tab and select Options (see Figure 1-6).

![Figure 1-6 Selecting Excel options.](image)

6. In the Excel Options dialog box, select the Advanced category and click Edit Custom Lists in the General section (see Figure 1-7).

![Figure 1-7 Opening frequently used lists.](image)
7. Make sure that the cell reference for the selected list is displayed in the Import List From Cells field, and click Import (see Figure 1-8).

![Figure 1-8 Specifying the cell range to be imported.](image)

The elements in the selected list are added to the List Entries field (see Figure 1-9).

![Figure 1-9 The list entries are added.](image)

8. Click OK twice.
Now you have to enter only the name of one sales manager in a cell and drag the fill handle in the desired direction to generate the list of the sales managers on any spreadsheet. The series is created automatically.

This strategy gives you almost unlimited possibilities for creating a data series.

**Entering Test Data Fast**

Now let’s return to the scenario described earlier in the chapter, in the section titled “Scenario and Goals.” To complete the table with sales and purchase values, you need a set of sample data so that you can create and check the example. A convenient way to do this is to generate a set of random data by using the RANDBETWEEN() function.

1. Select cell B3 in the Excel sheet that contains the table you created previously.

2. Enter the following function: `=RANDBETWEEN(1000,500000)`. The values 1000 and 500000 indicate the minimum and maximum values and are divided by the comma (see Figure 1-10).

3. Press the Enter key. A random number from 1,000 through 500,000 appears in the cell (see Figure 1-11).

4. Select the cell and double-click the fill handle. The Purchase column is automatically filled through December (see Figure 1-12).
5. Edit the table however you want.

Converting Formula Results into Fixed Values

To ensure that the random values in the Purchase and Sales columns don’t change, create a permanent copy of the entries by performing the following steps:

1. Select the cells in the Purchase column from January through December.

2. Point to the right edge of the selected column. The pointer changes into an arrow.

3. Click the right mouse button and drag the selection to the right and back. The movement is illustrated by a dashed line (see Figure 1-13).
Tip  Use the Paste Values icon

If you are working with Excel 2010, there is an easier way to copy the values. Copy the values in the Purchase column, and then paste them by opening the Paste menu and clicking the Paste Values icon (see Figure 1-14).

Figure 1-14  The Paste Values icon.

4.  When the selection is back in the original position, release the mouse button and select Copy Here As Values Only in the shortcut menu (see Figure 1-15).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Month</td>
<td>Purchase</td>
</tr>
<tr>
<td>3</td>
<td>January</td>
<td>176,314.00</td>
</tr>
<tr>
<td>4</td>
<td>February</td>
<td>100,419.00</td>
</tr>
<tr>
<td>5</td>
<td>March</td>
<td>181,190.00</td>
</tr>
<tr>
<td>6</td>
<td>April</td>
<td>60,947.00</td>
</tr>
<tr>
<td>7</td>
<td>May</td>
<td>66,849.00</td>
</tr>
<tr>
<td>8</td>
<td>June</td>
<td>57,936.00</td>
</tr>
<tr>
<td>9</td>
<td>July</td>
<td>2,957.00</td>
</tr>
<tr>
<td>10</td>
<td>August</td>
<td>4,410.00</td>
</tr>
<tr>
<td>11</td>
<td>September</td>
<td>183,933.00</td>
</tr>
<tr>
<td>12</td>
<td>October</td>
<td>102,958.00</td>
</tr>
<tr>
<td>13</td>
<td>November</td>
<td>172,551.00</td>
</tr>
<tr>
<td>14</td>
<td>December</td>
<td>98,044.00</td>
</tr>
</tbody>
</table>

Figure 1-15  Converting numbers into fixed values.

The random values in the column are now fixed values and not formula-generated.
5. Repeat these steps and those in the section titled “Entering Test Data Fast” for the values in the Sales column, after you generate a fixed set of random values there, too.

### Formatting Numeric Values

To format the numeric values in the Purchase and Sales columns as currency values, perform the following steps:

1. Select the cells B3 to C14.

2. Click the Accounting Number Format button in the Number group on the Home Tab (see Figure 1-16).

![Accounting Number Format](image)

**Figure 1-16** Formatting numbers as dollar values.

The selected values are automatically displayed as decimal numbers with two decimal places, in the currency format (see Figure 1-17).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Month</td>
<td>Purchase</td>
<td>Sales</td>
</tr>
<tr>
<td>3</td>
<td>January</td>
<td>178,314.00</td>
<td>219,572.00</td>
</tr>
<tr>
<td>4</td>
<td>February</td>
<td>100,419.00</td>
<td>205,043.00</td>
</tr>
<tr>
<td>5</td>
<td>March</td>
<td>181,190.00</td>
<td>385,835.00</td>
</tr>
<tr>
<td>6</td>
<td>April</td>
<td>60,947.00</td>
<td>201,285.00</td>
</tr>
<tr>
<td>7</td>
<td>May</td>
<td>66,848.00</td>
<td>213,776.00</td>
</tr>
<tr>
<td>8</td>
<td>June</td>
<td>57,386.00</td>
<td>397,653.00</td>
</tr>
<tr>
<td>9</td>
<td>July</td>
<td>2,957.00</td>
<td>263,100.00</td>
</tr>
<tr>
<td>10</td>
<td>August</td>
<td>4,410.00</td>
<td>354,351.00</td>
</tr>
<tr>
<td>11</td>
<td>September</td>
<td>183,339.00</td>
<td>247,343.00</td>
</tr>
<tr>
<td>12</td>
<td>October</td>
<td>102,958.00</td>
<td>352,121.00</td>
</tr>
<tr>
<td>13</td>
<td>November</td>
<td>172,501.00</td>
<td>340,069.00</td>
</tr>
<tr>
<td>14</td>
<td>December</td>
<td>85,044.00</td>
<td>379,739.00</td>
</tr>
</tbody>
</table>

**Figure 1-17** The numbers are displayed as dollar amounts.
Calculating Profit Margin

To calculate the profit margin, do the following:

1. Click in cell D3 and subtract the Purchase amount from the Sales amount. To do this, enter an equal sign (=) in cell D3, click in cell C3, enter a minus sign (–) and then click in cell B3 (see Figure 1-18).

   Figure 1-18 Subtracting values.

2. Press the Enter key.

3. Double-click the fill handle to calculate the profit margin through December (see Figure 1-19).

   Figure 1-19 The profit margin is calculated for all months.
Formatting Data as a Table

In Excel 2007 and Excel 2010, a selection of preset table formats can be readily accessed from the ribbon.

1. Select the cells containing the entire table (A2:D14).

2. On the Home tab, click the Format As Table button in the Style group and select one of the table layouts shown in Figure 1-20.

3. The Create Table dialog box shows the range to be formatted (see Figure 1-21). Click OK.
Calculating Profit Margin as a Percentage

This section explains how to calculate the profit margin as a percentage for the full year. To do this, perform the following steps:

1. Select cell D15, which is below the profit margin for December.

2. On the Home tab, in the Editing group, click the AutoSum button (see Figure 1-23).

The table is formatted in the selected layout (see Figure 1-22).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Month</td>
<td>Purchase</td>
<td>Sales</td>
<td>Profit margin</td>
</tr>
<tr>
<td>3</td>
<td>January</td>
<td>$178,314.00</td>
<td>$219,572.00</td>
<td>$41,258.00</td>
</tr>
<tr>
<td>4</td>
<td>February</td>
<td>$100,419.00</td>
<td>$205,043.00</td>
<td>$104,624.00</td>
</tr>
<tr>
<td>5</td>
<td>March</td>
<td>$181,190.00</td>
<td>$385,835.00</td>
<td>$204,645.00</td>
</tr>
<tr>
<td>6</td>
<td>April</td>
<td>$50,947.00</td>
<td>$201,285.00</td>
<td>$140,338.00</td>
</tr>
<tr>
<td>7</td>
<td>May</td>
<td>$66,848.00</td>
<td>$218,776.00</td>
<td>$156,927.00</td>
</tr>
<tr>
<td>8</td>
<td>June</td>
<td>$57,386.00</td>
<td>$397,653.00</td>
<td>$340,267.00</td>
</tr>
<tr>
<td>9</td>
<td>July</td>
<td>$29,557.00</td>
<td>$283,100.00</td>
<td>$253,543.00</td>
</tr>
<tr>
<td>10</td>
<td>August</td>
<td>$4,410.00</td>
<td>$334,551.00</td>
<td>$330,141.00</td>
</tr>
<tr>
<td>11</td>
<td>September</td>
<td>$183,993.00</td>
<td>$247,348.00</td>
<td>$63,410.00</td>
</tr>
<tr>
<td>12</td>
<td>October</td>
<td>$102,558.00</td>
<td>$352,121.00</td>
<td>$249,563.00</td>
</tr>
<tr>
<td>13</td>
<td>November</td>
<td>$172,501.00</td>
<td>$340,069.00</td>
<td>$167,568.00</td>
</tr>
<tr>
<td>14</td>
<td>December</td>
<td>$89,044.00</td>
<td>$379,739.00</td>
<td>$290,695.00</td>
</tr>
</tbody>
</table>

Figure 1-22 Formatting tables in only a few steps.

After you have formatted the data as a table, you can use the filter options that have been placed in the table header.

**INSIDE OUT** Format data as a table for added functionality

Formatting data as a table provides a convenient way to arrange the information neatly and concisely and also provides access to additional table features.
The sum is automatically calculated and displayed in the Profit Margin column (see Figure 1-24).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Month</td>
<td>Purchase</td>
<td>Sales</td>
<td>Profit margin</td>
</tr>
<tr>
<td>3</td>
<td>January</td>
<td>$176,314.00</td>
<td>$219,572.00</td>
<td>$41,258.00</td>
</tr>
<tr>
<td>4</td>
<td>February</td>
<td>$100,419.00</td>
<td>$205,043.00</td>
<td>$104,624.00</td>
</tr>
<tr>
<td>5</td>
<td>March</td>
<td>$181,190.00</td>
<td>$385,835.00</td>
<td>$204,645.00</td>
</tr>
<tr>
<td>6</td>
<td>April</td>
<td>$60,947.00</td>
<td>$201,265.00</td>
<td>$140,318.00</td>
</tr>
<tr>
<td>7</td>
<td>May</td>
<td>$66,043.00</td>
<td>$213,776.00</td>
<td>$146,733.00</td>
</tr>
<tr>
<td>8</td>
<td>June</td>
<td>$57,385.00</td>
<td>$337,653.00</td>
<td>$280,267.00</td>
</tr>
<tr>
<td>9</td>
<td>July</td>
<td>$2,857.00</td>
<td>$283,103.00</td>
<td>$280,146.00</td>
</tr>
<tr>
<td>10</td>
<td>August</td>
<td>$6,410.00</td>
<td>$334,551.00</td>
<td>$330,141.00</td>
</tr>
<tr>
<td>11</td>
<td>September</td>
<td>$183,993.00</td>
<td>$247,343.00</td>
<td>$63,350.00</td>
</tr>
<tr>
<td>12</td>
<td>October</td>
<td>$102,358.00</td>
<td>$362,121.00</td>
<td>$259,763.00</td>
</tr>
<tr>
<td>13</td>
<td>November</td>
<td>$172,501.00</td>
<td>$849,065.00</td>
<td>$676,564.00</td>
</tr>
<tr>
<td>14</td>
<td>December</td>
<td>$83,044.00</td>
<td>$375,739.00</td>
<td>$292,695.00</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>$2,375,179.00</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1-23 Calculating the sum with one mouse click.

Figure 1-24 Simplified calculation options with table formatting.
Tip  Choose calculations options

Did you notice the arrow to the right of the sum field? Click the arrow to open a menu, select one of the different options, and view the result (see Figure 1-25).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>Profit margin</td>
</tr>
<tr>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>$ 219,572.00</td>
<td>$ 41,258.00</td>
</tr>
<tr>
<td>$ 205,043.00</td>
<td>$ 104,624.00</td>
</tr>
<tr>
<td>$ 305,835.00</td>
<td>$ 204,645.00</td>
</tr>
<tr>
<td>$ 204,285.00</td>
<td>$ 140,383.00</td>
</tr>
<tr>
<td>$ 213,776.00</td>
<td>$ 146,927.00</td>
</tr>
<tr>
<td>$ 397,653.00</td>
<td>$ 340,267.00</td>
</tr>
<tr>
<td>$ 283,100.00</td>
<td>$ 280,148.00</td>
</tr>
<tr>
<td>$ 334,351.00</td>
<td>$ 330,141.00</td>
</tr>
<tr>
<td>$ 247,348.00</td>
<td>$ 65,410.00</td>
</tr>
<tr>
<td>$ 362,121.00</td>
<td>$ 253,163.00</td>
</tr>
<tr>
<td>$ 340,069.00</td>
<td>$ 167,568.00</td>
</tr>
<tr>
<td>$ 379,739.00</td>
<td>$ 296,695.00</td>
</tr>
</tbody>
</table>

$ 2,375,179.00

Figure 1-25 The calculation options for table ranges.

3. Create the profit margin percentage in the column next to the Profit Margin column. When you enter the text in column E, the table formatting is automatically extended to the additional column (see Figure 1-26).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit margin</td>
<td>Profit margin (%)</td>
</tr>
<tr>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>$ 41,258.00</td>
<td>$</td>
</tr>
<tr>
<td>$ 104,624.00</td>
<td>$</td>
</tr>
</tbody>
</table>

Figure 1-26 Adding columns to the table.
4. Press the Enter key. The column is added to the table automatically and inherits the table layout (see Figure 1-27).

![Table](image)

**Figure 1-27** New columns are automatically adjusted to the table layout.

5. To calculate the profit margin as a percentage for January, click cell E3 (Profit Margin (%) column, January row).

6. The formula is “the profit margin of January divided by the total profit margin.” To enter this in the cell, click cell D3 after the equal sign, type a forward slash, and then click cell D15 (see Figure 1-28).

![Figure 1-28](image)

**Figure 1-28** In Excel 2007 and Excel 2010, formulas include table values.

7. Press the Enter key to confirm. Because the data has been formatted as a table, the formula entered is automatically applied to all cells in the Profit Margin (%) column (see Figure 1-29).
Calculating Profit Margin as a Percentage

8. Select the numeric values in the Profit Margin (%) column, and click the Percent Style button in the Number group on the Home Tab (see Figure 1-30).

The values are now displayed as percentages (see Figure 1-31).

Figure 1-29 The formula is applied to all cells in the column.

<table>
<thead>
<tr>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit margin</td>
<td>Profit margin (%)</td>
</tr>
<tr>
<td>$41,258.00</td>
<td>0.02</td>
</tr>
<tr>
<td>$104,624.00</td>
<td>0.04</td>
</tr>
<tr>
<td>$204,645.00</td>
<td>0.06</td>
</tr>
<tr>
<td>$140,388.00</td>
<td>0.06</td>
</tr>
<tr>
<td>$246,927.00</td>
<td>0.06</td>
</tr>
<tr>
<td>$340,267.00</td>
<td>0.14</td>
</tr>
<tr>
<td>$280,143.00</td>
<td>0.12</td>
</tr>
<tr>
<td>$30,141.00</td>
<td>0.14</td>
</tr>
<tr>
<td>$68,410.00</td>
<td>0.08</td>
</tr>
<tr>
<td>$279,169.00</td>
<td>0.11</td>
</tr>
<tr>
<td>$187,568.00</td>
<td>0.07</td>
</tr>
<tr>
<td>$296,656.00</td>
<td>0.12</td>
</tr>
<tr>
<td>$2,375,179.00</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1-30 Numbers are displayed as percentages.

Figure 1-31 The profit margins as percentages.
Applying Conditional Formatting

To make data easier to interpret, use the conditional formatting feature to automatically format the data. With conditional formats, values are selected if they meet certain criteria, and the cell range is formatted accordingly. Conditional formats visually highlight the distribution and variation of data.

With regard to our example, the condition could be “Format in green all cells in the Profit Margin column that contain a value of at least $200,000.” To enter this format, perform the following steps:

1. Select the cell range in the Profit Margin column.

2. Click the Conditional Formatting button in the Style group on the Home tab, and then click New Rule (see Figure 1-32).

3. In the New Formatting Rule dialog box, under Select A Rule Type, select Format Only Cells That Contain.

4. Specify the settings in the Edit The Rule Description pane. Select Cell Value and Greater Than Or Equal To in the list boxes.

5. Enter the value **200000** in the third field (see Figure 1-33).
Figure 1-33  Defining the formatting rule.

6. Click the Format button.

7. Click the Fill tab of the Format Cells dialog box, and select a background color (see Figure 1-34).

Figure 1-34  The condition is displayed in color.
8. Click OK twice to confirm your selection. The values in the Profit margin column are displayed in the color you selected if the condition is met (see Figure 1-35).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Month</td>
<td>Purchase</td>
<td>Sales</td>
<td>Profit margin</td>
</tr>
<tr>
<td>2</td>
<td>January</td>
<td>$121,314.00</td>
<td>$219,872.00</td>
<td>$41,259.01</td>
</tr>
<tr>
<td>3</td>
<td>February</td>
<td>$103,419.00</td>
<td>$205,043.00</td>
<td>$104,624.00</td>
</tr>
<tr>
<td>4</td>
<td>March</td>
<td>$183,130.00</td>
<td>$365,035.00</td>
<td>$206,645.00</td>
</tr>
<tr>
<td>5</td>
<td>April</td>
<td>$60,047.00</td>
<td>$201,285.00</td>
<td>$140,238.00</td>
</tr>
<tr>
<td>6</td>
<td>May</td>
<td>$66,485.00</td>
<td>$213,775.00</td>
<td>$146,927.00</td>
</tr>
<tr>
<td>7</td>
<td>June</td>
<td>$57,386.00</td>
<td>$357,653.00</td>
<td>$345,267.00</td>
</tr>
<tr>
<td>8</td>
<td>July</td>
<td>$2,957.00</td>
<td>$283,100.00</td>
<td>$280,143.00</td>
</tr>
<tr>
<td>9</td>
<td>August</td>
<td>$4,410.00</td>
<td>$334,551.00</td>
<td>$330,141.00</td>
</tr>
<tr>
<td>10</td>
<td>September</td>
<td>$183,333.00</td>
<td>$247,345.00</td>
<td>$53,410.00</td>
</tr>
<tr>
<td>11</td>
<td>October</td>
<td>$122,358.00</td>
<td>$362,221.00</td>
<td>$255,163.00</td>
</tr>
<tr>
<td>12</td>
<td>November</td>
<td>$172,501.00</td>
<td>$340,069.00</td>
<td>$167,568.00</td>
</tr>
<tr>
<td>13</td>
<td>December</td>
<td>$213,044.00</td>
<td>$379,739.00</td>
<td>$296,695.00</td>
</tr>
</tbody>
</table>

Figure 1-35 Values meeting the condition have a green background.

You can use conditional formatting to automatically display the values in your table in different colors to give them significant visual impact.

You can also use other color fill options or an icon set to format cells. Conditions can apply to text, numeric, date, or time values, as well as to values that fall below or above the average.

Data bars are also a quick way to visually highlight values in tables (see Figure 1-36).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Month</td>
<td>Purchase</td>
<td>Sales</td>
<td>Profit margin</td>
</tr>
<tr>
<td>2</td>
<td>January</td>
<td>$170,314.00</td>
<td>$219,072.00</td>
<td>$41,259.01</td>
</tr>
<tr>
<td>3</td>
<td>February</td>
<td>$100,419.00</td>
<td>$205,043.00</td>
<td>$104,624.00</td>
</tr>
<tr>
<td>4</td>
<td>March</td>
<td>$183,130.00</td>
<td>$365,035.00</td>
<td>$206,645.00</td>
</tr>
<tr>
<td>5</td>
<td>April</td>
<td>$60,047.00</td>
<td>$201,285.00</td>
<td>$140,238.00</td>
</tr>
<tr>
<td>6</td>
<td>May</td>
<td>$66,485.00</td>
<td>$213,775.00</td>
<td>$146,927.00</td>
</tr>
<tr>
<td>7</td>
<td>June</td>
<td>$57,386.00</td>
<td>$357,653.00</td>
<td>$345,267.00</td>
</tr>
<tr>
<td>8</td>
<td>July</td>
<td>$2,957.00</td>
<td>$283,100.00</td>
<td>$280,143.00</td>
</tr>
<tr>
<td>9</td>
<td>August</td>
<td>$4,410.00</td>
<td>$334,551.00</td>
<td>$330,141.00</td>
</tr>
<tr>
<td>10</td>
<td>September</td>
<td>$183,333.00</td>
<td>$247,345.00</td>
<td>$53,410.00</td>
</tr>
<tr>
<td>11</td>
<td>October</td>
<td>$122,358.00</td>
<td>$362,221.00</td>
<td>$255,163.00</td>
</tr>
<tr>
<td>12</td>
<td>November</td>
<td>$172,501.00</td>
<td>$340,069.00</td>
<td>$167,568.00</td>
</tr>
<tr>
<td>13</td>
<td>December</td>
<td>$213,044.00</td>
<td>$379,739.00</td>
<td>$296,695.00</td>
</tr>
</tbody>
</table>

Figure 1-36 Using formats to highlight numeric values.

There are many different options to choose from.
Tip  Apply conditional formats to highlight data

In Excel 2007 and Excel 2010, conditional formats have improved significantly (see Figure 1-37). Now you can add not only colors but also arrows, traffic lights, and other icons. This functionality is also referred to as KPI (Key Performance Indicators).

Creating Meaningful Charts

Sometimes it is useful to display data in a chart instead of in a table. In Excel 2007 and Excel 2010, the options for creating bar charts, pie charts, and other charts have been enhanced.

Creating a Column Chart

To convert our example table into a simple but informative column chart, perform the following steps:

1. Select the table cells starting from Month to the profit margin December (see Figure 1-38).
22 Chapter 1 Solving Problems with Functions

2. On the Insert tab in the Chart group, click the Column button and select the first chart under 2D Column (see Figure 1-39).

Figure 1-39 Selecting the chart format.
The chart is immediately displayed on your Excel sheet (see Figure 1-40).

![Figure 1-40](image1.png) The data displayed as a chart.

In the same way you created a column chart, you can create a 2D, 3D, or line chart (see Figure 1-41). To do this, select a chart format by clicking the Line button to open the menu.

![Figure 1-41](image2.png) Another view of the chart.
Creating a Pie Chart

To display the values in the Profit Margin column by month, you can use a pie chart. Do the following:

1. Select the cells containing values in the Months and Profit Margin columns. To select only these two columns, first select the Months column. Then press the Ctrl key and select the Profit Margin column. Both columns are selected (see Figure 1-42).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Month</td>
<td>Purchase</td>
<td>Sales</td>
<td>Profit margin</td>
</tr>
<tr>
<td>3</td>
<td>January</td>
<td>$178,314.00</td>
<td>$219,572.00</td>
<td>$41,258.00</td>
</tr>
<tr>
<td>4</td>
<td>February</td>
<td>$100,419.00</td>
<td>$205,045.00</td>
<td>$104,626.00</td>
</tr>
<tr>
<td>5</td>
<td>March</td>
<td>$181,139.00</td>
<td>$385,035.00</td>
<td>$204,645.00</td>
</tr>
<tr>
<td>6</td>
<td>April</td>
<td>$60,947.00</td>
<td>$201,285.00</td>
<td>$140,338.00</td>
</tr>
<tr>
<td>7</td>
<td>May</td>
<td>$66,849.00</td>
<td>$213,775.00</td>
<td>$146,927.00</td>
</tr>
<tr>
<td>8</td>
<td>June</td>
<td>$57,306.00</td>
<td>$397,659.00</td>
<td>$340,262.00</td>
</tr>
<tr>
<td>9</td>
<td>July</td>
<td>$2,957.00</td>
<td>$283,100.00</td>
<td>$280,143.00</td>
</tr>
<tr>
<td>10</td>
<td>August</td>
<td>$4,410.00</td>
<td>$385,551.00</td>
<td>$381,141.00</td>
</tr>
<tr>
<td>11</td>
<td>September</td>
<td>$183,933.00</td>
<td>$247,343.00</td>
<td>$53,410.00</td>
</tr>
<tr>
<td>12</td>
<td>October</td>
<td>$102,958.00</td>
<td>$362,121.00</td>
<td>$258,163.00</td>
</tr>
<tr>
<td>13</td>
<td>November</td>
<td>$172,501.00</td>
<td>$340,065.00</td>
<td>$167,568.00</td>
</tr>
<tr>
<td>14</td>
<td>December</td>
<td>$83,044.00</td>
<td>$373,739.00</td>
<td>$290,695.00</td>
</tr>
</tbody>
</table>

Figure 1-42 Selecting only certain columns of the list.

2. Click the Pie button to open the menu, and select the first chart type under 3D Pie (see Figure 1-43).

Figure 1-43 Selecting a pie chart.
The pie chart is displayed immediately (see Figure 1-44).

![Pie Chart]

**Figure 1-44** The pie chart shows the profit margin.

### Formatting a Chart

Excel 2010 provides many formatting options you can use to emphasize values in pie charts.

Do the following:

1. Click the frame of the chart.

   The Chart Tools contextual tab opens. On this tab, you can choose between the available formatting options (see Figure 1-45).

![Chart Tools Tab]

**Figure 1-45** The Chart Tools tab in Excel 2010 for editing charts.
2. With these tools, you can select any of the format options. For example, click Layout 6 in the Chart Layouts section (see Figure 1-46).

![Figure 1-46 Changing the chart layout.](image)

Layout 6 displays your pie chart with percentages, or values (see Figure 1-47).

![Figure 1-47 The settings of the selected chart layout are applied.](image)

3. With the chart formats, you can also adjust the chart colors. Just click one of the available formats (see Figure 1-48).

![Figure 1-48 Using chart formats to adjust the color.](image)

The color of the chart changes according to your selection (see Figure 1-49).
4. In Excel 2010—as in Excel 2007 and Excel 2003—more chart format options are available in the shortcut menu of the selected chart. Right-click the chart to open the menu, and then select Format Data Labels or Format Data Series to change the format of your chart (see Figure 1-50).

Figure 1-49 The selected chart colors are applied.

Figure 1-50 Additional formatting options.
In Excel 2010, working with charts is a lot easier. The options for editing and formatting are more extensive, and fully formatted charts can be created with just a few clicks.

**INSIDE OUT**

Use sparklines to graphically represent values

Check out the new sparklines in Excel 2010. These “word graphics” illustrate values by using miniature line, bar, or profit-and-loss charts. Sparklines illustrate numeric values so that the values can be interpreted more easily (see Figure 1-51).

### Figure 1-51 Values illustrated by the new sparklines.

**Working with PivotTables**

PivotTables help you arrange and consolidate data into well-defined tables. With a PivotTable, you can easily generate cross-tabulations and analyze information by rotating and moving column and row selections and by filtering. The original data remains unchanged, and the PivotTable is quickly generated even with large amounts of data. In Excel 2007 and Excel 2010, PivotTable data can also easily be displayed as a PivotChart.
Tip
A PivotTable is useful for quickly obtaining summary information from long lists or large amounts of data.

Creating a PivotTable

Sample Files
Use the Basic data worksheet in the Excel_Pivot_Data.xls or Excel_Pivot_Data.xlsx sample file. The sample files are found in the Chapter01 folder. For more information about the sample files, see the section titled “Using the Sample Files” on page xxiii.

To create a PivotTable, perform the following steps:

1. Open the Excel_Pivot_Data.xlsx file from the sample files.

2. In the table, select the cell range for which you want to create the PivotTable. In this case, select cell A1 (Customer Name) through cell J100 (Total Price), or select the entire table by pressing Ctrl+A from anywhere within the table.

3. On the Insert tab, in the Table group, click the arrow on the PivotTable button and select PivotTable (see Figure 1-52).

Figure 1-52 Creating a PivotTable.
Because you have already selected the data, the PivotTable range is displayed in the Select Table Or Range box in the PivotTable dialog box.

4. Select an option under Choose Where You Want The PivotTable Report To Be Placed. Selecting the New Worksheet option is recommended (see Figure 1-53).

5. Click OK. The PivotTable framework is displayed.

---

**Tip**  Find Pivot functions on the Insert tab

In Excel 2003, the Pivot functions were located on the File menu. In Excel 2007 and Excel 2010, you can open the Pivot functions by clicking a button on the Insert tab. The functions open in a separate tool window as soon as you start creating a PivotTable.
An empty PivotTable report is added, in this case in a new worksheet, and the PivotTable field list is displayed. In this list, you can select fields, create a layout, and change the PivotTable report.

You can also use the PivotTable tools on the PivotTable Tool contextual tab, which you can access from the ribbon (see Figure 1-54).

Figure 1-54 The PivotTable layout.

Using a PivotTable

The following example illustrates the functionality of a PivotTable. Assume that you want to find out in which country the most orders for gloves are placed. For this you need the PivotTable fields Country, Product Category, and Order Quantity.
Follow these steps:

1. Select the Country, Product Category, and Order Quantity check boxes in the PivotTable field list.

After you have enabled the fields, the associated data are automatically positioned in the default range of the layout, but you can move the fields to any position (see Figure 1-55).

![Figure 1-55 The fields in the standard report.](image-url)
2. Because you want to view the order quantity for gloves per country, you should move the Product Category column into the Report Filter area. This will allow you to filter by country. Drag the Product Category field into the Report Filter area within the PivotTable field list (see Figure 1-56).

![Figure 1-56 Moving fields by dragging.](image)

As soon as you release the mouse button, the data is arranged in the PivotTable (see Figure 1-57).

![Figure 1-57 The newly arranged fields.](image)
3. In the (All) list, select Gloves and click OK (see Figure 1-58).

![Figure 1-58](image)

Select Gloves from the list so that only the result for gloves will be displayed.

Only the order quantities for gloves in the individual countries are displayed (see Figure 1-59). Canada is the frontrunner!

![Figure 1-59](image)

Figure 1-59 Getting meaningful results with only a few clicks.

**Note**

Don’t worry if a report is not what you were expecting. With Excel, you can try various options to see how the data looks in different formats by rearranging the data, moving data, or even starting again.
Using PivotCharts: Graphical Pivot

The new user interface also makes it easier to create PivotCharts. All filter enhancements for PivotTables are also available for PivotCharts. There are special PivotChart tools and shortcut menus you can use to create a PivotChart to analyze the data within a chart.

You can change the layout and the format of charts or the chart elements in the same way you make changes for Pivot Tables. Unlike in previous Excel versions, in Excel 2007 and Excel 2010, the chart format is maintained if you change the PivotChart.

Creating a PivotChart

Creating a chart for a PivotTable takes only seconds. Use the previous PivotTable example to practice. Do the following:

1. Click in the PivotTable, and select the PivotTable Tools contextual tab above the default tab (see Figure 1-60).

Figure 1-60 Working with PivotTable tools.

2. In the Tools group, click the PivotChart button (see Figure 1-61). The Insert Chart dialog box opens. The first layout under Column is selected (see Figure 1-62).

Figure 1-61 Creating a chart from PivotTable data.
Figure 1-62 Selecting the chart format.

3. Keep this setting and click OK. The chart and a PivotChart filter range are displayed (see Figure 1-63).

Figure 1-63 The PivotChart is created.

4. As soon as you change the filter, the chart also changes. In the Country list, select Germany and click OK (see Figure 1-64).
Using PivotCharts: Graphical Pivot

Figure 1-64 Selecting a filter.

The chart changes automatically, and the corresponding values are displayed (see Figure 1-65).

Figure 1-65 The chart changes depending on the Pivot data.
Changing the Original Data

PivotTables and PivotCharts change dynamically: If a value changes in the original data, the PivotTable and the associated chart also change. Try it out:

1. In the original data, increase the order quantity for gloves in Germany in any row (see Figure 1-66).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>Alexandra L</td>
<td>Washington</td>
<td>Canada</td>
<td>Canada</td>
<td>North America</td>
<td>Half-Finger Gloves, L Gloves</td>
<td>11,05,11</td>
<td>6</td>
</tr>
<tr>
<td>55</td>
<td>Cassidy</td>
<td>Washington</td>
<td>United Kingdom</td>
<td>United Kingdom</td>
<td>Europe</td>
<td>Half-Finger Gloves, L Gloves</td>
<td>64,05,11</td>
<td>1</td>
</tr>
<tr>
<td>88</td>
<td>Elijah Alexander</td>
<td>Canada</td>
<td>Canada</td>
<td>Canada</td>
<td>North America</td>
<td>Half-Finger Gloves, L Gloves</td>
<td>29,04,11</td>
<td>1</td>
</tr>
<tr>
<td>40</td>
<td>Bruno G Suri</td>
<td>Germany</td>
<td>Germany</td>
<td>Europe</td>
<td>Half-Finger Gloves, L Gloves</td>
<td>26,00,11</td>
<td>2500</td>
<td></td>
</tr>
</tbody>
</table>

   Figure 1-66 Changing the original data.

2. Go back to the PivotTable and open the PivotTable Tools contextual tab.

3. On the Analyze tab, in the Data group, click the Refresh button (see Figure 1-67).

   Figure 1-67 Applying changes to the original data by clicking Refresh.

   The PivotTable as well as the PivotChart are automatically updated (see Figure 1-68).

   Figure 1-68 The values are updated.
Note

You can change additional settings for PivotCharts: Select a chart element and open the shortcut menu (see Figure 1-69).

**Figure 1-69** The shortcut menu allows quick access to the settings.
Cube functions were introduced in Microsoft Excel 2007. They are used with connections to external SQL data sources and provide analysis tools. Data cubes are multidimensional sets of data that can be stored in a spreadsheet, providing a means to summarize information from the raw data source. A cube is different from queries in Microsoft Access or Microsoft SQL Server because the data in a cube is already grouped in hierarchies, and calculated measures are saved in the cube. This offers two advantages to the user: Summary information is readily available, and most of the heavy-duty calculations are performed on the server. The user does not have to spend much time consolidating the data in Excel. However, you cannot use calculated fields or elements for a PivotTable.

To use cube functions, you must be working with data that is available in one of these two forms:

- Through a connection to a SQL Server Analysis Services data source
- In an offline cube in the user’s local file system

These conditions limit the usefulness of cube functions. So that you will be able to work through some examples, the sample files accompanying this book include offline cube and data connection files for the example outlined in Chapter 2, “Using Functions and PowerPivot.”

**Note**

You can create and change an offline cube (a file with the extension .cub) in Excel.

First, you must establish a connection to the Analysis Services by using Microsoft Query (on the Data Tab, Query External Data/From Other Source/From Microsoft Query), or by using the Data Connection Assistant (on the Insert Tab, select PivotTable/Use External Data Source). Then click the OLAP Tools button, as shown in Figure 14-1, to open the
Offline OLAP Settings dialog box. (OLAP stands for online analytical processing.) Click the Create Offline Data File button to create the cube, and follow the step-by-step instructions.

Figure 14-1 Creating an offline cube.

However, you will have to change the sample data connection files (they have either the extension .odc for a workbook connection, or .qy for Microsoft Query) because the path to a database must be the full path. Use Windows Notepad to change the paths as follows:

Data Source='X:\Documents\Chp14\Book\CubeTest.cub';
Location='X:\Documents\Chp14\Book\CubeTest.cub';

Sample Files
Use the offline cubeTest.xlsx sample file. This sample file and the additional files are found in the Chapter14 folder. For more information about the sample files, see the section titled “Using the Sample Files” on page xxiii.

The prepared sample workbook serves as a guide. To avoid unnecessary errors when modifying this sample, perform the following steps to create your own workbook:

1. On the Insert tab, select PivotTable/Use External Data Source. (You can search for additional elements and use the existing data connection files.)

2. Create the layout and include the content from the data source.

3. Use the cube functions.
When you open a workbook with data connections and use the default Excel settings, you have to explicitly allow these connections (click the Enable Content button, as shown in Figure 14-2). When you activate a document in Excel 2010, the document is trusted and you don’t have to confirm the activation again until the trusted document is reset in the Trust Center.

Figure 14-2 The security warning that is shown when Excel is accessing external data.

Note

If you select Convert To Formulas from the OLAP Tools menu (see Figure 14-1, shown earlier in this chapter), Excel converts part of the PivotTable or the entire PivotTable into an unformatted table with the same content as the PivotTable. The advantage of this is that the entire layout (columns and rows) is fixed. You can also include filters.

If you are familiar with formulas, you can create individual structures similar to PivotTables that allow for flexible data evaluation.

The descriptions of the functions throughout the rest of this chapter refer to the example in Chapter 2. The example uses two store groups named North and South, which sell sweets (chocolate and cookies) from the years 2008 through 2011. Each store group consists of two stores. Table 14-1 describes the functions.
Table 14-1  Overview of the Cube Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUBEKPIMEMBER()</td>
<td>Returns the requested property for a Key Performance Indicator (KPI) of a cube</td>
</tr>
<tr>
<td>CUBEMEMBER()</td>
<td>Returns a member of the cube</td>
</tr>
<tr>
<td>CUBEMEMBERPROPERTY()</td>
<td>Returns the requested property (attribute) for a cube member</td>
</tr>
<tr>
<td>CUBERANKEDMEMBER()</td>
<td>Returns the n-th ranked member of a set</td>
</tr>
<tr>
<td>CUBESET()</td>
<td>Defines a set of members to create a subcube</td>
</tr>
<tr>
<td>CUBESETCOUNT()</td>
<td>Returns the number of items in a set</td>
</tr>
<tr>
<td>CUBEVALUE()</td>
<td>Returns the aggregated value from a data cube</td>
</tr>
</tbody>
</table>

**CUBEKPIMEMBER()**

**Syntax**  
CUBEKPIMEMBER(connection,kpi_name,kpi_property,caption)

**Definition**  
This function returns a Key Performance Indicator (KPI) property and displays the KPI name in the cell.

**Arguments**

- **connection (required)**  
  A string with the name of the workbook connection to the cube. After you enter the first quotation mark, the existing context-sensitive data connections are displayed (see Figure 14-4, shown later in this chapter in the description of CUBEMEMBER()).

- **kpi_name (required)**  
  Specifies the name of the KPI in the cube.

- **kpi_property (required)**  
  A KPI consists of several components that are specified by using an integer (see Table 14-2).

<table>
<thead>
<tr>
<th>Integer</th>
<th>MDX expression</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>[KPIValue]</td>
<td>Actual value</td>
</tr>
<tr>
<td>2</td>
<td>[KPIGoal]</td>
<td>Target value</td>
</tr>
<tr>
<td>3</td>
<td>[KPIStatus]</td>
<td>State of the KPI at a specific moment in time</td>
</tr>
<tr>
<td>4</td>
<td>[KPI Trend]</td>
<td>Measure of the value over time</td>
</tr>
<tr>
<td>5</td>
<td>[KPIWeight]</td>
<td>Relative importance assigned to the KPI</td>
</tr>
<tr>
<td>6</td>
<td>[KPI Current Time Member]</td>
<td>Temporal context for the KPI</td>
</tr>
</tbody>
</table>
● **caption (optional)** A string displayed in the cell instead of the caption of the KPI components in the cube.

**Background**

**Note**

In the cell containing the function, the message #GETTING_DATA temporarily appears while the data is being queried.

Error values and messages provide information about incorrect or missing entries:

- If the connection name is not a valid workbook connection, the CUBEKPIMEMBER() function returns the #NAME? error.
- If the OLAP server (or the offline cube) is not available, you get an error message. The content of the affected cell doesn’t change.
- CUBEKPIMEMBER() returns the #N/A error value when kpi_name or kpi_property is invalid.
- CUBEKPIMEMBER() might return the #N/A error when the connection to the data source is interrupted and cannot be re-established.

You can combine CUBEKPIMEMBER() with CUBEVALUE(). Specify CUBEKPIMEMBER() as the second argument or reference for CUBEVALUE().

**Example** In this example, a KPI named **average** is saved in the cube. This cube calculates the average of the sales and the total number of sales as integers. Both values are also saved as measures in the cube but cannot be used to calculate fields in the PivotTable. The target value (goal) is $1,500. Figure 14-3 shows the example for cookies.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Year</td>
<td>All</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sales</td>
<td>Column Labels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Row Labels</td>
<td>Cookies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>North</td>
<td>13796</td>
<td>7421</td>
<td>21217</td>
</tr>
<tr>
<td>5</td>
<td>NorthEast</td>
<td>6242</td>
<td>4181</td>
<td>10403</td>
</tr>
<tr>
<td>6</td>
<td>NorthWest</td>
<td>7554</td>
<td>3260</td>
<td>10824</td>
</tr>
<tr>
<td>7</td>
<td>South</td>
<td>10000</td>
<td>10391</td>
<td>10391</td>
</tr>
<tr>
<td>8</td>
<td>SouthEast</td>
<td>2467</td>
<td>5033</td>
<td>8500</td>
</tr>
<tr>
<td>9</td>
<td>SouthWest</td>
<td>4533</td>
<td>5359</td>
<td>9891</td>
</tr>
<tr>
<td>10</td>
<td>Grand Total</td>
<td>21796</td>
<td>17812</td>
<td>39600</td>
</tr>
</tbody>
</table>

**Figure 14-3** The KPI average.
The formula

\[=\text{CUBEKPIMEMBER("offline","average",1)}\]

displays the word *average*. The formula

\[=\text{CUBEVALUE("offline","average",1)}\]

returns 1453 (the rounded average of all sales). In the second formula, you can enter a reference to the cell containing the first formula as the second argument. To get the target value of the average, use the formula

\[=\text{CUBEVALUE("offline","average",2)}\]

The value of 2 in the last argument is important, because it indicates, in this case, the target value.

You can use the cell containing the formula to create cell captions. The real content of the cell is more informative, as shown by using the CUBEVALUE() function.

**See Also** All other cube functions, GETPIVOTDATA()

### CUBEMEMBER()

**Syntax**

\[\text{CUBEMEMBER(connection,member_expression,caption)}\]

**Definition**

This function returns a member (cell) from a cube. Use CUBEMEMBER() to validate that the member exists and to pass the member to other functions through a cell reference.

**Arguments**

- **connection (required)**

  The text string name of the workbook connection to the cube, in quotation marks. When you are entering the connection, after you type the first quotation mark, existing context-sensitive data connections are displayed (see Figure 14-4).

**Figure 14-4** Context sensitivity helps you enter formulas.
CUBEMEMBER()<br>

- **member_expression (required)** Defines the position of a member in the cube based on a multidimensional expression (MDX). The expression can be entered directly or it can be referenced in a cell. You can also use tuples in expressions.

- **caption (optional)** A string displayed in the cell instead of the caption of the member in the cube. If a tuple is used, the function returns the caption of the last member in the tuple.

**Background** When you use CUBEMEMBER() as an argument for another cube function, the MDX expression instead of the displayed value is used in the argument.

**Note**
In the cell containing the function, the message #GETTING_DATA temporarily appears while the data is being queried.

Error values and messages provide information about incorrect or missing entries:

- If the connection name is not a valid workbook connection, the CUBEMEMBER() function returns the #NAME? error.

- If the OLAP server (or the offline cube) is not available, you get an error message. The content of the affected cell doesn’t change.

- If at least one member within the tuple is invalid, the CUBEMEMBER() function returns the #VALUE! error.

- If member_expression is longer than 255 characters, the CUBEMEMBER() function returns the #VALUE! error.

- CUBEMEMBER() returns the #N/A error when:
  - The member_expression syntax is incorrect.
  - The member specified in the MDX query doesn’t exist in the cube.
  - The tuple is invalid because there is no intersection for the specified values.
  - The set contains at least one member with a different dimension from the other members.

- CUBEMEMBER() may also return the #N/A error when the connection to the data source is interrupted and cannot be re-established.
Example  So that you can gain a better understanding of the use of the functions in this section, take a close look at the PivotTable in Figure 14-5.

**Figure 14-5** The candy sales PivotTable used to demonstrate the cube functions.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>All</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Column Labels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cookies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Row Labels</td>
<td>Sales</td>
<td>Sales Count</td>
<td>Average</td>
</tr>
<tr>
<td>6</td>
<td>North</td>
<td>13796</td>
<td>0</td>
<td>1724</td>
</tr>
<tr>
<td>7</td>
<td>NorthEast</td>
<td>6242</td>
<td>4</td>
<td>1560</td>
</tr>
<tr>
<td>8</td>
<td>NorthWest</td>
<td>7554</td>
<td>4</td>
<td>1088</td>
</tr>
<tr>
<td>9</td>
<td>South</td>
<td>8000</td>
<td>7</td>
<td>1143</td>
</tr>
<tr>
<td>10</td>
<td>SouthEast</td>
<td>9467</td>
<td>8</td>
<td>1156</td>
</tr>
<tr>
<td>11</td>
<td>SouthWest</td>
<td>4533</td>
<td>4</td>
<td>1133</td>
</tr>
<tr>
<td>12</td>
<td>Grand Total</td>
<td>21796</td>
<td>15</td>
<td>1453</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The formula

=CUBEMEMBER("offLine","[Products].[Product].[All].[Cookies]"")

looks for a single cell and returns the Cookies member which has the caption we looked for. If you use the tuple

=CUBEMEMBER("offLine",
    "([Stores].[Store].[All].[NorthEast],[Products].[All].[Cookies],
    [Years].[2009])")

the result is 2009 (the cookie sales in the year 2009 in the NorthEast store). If you use

=CUBEMEMBER("offLine",
    "([Stores].[Group].[All].[North],[Stores].[Store].[All].[NorthEast])")

to find an empty intercept, you get the #N/A error. To display the word total, enter

=CUBEMEMBER("offLine","[Products].[Product].[All]","total")

You can use the cell containing the formula to create cell captions. The actual content of the cell is more informative if it refers to the cells with the CUBEMEMBER() entries.

See Also All other cube functions, GETPIVOTDATA()
CUBEMEMBERPROPERTY()

Syntax  
CUBEMEMBERPROPERTY(connection, member_expression, property)

Definition  
This function returns the property of a member from the cube. Use CUBEMEMBERPROPERTY() to validate that a member exists within the cube and to return the property for this member as a value.

Arguments

- **connection (required)**  
  A string with the name of the workbook connection to the cube. After you enter the first quotation mark, the existing context-sensitive data connections are displayed (see Figure 14-4, shown earlier).

- **member_expression (required)**  
  Defines the position of a member in the cube based on an MDX. The expression can be entered directly or can be in a cell that is referenced. You can also use tuples in expressions.

- **property (required)**  
  The name of the property for which you want to return the value.

Note  
For a PivotTable that retrieves data from a cube, use the PivotTable tools to find out whether a member has properties (see Figure 14-6).

![Figure 14-6](image)

Figure 14-6  
Checking whether cube members have properties—not all members do.

Background  
In the example in this section, the stores have the Group property with the possible values North or South (shown previously in Figure 14-5).

In the cell containing the function, the message #GETTING_DATA temporarily appears while the data is being queried.

Error values and messages provide information about wrong or missing entries:

- If the connection name is not a valid workbook connection, the CUBEMEMBERPROPERTY() function returns the #NAME? error.

- If the OLAP server (or the offline cube) is not available, you get an error message. The content of the affected cell doesn’t change.
If the `member_expression` syntax is incorrect, or if the member specified by `member_expression` doesn’t exist in the cube, the CUBEMEMBERPROPERTY() function returns the #N/A error.

CUBEMEMBERPROPERTY() might return the #N/A error when the connection to the data source is interrupted and cannot be re-established.

**Example**  As previously mentioned, the stores in the PivotTable have the Group properties North and South. The formula

= CUBEMEMBERPROPERTY("offline","[Stores].[Store].[All].[NorthEast]","group")

returns North, and the formula

= CUBEMEMBERPROPERTY("offline","[Stores].[Store].&[3]","group")

returns South. This example uses the position number of the store in the list instead of the store name.

**See Also**  All other cube functions, GETPIVOTDATA()

**CUBERANKEDMEMBER()**

**Syntax**  CUBERANKEDMEMBER(`connection`, `set_expression`, `rank`, `caption`)

**Definition**  This function returns the \( n \)-th member in a set.

**Arguments**

- **`connection` (required)**  A string with the name of the workbook connection to the cube. After you enter the first quotation mark, the existing context-sensitive data connections are displayed (see Figure 14-4, shown earlier).

- **`set_expression` (required)**  Defines the number of members in the cube based on an MDX. The expression can be entered directly or can be in a cell that is referenced. You can also use tuples in expressions.

- **`rank` (required)**  An integer indicating the position of a member in the set.

- **`caption` (required)**  A string displayed in the cell instead of the caption of the member in the cube. If a tuple is used, the function returns the caption of the last member in the tuple.
Background

Note
In the cell containing the function, the message #GETTING_DATA temporarily appears while the data is being queried.

Error values and messages provide information about incorrect or missing entries:

- If the connection name is not a valid workbook connection, the CUBERANKEDMEMBER() function returns the #NAME? error.
- If the OLAP server (or the offline cube) is not available, you get an error message. The content of the affected cell doesn’t change.
- If set_expression is longer than 255 characters, the CUBERANKEDMEMBER() function returns the #VALUE! error.
- CUBERANKEDMEMBER() returns the #N/A error when:
  - The set_expression syntax is incorrect.
  - The set specified in the MDX query doesn’t exist in the cube.
- CUBERANKEDMEMBER() might return the #N/A error when the connection to the data source is interrupted and cannot be re-established.

Example  If you reference a cell in the formula

= CUBERANKEDMEMBER("offline", B9, 1)

that returns the store set with

=CUBESET("offline","[Stores].[Store].Children", "all store sales",2,"[Measures].[Sale]"")

the result is NorthEast. This store has the most sales for all products and in all years. The nested formula

= CUBERANKEDMEMBER("offLine",CUBESET("offLine","([Stores].[Store].[All].[NorthEast],[Years].Children)","all sales",2;"[Measures].[Sales]")",3)

calculates the year with the least sales for this store (position 3): 2011.

See Also  All other cube functions, GETPIVOTDATA()
CUBESET()

Syntax  
CUBESET(connection, set_expression, caption, sort_order, sort_by)

Definition  
This function returns a calculated set of members by sending a set expression to the cube on the server, which creates the set and then returns that set to Excel. The content of the cell and the actual value of the cell are different.

Arguments

- **connection (required)**  
  A string with the name of the workbook connection to the cube. After you enter the first quotation mark, the existing context-sensitive data connections are displayed (see Figure 14-4, shown earlier).

- **set_expression (required)**  
  Defines the number of elements in the cube based on an MDX. The expression can be entered directly or can be in a cell that is referenced. You can also use tuples in expressions.

- **caption (optional)**  
  A string displayed in the cell instead of the caption of the member in the cube. If a tuple is used, the function returns the caption of the last member in the tuple.

- **sort_order (optional)**  
  The type of sorting; the values are integers that affect the treatment of the fifth argument, `sort_by` (see Table 14-3). The formulas are context-sensitive (see Figure 14-7).

```
=CUBESET("'offline'","[Stores].[Store Name].Children","'all sales'",

=CUBESET("'offline'","[Stores].[Store Name].Children","'all sales'",
  CUBESET(connection, set_expression, caption, sort_order, sort_by),
  sort_by)
```

Figure 14-7  
Tooltips show the choices for the CUBESET() function.

Table 14-3  
**Integers for the Fourth Argument of the CUBESET() Function**

<table>
<thead>
<tr>
<th>Integer</th>
<th>Description</th>
<th>Impact on the Fifth Argument</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Leaves the set in the existing order in the cube</td>
<td>Ignored</td>
</tr>
<tr>
<td>1</td>
<td>Sorts the set in ascending order by <code>sort_by</code></td>
<td>Required</td>
</tr>
<tr>
<td>2</td>
<td>Sorts the set in descending order by <code>sort_by</code></td>
<td>Required</td>
</tr>
<tr>
<td>3</td>
<td>Sorts the set in ascending alphabetical order</td>
<td>Ignored</td>
</tr>
<tr>
<td>Integer</td>
<td>Description</td>
<td>Impact on the Fifth Argument</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Sorts the set in descending alphabetical order</td>
<td>Ignored</td>
</tr>
<tr>
<td>5</td>
<td>Sorts the set in natural ascending order</td>
<td>Ignored</td>
</tr>
<tr>
<td>6</td>
<td>Sorts the set in natural descending order</td>
<td>Ignored</td>
</tr>
</tbody>
</table>

The default value of the fourth argument is 0. An alphabetical sorting for a set of tuples is based on the last element in the tuple. You will find more information about the different sort orders in the SQL Analysis Services Help.

- **sort_by (optional)** The `sort_by` argument depends on the fourth argument and defines the values in the set that is sorted. If `sort_by` is not provided but `sort_order` requires `sort_by`, the function returns the `#VALUE!` error.

**Background** When you use CUBESET() as an argument for another cube function, the set instead of the displayed value is used in the argument.

**Note**

In the cell containing the function, the message `#GETTING_DATA` temporarily appears while the data is being queried.

Error values and messages provide information about incorrect or missing entries:

- If the connection name is not a valid workbook connection, the CUBESET() function returns the `#NAME?` error.

- If the OLAP server (or the offline cube) is not available, you get an error message. The content of the affected cell doesn’t change.

- If `set_expression` is longer than 255 characters, the CUBESET() function returns the `#VALUE!` error.

- CUBESET() returns the `#N/A` error when:
  - The `set_expression` syntax is incorrect.
  - The set specified in the MDX query doesn’t exist in the cube.
  - The set contains at least one member with a different dimension from the other members.

- CUBESET() might return the `#N/A` error when the connection to the data source is interrupted and cannot be re-established.
Example  The formula

=CUBESET("offline","[Stores].[Store].Children", 
"all store sales",2,"[Measures].[Sale]"
)

returns the sorted set of all stores based on the sales (all products and years). The store with
the largest sale is listed first.

You can use the cell containing the formula to create cell labels. The actual content of the
cell is more informative if it refers to the cells with the CUBESET() entries.

See Also  All other cube functions, GETPIVOTDATA()

CUBESETCOUNT()

Syntax  CUBESETCOUNT(set)

Definition  This function returns the number of members in a set.

Argument

- set (required) A set defined with the CUBESET() function or a reference to the cell
  containing members of the cube

Background  The result of this function is an integer. If the argument causes an error, this
error is also returned as the result.

Note

In the cell containing the function, the message #GETTING_DATA temporarily appears
while the data is being queried.

Example  In the CUBESETCOUNT() function, if you reference a cell that returns the sorted
set of the stores like

=CUBESET("offline","[Stores].[Store].Children", "all store sales",2,"[Measures].
[Sale]"
)

the result will be 4. You get the same result if you pass this formula as an argument. The
keyword Children is not context sensitive.

See Also  All other cube functions, GETPIVOTDATA()
CUBEVALUE()

Syntax  CUBEVALUE(connection,member_expression1,member_expression2,...)

Definition  This function returns the value of a member (cell) from a cube.

Arguments

- **connection (required)**  A string with the name of the workbook connection to the cube. After you enter the first quotation mark, the existing context-sensitive data connections are displayed (see Figure 14-4, shown earlier).

- **member_expression1 (required) and member_expression2 (optional)**  At least one and up through 255 expressions that define the position of a member in the cube based on an MDX. The expression can be entered directly or can be in a cell that is referenced. You can also use tuples in expressions. Alternatively, member_expression can be a set defined with the CUBESET() function. If no measure is specified in member_expression, the default measure for that cube is used.

  Because the argument can be repeated, you can define intersections. You can also use tuples.

Background  When you use CUBEVALUE() as an argument for another cube function, the MDX expression instead of the displayed value is used in the argument.

Note

In the cell containing the function, the message #GETTING_DATA temporarily appears while the data is being queried.

Error values and messages provide information about wrong or missing entries:

- If the connection name is not a valid workbook connection, the CUBEVALUE() function returns the #NAME? error.

- If the OLAP server (or the offline cube) is not available, you get an error message. The content of the affected cell doesn’t change.

- If at least one member within the arguments or the tuple is invalid, the CUBEVALUE() function returns the #VALUE! error.

- If member_expression is longer than 255 characters, the CUBEVALUE() function returns the #VALUE! error.
- CUBEVALUE() returns the #N/A error when:
  - The member_expression syntax is incorrect.
  - The member specified in the MDX query doesn't exist in the cube.
  - The tuple is invalid because there is no intersection for the specified values.
  - The set contains at least one member with a different dimension from the other members.

- CUBEVALUE() might return the #N/A error when the connection to the data source is interrupted and cannot be re-established.

The formula

```
=CUBEVALUE("offline","[Measures].[GrossSales]","[Stores].[Store].[All].

  [NorthEast]"," [Years].[Year].[All].[2009]","[Products].[Product].

  [All].[Cookies]")
```

calculates the gross sales for cookies in the store NorthEast in the year 2009: $1,856.40. You get the same result if you use a tuple (the arguments of the previous formula are enclosed in parentheses):

```
=CUBEVALUE("offline","([Measures].[GrossSales],[Stores].[Store].[All].

  [NorthEast],[Years].[Year].[All].[2009],[Products].[Product].[All].

  [Cookies])")
```

If you enter the formula

```
=CUBEMEMBER("offline","[Products].[Product].[All].[Cookies]")
```

in cell B3, the formula

```
=CUBEVALUE("offline",B3)
```

returns the total sales for cookies: $21,796.

You can also use the examples for the CUBEKPI MEMBER() function. The formula

```
=CUBEVALUE("offline",CUBERANKEDMEMBER("offline",CUBESET("offline","[Stores]

  .[Store].Children","all store sales",2;"[Measures].[sale"]",1))
```

returns $10,814 for the total sales of the best store (NorthEast).

See Also All other cube functions, GETPIVOTDATA()

Sample Files

Use the offline cubeTest.xlsx sample file. This sample file and the additional files are found in the Chapter14 folder. For more information about the sample files, see the section titled "Using the Sample Files" on page xxiii.
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