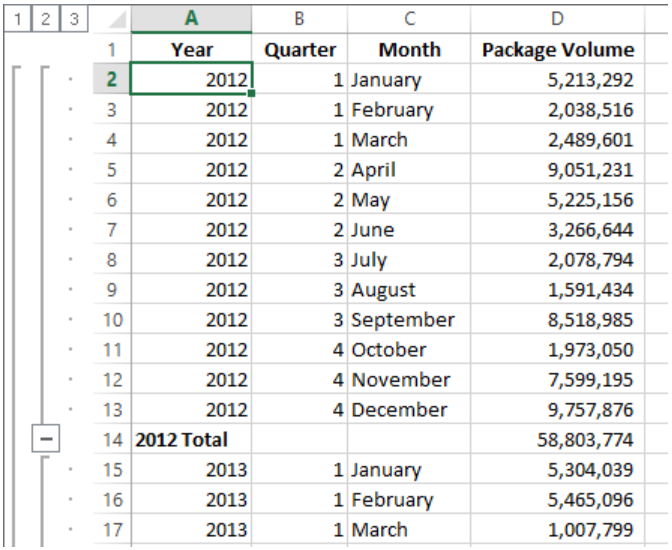
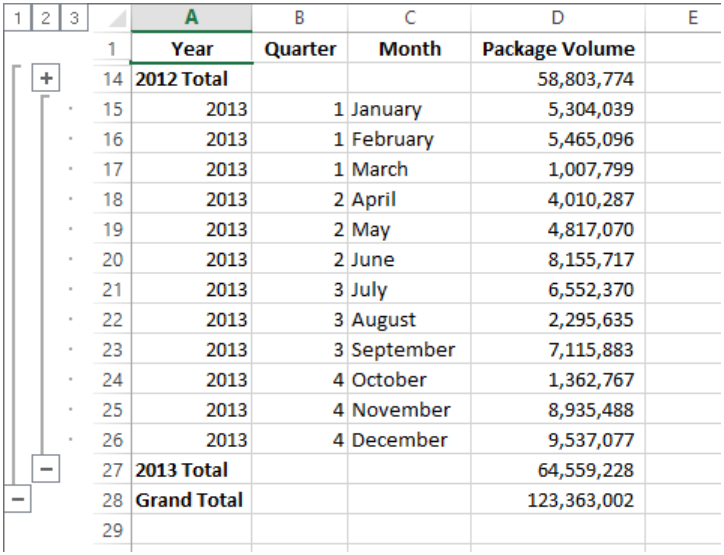


	A	B	C	D
1	Year	Quarter	Month	Package Volume
2	2012	1	January	5,213,292
3	2012	1	February	2,038,516
4	2012	1	March	2,489,601
5	2012	2	April	9,051,231
6	2012	2	May	5,225,156
7	2012	2	June	3,266,644
8	2012	3	July	2,078,794
9	2012	3	August	1,591,434
10	2012	3	September	8,518,985
11	2012	4	October	1,973,050
12	2012	4	November	7,599,195
13	2012	4	December	9,757,876
14	2012 Total			58,803,774
15	2013	1	January	5,304,039
16	2013	1	February	5,465,096
17	2013	1	March	1,007,799

When you add subtotals to a worksheet, Excel also defines groups based on the rows used to calculate a subtotal. The groupings form an outline of your worksheet based on the criteria you used to create the subtotals. For example, all the rows representing months in the year 2012 could be in one group, rows representing months in 2013 in another, and so on. The outline area at the left of your worksheet holds controls you can use to hide or display groups of rows in your worksheet.

Three types of controls can appear in the outline area: Hide Detail buttons, Show Detail buttons, and level buttons. The Hide Detail button beside a group can be clicked to hide the rows in that group. In a worksheet that has a subtotal group consisting of rows 2 through 13, clicking the Hide Detail button next to row 14 would hide rows 2 through 13 but leave the row holding the subtotal for that group, row 14, visible.



	Year	Quarter	Month	Package Volume
14	2012 Total			58,803,774
15	2013	1	January	5,304,039
16	2013	1	February	5,465,096
17	2013	1	March	1,007,799
18	2013	2	April	4,010,287
19	2013	2	May	4,817,070
20	2013	2	June	8,155,717
21	2013	3	July	6,552,370
22	2013	3	August	2,295,635
23	2013	3	September	7,115,883
24	2013	4	October	1,362,767
25	2013	4	November	8,935,488
26	2013	4	December	9,537,077
27	2013 Total			64,559,228
28	Grand Total			123,363,002
29				

When you hide a group of rows, the button displayed next to the group changes to a Show Detail button. Clicking a group's Show Detail button restores the rows in the group to the worksheet.

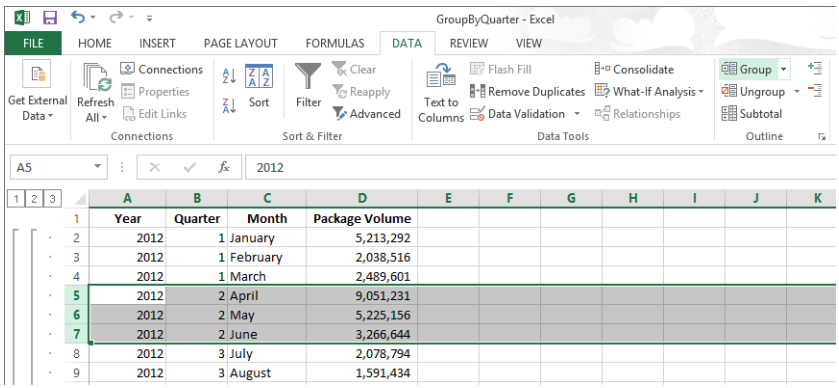
The level buttons are the other buttons in the outline area of a worksheet that has subtotals. Each button represents a level of organization in a worksheet; clicking a level button hides all levels of detail below that of the button you clicked. The following table describes the data contained at each level of a worksheet that has three levels of organization.

Level	Description
1	Grand total
2	Subtotals for each group
3	Individual rows in the worksheet

Clicking the Level 2 button in the worksheet would hide the rows with data on, for example, each month's revenue, but would leave the row that contains the grand total (Level 1) and all rows that contain the subtotal for each year (Level 2) visible in the worksheet.

	A	B	C	D	E
1	Year	Quarter	Month	Package Volume	
14	2012 Total			58,803,774	
27	2013 Total			64,559,228	
28	Grand Total			123,363,002	
29					

If you want to, you can add levels of detail to the outline that Excel creates. For example, you might want to be able to hide revenues from April to June, which you know are traditionally strong months. To create a new outline group within an existing group, select the rows you want to group; on the Data tab, in the Outline group, point to Group, and then click Group.



	A	B	C	D
1	Year	Quarter	Month	Package Volume
2	2012	1	January	5,213,292
3	2012	1	February	2,038,516
4	2012	1	March	2,489,601
5	2012	2	April	9,051,231
6	2012	2	May	5,225,156
7	2012	2	June	3,266,644
8	2012	3	July	2,078,794
9	2012	3	August	1,591,434

You can remove a group by selecting the rows in the group and then, in the Outline group, clicking Ungroup.

TIP If you want to remove all subtotals from a worksheet, open the Subtotal dialog box, and click the Remove All button.

In this exercise, you'll add subtotals to a worksheet and then show and hide different groups of data in your worksheet by using the outline that appears.

SET UP **You need the GroupByQuarter workbook located in the Chapter06 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1 Click any cell in the data list. Then, on the **Data** tab, in the **Outline** group, click **Subtotal** to open the **Subtotal** dialog box. The **Subtotal** dialog box displays the default options to add a subtotal at every change in the **Year** column, to return the sum of the values in the subtotaled rows, and to add a row with the subtotal of values in the **Package Volume** column below the final selected row.

2 Click **OK** to close the **Subtotal** dialog box. New rows appear with subtotals for package volume during each year represented in the worksheet. The new rows are numbered **14** and **27**. A row that contains the grand total of all rows also appears; that row is row **28**. A new area with outline bars and group-level indicators appears to the left of column **A**.

	A	B	C	D	E
1	Year	Quarter	Month	Package Volume	
2	2012	1	January	5,213,292	
3	2012	1	February	2,038,516	
4	2012	1	March	2,489,601	
5	2012	2	April	9,051,231	
6	2012	2	May	5,225,156	
7	2012	2	June	3,266,644	
8	2012	3	July	2,078,794	
9	2012	3	August	1,591,434	
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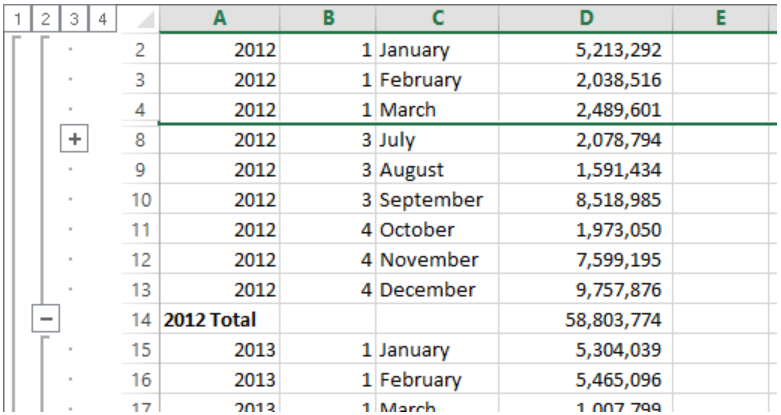
11	2012	4	October	1,973,050	
12	2012	4	November	7,599,195	
13	2012	4	December	9,757,876	
14	2012 Total			58,803,774	
15	2013	1	January	5,304,039	
16	2013	1	February	5,465,096	
17	2013	1	March	1,007,799	
18	2013	2	April	4,010,287	
19	2013	2	May	4,817,070	
20	2013	2	June	8,155,717	
21	2013	3	July	6,552,370	
22	2013	3	August	2,295,635	
23	2013	3	September	7,115,883	
24	2013	4	October	1,362,767	
25	2013	4	November	8,935,488	
26	2013	4	December	9,537,077	
27	2013 Total			64,559,228	
28	Grand Total			123,363,002	

Sheet1

3 Click the row heading of row **5**, and drag to the row heading of row **7** to select rows **5** through **7**.

4 On the **Data** tab, in the **Outline** group, click **Group** to make rows **5** through **7** into a new group. An outline bar appears on a new level in the outline area, and a corresponding **Level 4** button appears at the top of the outline area.

5 In the outline area, click the **Hide Detail** button next to row **8** to hide rows **5** through **7**. The **Hide Detail** button you clicked changes to a **Show Detail** button.



	A	B	C	D	E
2	2012	1	January	5,213,292	
3	2012	1	February	2,038,516	
4	2012	1	March	2,489,601	
8	2012	3	July	2,078,794	
9	2012	3	August	1,591,434	
10	2012	3	September	8,518,985	
11	2012	4	October	1,973,050	
12	2012	4	November	7,599,195	
13	2012	4	December	9,757,876	
14	**2012 Total**			58,803,774	
15	2013	1	January	5,304,039	
16	2013	1	February	5,465,096	
17	2013	1	March	1,007,799	

6 In the outline area, click the **Show Detail** button next to row **8** to display rows **5** through **7**. In the outline area, click the **Level 1** button to hide all rows except row **1** with the column headings and row **28** with the grand total.

7 In the outline area, click the **Level 2** button to display the rows that have the subtotals for each year.

8 In the outline area, click the **Level 3** button to display all rows except rows **5** through **7**.

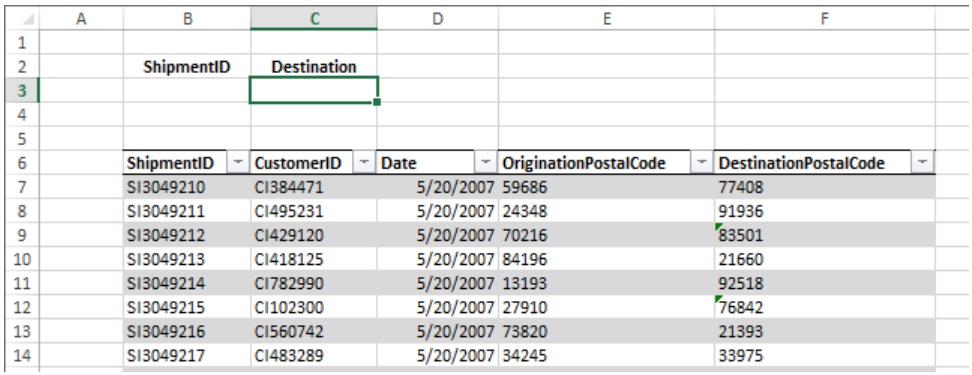
9 In the outline area, click the **Level 4** button to display rows **5** through **7**.

CLEAN UP **Close the GroupByQuarter workbook, saving your changes if you want to.**

Looking up information in a worksheet

Whenever you create a worksheet that holds information about a list of distinct items, such as products offered for sale by a company, you should ensure that at least one column in the list contains a unique value that distinguishes that row (and the item the row represents) from every other row in the list. Assigning each row a column that contains a unique value means that you can associate data in one list with data in another list. For example, if you assign every customer a unique identification number, you can store a customer's contact information in one worksheet and all orders for that customer in another worksheet. You can then associate the customer's orders and contact information without writing the contact information in a worksheet every time the customer places an order.

In the case of shipments handled by Consolidated Messenger, the column that contains those unique values, also known as the *primary key column*, is the ShipmentID column.



	A	B	C	D	E	F
1						
2		ShipmentID	Destination			
3						
4						
5						
6		ShipmentID	CustomerID	Date	OriginationPostalCode	DestinationPostalCode
7		SI3049210	CI384471	5/20/2007	59686	77408
8		SI3049211	CI495231	5/20/2007	24348	91936
9		SI3049212	CI429120	5/20/2007	70216	83501
10		SI3049213	CI418125	5/20/2007	84196	21660
11		SI3049214	CI782990	5/20/2007	13193	92518
12		SI3049215	CI102300	5/20/2007	27910	76842
13		SI3049216	CI560742	5/20/2007	73820	21393
14		SI3049217	CI483289	5/20/2007	34245	33975

If you know a shipment's ShipmentID, it's no trouble to look through a list of 20 or 30 items to find a particular shipment. If, however, you have a list of many thousands of shipments, looking through the list to find one would take quite a bit of time. Instead, you can use the *VLOOKUP* function so that your colleagues can enter a ShipmentID in a cell and have the corresponding details appear in another cell.

The *VLOOKUP* function finds a value in the leftmost column of a named range, such as a table, and then returns the value from the specified cell to the right of the cell that has the found value. A properly formed *VLOOKUP* function has four arguments (data that is passed to the function), as shown in the following definition: *=VLOOKUP(lookup_value, table_array, col_index_num, range_lookup)*.

The following table summarizes the values Excel expects for each of these arguments.

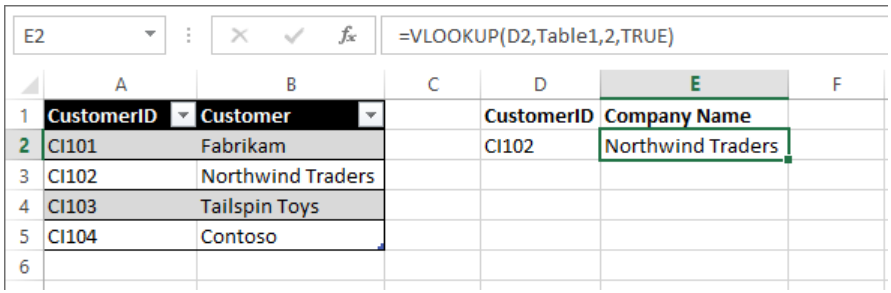
Argument	Expected value
lookup_value	The value to be found in the first column of the named range specified by the *table_array* argument. The *lookup_value* argument can be a value, a cell reference, or a text string.
table_array	The multicolumn range or name of the range or Excel table to be searched.
col_index_num	The number of the column in the named range that has the value to be returned.
range_lookup	A *TRUE* or *FALSE* value, indicating whether the function should find an approximate match (*TRUE*) or an exact match (*FALSE*) for the *lookup_value*. If left blank, the default value for this argument is *TRUE*.

IMPORTANT When *range_lookup* is left blank or set to *TRUE*, for *VLOOKUP* to work properly the rows in the named range specified in the *table_array* argument must be sorted in ascending order based on the values in the leftmost column of the named range.

The *VLOOKUP* function works a bit differently depending on whether the *range_lookup* argument is set to *TRUE* or *FALSE*. The following list summarizes how the function works based on the value of *range_lookup*:

- If the *range_lookup* argument is left blank or set to *TRUE*, and *VLOOKUP* doesn't find an exact match for *lookup_value*, the function returns the largest value that is less than *lookup_value*.
- If the *range_lookup* argument is left blank or set to *TRUE*, and *lookup_value* is smaller than the smallest value in the named range, an *#N/A* error is returned.
- If the *range_lookup* argument is left blank or set to *TRUE*, and *lookup_value* is larger than all values in the named range, the largest value in the named range is returned.
- If the *range_lookup* argument is set to *FALSE*, and *VLOOKUP* doesn't find an exact match for *lookup_value*, the function returns an *#N/A* error.

As an example of a *VLOOKUP* function, consider an Excel table that has its headers in row 1 and the first column in column A of the worksheet. If the *=VLOOKUP (D2, Table1, 2, TRUE)* formula is used, when you enter *CI02* in cell D2 and press Enter, the *VLOOKUP* function searches the first column of the table, finds an exact match, and returns the value *Northwind Traders* to cell E2.



TIP The related *HLOOKUP* function matches a value in a column of the first row of a table and returns the value in the specified row number of the same column. The letter "H" in the *HLOOKUP* function name refers to the horizontal layout of the data, just as the "V" in the *VLOOKUP* function name refers to the data's vertical layout. For more information on using the *HLOOKUP* function, click the Excel Help button, enter *HLOOKUP* in the search terms box, and then click Search.

IMPORTANT Be sure to format the cell in which you enter the *VLOOKUP* formula with the same format as the data you want the formula to display. For example, if you create a *VLOOKUP* formula in cell G14 that finds a date, you must apply a date cell format to cell G14 for the result of the formula to display properly.

In this exercise, you'll create a *VLOOKUP* function to return the destination postal code of deliveries that have ShipmentIDs entered in a specific cell.

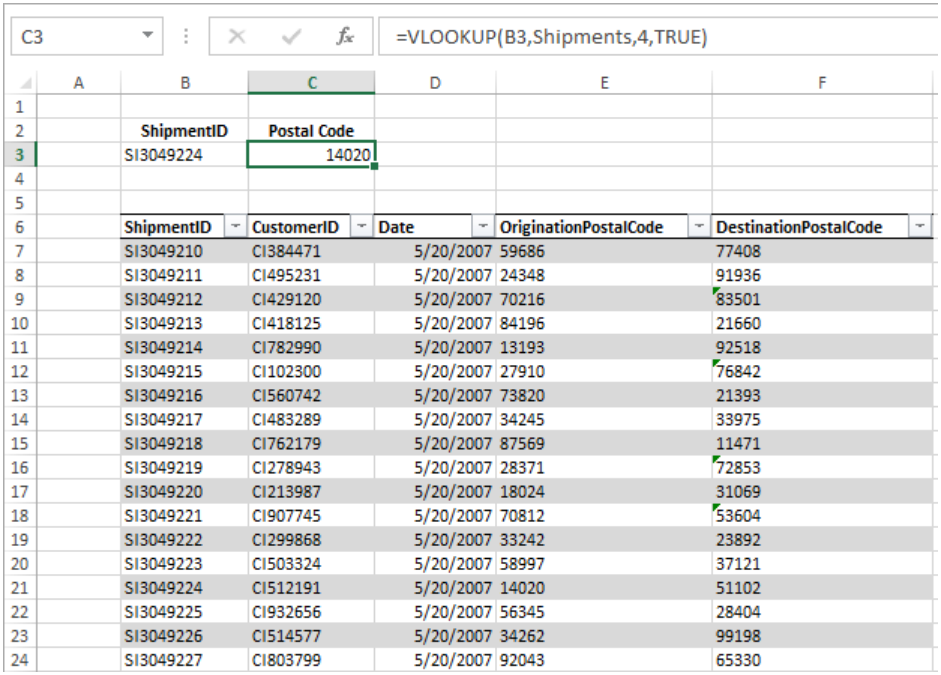
SET UP **You need the ShipmentLog workbook located in the Chapter06 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1 In cell **C3**, enter the formula **=VLOOKUP(B3, Shipments, 5, FALSE)**. Cell **B3**, which the formula uses to look up values in the **Shipments** table, is blank, so the **#N/A** error code appears in cell **C3**.

2 In cell **B3**, enter **SI3049224**, and press **Enter**. The value **51102** appears in cell **C3**.

3 In cell **C3**, edit the formula so that it reads **=VLOOKUP(B3, Shipments, 2, FALSE)**. The formula now finds its target value in table column 2 (the **CustomerID** column), so the value **CI512191** appears in cell **C3**.

4 In cell **C3**, edit the formula so that it reads **=VLOOKUP(B3, Shipments, 4, TRUE)**. Changing the last argument to *TRUE* enables the *VLOOKUP* formula to find an approximate match for the **ShipmentID** in cell **B3**, whereas changing the column to **4** means the formula gets its result from the **OriginationPostalCode** column. The value **14020** appears in cell **C3**.



C3 =VLOOKUP(B3,Shipments,4,TRUE)

	A	B	C	D	E	F
1						
2		ShipmentID	Postal Code			
3		SI3049224	14020			
4						
5						
6		ShipmentID	CustomerID	Date	OriginationPostalCode	DestinationPostalCode
7		SI3049210	CI384471	5/20/2007	59686	77408
8		SI3049211	CI495231	5/20/2007	24348	91936
9		SI3049212	CI429120	5/20/2007	70216	83501
10		SI3049213	CI418125	5/20/2007	84196	21660
11		SI3049214	CI782990	5/20/2007	13193	92518
12		SI3049215	CI102300	5/20/2007	27910	76842
13		SI3049216	CI560742	5/20/2007	73820	21393
14		SI3049217	CI483289	5/20/2007	34245	33975
15		SI3049218	CI762179	5/20/2007	87569	11471
16		SI3049219	CI278943	5/20/2007	28371	72853
17		SI3049220	CI213987	5/20/2007	18024	31069
18		SI3049221	CI907745	5/20/2007	70812	53604
19		SI3049222	CI299868	5/20/2007	33242	23892
20		SI3049223	CI503324	5/20/2007	58997	37121
21		SI3049224	CI512191	5/20/2007	14020	51102
22		SI3049225	CI932656	5/20/2007	56345	28404
23		SI3049226	CI514577	5/20/2007	34262	99198
24		SI3049227	CI803799	5/20/2007	92043	65330

5 In cell **B3**, enter **SI3049209**. The value in cell **B3** is smaller than the smallest value in the **Shipments** table's first column, so the *VLOOKUP* formula displays the **#N/A** error code in cell **C3**.

6 In cell **B3**, enter **SI3049245**. The **ShipmentID** entered into cell **B3** is greater than the last value in the table's first column, so the *VLOOKUP* formula displays the last value in the target column (in this case, the fourth column). Therefore, the incorrect value **44493** appears in cell **C3**. The error occurs because the *range_lookup* argument is set to *TRUE*.

CLEAN UP **Close the ShipmentLog workbook, saving your changes if you want to.**

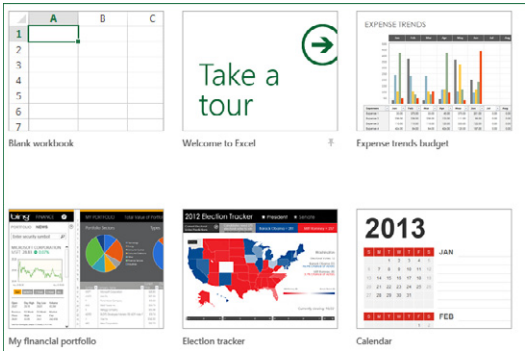
Key points

- You can rearrange the data in a worksheet quickly by clicking either the Sort Ascending or Sort Descending button in the Sort & Filter group on the Data tab.
- Don't forget that you can sort the rows in a worksheet by using orders other than alphabetical or numerical. For example, you can sort a series of days based on their order in the week or by cell color.
- If none of the existing sort orders (days, weekdays, and so on) meets your needs, you can create your own custom sort order.
- You can divide the data in your worksheet into levels and find a subtotal for each level.
- By creating subtotals, you can show or hide groups of data in your worksheets.
- You can use the *VLOOKUP* function to look up a value in one column of data and return a value from another column in the same row.

Chapter at a glance

Templates

Use workbooks as templates for other workbooks, page 196



Link

Link to data in other worksheets and workbooks, page 204

	E	F	G	H	I
1					
2	**Facilities**			**Transportation**	
3					
4	**Power**	$ 1,800,000.00		**Truck Fuel**	$ 24,808,206
5	**Water**	$ 900,000.00		**Truck Maintenance**	
6	**Rent**	$ 2,350,000.00		**Airplane Fuel**	
7	**Mortgage**	$ 4,590,210.00		**Airplane Maintenance**	

Consolidate

Consolidate multiple sets of data into a single workbook, page 209

	A	B	C	D	E	F	G	H
1								
2								
3			**Hour**					
4		**Call Center**	*9:00 AM*	*10:00 AM*	*11:00 AM*	*12:00 PM*	*1:00 PM*	*2:00 PM*
5		*Northeast*	15931	15958	13140	25367	19558	20624
6		*Atlantic*	28432	22326	15436	20884	30000	19770
7		*Southeast*	13132	12568	19732	14762	18885	20882
8		*North Central*	17588	26324	24121	24453	20048	21994
9		*Midwest*	24875	19965	19386	11374	26007	29378
10		*Southwest*	15353	27755	19718	17889	22116	28816
11		*Mountain West*	21516	28321	9754	26384	15926	23572
12		*Northwest*	19806	24154	12389	10151	24078	11642
13		*Central*	21018	24884	18655	31525	13407	19683
14								

Combining data from multiple sources

7

IN THIS CHAPTER, YOU WILL LEARN HOW TO

- Use workbooks as templates for other workbooks.
- Link to data in other worksheets and workbooks.
- Consolidate multiple sets of data into a single workbook.

Microsoft Excel 2013 gives you a wide range of tools with which to format, summarize, and present your data. After you have created a workbook to hold data about a particular subject, you can create as many worksheets as you need to make that data easier to find within your workbook. For example, you can create a workbook to store sales data for a year, with each worksheet representing a month in that year. To ensure that every year's workbook has a similar appearance, you can create a workbook with the characteristics you want (such as more than the standard number of worksheets, custom worksheet formatting, or a particular color for the workbook's sheet tabs) and save it as a pattern, or *template*, for similar workbooks you will create in the future. The benefit of ensuring that all your sales data worksheets have the same layout is that you and your colleagues immediately know where to look for specific totals. You can use that knowledge to summarize, or consolidate, that data into a single worksheet.

A consequence of organizing your data into different workbooks and worksheets is that you need ways to manage, combine, and summarize data from more than one Excel file. You can always copy data from one worksheet to another, but if the original value were to change, that change would not be reflected in the cell range to which you copied the data. Rather than remembering which cells you need to update when a value changes, you can create a link to the original cell. That way, Excel will update the value for you whenever you open the workbook. If multiple worksheets hold related values, you can use links to summarize those values in a single worksheet.

In this chapter, you'll use a workbook as a template for other workbooks, work with more than one set of data, link to data in other workbooks, and summarize multiple sets of data.

PRACTICE FILES To complete the exercises in this chapter, you need the practice files contained in the Chapter07 practice file folder. For more information, see "Download the practice files" in this book's Introduction.

Using workbooks as templates for other workbooks

After you decide on the type of data you want to store in a workbook and what that workbook should look like, you probably want to be able to create similar workbooks without adding all of the formatting and formulas again. For example, you might have established a design for your monthly sales-tracking workbook.

When you have settled on a design for your workbooks, you can save one of the workbooks as a template for similar workbooks you will create in the future. You can leave the workbook's labels to aid data entry, but you should remove any existing data from a workbook that you save as a template, both to avoid data entry errors and to remove any confusion as to whether the workbook is a template. You can also remove any worksheets you and your colleagues won't need by right-clicking the tab of an unneeded worksheet and, on the shortcut menu that appears, clicking Delete.

If you want your template workbook to have more than the standard number of worksheets (such as 12 worksheets to track shipments for a year, by month), you can add worksheets by clicking the Insert Worksheet button that appears to the right of the existing worksheet tabs.

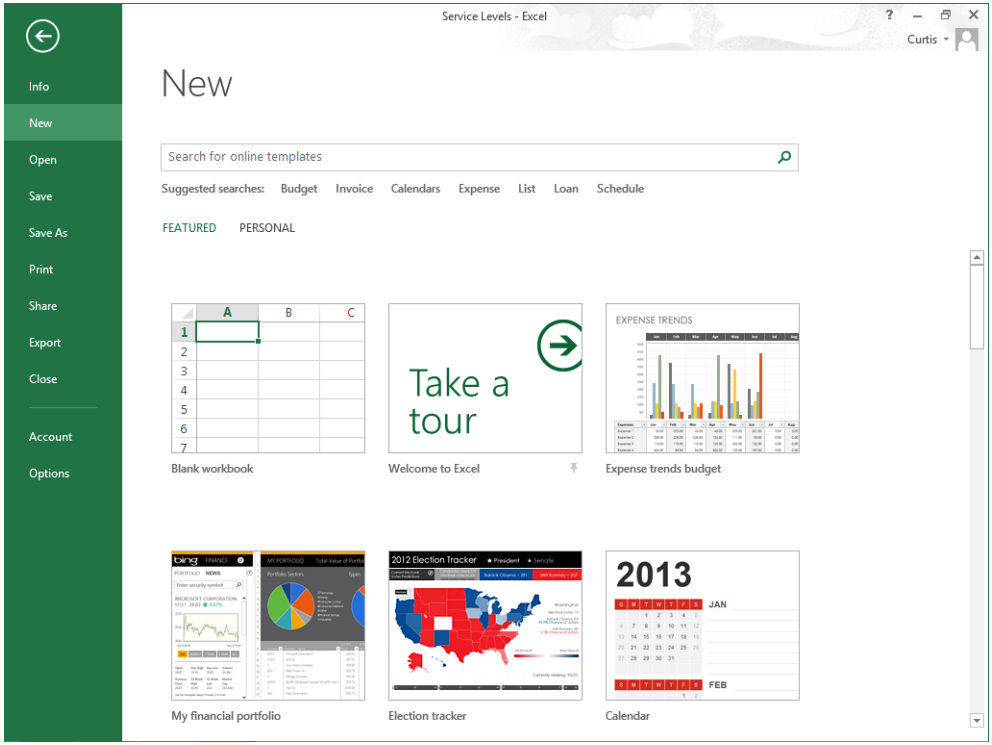
Before you create your first template, you should identify the path to the default template folder on your computer. The path for users whose Windows local settings are English (US) is typically Program Files (x86)\Microsoft Office\Templates\1033. The language identifier for English (US) is 1033, which is why the path includes that identifier. You can enter that path as your default template path on the Save page of the Excel Options dialog box. To open the Excel Options dialog box, click the File tab and then click Options. In the dialog box, click Save and then, in the Default Personal Templates Location box, enter the template folder's path.

TIP You can discover your template folder's path by opening File Explorer and navigating to the template folder, starting with the Program Files or Program Files (x86) folder, depending on your installation. To copy the path of the folder, click the folder icon at the left end of the File Explorer address box at the top of the File Explorer window and then press Ctrl+C.

To create a template from an existing workbook, save the model workbook as an Excel template file (a file with an .xltx extension), which is a file format you can choose from the Save As Type dialog box. If you ever want to change the template, you can open it like a standard workbook and make your changes. When you have completed your work, save the file by clicking the Save button on the Quick Access Toolbar—it will still be a template.

TIP You can also save your Excel 2013 workbook either as an Excel 97–2003 template (.xlt) or as a macro-enabled Excel 2013 workbook template (.xltm). For information about using macros in Excel 2013 workbooks, see Chapter 12, "Working with macros and forms."

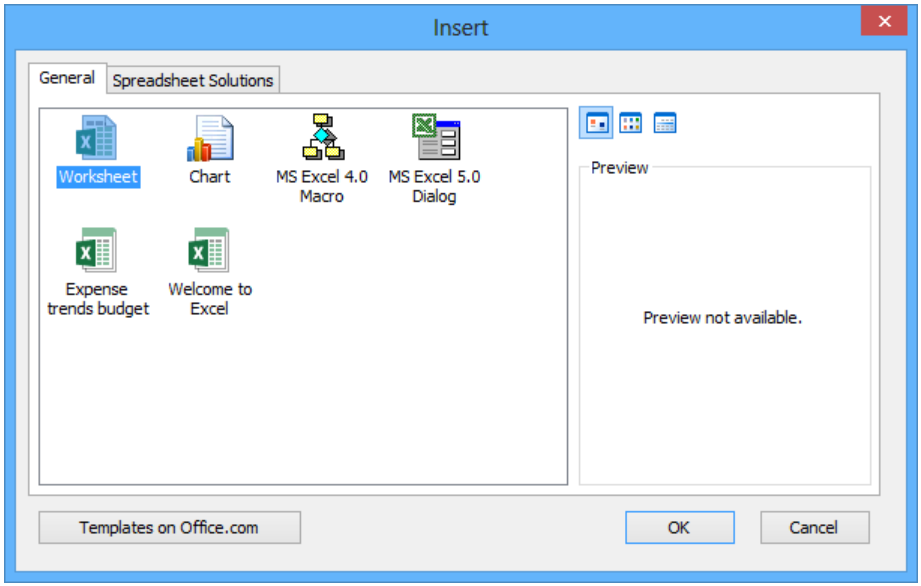
After you save a workbook as a template, you can use it as a model for new workbooks. To create a workbook from a template in Excel, click the File tab to display the Backstage view, and then click New.



The New page of the Backstage view displays the blank workbook template, sample templates, a search box you can use to locate helpful templates on Office.com, and a set of sample search terms.

From the list of available templates, you can click the template you want to use as the model for your workbook. Excel creates a new workbook (an .xlsx workbook file, not an .xltx template file) with the template's formatting and contents in place.

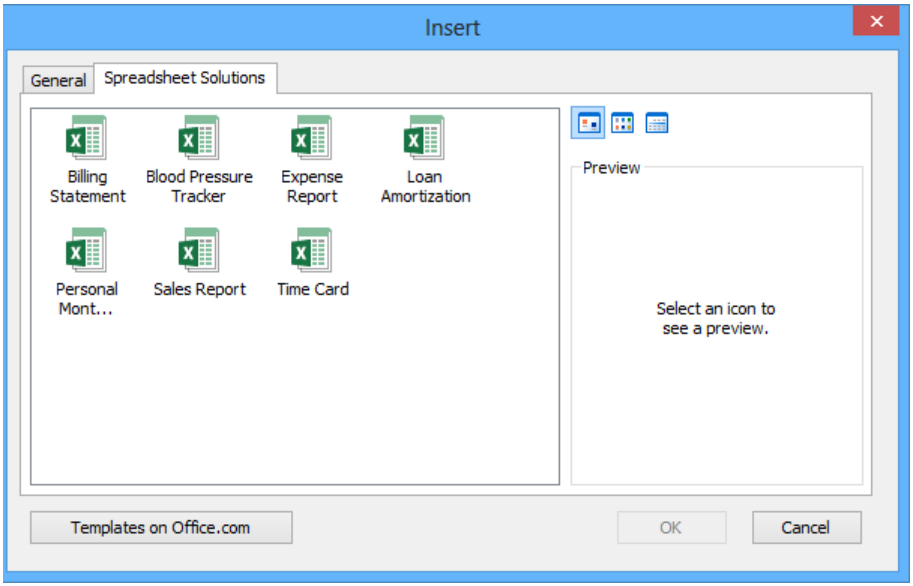
In addition to creating a workbook template, you can add a worksheet based on a template to your workbook by right-clicking a sheet tab and then clicking Insert to open the Insert dialog box.



The Insert dialog box splits its contents into two pages. The General page contains icons you can click to insert a blank worksheet, a chart sheet, and any worksheet templates available to you.

TIP The MS Excel 4.0 Macro and MS Excel 5.0 Dialog icons on the General page are there to help users integrate older Excel spreadsheet solutions into Excel 2013.

The Spreadsheet Solutions page contains a set of useful templates for a variety of financial and personal tasks.

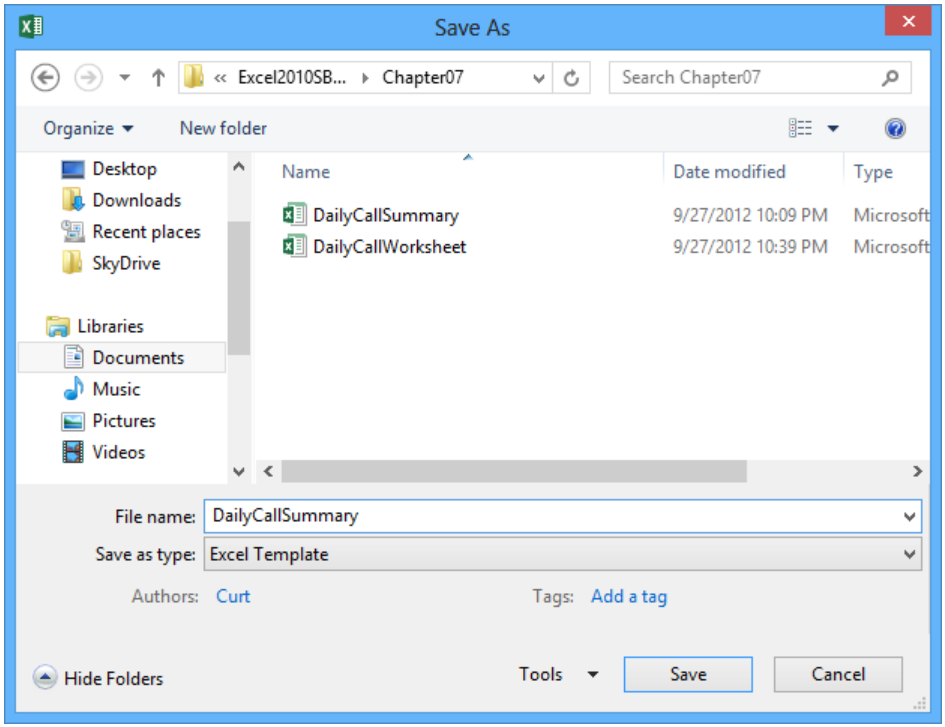


To add a spreadsheet from the Insert dialog box to your workbook, click the template you want, and then click OK. When you click a template, a preview of that template's contents appears in the preview pane, so you can verify you've selected the template you want.

In this exercise, you'll create a workbook from an existing template, save a template to track hourly call volumes to each regional center, and insert a worksheet based on a worksheet template into a new workbook.

SET UP **You need the DailyCallSummary workbook located in the Chapter07 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1. Click the **File** tab, and then in the **Backstage** view, click **Save As**.
2. On the **Save As** page, click **Computer**.
3. Click **Browse** to open the **Save As** dialog box.
4. In the **Save as type** list, click **Excel Template**.



5 Click **Save** to save the workbook as a template and close the **Save As** dialog box.

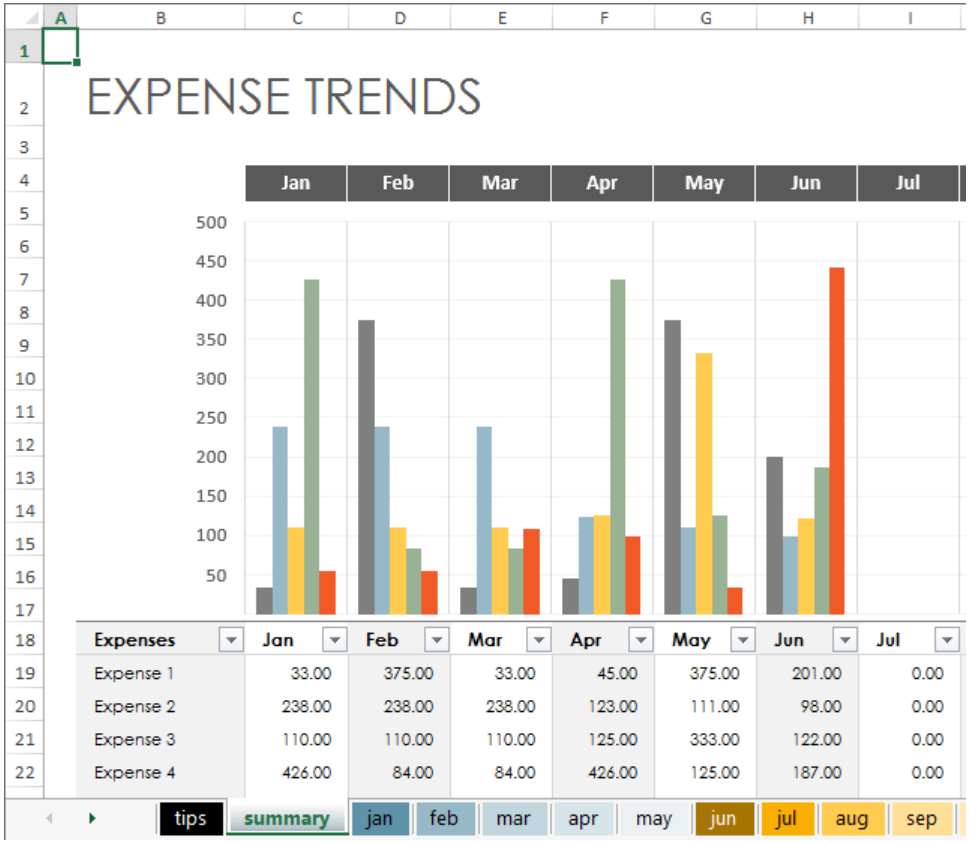
TIP You must remember where you saved your template file to use it later. If you updated the Default Personal Templates Location setting in the Excel Options dialog box and saved the file in that folder, the template you just created will appear on the New page of the Backstage view.

6 In the **Backstage** view, click **Close** to close the **DailyCallSummary** workbook.

7 Display the **Backstage** view again, and then click **New**.

8 In the templates gallery, click **Expense Trends Budget** to display information about the template.

9 Click **Create** to create a workbook based on the selected template.



10 On the **Quick Access Toolbar**, click the **Save** button to display the **Backstage** view.

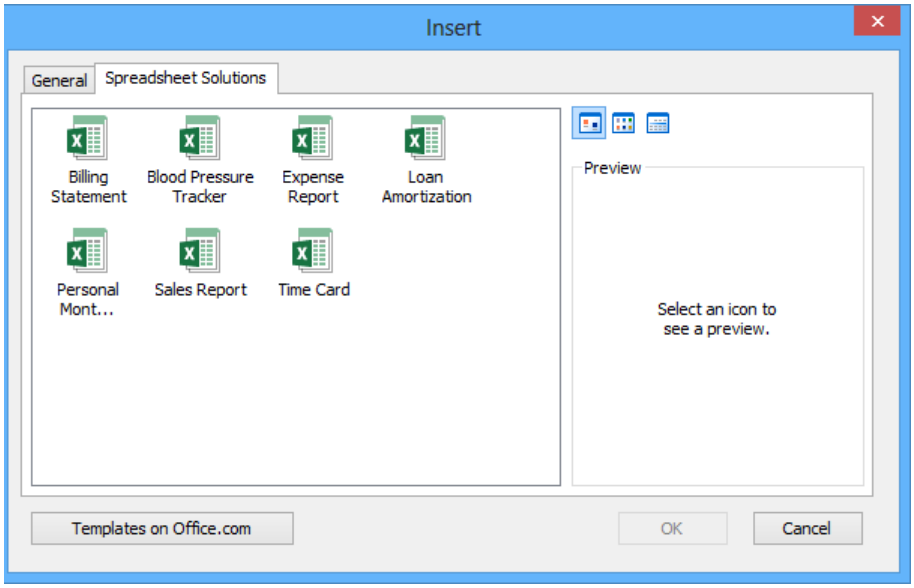
11 On the **Save As** page of the **Backstage** view, click **Computer** and then click **Browse** to open the **Save As** dialog box.

12 In the **File name** box, enter **ExpenseReport**. Use the dialog box controls to browse to the **Chapter07** folder, and then click **Save** to save your workbook.

13 In the **Backstage** view, click **Open** to display that page, and then click **Recent Workbooks**. In the **Recent Workbooks** list, click the **DailyCallSummary** workbook file (not the template) to display the **DailyCallSummary** workbook.

	Hour				
Call Center	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
Northeast					
Atlantic					
Southeast					
North Central					
Midwest					
Southwest					
Mountain West					
Northwest					
Central					

14 Right-click the **Daily** sheet tab, and then click **Insert** to open the **Insert** dialog box.



15 On the **Spreadsheet Solutions** page, click **TimeCard**, and then click **OK** to create a new worksheet based on the template.

CLEAN UP **Close the DailyCallSummary and ExpenseReport workbooks, saving your changes if you want to.**

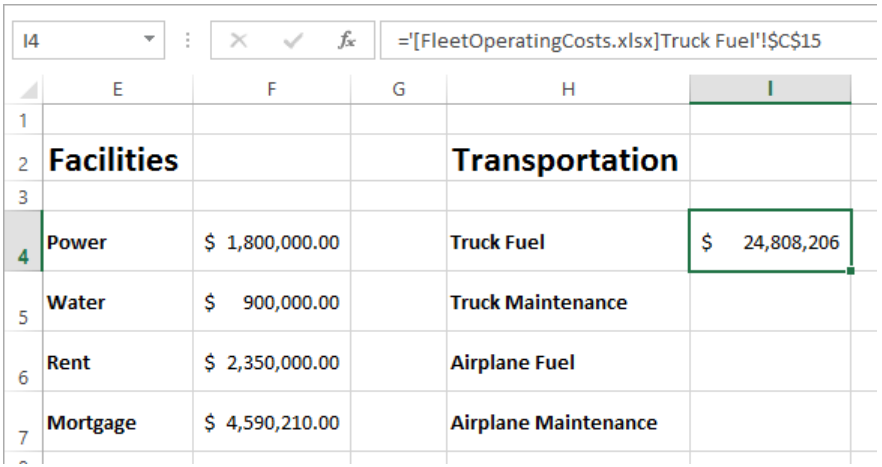
Linking to data in other worksheets and workbooks

Copying and pasting data from one workbook to another is a quick and easy way to gather related data in one place, but there is a substantial limitation: if the data from the original cell changes, the change is not reflected in the cell to which the data was copied. In other words, copying and pasting a cell's contents doesn't create a relationship between the original cell and the target cell.

You can ensure that the data in the target cell reflects any changes in the original cell by creating a link between the two cells. Instead of entering a value into the target cell by typing or pasting, you create a formula that identifies the source from which Excel will derive the target cell's value and updates the value when it changes in the source cell.

To create a link between cells, open both the workbook that contains the cell from which you want to pull the value and the workbook that has the target cell. Then click the target cell and enter an equal sign, signifying that you want to create a formula. After you enter the equal sign, activate the workbook that has the cell from which you want to derive the value, click that cell, and then press the Enter key.

When you switch back to the workbook with the target cell, you will find that Excel has filled in the formula with a reference to the cell you clicked.



For example, the reference *='[FleetOperatingCosts.xlsx]Truck Fuel'!$C$15* gives three pieces of information: the workbook, the worksheet, and the cell you clicked in the worksheet. The first element of the reference (the name of the workbook) is enclosed in square brackets; the end of the second element (the worksheet) is marked with an exclamation point; and the third element (the cell reference) has a dollar sign before both the row and the column identifier. The single quotes around the workbook name and worksheet name are there to account for the space in the Truck Fuel worksheet's name. This type of reference is known as a *3-D* reference, reflecting the three dimensions (workbook, worksheet, and cell range) that you need in order to point to a group of cells in another workbook.

TIP For references to cells in the same workbook, the workbook information is omitted. Likewise, references to cells in the same worksheet don't use a worksheet identifier.

You can also link to cells in an Excel table. Such links include the workbook name, worksheet name, name of the Excel table, and row and column references of the cell to which you've linked. Creating a link to the Cost column's cell in a table's Totals row, for example, results in a reference such as *='FleetOperatingCosts.xlsx'!Truck Maintenance[[#Totals],[Cost]]*.

IMPORTANT Hiding or displaying a table's Totals row affects any links to a cell in that row. Hiding the Totals row causes references to that row to display a *#REF!* error message.

Whenever you open a workbook that contains a link to another document, Excel tries to update the information in linked cells. If the program can't find the source, as would happen if a workbook or worksheet is deleted or renamed, an alert box appears, telling you that there is a broken link. At that point, you can click the Update button and then the Edit Links button to open the Edit Links dialog box and find which link is broken. After you identify the broken link, you can close the Edit Links dialog box, click the cell containing the broken link, and create a new link to the data you want.

If you enter a link and you make an error, a *#REF!* error message appears in the cell that contains the link. To fix the link, click the cell, delete its contents, and then either reenter the link or create it by using the method described earlier in this section.

TIP Excel tracks workbook changes, such as when you change a workbook's name, very well. Unless you delete a worksheet or workbook, or move a workbook to a new folder, odds are good that Excel can update your link references automatically to reflect the change.

In this exercise, you'll create a link to another workbook, make the link's reference invalid, use the Edit Links dialog box to break the link, and then re-create the link correctly.

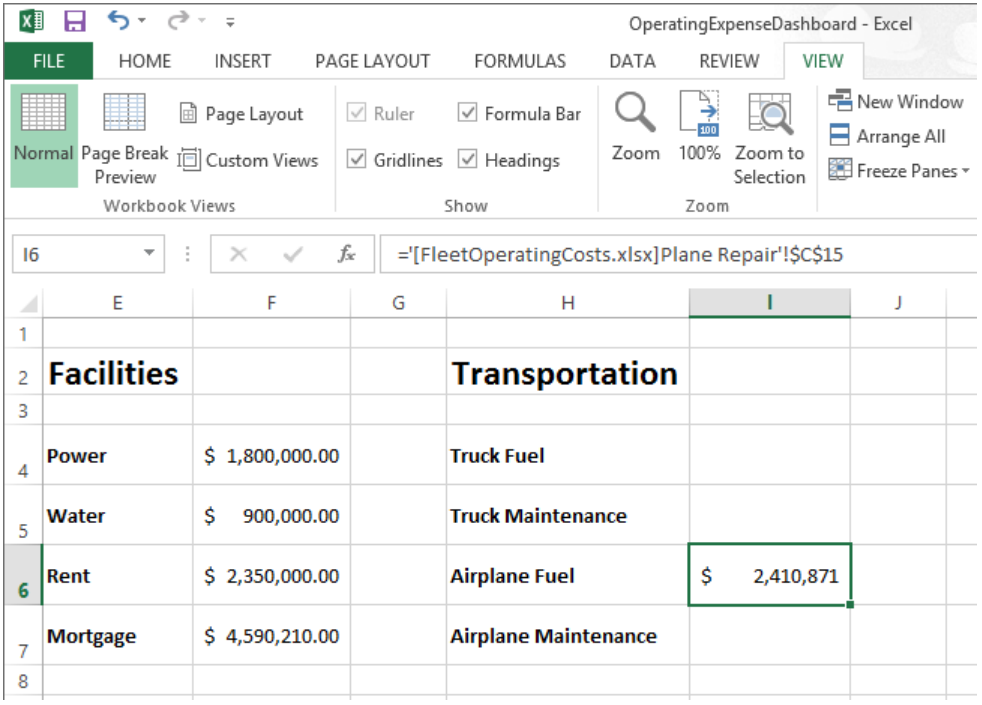
SET UP **You need the OperatingExpenseDashboard and FleetOperatingCosts workbooks located in the Chapter07 practice file folder to complete this exercise. Open the workbooks, and then follow the steps.**

1 In the **OperatingExpenseDashboard** workbook, in cell **I6**, enter **=**, but do not press Enter.

2 On the **View** tab, in the **Window** group, click **Switch Windows** and then, in the list, click **FleetOperatingCosts** to display the **FleetOperatingCosts** workbook.

3 If necessary, click the **Plane Repair** sheet tab to display the **Plane Repair** worksheet, and then click cell **C15**. Excel updates the formula to **='[FleetOperatingCosts.xlsx]Plane Repair'!$C$15**.

4 Press **Enter**. Excel displays the **OperatingExpenseDashboard** workbook; the value **$2,410,871** appears in cell **I6**.



TIP Yes, cell C15 on the Plane Repair worksheet contains the wrong total for the Airplane Fuel category; that's why you replace it later in this exercise.

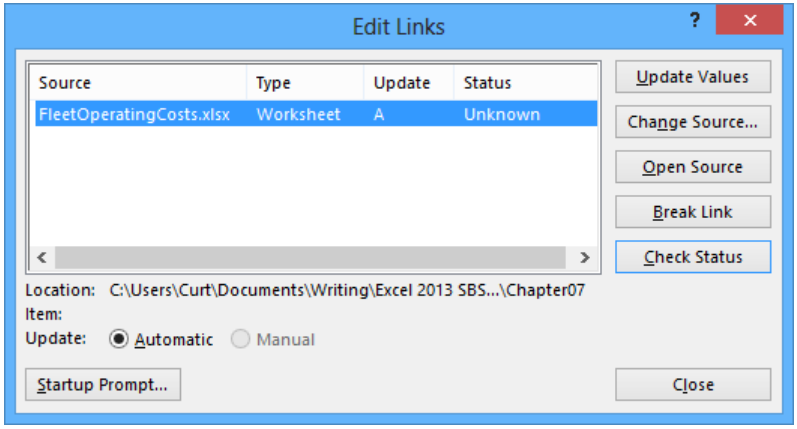
5 In the **Switch Windows** list, click **FleetOperatingCosts** to display the **FleetOperatingCosts** workbook.

6 Right-click the **Plane Repair** sheet tab, and then click **Delete**. In the message box that appears, click **Delete** to confirm that you want to delete the worksheet.

7 In the **Switch Windows** list, click **OperatingExpenseDashboard** to display the **OperatingExpenseDashboard** workbook. Note that cell **I6** shows a **#REF!** error because the worksheet containing the linked cell has been deleted.

	E	F	G	H	I
1					
2	**Facilities**			**Transportation**	
3					
4	**Power**	$ 1,800,000.00		**Truck Fuel**	
5	**Water**	$ 900,000.00		**Truck Maintenance**	
6	**Rent**	$ 2,350,000.00		**Airplane Fuel**	#REF!
7	**Mortgage**	$ 4,590,210.00		**Airplane Maintenance**	
8					

8 On the **Data** tab, in the **Connections** group, click **Edit Links** to open the **Edit Links** dialog box.



9 Click **Break Link**. Excel displays a warning box asking if you're sure you want to break the link.

10 Click **Break Links** to close the warning box and remove the link from the workbook.

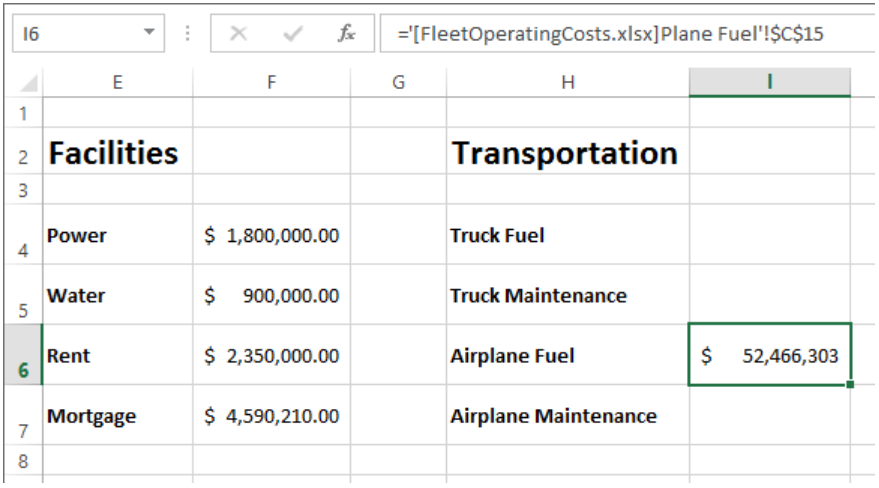
11 Click **Close** to close the **Edit Links** dialog box.

12 In cell **I6**, enter **=**, but do not press Enter.

13 In the **Switch Windows** list, click **FleetOperatingCosts** to display the **FleetOperatingCosts** workbook.

14 Click the **Plane Fuel** sheet tab to display the **Plane Fuel** worksheet.

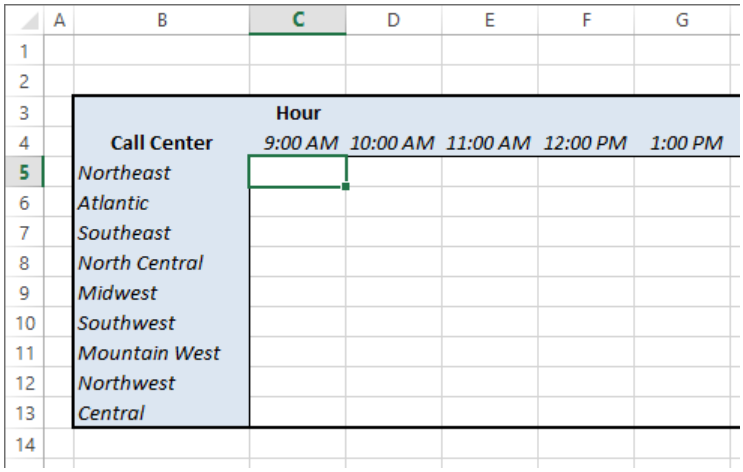
15 Click cell **C15**, and then press **Enter** to complete the formula. Excel displays the **OperatingExpenseDashboard** workbook with the value **$52,466,303** in cell **I6**.



CLEAN UP **Close the OperatingExpenseDashboard and FleetOperatingCosts workbooks, saving your changes if you want to.**

Consolidating multiple sets of data into a single workbook

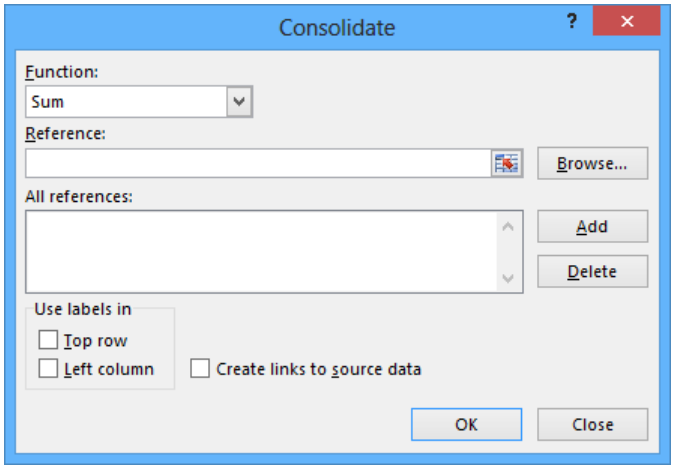
When you create a series of worksheets that contain similar data, perhaps by using a template, you build a consistent set of workbooks in which data is stored in a predictable place. For example, consider a workbook template that uses cell C5 to record the number of calls received from 9:00 A.M. to 10:00 A.M. by the Northeast distribution center.



	Hour				
Call Center	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
Northeast					
Atlantic					
Southeast					
North Central					
Midwest					
Southwest					
Mountain West					
Northwest					
Central					

Using links to bring data from one worksheet to another gives you a great deal of power to combine data from several sources into a single resource. For example, you can create a worksheet that lists the total revenue just for certain months of a year, use links to draw the values from the worksheets in which the sales were recorded, and then create a formula to perform calculations on the data. However, for large worksheets with hundreds of cells filled with data, creating links from every cell is a time-consuming process. Also, to calculate a sum or an average for the data, you would need to include links to cells in every workbook.

Fortunately, there is an easier way to combine data from multiple worksheets into a single worksheet. By using this process, called *data consolidation*, you can define ranges of cells from multiple worksheets and have Excel summarize the data. You define these ranges in the Consolidate dialog box.



IMPORTANT The ranges must all have the same shape.

After you open the dialog box, you move to the worksheet that contains the first cell range you want to include in your summary. When you select the cells, the 3-D reference for the range appears in the Consolidate dialog box. Clicking Add stores the reference. You can then choose the other cell ranges that contain data you want to include in the summary, or you can remove a range from the calculation by clicking the range and then clicking Delete.

Cells that are in the same relative position in the ranges have their contents summarized together. When you consolidate the ranges, the cell in the upper-left corner of one range is added to the cell in the upper-left corner of every other range, even if those ranges are in different areas of the worksheet. After you choose the ranges to be used in your summary, you can choose the calculation to perform on the data (sum, average, and so on). When you're done selecting ranges to use in the calculation, click OK to have Excel summarize the data on your target worksheet.

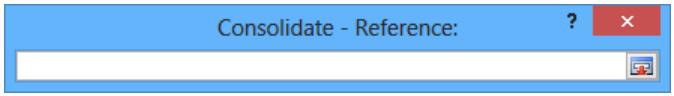
IMPORTANT You can define only one data consolidation summary per workbook.

In this exercise, you'll define a data consolidation range consisting of ranges from two other workbooks. You'll then add the contents of the ranges and show the results in a worksheet.

SET UP **You need the Consolidate, JanuaryCalls, and FebruaryCalls workbooks located in the Chapter07 practice file folder to complete this exercise. Open the workbooks, and then follow the steps.**

1 In the **Consolidate** workbook, on the **Data** tab, in the **Data Tools** group, click **Consolidate** to open the **Consolidate** dialog box.

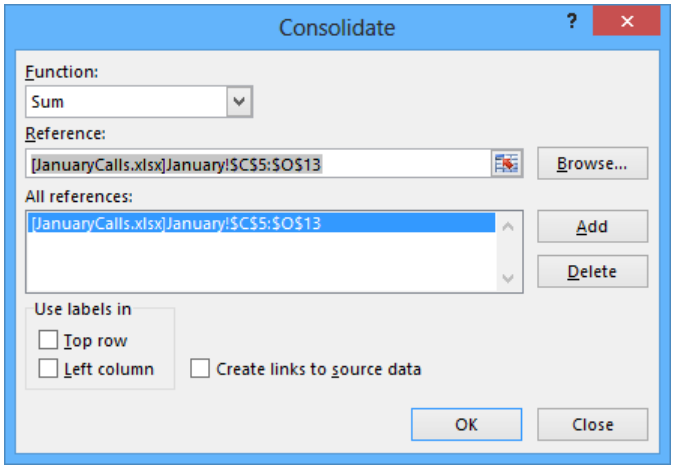
2 Click the **Collapse Dialog** button at the right edge of the **Reference** field to contract the **Consolidate** dialog box.



3 On the **View** tab, in the **Window** group, click **Switch Windows** and then, in the list, click **JanuaryCalls** to display the **JanuaryCalls** workbook.

4 Select the cell range **C5:O13**, and then click the **Expand Dialog** button to restore the **Consolidate** dialog box to its full size.

5 Click **Add** to add the selected range to the **All references** box.



7

6 Click the **Collapse Dialog** button again to contract the **Consolidate** dialog box.

7 In the **Switch Windows** list, click **FebruaryCalls** to display the **FebruaryCalls** workbook.

8 Select the cell range **C5:O13**, and then click the **Expand Dialog** button to restore the **Consolidate** dialog box to its full size.

9 Click **Add** to add the range '**[FebruaryCalls.xlsx]February'!$C$5:$O$13** to the **All references** box.

10 Click **OK** to consolidate the **JanuaryCalls** and **FebruaryCalls** workbook data into the range **C5:O13** in the **Consolidate** workbook. You didn't change the **SUM** operation in the **Function** box, so the values in the **Consolidate** workbook are the sum of the other workbooks' values.

	A	B	C	D	E	F	G	H
1								
2								
3			Hour					
4		Call Center	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM
5		Northeast	15931	15958	13140	25367	19558	20624
6		Atlantic	28432	22326	15436	20884	30000	19770
7		Southeast	13132	12568	19732	14762	18885	20882
8		North Central	17588	26324	24121	24453	20048	21994
9		Midwest	24875	19965	19386	11374	26007	29378
10		Southwest	15353	27755	19718	17889	22116	28816
11		Mountain West	21516	28321	9754	26384	15926	23572
12		Northwest	19806	24154	12389	10151	24078	11642
13		Central	21018	24884	18655	31525	13407	19683
14								

CLEAN UP **Close the Consolidate, JanuaryCalls, and FebruaryCalls workbooks, saving your changes if you want to.**

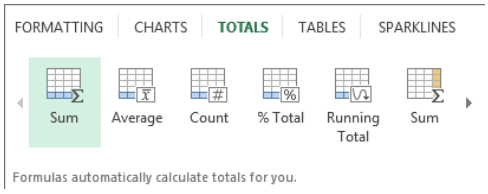
Key points

- If you create a lot of workbooks that have the same layout and design, saving a workbook with the common elements (and no data) will save you time when you create similar workbooks in the future.
- You can use data in other worksheets or workbooks in your formulas. You create a link by clicking the cell, which creates a 3-D reference to that cell.
- When you create a link to a cell in a table's Totals row, hiding the Totals row causes Excel to display a #REF! error in the cell in which you created the link.

Chapter at a glance

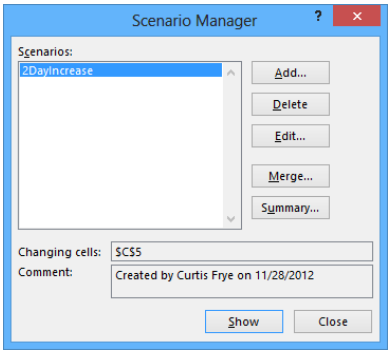
Examine

Examine data by using the Quick Analysis Lens, page 216



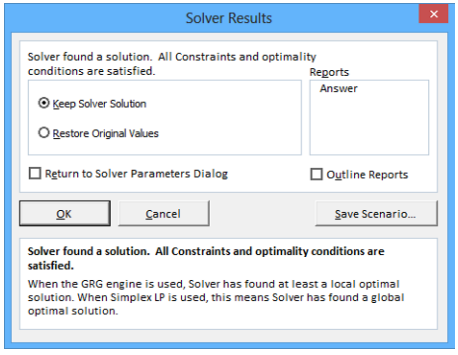
Define

Define an alternative data set, page 219



Optimize

Find optimal solutions by using Solver, page 233



Analyze

Analyze data by using descriptive statistics, page 240

	A	B	C
1	*Column1*		
2			
3	Mean	120.7333	
4	Standard Error	7.036955	
5	Median	109	
6	Mode	102	
7	Standard Deviation	27.25401	
8	Sample Variance	742.781	
9	Kurtosis	-1.17215	
10	Skewness	0.642027	
11	Range	74	
12	Minimum	91	

Analyzing data and alternative data sets

8

IN THIS CHAPTER, YOU WILL LEARN HOW TO

- Examine data by using the Quick Analysis Lens.
- Define an alternative data set.
- Define multiple alternative data sets.
- Analyze data by using data tables.
- Vary your data to get a specific result by using Goal Seek.
- Find optimal solutions by using Solver.
- Analyze data by using descriptive statistics.

When you store data in a Microsoft Excel 2013 workbook, you can use that data, either by itself or as part of a calculation, to discover important information about your organization. You can summarize your data quickly by creating charts, calculating totals, or applying conditional formatting. When you track total sales on a time basis, you can find your best and worst sales periods and correlate them with outside events. For businesses such as Consolidated Messenger, package volume increases dramatically during the holidays as customers ship gifts to friends and family members.

The data in your worksheets is great for answering the question, "What happened?" The data is less useful for answering "what-if" questions, such as, "How much money would we save if we reduced our labor to 20 percent of our total costs?" You can always save an alternative version of a workbook and create formulas that calculate the effects of your changes, but you can do the same thing in your existing workbooks by defining one or more alternative data sets and switching between the original data and the new sets you create. Within a single workbook, you can create a data table that calculates the effects of changing one or two variables in a formula.

Excel also provides the tools to determine the input values that would be required for a formula to produce a specified result. For example, the chief operating officer of Consolidated Messenger, Lori Penor, could find out to what level the revenues from three-day shipping would need to rise for that category to account for 25 percent of total revenue.

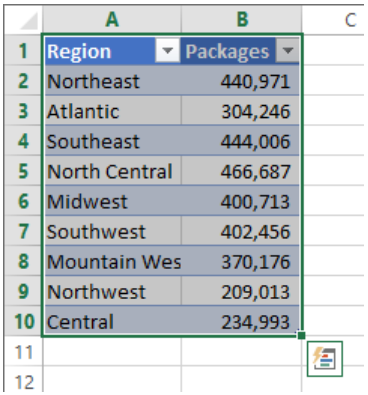
In this chapter, you'll examine data by using the Quick Analysis Lens, define alternative data sets, and use different methods to determine the necessary inputs to make a calculation produce a specific result.

PRACTICE FILES To complete the exercises in this chapter, you need the practice files contained in the Chapter08 practice file folder. For more information, see "Download the practice files" in this book's Introduction.

Examining data by using the Quick Analysis Lens

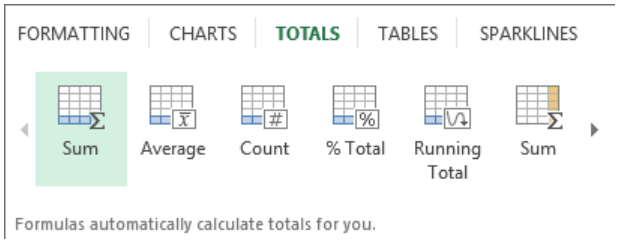
One of the refinements in Excel 2013 is the addition of the Quick Analysis Lens, which brings the most commonly used formatting, charting, and summary tools into one convenient location. To examine data by using the Quick Analysis Lens tools, select the data you want to summarize. When you select a range, Excel displays the Quick Analysis button in the lower-right corner of the range. Clicking the Quick Analysis button displays the tools you can use to analyze your data.

KEYBOARD SHORTCUT Press Ctrl+Q to display the Quick Analysis Lens tools. For a complete list of keyboard shortcuts, see "Keyboard shortcuts" at the end of this book.



	A	B	C
1	Region	Packages	
2	Northeast	440,971	
3	Atlantic	304,246	
4	Southeast	444,006	
5	North Central	466,687	
6	Midwest	400,713	
7	Southwest	402,456	
8	Mountain Wes	370,176	
9	Northwest	209,013	
10	Central	234,993	
11			
12			

The Quick Analysis Lens provides a wide range of tools that you can use, including the ability to create an Excel table or PivotTable, insert a chart, or add conditional formatting. You can also add total columns and rows to your data range. For example, you can click the Totals tab of the Quick Analysis Lens, and then click Running Total for columns, identified by the icon labeled Running Total and the blue row at the bottom of the button, to add a row that calculates the running total for each column.



You can add one summary column and one summary row to each data range. If you select a new summary column or row when one exists, Excel displays a confirmation dialog box to verify that you want to replace the existing summary. When you click Yes, Excel makes the change.

In this exercise, you'll use the Quick Analysis Lens to analyze data.

SET UP **You need the PackageAnalysis workbook located in the Chapter08 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1. Click any cell in the data range.
2. Press **Ctrl+*** to select the entire data range.
3. Click the **Quick Analysis** button to display the tools available in the **Quick Analysis** gallery.
4. Click the **Totals** tab to display the tools on that tab, point to (but don't click) the **Sum** button that has the blue row at the bottom to display a live preview of the effect of clicking the button, and then click the **Sum** button to add a sum total to the bottom of the data range.

	A	B	C
1	Region	Packages	
2	Northeast	440,971	
3	Atlantic	304,246	
4	Southeast	444,006	
5	North Central	466,687	
6	Midwest	400,713	
7	Southwest	402,456	
8	Mountain Wes	370,176	
9	Northwest	209,013	
10	Central	234,993	
11	**Sum**	**3,273,261**	
12			

TIP When your data range is an Excel table, as it is in this exercise, you can show or hide the summary by displaying or hiding the table's Total row.

5 In the **Quick Analysis** gallery, click the **Totals** tab again. Then click the arrow on the far right of the gallery to scroll to the right.

6 Click the **% Total** button that has the yellow column at the right edge to add that summary column to the worksheet.

	A	B	C
1	Region	Packages	% Total
2	Northeast	440,971	**13.47%**
3	Atlantic	304,246	**9.29%**
4	Southeast	444,006	**13.56%**
5	North Central	466,687	**14.26%**
6	Midwest	400,713	**12.24%**
7	Southwest	402,456	**12.30%**
8	Mountain Wes	370,176	**11.31%**
9	Northwest	209,013	**6.39%**
10	Central	234,993	**7.18%**
11	**Sum**	**3,273,261**	

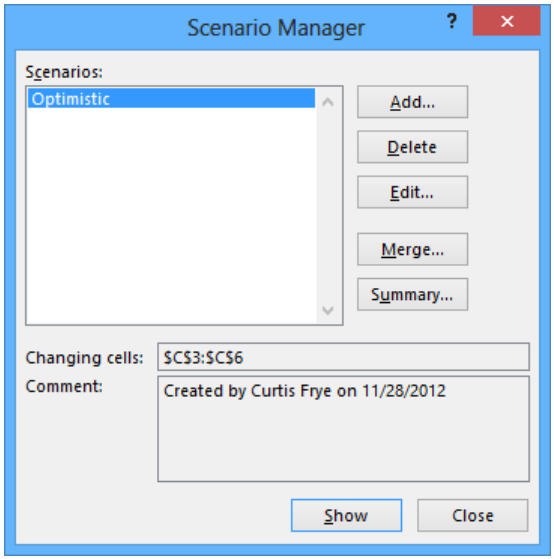
CLEAN UP **Close the PackageAnalysis workbook, saving your changes if you want to.**

Defining an alternative data set

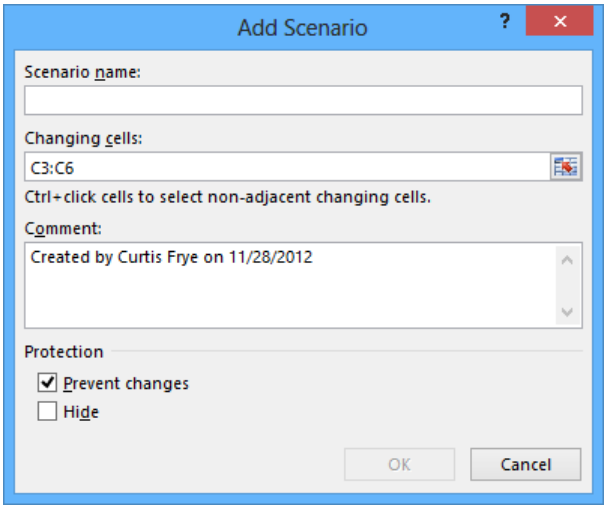
When you save data in an Excel worksheet, you create a record that reflects the characteristics of an event or object. That data could represent the number of deliveries in an hour on a particular day, the price of a new delivery option, or the percentage of total revenue accounted for by a delivery option. After the data is in place, you can create formulas to generate totals, find averages, and sort the rows in a worksheet based on the contents of one or more columns. However, if you want to perform a what-if analysis or explore the impact that changes in your data would have on any of the calculations in your workbooks, you need to change your data.

The problem with manipulating data that reflects an event or item is that when you change any data to affect a calculation, you run the risk of destroying the original data if you accidentally save your changes. You can avoid ruining your original data by creating a duplicate workbook and making your changes to it, but you can also create alternative data sets, or *scenarios*, within an existing workbook.

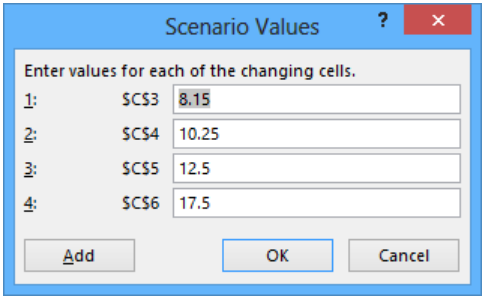
When you create a scenario, you give Excel alternative values for a list of cells in a worksheet. You can use the Scenario Manager to add, delete, and edit scenarios.



Clicking the Add button displays the Add Scenario dialog box.



From within this dialog box, you can name the scenario and identify the cells for which you want to define alternative values. After you click OK, the Scenario Values dialog box opens with fields for you to enter the new values.



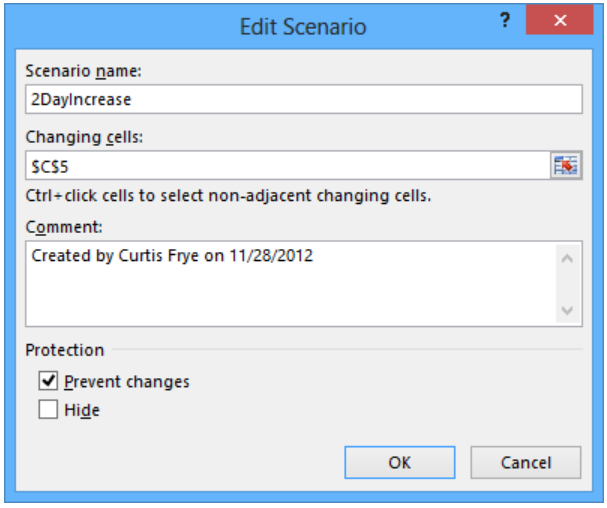
Clicking OK returns you to the Scenario Manager dialog box. From there, clicking the Show button replaces the values in the original worksheet with the alternative values you just defined in the scenario. Any formulas referencing cells that have changed values will recalculate their results. You can then remove the scenario by clicking the Undo button on the Quick Access Toolbar.

IMPORTANT If you save and close a workbook while a scenario is in effect, those values become the default values for the cells changed by the scenario! You should seriously consider creating a scenario that contains the original values of the cells you change or creating a scenario summary worksheet (described in the next section, "Defining multiple alternative data sets").

In this exercise, you'll create a scenario to measure the projected impact on total revenue of a rate increase on two-day shipping.

SET UP **You need the 2DayScenario workbook located in the Chapter08 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1. On the **Data** tab, in the **Data Tools** group, click **What-If Analysis** and then, in the list, click **Scenario Manager** to open the **Scenario Manager** dialog box.
2. Click **Add** to open the **Add Scenario** dialog box.
3. In the **Scenario name** field, enter **2DayIncrease**.
4. At the right edge of the **Changing cells** field, click the **Collapse Dialog** button so the worksheet contents are visible.
5. In the worksheet, click cell **C5** and then, in the **Add Scenario** dialog box, click the **Expand Dialog** button. **$C$5** appears in the **Changing Cells** field, and the dialog box title changes to **Edit Scenario**.

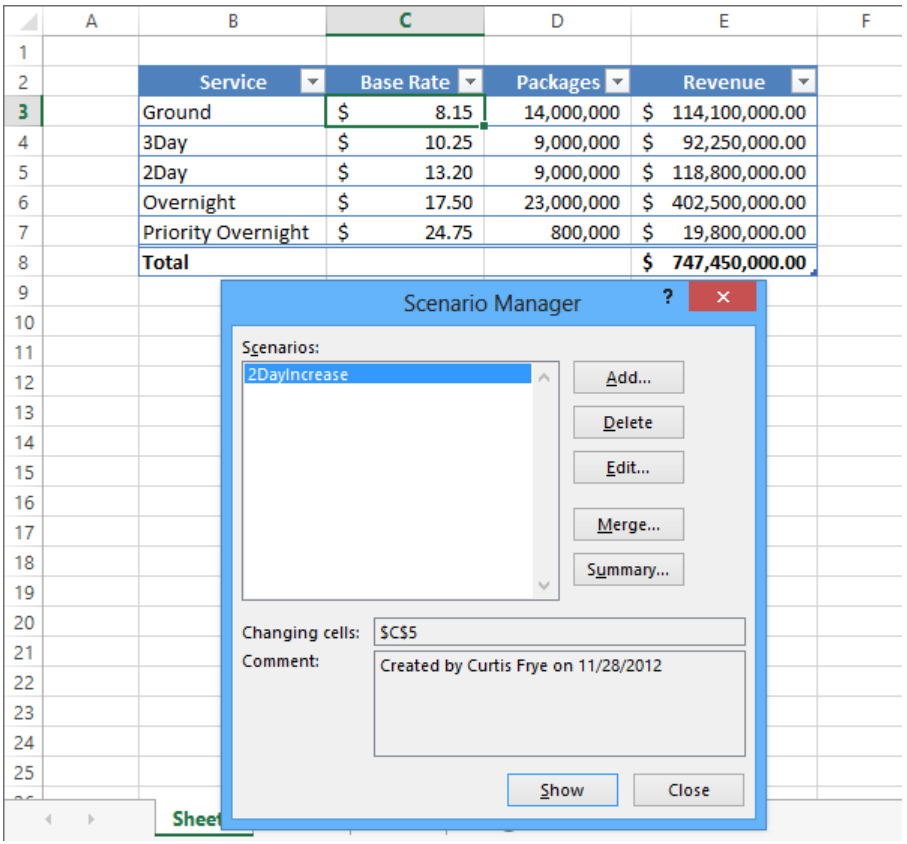


6 Click **OK** to open the **Scenario Values** dialog box.

7 In the value field, enter **13.2**, and then click **OK**. The **Scenario Values** dialog box closes, and the **Scenario Manager** dialog box opens again.

8 If necessary, drag the **Scenario Manager** dialog box to another location on the screen so that you can view the entire table.

9 In the **Scenario Manager** dialog box, click **Show**. Excel applies the scenario, changing the value in cell **C5** to **$13.20**, which in turn increases the value in cell **E8** to **$747,450,000.00**.



10 In the **Scenario Manager** dialog box, click **Close**.

11 On the **Quick Access Toolbar**, click the **Undo** button to remove the effect of the scenario and prevent Excel from overwriting the original values with the scenario's values if you decide to save the workbook.

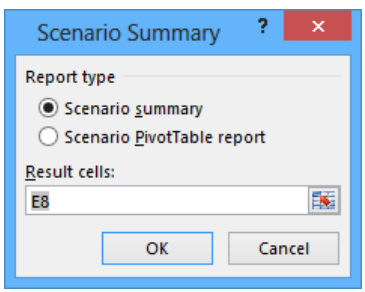
CLEAN UP **Close the 2DayScenario workbook, saving your changes if you want to.**

Defining multiple alternative data sets

One great feature of Excel scenarios is that you're not limited to creating one alternative data set—you can create as many scenarios as you like and apply them by using the Scenario Manager. To apply more than one scenario by using the Scenario Manager, click the name of the first scenario you want to display, click the Show button, and then do the same for any subsequent scenarios. The values you defined as part of those scenarios will appear in your worksheet, and Excel will update any calculations involving the changed cells.

TIP If you apply a scenario to a worksheet and then apply another scenario to the same worksheet, both sets of changes appear. If multiple scenarios change the same cell, the cell will contain the value in the most recently applied scenario.

Applying multiple scenarios alters the values in your worksheets. You can understand how those changes affect your formulas, but Excel also gives you a way to view the results of all your scenarios in a single, separate worksheet. To create a worksheet in your current workbook that summarizes the changes caused by your scenarios, open the Scenario Manager, and then click the Summary button. When you do, the Scenario Summary dialog box opens.



From within the dialog box, you can choose the type of summary worksheet you want to create and the cells you want to display in the summary worksheet. To choose the cells to display in the summary, click the Collapse Dialog button at the right of the Result Cells field, select the cells you want to display, and then expand the dialog box. After you verify that the range in the box represents the cells you want to have included on the summary sheet, click OK to create the new worksheet.

It's a good idea to create an "undo" scenario named *Normal* that holds the original values of the cells you're going to change before they're changed in other scenarios. For example, if you create a scenario named *High Fuel Costs* that changes the sales figures in three cells, your Normal scenario restores those cells to their original values. That way, even if you accidentally modify your worksheet, you can apply the Normal scenario and not have to reconstruct the worksheet from scratch.

TIP Each scenario can change a maximum of 32 cells, so you might need to create more than one scenario to ensure that you can restore a worksheet.

In this exercise, you'll create scenarios to represent projected revenue increases from two rate changes, view the scenarios, and then summarize the scenario results in a new worksheet.

SET UP **You need the MultipleScenarios workbook located in the Chapter08 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1. On the **Data** tab, in the **Data Tools** group, click **What-If Analysis** and then, in the list, click **Scenario Manager** to open the **Scenario Manager** dialog box.
2. Click **Add** to open the **Add Scenario** dialog box.
3. In the **Scenario name** field, enter **3DayIncrease**.
4. At the right edge of the **Changing cells** field, click the **Collapse Dialog** button to collapse the **Add Scenario** dialog box.
5. In the worksheet, click cell **C4** and then, in the dialog box, click the **Expand Dialog** button. **$C$4** appears in the **Changing Cells** field, and the dialog box title changes to **Edit Scenario**.

6 Click **OK** to open the **Scenario Values** dialog box.

7 In the value field, enter **11.50**.

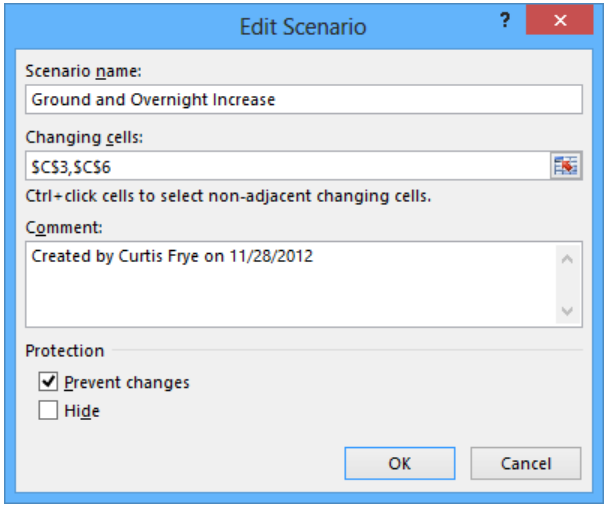
8 Click **OK** to close the **Scenario Values** dialog box and open the **Scenario Manager**.

9 Click **Add** to open the **Add Scenario** dialog box.

10 In the **Scenario name** field, enter **Ground and Overnight Increase**.

11 At the right edge of the **Changing cells** field, click the **Collapse Dialog** button to collapse the **Add Scenario** dialog box.

12 Click cell **C3**, hold down the **Ctrl** key, and click cell **C6**. Then click the **Expand Dialog** button. **$C$3,$C$6** appears in the **Changing Cells** field, and the dialog box title changes to **Edit Scenario**.

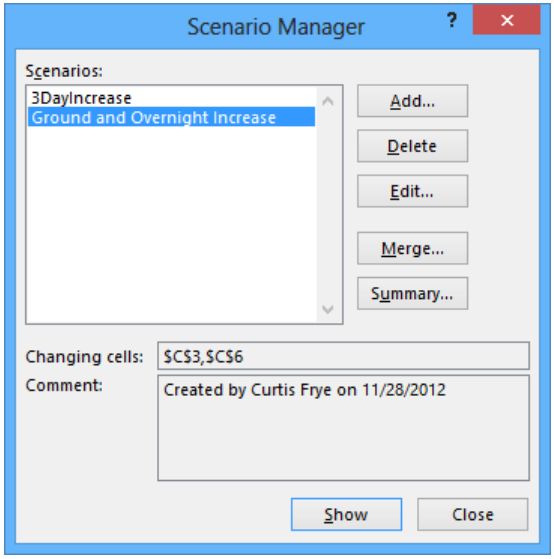


13 Click **OK** to open the **Scenario Values** dialog box.

14 In the **$C$3** field, enter **10.15**.

15 In the **$C$6** field, enter **18.5**.

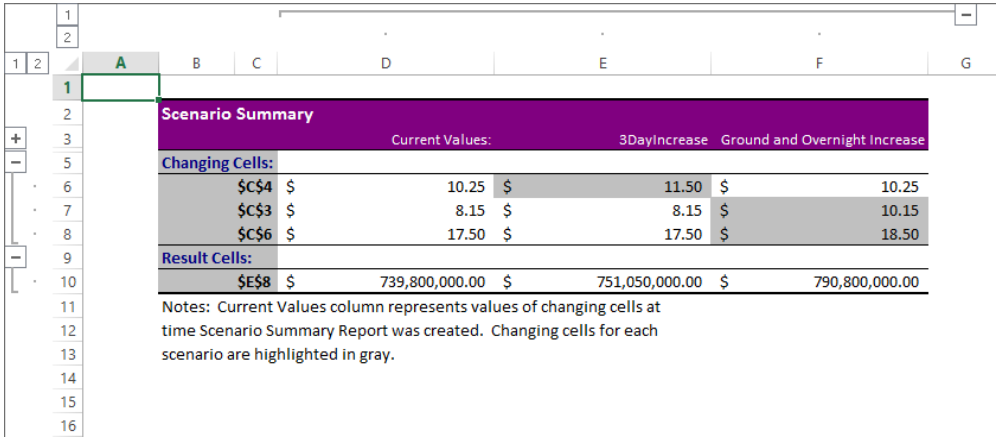
16 Click **OK** to close the **Scenario Values** dialog box and open the **Scenario Manager** dialog box.



17 Click **Summary** to open the **Scenario Summary** dialog box.

18 Verify that **Scenario summary** is selected and that cell **E8** appears in the **Result cells** field.

19 Click **OK** to create a **Scenario Summary** worksheet.



Scenario Summary						
	Current Values:		3DayIncrease		Ground and Overnight Increase	
Changing Cells:						
$C$4	$	10.25	$	11.50	$	10.25
$C$3	$	8.15	$	8.15	$	10.15
$C$6	$	17.50	$	17.50	$	18.50
Result Cells:						
$E$8	$	739,800,000.00	$	751,050,000.00	$	790,800,000.00

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

CLEAN UP **Close the MultipleScenarios workbook, saving your changes if you want to.**

Analyzing data by using data tables

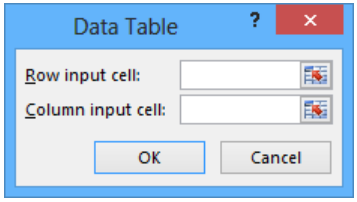
When you examine business data in Excel, you will often want to discover the result of formulas if you provide different inputs. For example, the executive team of Consolidated Messenger might want to calculate the change in revenue from raising shipping rates, increasing package volume, or both. In Excel 2013, you can calculate the results of those changes by using a data table.

To create a data table that has one variable, you create a worksheet that contains the data required to calculate the variations in the table.

	A	B	C	D
1	**Revenue Increases**			**Revenue**
2	Year	2012		$ 2,102,600.70
3	Increase	0%	2%	
4	Package Count	237,582	5%	
5	Rate	$ 8.85	8%	
6				

IMPORTANT The data and formulas must be laid out in a rectangle so the data table you create will appear in the lower-right corner of the cell range you select.

The formula used to summarize the base data appears in cell D2, the cells with the changing values are the range C3:C5, and the cells to contain the calculations based on those values are D3:D5. To create the single-variable data table, select the cell range C2:D5, which encompasses the changing rates, summary formula, and target cells. Then, on the Data tab, click What-If Analysis, and then click Data Table to display the Data Table dialog box.



Now you need to identify the cell that contains the summary formula's value that will change in the data table's cells. In this case, that cell is B3. Because the target cells D3:D5 are laid out as a column, you enter the cell address B3 in the Column Input Cell box and click OK.

TIP If your target cells were laid out as a row, you would enter the address of the cell that contains the value to be changed in the Row Input Cell box.

When you click OK, Excel fills in the results of the data table, using the replacement values in cells C3:C5 to provide the values for cells D3:D5.

	A	B	C	D
1	**Revenue Increases**			**Revenue**
2	Year	2012		$ 2,102,600.70
3	Increase	0%	2%	$ 2,107,352.34
4	Package Count	237,582	5%	$ 2,114,479.80
5	Rate	$ 8.85	8%	$ 2,121,607.26
6				

To create a two-variable data table, you lay your data out with one set of replacement values as row headers and the other set as column headers. For example, you could build a worksheet to calculate total revenue as a function of both rate increases and package count increases.

	A	B	C	D	E
1	**Revenue Increases**		**Revenue**		
2	Year	2012	$ 2,102,600.70	260,000	300,000
3	Increase	0%	2%		
4	Package Count	237,582	5%		
5	Rate	$ 8.85	8%		
6					

In this case, you select the cell range C2:E5 and then, on the Data tab, click What-If Analysis and then click Data Table to display the Data Table dialog box. Because you're creating a two-variable data table, you need to enter cell addresses for both the Column Input Cell and Row Input Cell. In this case, the column input cell is B3, which represents the rate increase, and the row input cell is B4, which contains the package count. When you click OK, Excel creates your data table.

	A	B	C	D	E
1	**Revenue Increases**		**Revenue**		
2	Year	2012	$ 2,102,600.70	260,000	300,000
3	Increase	0%	2%	$ 2,306,200.00	$ 2,661,000.00
4	Package Count	237,582	5%	$ 2,314,000.00	$ 2,670,000.00
5	Rate	$ 8.85	8%	$ 2,321,800.00	$ 2,679,000.00
6					

TIP You can't edit the formulas Excel creates when you define a data table. You can only change them successfully by creating another data table that includes the same cells.

In this exercise, you'll create one-variable and two-variable data tables.

SET UP **You need the RateProjections workbook located in the Chapter08 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1. If necessary, click the **RateIncreases** sheet tab to display that worksheet.
2. Select cells **C2:D5**.
3. On the **Data** tab, in the **Data Tools** group, click the **What-If Analysis** button and then, in the list, click **Data Table**.
4. In the **Column input cell** box, enter **B3**.
5. Click **OK** to close the **Data Table** dialog box and fill the what-if values into cells **D3:D5**.
6. Click the **RateAndVolume** sheet tab to display that worksheet.
7. Select cells **C2:E5**.
8. On the **Data** tab, in the **Data Tools** group, click the **What-If Analysis** button and then, in the list, click **Data Table**.
9. In the **Row input cell** box, enter **B4**.
10. In the **Column input cell** box, enter **B3**.
11. Click **OK** to close the **Data Table** dialog box and update your worksheet.

	A	B	C	D	E
1	**Revenue Increases**		**Revenue**		
2	Year	2012	$ 2,102,600.70	260,000	300,000
3	Increase	0%	2.00%	$ 2,306,200.00	$ 2,661,000.00
4	Package Count	237,582	4.75%	$ 2,313,350.00	$ 2,669,250.00
5	Rate	$ 8.85	9.25%	$ 2,325,050.00	$ 2,682,750.00
6					

CLEAN UP **Close the RateProjections workbook, saving your changes if you want to.**

Varying your data to get a specific result by using Goal Seek

When you run an organization, you must track how every element performs, both in absolute terms and in relation to other parts of the organization. Just as you might want to reward your employees for maintaining a perfect safety record and keeping down your insurance rates, you might also want to stop carrying products you cannot sell.

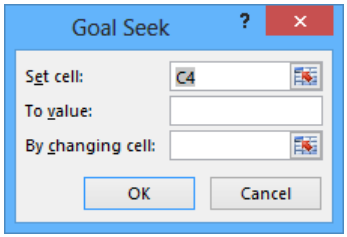
When you plan how you want to grow your business, you should have specific goals in mind for each department or product category. For example, Lori Penor of Consolidated Messenger might have the goal of reducing the firm's labor costs by 20 percent as compared to the previous year. Finding the labor amount that represents a 20-percent decrease is simple, but expressing goals in other ways can make finding the solution more challenging. Instead of decreasing labor costs 20 percent over the previous year, Lori might want to decrease labor costs so they represent no more than 20 percent of the company's total outlay.

As an example, consider a worksheet that holds cost figures for Consolidated Messenger's operations and uses those figures to calculate both total costs and the share each category has of that total.

	A	B	C	D	E	F	G	H
1								
2			Labor	Transportation	Taxes	Facilities	Total	
3		Cost	$ 18,000,382.00	$35,000,000.00	$ 7,000,000.00	$ 19,000,000.00	**$ 79,000,382.00**	
4		Share	22.79%	44.30%	8.86%	24.05%		
5								

IMPORTANT In the worksheet, the values in the Share row are displayed as percentages, but the underlying values are decimals. For example, Excel represents *0.3064* as *30.64%*.

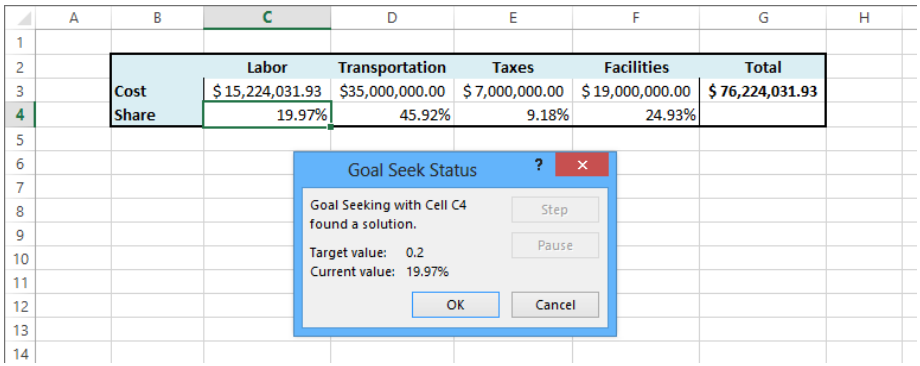
Although it would certainly be possible to figure the target number that would make labor costs represent 20 percent of the total, there is an easier way to do it in Excel: by using Goal Seek. To use Goal Seek, you display the Data tab and then, in the Data Tools group, click What-If Analysis. On the menu that is displayed, click Goal Seek to open the Goal Seek dialog box.



IMPORTANT If you save a workbook with the results of a Goal Seek calculation in place, you will overwrite the values in your workbook.

In the dialog box, you identify the cell that has the target value; in this example, it is cell C4, which has the percentage of costs accounted for by the Labor category. The To Value field has the target value (.2, which is equivalent to 20 percent), and the By Changing Cell field identifies the cell that has the value Excel should change to generate the target value of 20 percent in cell C4. In this example, the cell to be changed is C3.

Clicking OK tells Excel to find a solution for the goal you set. When Excel finishes its work, the new values appear in the designated cells, and the Goal Seek Status dialog box opens.

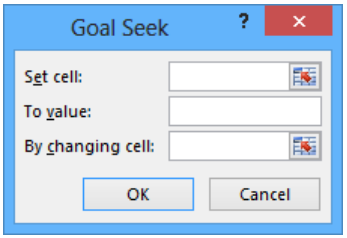


TIP Goal Seek finds the closest solution it can without exceeding the target value. In this case, the closest percentage it could find was 19.97 percent.

In this exercise, you'll use Goal Seek to determine how much you need to decrease transportation costs so that those costs make up no more than 40 percent of Consolidated Messenger's operating costs.

SET UP **You need the TargetValues workbook located in the Chapter08 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1 On the **Data** tab, in the **Data Tools** group, click the **What-If Analysis** button, and then, in the list, click **Goal Seek** to open the **Goal Seek** dialog box.

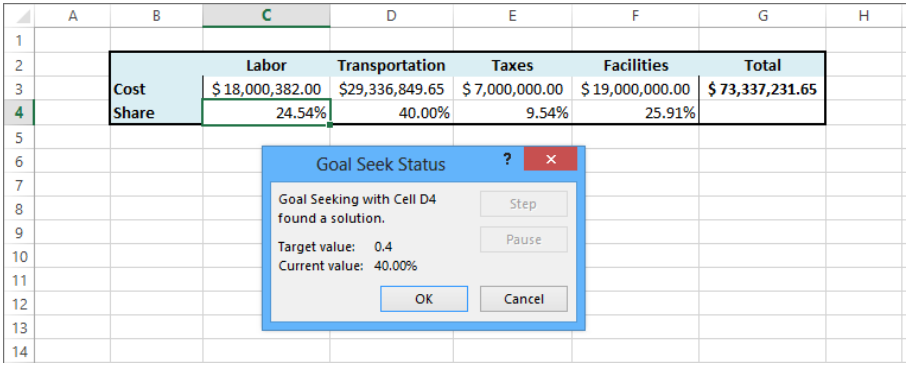


2 In the **Set cell** field, enter **D4**.

3 In the **To value** field, enter **40%**.

4 In the **By changing cell** field, enter **D3**.

5 Click **OK** to display the solution in both the worksheet and the **Goal Seek Status** dialog box. The target value of 0.4 is equivalent to the 40 percent value you entered earlier.



6 Click **Cancel** to close the **Goal Seek Status** dialog box without saving the new worksheet values.

CLEAN UP **Close the TargetValues workbook, saving your changes if you want to.**

Finding optimal solutions by using Solver

Goal Seek is a great tool for finding out how much you need to change a single input value to generate a desired result from a formula, but it's of no help if you want to find the best mix of several input values. For example, marketing vice president Craig Dewar might want to advertise in four national magazines to drive customers to Consolidated Messenger's website, but he might not know the best mix of ads to reach the greatest number of readers. He asked the publishers for ad pricing and readership numbers, which he recorded in a spreadsheet, along with the minimum number of ads per publication (three) and the minimum number of times he wants the ad to be seen (10,000,000). Because one of the magazines has a high percentage of corporate executive readers, Craig does want to take out at least four ads in that publication, despite its relatively low readership. The goal of the ad campaign is for the ads to be seen as many times as possible without costing the company more than the $3,000,000 budget.

Magazine	Cost per Ad	Readers	Number of Ads	Total Cost	Audience
Mag1	$ 30,000.00	100,000	8	$ 240,000.00	800,000
Mag2	$ 40,000.00	400,000	8	$ 320,000.00	3,200,000
Mag3	$ 27,000.00	350,000	8	$ 216,000.00	2,800,000
Mag4	$ 80,000.00	200,000	10	$ 800,000.00	2,000,000
Totals				**$ 1,576,000.00**	**8,800,000**

Constraints		
	Total Budget	$ 3,000,000.00
	Minimum Audience	10,000,000
	Minimum Ads for Magazines 1 through 3	8
	Minimum Ads for Magazine 4	10
	Maximum Ads in Any Magazine	20

TIP It helps to spell out every aspect of your problem so that you can identify the cells you want Solver to use in its calculations.

If you performed a complete installation when you installed Excel on your computer, the Solver button is available on the Data tab in the Analysis group. If not, you need to install the Solver Add-In. To do so, click the File tab, and then click Options. In the Excel Options dialog box, click Add-Ins to display the Add-Ins page. At the bottom of the dialog box, in the Manage list, click Excel Add-Ins, and then click Go to display the Add-Ins dialog box. Select the Solver Add-In check box and click OK to install Solver.

TIP You might be prompted for the Microsoft Office system installation CD. If so, put the CD in your CD drive, and click OK.