Excel For Decision Making

EXCEL FOR DECISION MAKING

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Cover by Tamás Szoboti.

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CHAPTER 1 –
FUNDAMENTAL SKILLS

Microsoft® Excel® is a tool that can be used in virtually all careers and is valuable in both professional and personal settings. Whether you need to keep track of medications in inventory for a hospital or create a financial plan for your retirement, Excel enables you to do these activities efficiently and accurately. This chapter introduces the fundamental skills necessary to get you started in using Excel. You will find that just a few skills can make you very productive in a short period of time.

This core Microsoft® Excel® text provides students with the skills needed to execute many personal and professional activities. It also prepares them to go on to more advanced skills using the Excel software. The text takes the approach of making decisions using Excel. Personal decisions introduced include important purchases, such as homes and automobiles, savings for retirement, and personal budgets. Professional decisions include budgets for managing expenses, merchandise items to mark down or discontinue, and inventory management. Students are given clear, easy-to-follow

instructions for each skill presented and are also provided with opportunities to learn additional skills related to the personal or professional objectives presented. For example, students learn the key terms with respect to home mortgages and understand the impact interest rates have on monthly mortgage payments. This text also places an emphasis on "what-if" scenarios so students gain an appreciation for the computational power of the Excel application. In addition, students learn how Excel is used with Microsoft® Word® and Microsoft® PowerPoint® to accomplish a variety of personal and professional objectives.

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1.1 OVERVIEW OF MICROSOFT EXCEL

Learning Objectives

1. Examine the value of using Excel to make decisions.

2. Learn how to start Excel.

3. Become familiar with the Excel workbook.

4. Understand how to navigate worksheets.

5. Examine the Excel Ribbon.

6. Examine the right-click menu options.

7. Learn how to save workbooks.

8. Examine the Status Bar.

9. Become familiar with the features in the Excel Help window.

Microsoft® Office contains a variety of tools that help people accomplish many personal and professional objectives. Microsoft Excel is perhaps the most versatile and widely used of all the Office applications. No matter which career path you choose, you will likely need to use Excel to accomplish your professional objectives, some

of which may occur daily. This chapter provides an overview of the Excel application along with an orientation for accessing the commands and features of an Excel workbook.

MAKING DECISIONS WITH EXCEL

Taking a very simple view, Excel is a tool that allows you to enter quantitative data into an electronic spreadsheet to apply one or many mathematical computations. These computations ultimately convert that quantitative data into information. The information produced in Excel can be used to make decisions in both professional and personal contexts. For example, employees can use Excel to determine how much inventory to buy for a clothing retailer, how much medication to administer to a patient, or how much money to spend to stay within a budget. With respect to personal decisions, you can use Excel to determine how much money you can spend on a house, how much you can spend on car lease payments, or how much you need to save to reach your retirement goals. We will demonstrate how you can use Excel to make these decisions and many more throughout this text.

Figure 1.1 shows a completed Excel worksheet that will be constructed in this chapter. The information shown in this worksheet is top-line sales data for a hypothetical merchandise retail company. The worksheet data can help this retailer determine the number of salespeople needed for each month, how much inventory is needed to satisfy sales, and what types of products should be purchased.

General Merchandise World Retail Sales (in millions)			
Month	Unit Sales	Average Price	Sales Dollars
January	2,670	$ 9.99	$ 26,685
February	2,160	$ 12.49	$ 26,937
March	515	$ 14.99	$ 7,701
April	590	$ 17.49	$ 10,269
May	1,030	$ 14.99	$ 15,405
June	2,875	$ 12.49	$ 35,916
July	2,700	$ 9.99	$ 26,937
August	900	$ 19.99	$ 17,958
September	775	$ 19.99	$ 15,708
October	1,180	$ 19.99	$ 23,562
November	1,800	$ 17.49	$ 31,416
December	3,560	$ 14.99	$ 53,370
Total Sales	20,755		$ 291,864

Figure 1.1 Example of an Excel Worksheet

STARTING EXCEL

1. Locate Excel on your computer.

2. Click Microsoft Excel to launch the Excel application and present you with workbook options.

3. Click the first option; "Blank Workbook".

THE EXCEL WORKBOOK

Once Excel is started, a blank workbook will open on

your screen. A workbook is an Excel file that contains one or more worksheets (sometimes referred to as spreadsheets). Excel will assign a file name to the workbook, such as **Book1**, **Book2**, **Book3**, and so on, depending on how many new workbooks are opened. **Figure 1.2** shows a blank workbook after starting Excel. Take some time to familiarize yourself with this screen. Your screen may be slightly different based on the version you're using.
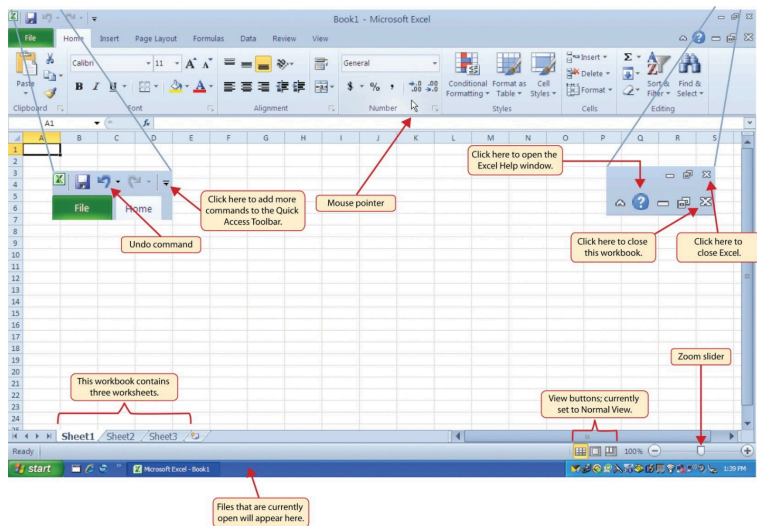
Figure 1.2 Blank Workbook

Your workbook should already be maximized (or shown at full size) once Excel is started, as shown in **Figure 1.2**. However, if your screen looks like **Figure 1.3** after starting Excel, you should click the Maximize button, as shown in the figure.
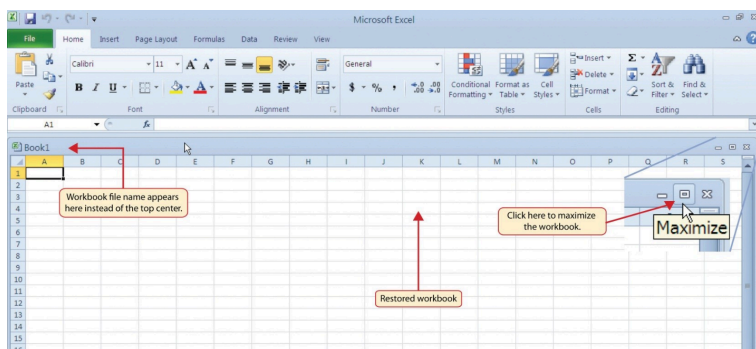
Figure 1.3 Restored Worksheet

NAVIGATING WORKSHEETS

Data are entered and managed in an Excel worksheet. The worksheet contains several rectangles called cells for entering numeric and nonnumeric data. Each cell in an Excel worksheet contains an address, which is defined by a column letter followed by a row number. For example, the cell that is currently activated in **Figure 1.3** is A1. This would be referred to as cell location A1 or cell reference A1. The following steps explain how you can navigate in an Excel worksheet:

1. Place your mouse pointer over cell D5 and left click.

2. Check to make sure column letter D and row number 5 are highlighted, as shown in **Figure 1.4**.

Note: Your highlighted column letter and row number may be different than the figure shown.
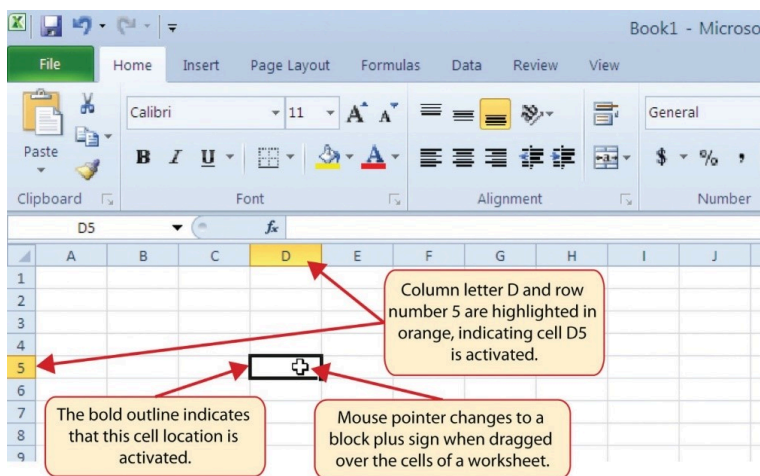
Figure 1.4 Activating a Cell Location

1. Move the mouse pointer to cell A1.

2. Click and hold the left mouse button and drag the mouse pointer back to cell D5.

3. Release the left mouse button. You should see several cells highlighted, as shown in **Figure 1.5**.

This is referred to as a *cell range* and is documented as follows: **A1:D5**. Any two cell locations separated by a colon are known as a cell range. The first cell is the top left corner of the range and the second cell is the lower right corner of the range.

The cell range A1:D5 is highlighted.

Click the tab to open the worksheet

Click here to add a new worksheet to the workbook

Insert Worksheet (Shift+F11)
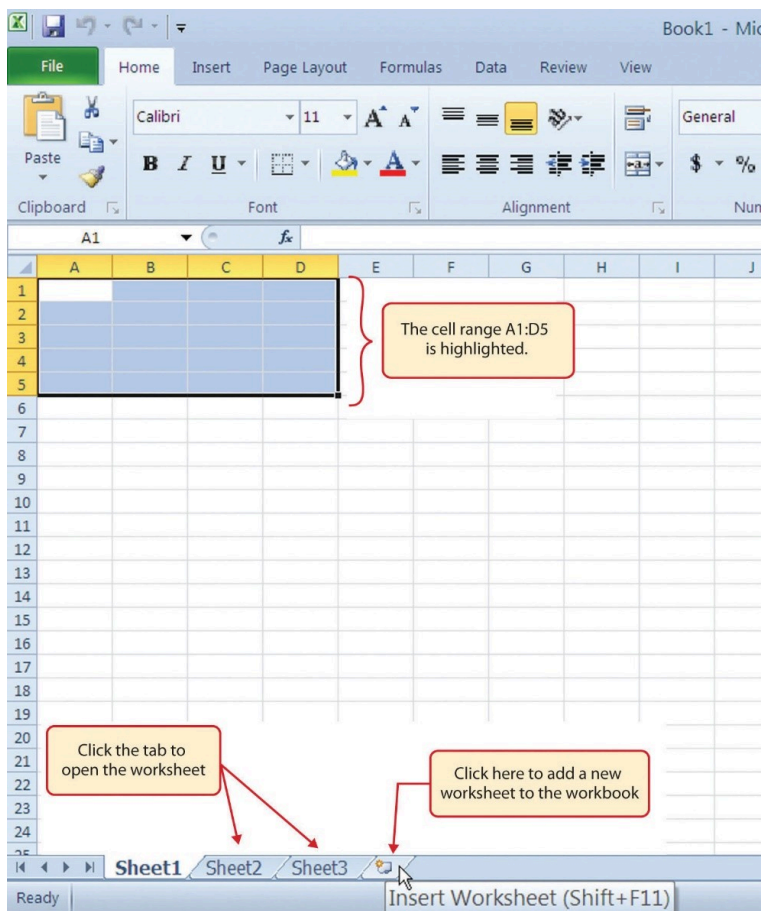
Figure 1.5 Highlighting a Range of Cells and adding a new sheet.

1. At the bottom of the screen, you'll see worksheets (Sheet 1, Sheet 2, Sheet 3 shown similar to how tabs look in a file folder). Depending on your version of Excel, you will see either three as displayed above or just one. If you only have one sheet, click the "Insert Worksheet" to add a worksheet.

19						
20				Click here to add a new worksheet to the workbook		
21						
22						
23						

◄ ► **Sheet1** ⊕

READY

11	
12	
13	Insert...
14	☒ Delete
15	Rename
16	Move or Copy...
17	
18	💠 View Code
19	🔒 Protect Sheet...
20	Tab Color ►
21	Hide
22	
23	Unhide...
	Select All Sheets

◄ ► **Sheet1** ⊕

READY
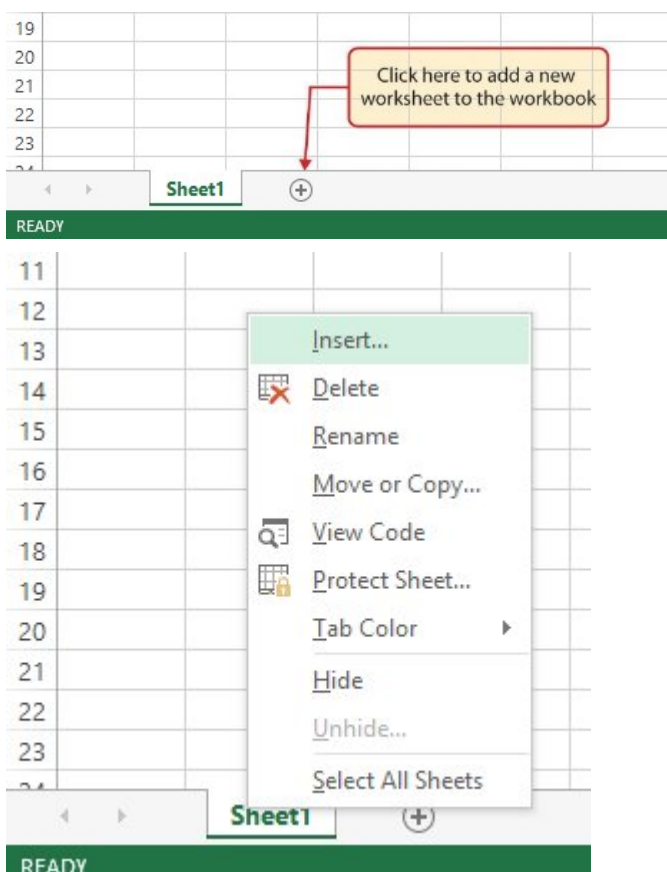
Depending on your version, you instead may have a + sign; a click on the + adds an additional worksheet as well. This is how you open or add a worksheet within a workbook. You can also right-click the Sheet name and select Insert from the list of features that appear. Add another worksheet so that you have a total of three sheets displaying here.

2. Click the Sheet1 worksheet tab at the bottom of the worksheet to return to the worksheet shown in **Figure 1.5**.

THE EXCEL RIBBON

Excel's features and commands are found in the Ribbon, which is the upper area of the Excel screen that contains several tabs running across the top. Each tab provides access to a different set of Excel commands. **Figure 1.6** shows the commands available in the Home tab of the Ribbon. **Table 1.1 "Command Overview for Each Tab of the Ribbon"** provides an overview of the commands that are found in each tab of the Ribbon.
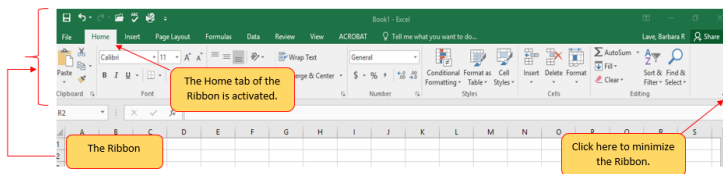
Figure 1.6 Home Tab of Ribbon

Table 1.1 Command Overview for Each Tab of the Ribbon

Tab Name	Description of Commands
File	Also known as the Backstage view of the Excel workbook. Contains all commands for opening, closing, saving, and creating new Excel workbooks. Includes print commands, document properties, e-mailing options, and help features. The default settings and options are also found in this tab.
Home	Contains the most frequently used Excel commands. Formatting commands are found in this tab along with commands for cutting, copying, pasting, and for inserting and deleting rows and columns.
Insert	Used to insert objects such as charts, pictures, shapes, PivotTables, Internet links, symbols, or text boxes.
Page Layout	Contains commands used to prepare a worksheet for printing. Also includes commands used to show and print the gridlines on a worksheet.
Formulas	Includes commands for adding mathematical functions to a worksheet. Also contains tools for auditing mathematical formulas.
Data	Used when working with external data sources such as Microsoft® Access®, text files, or the Internet. Also contains sorting commands and access to scenario tools.
Review	Includes Spelling and Track Changes features. Also contains protection features to password protect worksheets or workbooks.
View	Used to adjust the visual appearance of a workbook. Common commands include the Zoom and Page Layout view.

The Ribbon shown in **Figure 1.6** is full, or maximized. The benefit of having a full Ribbon is that the commands are always visible while you are developing a worksheet. However, depending on the screen dimensions of your computer, you may find that the Ribbon takes up too much vertical space on your worksheet. If this is the case,

you can minimize the Ribbon by clicking the button shown in **Figure 1.6**. When minimized, the Ribbon will show only the tabs and not the command buttons. When you click on a tab, the command buttons will appear until you select a command or click anywhere on your worksheet.

<div>

Keyboard Shortcuts

Minimizing or Maximizing the Ribbon

- Hold down the CTRL key and press the F1 key.
- Hold down the CTRL key and press the F1 key again to maximize the Ribbon.

</div>

QUICK ACCESS TOOLBAR AND RIGHT-CLICK MENU

The Quick Access Toolbar is found at the upper left side of the Excel screen above the Ribbon, as shown in **Figure 1.7**. This area provides access to the most frequently used commands, such as Save and Undo. You can customize the Quick Access Toolbar by adding commands that you use on a regular basis. By placing these commands in the Quick Access Toolbar, you do not have to navigate through the Ribbon to find them. To customize the Quick Access Toolbar, click the down arrow as shown in **Figure 1.7**. This will open a menu of commands that you can add to the Quick Access Toolbar. If you do not see the command you are looking for on the list, select the More Commands option.
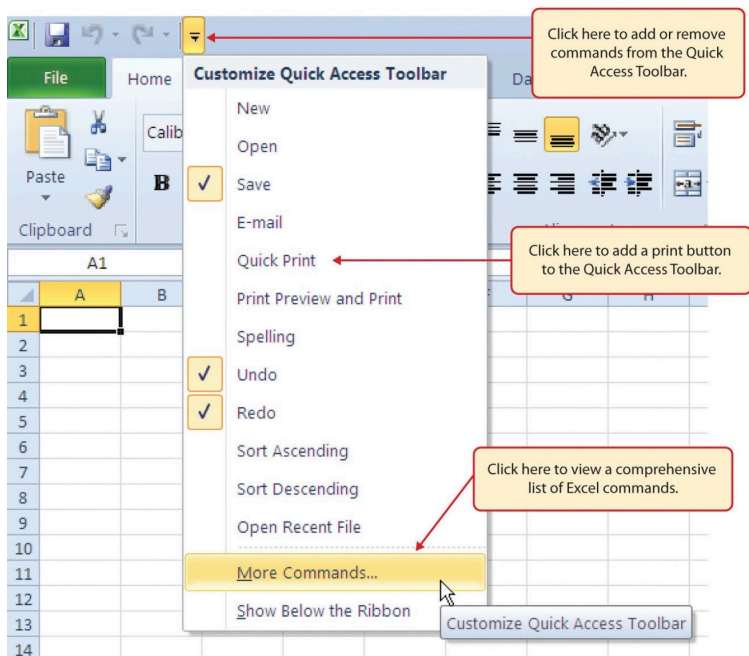
Figure 1.7 Customizing the Quick Access Toolbar

In addition to the Ribbon and Quick Access Toolbar, you can also access commands by right clicking anywhere on the worksheet. **Figure 1.8** shows an example of the commands available in the right-click menu.
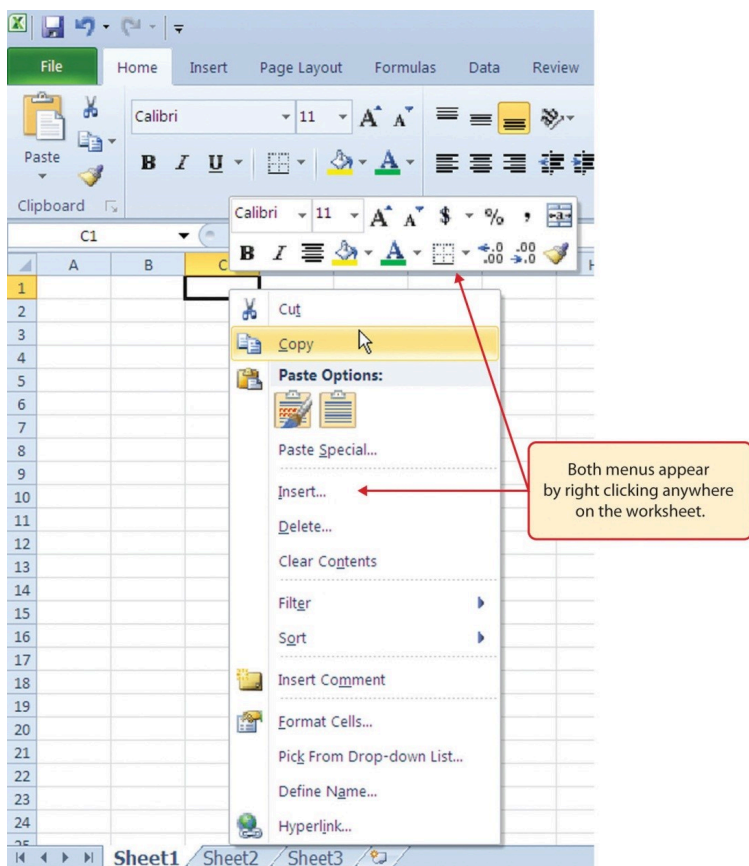
Figure 1.8 Right-Click Menu

THE FILE TAB

The File tab is also known as the **Backstage** view of the workbook. It contains a variety of features and commands related to the workbook that is currently open, new workbooks, or workbooks stored in other locations on your computer or network. **Figure 1.9** shows the options available in the File tab or Backstage view. To leave the Backstage view and return

to the worksheet, click the arrow in the upper left-hand corner as shown below.
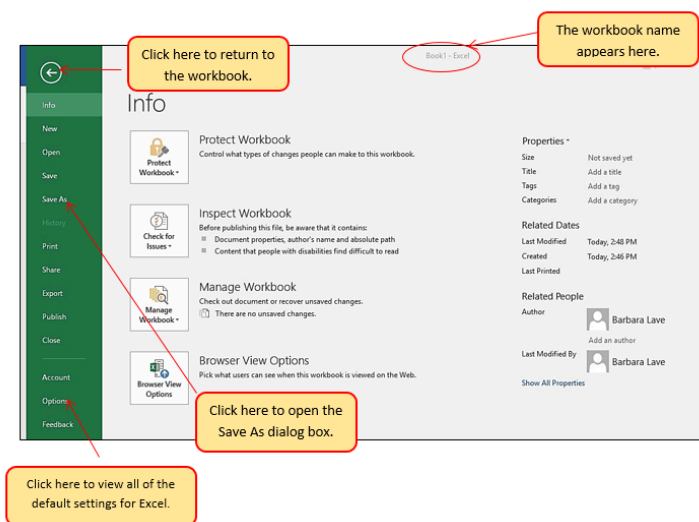
Figure 1.9 File Tab or Backstage View of a Workbook

Included in the File tab are the default settings for the Excel application that can be accessed and modified by clicking the Options button. **Figure 1.10** shows the Excel Options window, which gives you access to settings such as the default font style, font size, and the number of worksheets that appear in new workbooks.
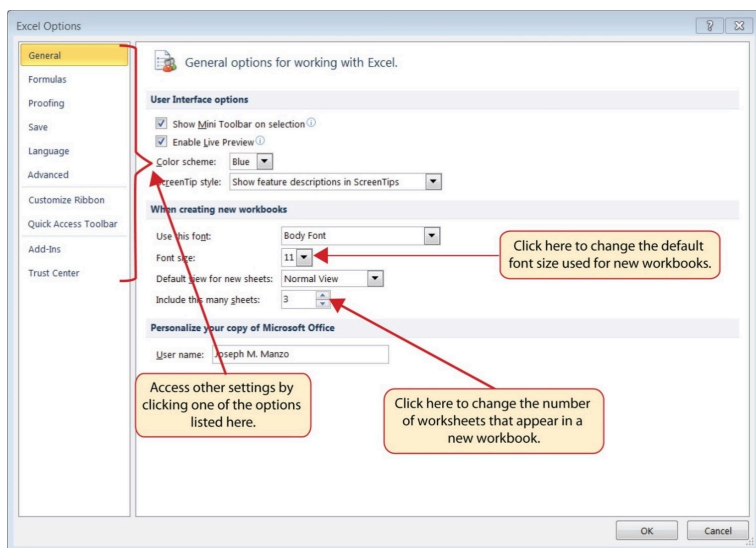
Figure 1.10 Excel Options Window

SAVING WORKBOOKS (SAVE AS)

Once you create a new workbook, you will need to change the file name and choose a location on your computer or network to save that file. It is important to remember where you save this workbook on your computer or network as you will be using this file in the **Section 1.2 "Entering, Editing, and Managing Data"** to construct the workbook shown in **Figure 1.1**. The process of saving can be different with different versions of Excel. Please be sure you follow the steps for the version of Excel you are using. The following steps explain how to save a new workbook and assign it a file name.

SAVING WORKBOOKS IN EXCEL 2013

1. If you have not done so already, open a blank

workbook in Excel.

2. When saving your workbook for the *first* time, click the File tab.

3. Click the **Save As** button in the upper left side of the Backstage view window. This will open the **Save As** dialog box, as shown in **Figure 1.11**.

4. Click in the File Name box at the bottom of the **Save As** dialog box and use the BACKSPACE key to remove the current default name of the workbook.

5. Type the file name: **CH1 GMW Sales Data**.

6. Click the Desktop button on the left side of the **Save As** dialog box if you wish to save this file on your desktop. If you want to save this workbook in a different location, such as a USB drive, select your preferred location.

7. Click the Save button on the lower right side of the **Save As** dialog box.

8. As you continue to work on your workbook, you will want to Save frequently by clicking either the Save button on the Home ribbon; or by selecting the Save option from the File menu.
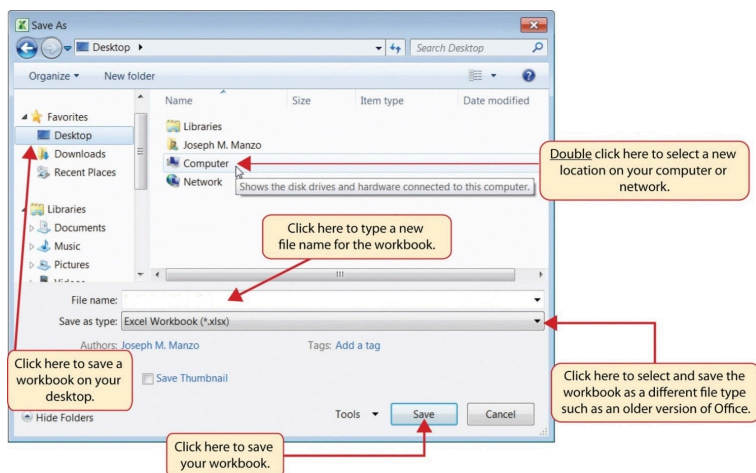
Figure 1.11 Save As Dialog Box in Excel 2013

SAVING WORKBOOKS IN EXCEL 2016

1. If you have not done so already, open a blank workbook in Excel.

2. Click the File tab and then the **Save As** button in the left side of the Backstage view window. This will open the **Save As** dialog box.

3. Determine a location for saving on your computer by clicking **Browse** on the left side to open the **Save As** dialog box.

4. Click in the File Name box near the bottom of the **Save As** dialog box. Type the new file name: **CH1 GMW Sales Data**

5. Review the settings in the screen for correctness and click the Save button.
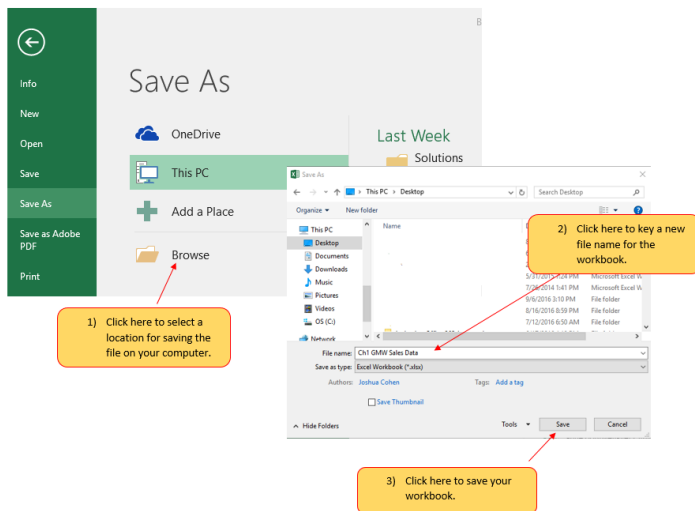
Figure 1.12 Save As Dialog in 2016

Keyboard Shortcuts

"Save" and "Save As"

- CTRL+S will call up the Save As dialog box. If you have already saved your file, CTRL+S will save your progress from the last auto-save point. All Office applications will Save AutoRecover information at specific intervals (usually every 10 minutes), you can edit this setting to 5 minutes or to every minute under File > Options > Excel Options > Save workbooks.

Excel Options

General
Formulas
Proofing
Save
Language
Advanced
Customize Ribbon

Customize how workbooks are saved.

Save workbooks

Save files in this format: Excel Workbook

☑ Save AutoRecover information every 10 minutes
  ☑ Keep the last aut

Enter a whole number from 1 to 120

AutoRecover file locatio   Roaming\Mi
☐ Don't show the Backstage when opening or saving files
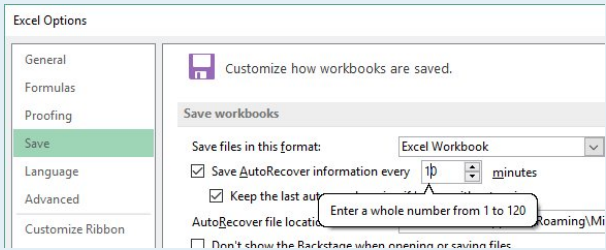
- Press the F12 key and use the tab and arrow keys to navigate around the Save As dialog box. Use the ENTER key to make a selection.

- Or press the ALT key on your keyboard. You will see letters and numbers, called Key Tips, appear on the Ribbon. Press the F key on your keyboard for the File tab and then the A key. This will open the Save As dialog box.

Skill Refresher

Saving Workbooks (Save As)

1. Click the File tab on the Ribbon.

2. Click the Save As option.

3. Select a location on your PC.

4. Click in the File name box and type a new file name if needed.

5. Click the down arrow next to the "Save as type" box and select the appropriate file type if needed.

6. Click the Save button.

THE STATUS BAR

The Status Bar is located below the worksheet tabs on the Excel screen (see Figure 1.13). It displays a variety of information, such as the status of certain keys on your keyboard (e.g., CAPS LOCK), the available views for a workbook, the magnification of the screen, and mathematical functions that can be performed when data are highlighted on a worksheet. You can customize the Status Bar as follows:

1. Place the mouse pointer over any area of the Status Bar and right click to display the "Customize Status Bar" list of options (**see Figure 1.13**).

2. Select the Caps Lock option from the menu (see **Figure 1.13**).

3. Press the CAPS LOCK key on your keyboard. You will see the Caps Lock indicator on the lower right side of the Status Bar.

4. Press the CAPS LOCK on your keyboard again. The indicator on the Status Bar goes away.
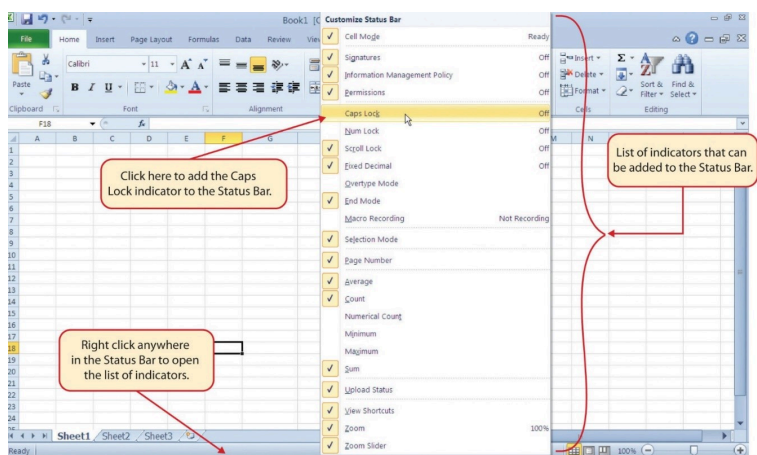
Figure 1.13 Customizing the Status Bar

EXCEL HELP

The Help feature provides extensive information about the Excel application. Although some of this information may be stored on your computer, the Help window will automatically connect to the Internet, if you have a live connection, to provide you with resources that can answer most of your questions. You can open the Excel Help window by clicking the question mark in the upper right area of the screen or ribbon. With newer versions of Excel, use the query box to enter your question and select from helpful option links or select the question mark from the dropdown list to launch Excel Help windows.
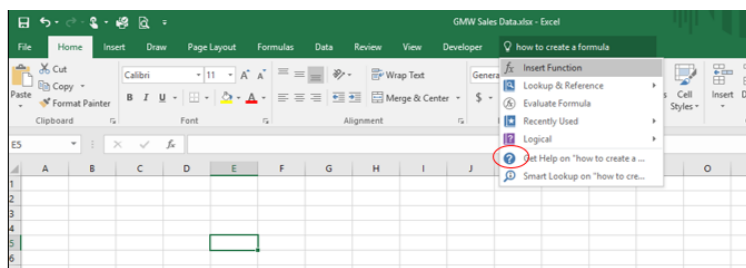
Figure 1.14 Excel Help Window

Keyboard Shortcuts

Excel Help

- Press the F1 key on your keyboard.

Key Takeaways

- Excel is a powerful tool for processing data for the purposes of making decisions.

- You can find Excel commands throughout the tabs in the Ribbon.

- You can customize the Quick Access Toolbar by adding commands you frequently use.

- You can add or remove the information that is displayed on the Status Bar.

- The Help window provides you with extensive information about Excel.

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Media Attributions

- NewSheet
- NewSheet_B
- figure_1-6_ribbon_for_excel
- figure-1-9
- figure_1-12_save_as_dialog_box_in_2016
- autosave
- 1-14_excel_help_window

1.2 ENTERING, EDITING, AND MANAGING DATA

Learning Objectives

1. Understand how to enter data into a worksheet.

2. Examine how to edit data in a worksheet.

3. Examine how Auto Fill is used when entering data.

4. Understand how to delete data from a worksheet and use the Undo command.

5. Examine how to adjust column widths and row heights in a worksheet.

6. Understand how to hide columns and rows in a worksheet.

7. Examine how to insert columns and rows into a worksheet.

8. Understand how to delete columns and rows from a worksheet.

9. Learn how to move data to different locations in a worksheet.

In this section, we will begin the development of the workbook shown in **Figure 1.1**. The skills covered in this section are typically used in the early stages of developing one or more worksheets in a workbook.

ENTERING DATA

You will begin building the workbook shown in **Figure 1.1** by manually entering data into the worksheet. The following steps explain how the column headings in Row 2 are typed into the worksheet:

1. Click cell location A2 on the worksheet.

2. Type the word **Month**.

3. Press the RIGHT ARROW key. This will enter the word into cell A2 and activate the next cell to the right.

4. Type **Unit Sales** and press the RIGHT ARROW key.

5. Repeat step 4 for the words **Average Price** and then again for **Sales Dollars**.

Figure 1.15 shows how your worksheet should appear after you have typed the column headings into Row 2. Notice that the word **Price** in cell location C2 is not visible. This is because the column is too narrow to fit the entry you typed. We will examine formatting techniques to correct this problem in the next section.
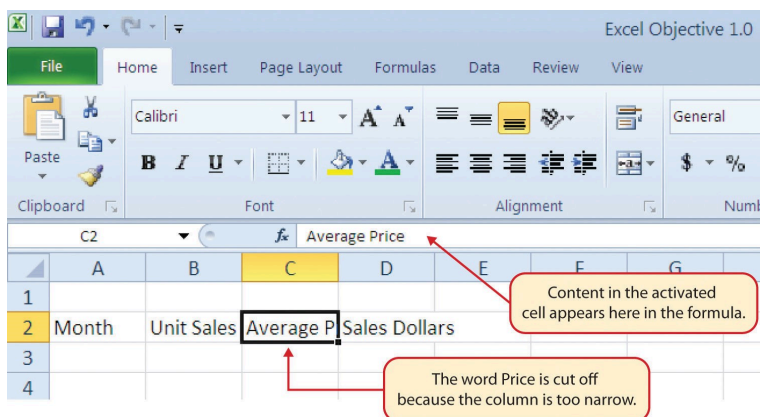
Figure 1.15 Entering Column Headings into a Worksheet

Integrity Check

Column Headings

It is critical to include column headings that accurately describe the data in each column of a worksheet. In professional environments, you will likely be sharing Excel workbooks with coworkers. Good column headings reduce the chance of someone misinterpreting the data contained in a worksheet, which could lead to costly errors depending on your career.

1. Click cell location B3.

2. Type the number **2670** and press the ENTER key. After you press the ENTER key, cell B4 will be activated. Using the ENTER key is an efficient way to enter data vertically down a column.

3. Enter the following numbers in cells B4 through B14: **2160**, **515, 590, 1030, 2875, 2700, 900, 775, 11 80, 1800**, and **3560**.

4. Click cell location C3.

5. Type the number **9.99** and press the ENTER key.

6. Enter the following numbers in cells C4 through C14: **12.49, 14.99, 17.49, 14.99, 12.49, 9.99, 19.99, 1 9.99, 19.99, 17.49**, and **14.99**.

7. Activate cell location D3.

8. Type the number 26685 and press the ENTER key.

9. Enter the following numbers in cells D4 through D14: **26937, 7701, 10269, 15405, 35916, 26937, 179 58, 15708, 23562, 31416**, and **53370**.

10. When finished, check that the data you entered matches **Figure 1.16**.

Why?

Avoid Formatting Symbols When Entering Numbers

When typing numbers into an Excel worksheet, it is best to avoid adding any formatting symbols such as dollar signs and commas. Although Excel allows you to add these symbols while typing numbers, it slows down the process of entering data. It is more efficient to use Excel's formatting features to add

these symbols to numbers after you type them into a worksheet.

Integrity Check

Data Entry

It is very important to proofread your worksheet carefully, especially when you have entered numbers. Transposing numbers when entering data manually into a worksheet is a common error. For example, the number **563** could be transposed to **536.** Such errors can seriously compromise the integrity of your workbook.

Integrity Check

Figure 1.16 shows how your worksheet should appear after entering the data. Check your numbers carefully to make sure they are accurately entered into the worksheet.
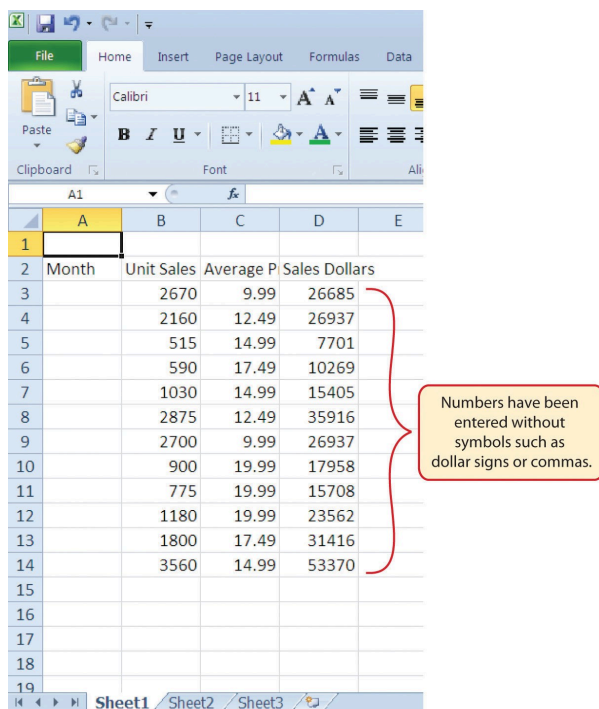
Figure 1.16 Completed Data Entry for Columns B, C, and D

EDITING DATA

Data that has been entered in a cell can be changed by double clicking the cell location or using the Formula Bar. You may have noticed that as you were typing data into a cell location, the data you typed appeared in the Formula Bar. The Formula Bar can be used for entering data into cells as well as for editing data that already exists in a cell. The following steps provide

an example of entering and then editing data that has been entered into a cell location:

1. Click cell A15 in the Sheet1 worksheet.

2. Type the abbreviation **Tot** and press the ENTER key.

3. Click cell A15.

4. Move the mouse pointer up to the Formula Bar. You will see the pointer turn into a cursor. Move the cursor to the end of the abbreviation **Tot** and left click.

5. Type the letters **al** to complete the word Total.

6. Click the checkmark to the left of the Formula Bar (see **Figure 1.17**). This will enter the change into the cell.
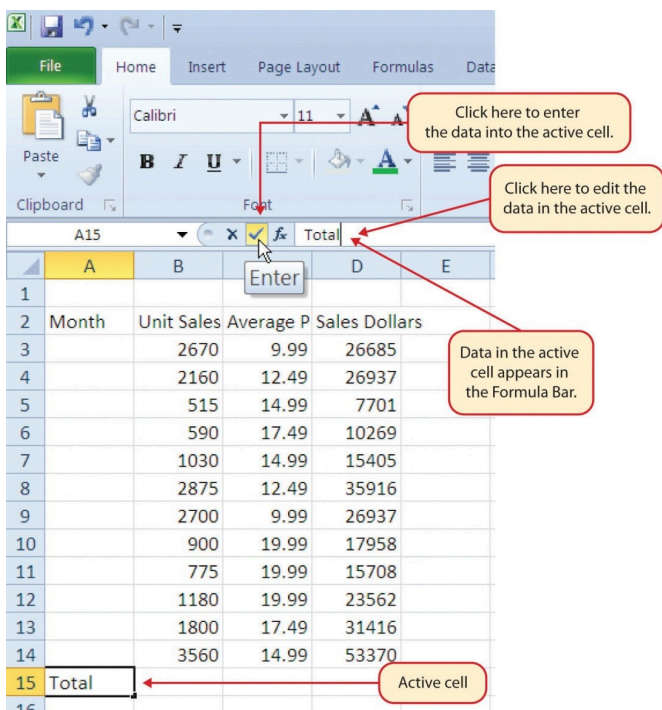
Figure 1.17 Using the Formula Bar to Edit and Enter Data

7. Double click cell A15.

8. Add a space after the word Total and type the word **Sales**.

9. Press the ENTER key.

Keyboard Shortcuts

Editing Data in a Cell

- Activate the cell that is to be edited and press the F2 key on your keyboard.

AUTO FILL

The Auto Fill feature is a valuable tool when manually entering data into a worksheet. This feature has many uses, but it is most beneficial when you are entering data in a defined sequence, such as the numbers 2, 4, 6, 8, and so on, or nonnumeric data such as the days of the week or months of the year. The following steps demonstrate how Auto Fill can be used to enter the months of the year in Column A:

1. Click cell A3 in the Sheet1 worksheet.

2. Type the word **January** and press the ENTER key.

3. Activate cell A3 again.

4. Move the mouse pointer to the lower right corner of cell A3. You will see a small square in this corner of the cell; this is called the Fill Handle (See **Figure 1.18**) When the mouse pointer gets close to the Fill Handle, the white block plus sign will turn into a black plus sign.
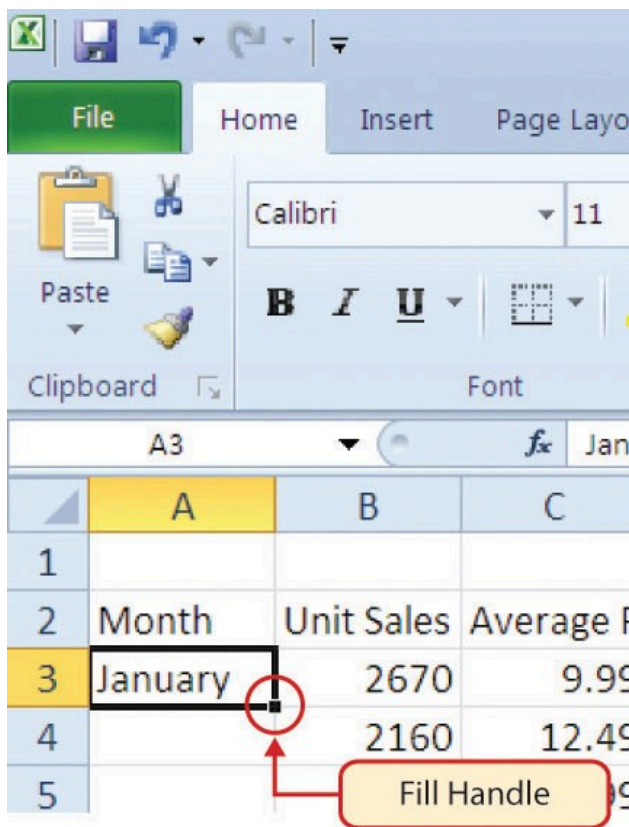
Figure 1.18 Fill Handle

Left click and drag the Fill Handle to cell A14. Notice that the Auto Fill tip box indicates what month will be placed into each cell (see **Figure 1.19**). Release the left mouse button when the tip box reads "December."
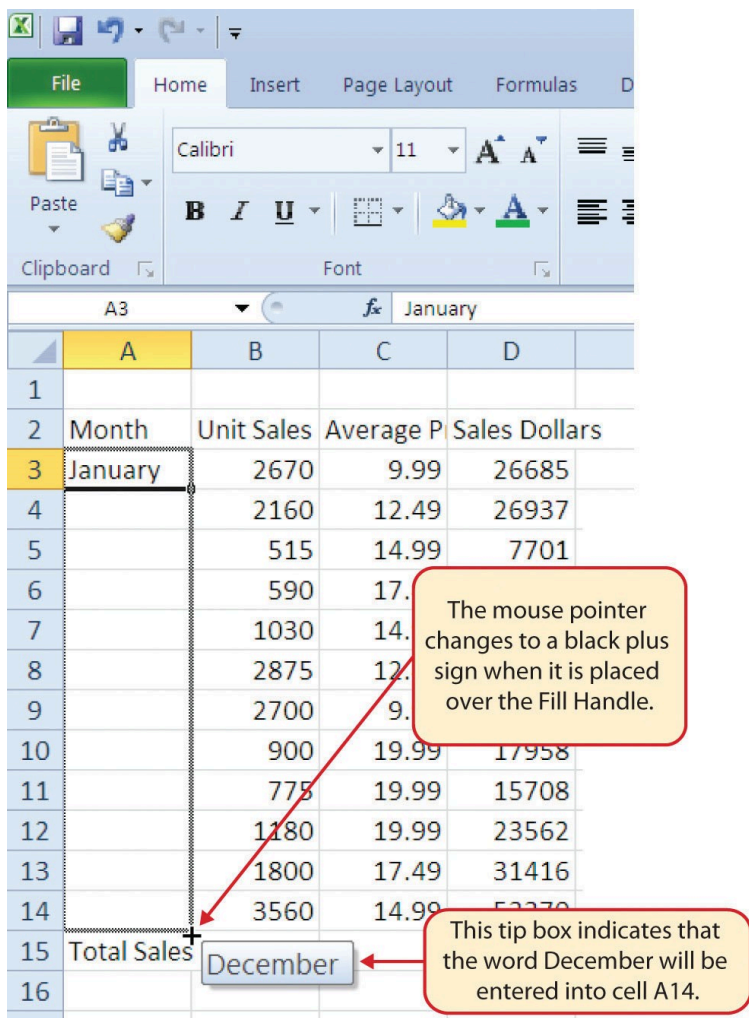
Figure 1.19 Using Auto Fill to Enter the Months of the Year

Once you release the left mouse button, all twelve months of the year should appear in the cell range A3:A14, as shown in **Figure 1.20**. You will also see the Auto Fill Options button. By clicking this button, you have several options for inserting data into a group of cells.
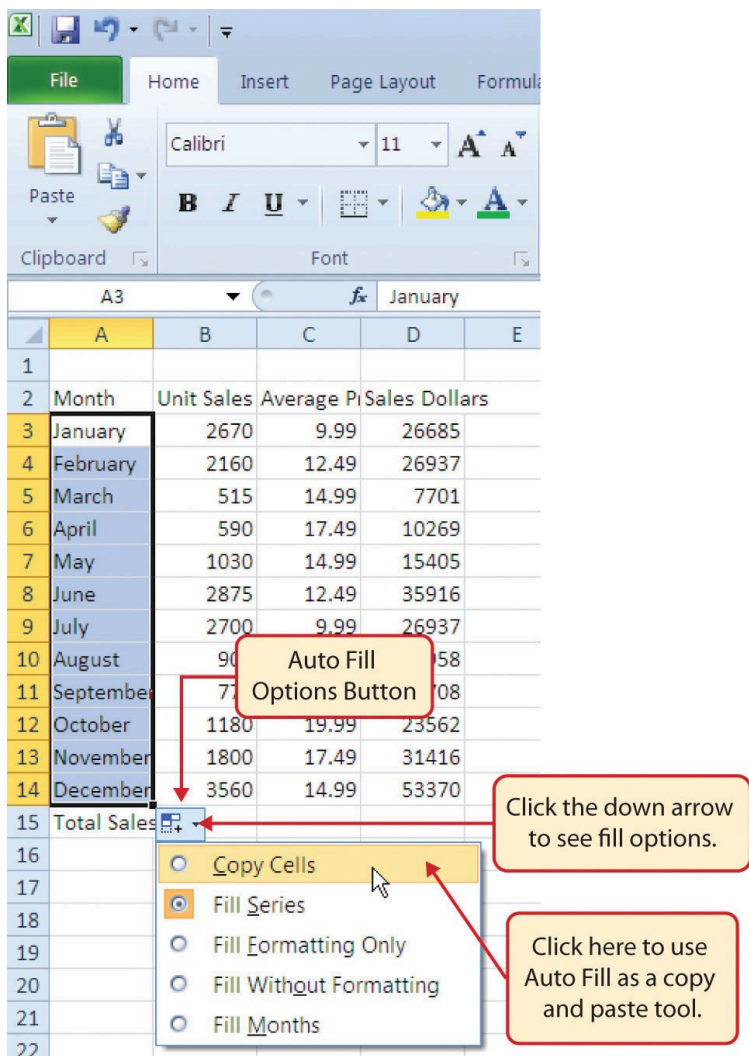
Figure 1.20 Auto Fill Options Button

1. Click the Auto Fill Options button.

2. Click the Copy Cells option. This will change the months in the range A4:A14 to January.

3. Click the Auto Fill Options button again.

4. Click the Fill Months option to return the months of the year to the cell range A4:A14. The Fill Series option will provide the same result.

DELETING DATA AND THE UNDO COMMAND

There are several methods for removing data from a worksheet, a few of which are demonstrated here. With each method, you use the Undo command. This is a helpful command in the event you mistakenly remove data from your worksheet. The following steps demonstrate how you can delete data from a cell or range of cells:

1. Click cell C2 by placing the mouse pointer over the cell and clicking the left mouse button.

2. Press the **DELETE** key on your keyboard. This removes the contents of the cell.

3. Highlight the range C3:C14 by placing the mouse pointer over cell C3. Then left click and drag the mouse pointer down to cell C14.

4. Place the mouse pointer over the Fill Handle. You will see the white block plus sign change to a black plus sign.

5. Click and drag the mouse pointer up to cell C3 (see **Figure 1.21**). Release the mouse button. The contents in the range C3:C14 will be removed.
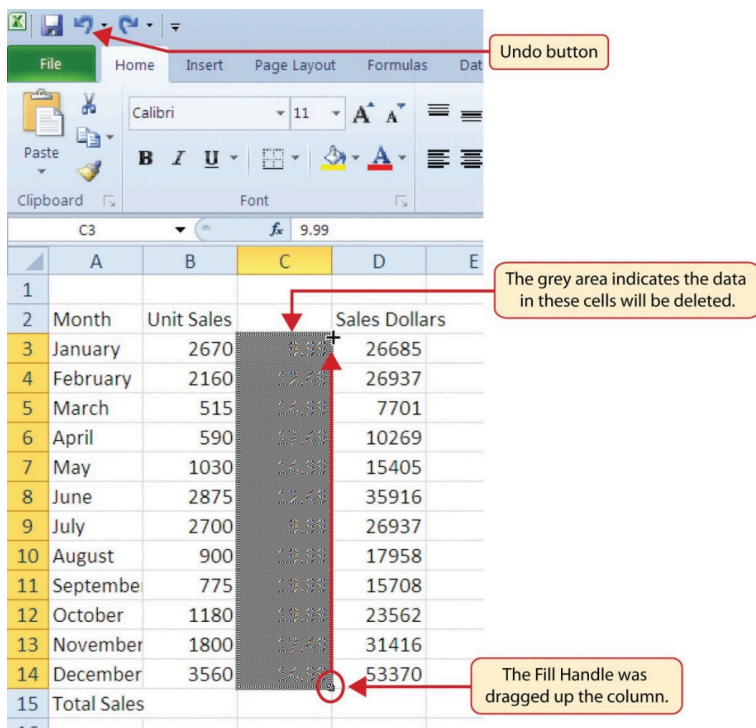
Figure 1.21 Using Auto Fill to Delete Contents of Cell

1. Click the Undo button in the Quick Access Toolbar (see **Figure 1.2**). This should replace the data in the range C3:C14.

2. Click the Undo button again. This should replace the data in cell C2.

Keyboard Shortcuts

Undo Command

- Hold down the CTRL key while pressing the letter Z on your keyboard.

- Highlight the range C2:C14 by placing the mouse pointer over cell C2. Then left click and drag the mouse pointer down to cell C14.

- Click the Clear button in the Home tab of the Ribbon, which is next to the Cells group of commands (see **Figure 1.22**). This opens a drop-down menu that contains several options for removing or clearing data from a cell. Notice that you also have options for clearing just the formats in a cell or the hyperlinks in a cell.

- Click the Clear All option. This removes the data in the cell range.

- Click the Undo button. This replaces the data in the range C2:C14.
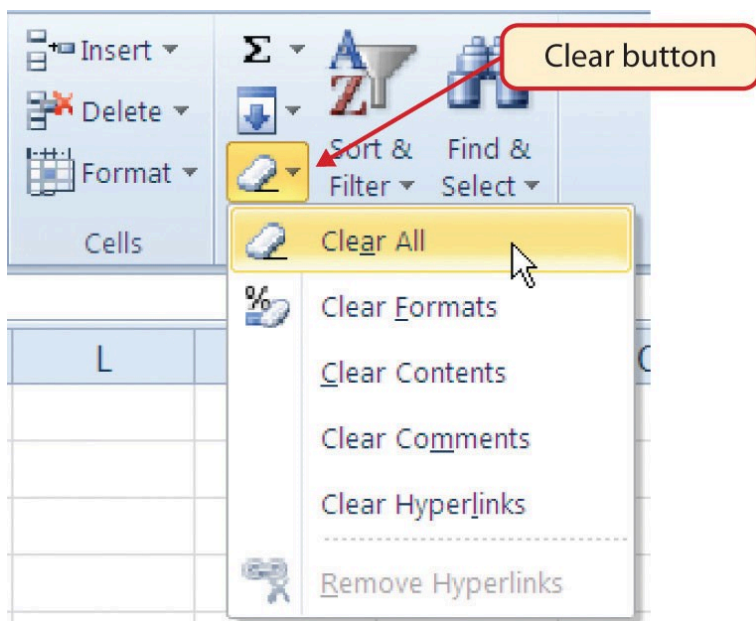
Figure 1.22 Clear Command Drop-Down Menu

ADJUSTING COLUMNS AND ROWS

There are a few entries in the worksheet that appear cut off. For example, the last letter of the word September cannot be seen in cell A11. This is because the column is too narrow for this word. The columns and rows on an Excel worksheet can be adjusted to accommodate the data that is being entered into a cell. The following steps explain how to adjust the column widths and row heights in a worksheet:

1. Bring the mouse pointer between Column A and Column B in the Sheet1 worksheet, as shown in **Figure 1.23**. You will see the white block plus sign turn into double arrows.

2. Click and drag the column to the right so the

entire word September in cell A11 can be seen. As you drag the column, you will see the column width tip box. This box displays the number of characters that will fit into the column using the Calibri 11-point font which is the default setting for font/size.

3. Release the left mouse button.
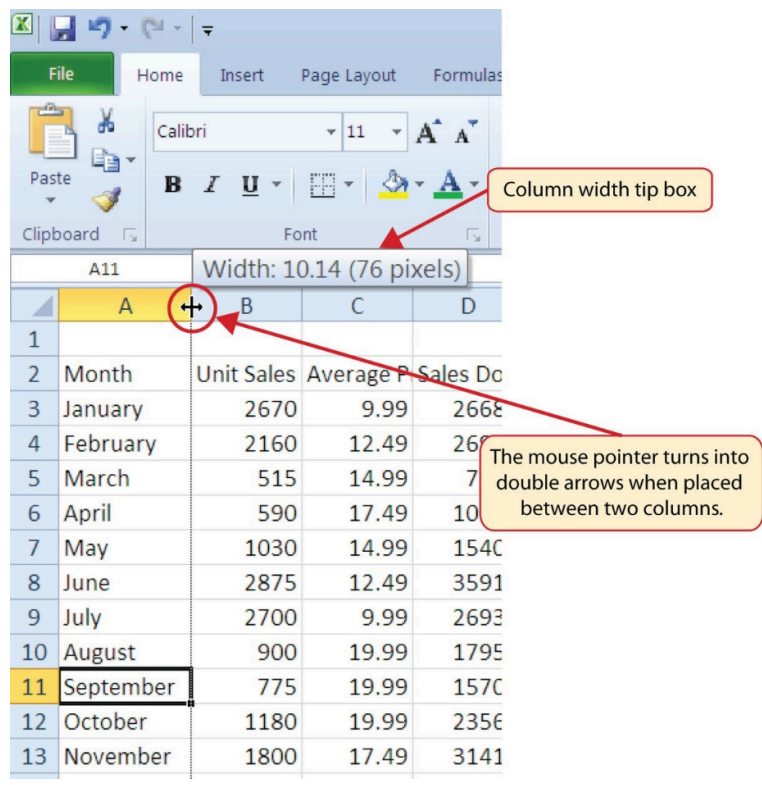
Figure 1.23 Adjusting Column Widths

You may find that using the click-and-drag method is inefficient if you need to set a specific character width for one or more columns. Steps 1 through 6 illustrate a

second method for adjusting column widths when using a specific number of characters:

1. Click any cell location in Column A by moving the mouse pointer over a cell location and clicking the left mouse button. You can highlight cell locations in multiple columns if you are setting the same character width for more than one column.

2. In the Home tab of the Ribbon, left click the Format button in the Cells group.

3. Click the Column Width option from the drop-down menu. This will open the Column Width dialog box.

4. Type the number **13** and click the OK button on the Column Width dialog box. This will set Column A to this character width (see **Figure 1.24**).

5. Once again bring the mouse pointer between Column A and Column B so that the double arrow pointer displays and then double-click to activate AutoFit. This feature adjusts the column width based on the longest entry in the column.

6. Use the Column Width dialog box (step 6 above) to reset the width to 13.
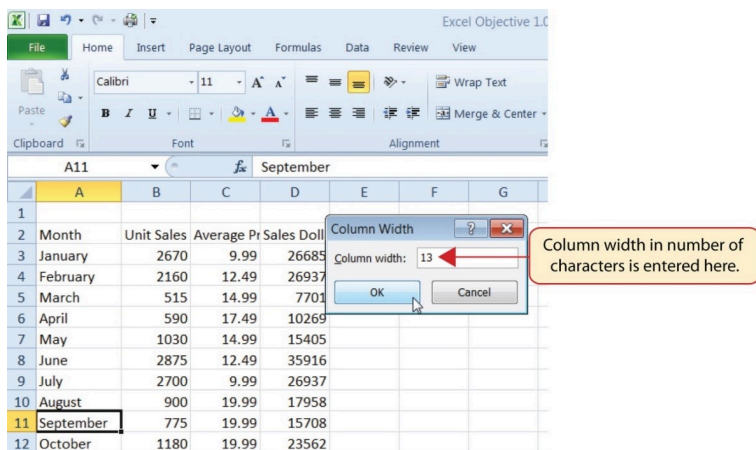
Figure 1.24 Column Width Dialog Box

Keyboard Shortcuts

Column Width

- To set the column width, press the ALT key on your keyboard, while having that still pressed, also press the letters H, O, and W one after another. You will see options highlighted on the ribbon as you press ALT+H, then O, then W. When you press W, you will see the width dialogue box show up. Edit your desired width here.

  Your Excel interface when pressing H while ALT is pressed in:
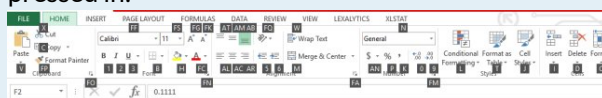
Your Excel interface when pressing O:
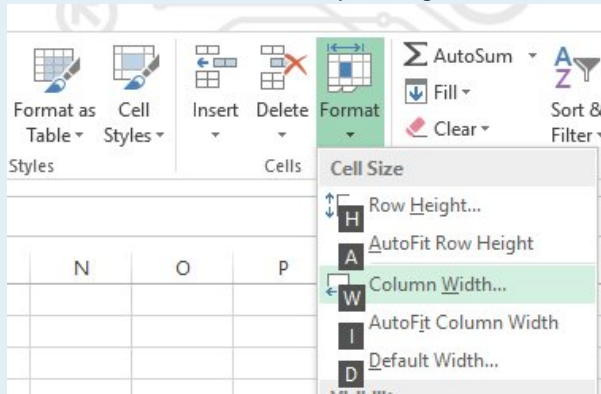
Your pop-up when pressing W:
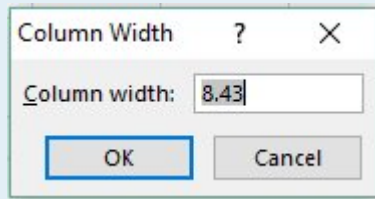
"The standard column width in Microsoft Excel 2000 is 8.43 characters; however, the actual width that you see on the screen varies, depending on the width of the font defined for the Normal style of your workbook." More on this topic here.

Steps 1 through 4 demonstrate how to adjust row height, which is similar to adjusting column width:

1. Click cell A15 by placing the mouse pointer over the cell and clicking the left mouse button.

2. In the Home tab of the Ribbon, left click the Format button in the Cells group.

3. Click the Row Height option from the drop-down

menu. This will open the Row Height dialog box.

4. Type the number **24** and click the OK button on the Row Height dialog box. This will set Row 15 to a height of 24 points. A point is equivalent to approximately 1/72 of an inch. This adjustment in row height was made to create space between the totals for this worksheet and the rest of the data.

Keyboard Shortcuts

Row Height

- Similarly to how you could set the column width above, you can use a combination of the ALT key and other keys to resize your row height. Press ALT on your keyboard, then press the letters H, O, and H one at a time. Observe how different portions of your Ribbon pop up and allow you to select them without having to move your mouse to them. This can be a great time saver!

Figure 1.25 shows the appearance of the worksheet after Column A and Row 15 are adjusted.

The width of Column A was increased.

The height of Row 15 was increased to create space between the totals and the rest of the data.

Row heights can be adjusted by placing the mouse pointer between two row numbers and clicking and dragging to the desired height.
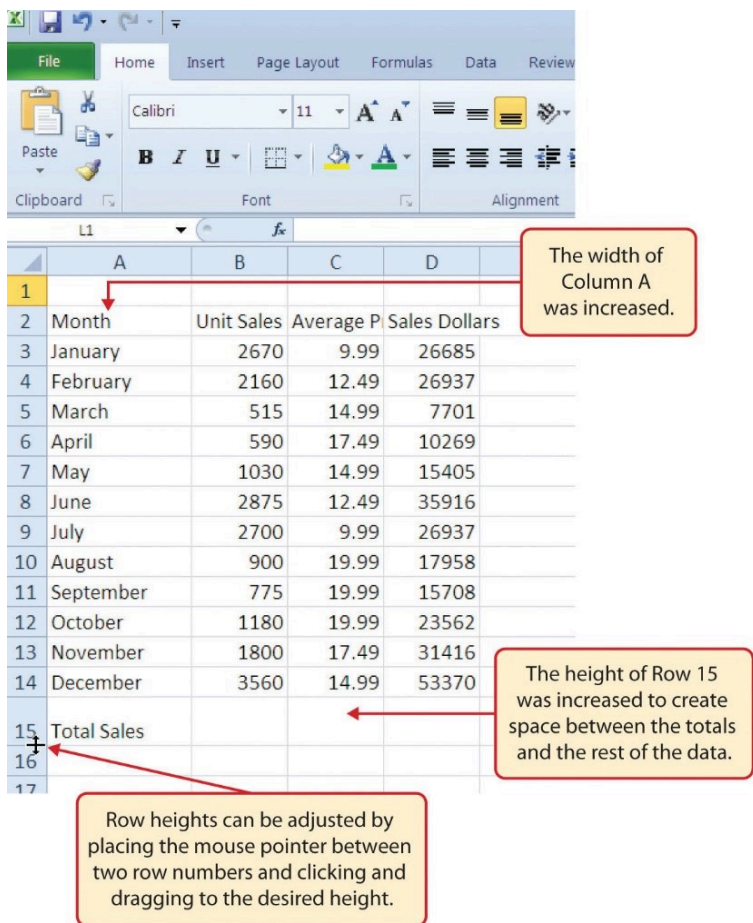
Figure 1.25 GMW Sales Data with Column A and Row 15 Adjusted

Skill Refresher

Adjusting Columns and Rows

1. Activate at least one cell in the row or column you are adjusting.

2. Click the Home tab of the Ribbon.

3. Click the Format button in the Cells group.

4. Click either Row Height or Column Width from the drop-down menu.

5. Enter the Row Height in points or Column Width in characters in the dialog box.

6. Click the OK button.

HIDING COLUMNS AND ROWS

In addition to adjusting the columns and rows on a worksheet, you can also hide columns and rows. This is a useful technique for enhancing the visual appearance of a worksheet that contains data that is not necessary to display. These features will be demonstrated using the GMW Sales Data workbook. However, there is no need to have hidden columns or rows for this worksheet. The use of these skills here will be for demonstration purposes only.

1. Click cell C1 in the Sheet1 worksheet by placing the mouse pointer over the cell location and clicking the left mouse button.

2. Click the Format button in the Home tab of the Ribbon.

3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu. This will open a submenu of options.

4. Click the Hide Columns option in the submenu of options (see **Figure 1.26**). This will hide Column C.
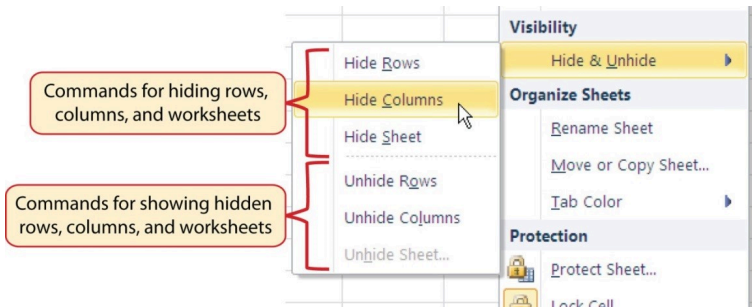
Figure 1.26 Hide & Unhide Submenu

> ### Keyboard Shortcuts
>
> **Hiding Columns**
>
> - Hold down the CTRL key while pressing the number 0 on your keyboard.

Figure 1.27 shows the workbook with Column C hidden in the Sheet1 worksheet. You can tell a column is hidden by the missing letter C.
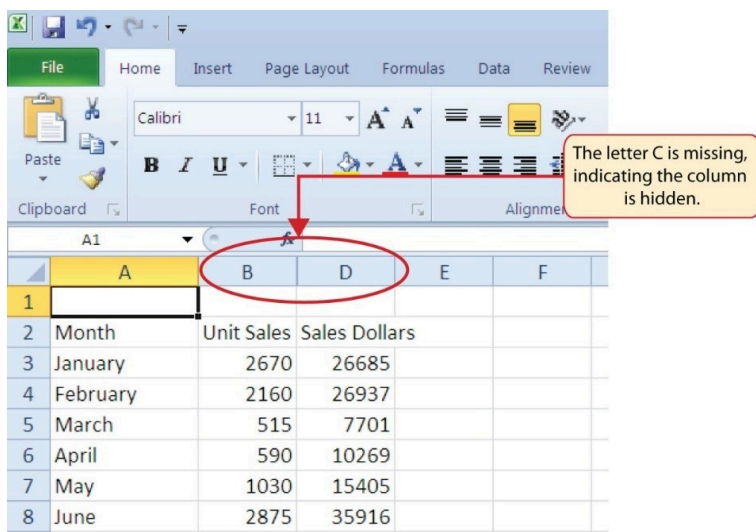
Figure 1.27 Hidden Column

To unhide a column, follow these steps:

1. Highlight the range B1:D1 by activating cell B1 and clicking and dragging over to cell D1.

2. Click the Format button in the Home tab of the Ribbon.

3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu.

4. Click the Unhide Columns option in the submenu of options. Column C will now be visible on the worksheet.

Keyboard Shortcuts

Unhiding Columns

> • Highlight cells on either side of the hidden column(s), then hold down the CTRL key and the SHIFT key while pressing the close parenthesis key ()) on your keyboard.

The following steps demonstrate how to hide rows, which is similar to hiding columns:

1. Click cell A3 in the Sheet1 worksheet by placing the mouse pointer over the cell location and clicking the left mouse button.

2. Click the Format button in the Home tab of the Ribbon.

3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu. This will open a submenu of options.

4. Click the Hide Rows option in the submenu of options. This will hide Row 3.

Keyboard Shortcuts

Hiding Rows

> • Hold down the CTRL key while pressing the number 9 key on your keyboard.

To unhide a row, follow these steps:

1. Highlight the range A2:A4 by activating cell A2 and clicking and dragging over to cell A4.

2. Click the Format button in the Home tab of the Ribbon.

3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu.

4. Click the Unhide Rows option in the submenu of options. Row 3 will now be visible on the worksheet.

Integrity Check

Hidden Rows and Columns

In most careers, it is common for professionals to use Excel workbooks that have been designed by a coworker. Before you use a workbook developed by someone else, always check for hidden rows and columns. You can quickly see whether a row or

column is hidden if a row number or column letter is missing.

> 4. Place the mouse pointer over the Hide & Unhide option.
>
> 5. Click either the Unhide Rows or Unhide Columns option.

INSERTING COLUMNS AND ROWS

Using Excel workbooks that have been created by others is a very efficient way to work because it eliminates the need to create data worksheets from scratch. However, you may find that to accomplish your goals, you need to add additional columns or rows of data. In this case, you can insert blank columns or rows into a worksheet. The following steps demonstrate how to do this:

1. Click cell C1 in the Sheet1 worksheet by placing the mouse pointer over the cell location and clicking the left mouse button.

2. Click the down arrow on the Insert button in the Home tab of the Ribbon (see **Figure 1.28**).
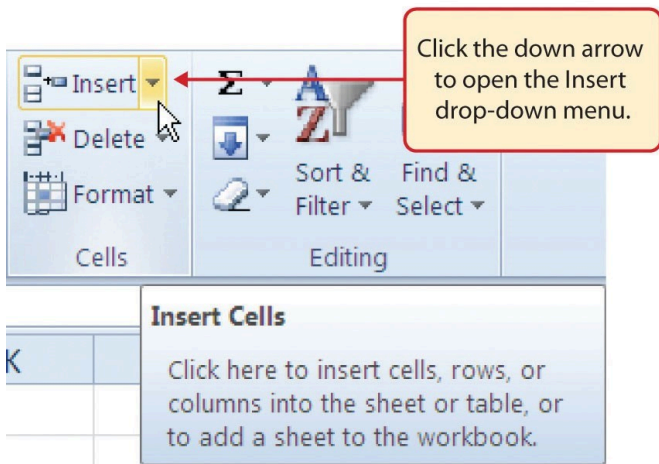
Figure 1.28 Insert Button (Down Arrow)

3. Click the Insert Sheet Columns option from the drop-down menu (see **Figure 1.29**). A blank column will be inserted to the left of Column C. The contents that were previously in Column C now appear in Column D. Note that columns are always inserted to the left of the activated cell.
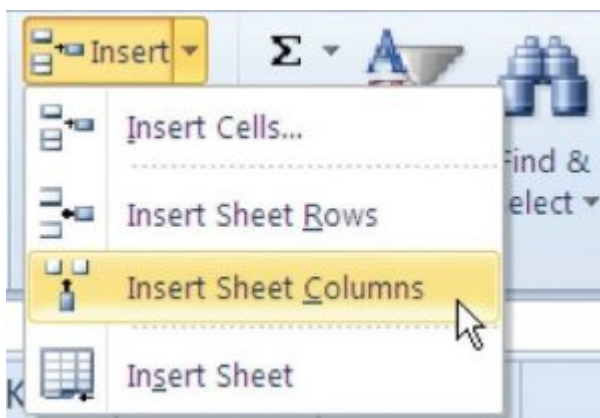
Figure 1.29 Insert Drop-Down Menu

4. Click cell A3 in the **Sheet1** worksheet by placing the mouse pointer over the cell location and clicking the left mouse button.

5. Click the down arrow on the Insert button in the Home tab of the Ribbon (see **Figure 1.28**).

6. Click the Insert Sheet Rows option from the drop-down menu (see **Figure 1.29**). A blank row will be inserted above Row 3. The contents that were previously in Row 3 now appear in Row 4. Note that rows are always inserted above the activated cell.

MOVING DATA

Once data are entered into a worksheet, you have the ability to move it to different locations. The following steps demonstrate how to move data to different locations on a worksheet:

1. Highlight the range D2:D15 by activating cell D2 and clicking and dragging down to cell D15.

2. Bring the mouse pointer to the left edge of cell D2. You will see the white block plus sign change to cross arrows (see **Figure 1.30**). This indicates that you can left click and drag the data to a new location.
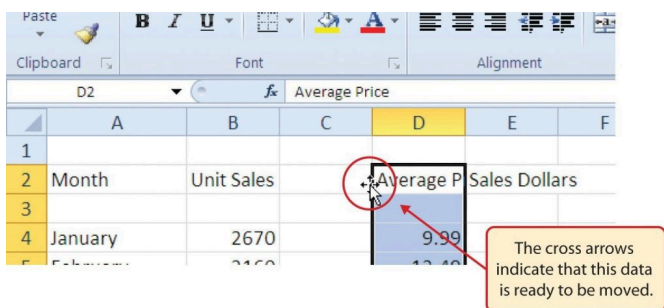
Figure 1.30 Moving Data

3. Left Click and drag the mouse pointer to cell C2.

4. Release the left mouse button. The data now appears in Column C.

5. Click the Undo button in the Quick Access Toolbar. This moves the data back to Column D.

Integrity Check

Moving Data

Before moving data on a worksheet, make sure you identify all the components that belong with the series you are moving. For example, if you are moving a column of data, make sure the column heading is included. Also, make sure all values are highlighted in the column before moving it.

DELETING COLUMNS AND ROWS

You may need to delete entire columns or rows of data from a worksheet. This need may arise if you need to remove either blank columns or rows from a worksheet or columns and rows that contain data. The methods for removing cell contents were covered earlier and can be used to delete unwanted data. However, if you do not want a blank row or column in your workbook, you can delete it using the following steps:

1. Click cell A3 by placing the mouse pointer over the cell location and clicking the left mouse button.

2. Click the down arrow on the Delete button in the Cells group in the Home tab of the Ribbon.

3. Click the Delete Sheet Rows option from the drop-down menu (see **Figure 1.31**). This removes Row 3 and shifts all the data (below Row 2) in the worksheet up one row.

Keyboard Shortcuts

Deleting Rows

- ◦ Press the ALT key and then the letters H, D, and R one at a time. The row with the activated cell will be deleted.
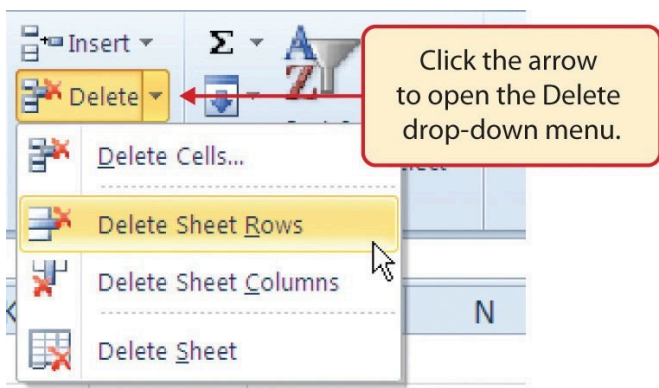
Figure 1.31 Delete Drop-Down Menu

4. Click cell C1 by placing the mouse pointer over the cell location and clicking the left mouse button.

5. Click the down arrow on the Delete button in the Cells group in the Home tab of the Ribbon.

6. Click the Delete Sheet Columns option from the drop-down menu (see **Figure 1.31**). This removes Column C and shifts all the data in the worksheet (to the right of Column B) over one column to the left.

7. Save the changes to your workbook by clicking either the **Save** button on the Home ribbon; or by selecting the **Save** option from the File menu.

Keyboard Shortcuts
Deleting Columns

- Press the ALT key and then the letters H, D, and C one at a time. The column with the activated cell will be deleted.

Key Takeaways

- Column headings should be used in a worksheet and should accurately describe the data contained in each column.

- Using symbols such as dollar signs when entering numbers into a worksheet can slow down the data entry process.

- Worksheets must be carefully proofread when data has been manually entered.

- The Undo command is a valuable tool for

recovering data that was deleted from a worksheet.

- When using a worksheet that was developed by someone else, look carefully for hidden columns or rows.

ATTRIBUTION

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- 1-2-fig-1-30
- 1-2-fig-1-31

1.3 FORMATTING AND DATA ANALYSIS

This section addresses formatting commands that can be used to enhance the visual appearance of a worksheet. It also provides an introduction to mathematical

calculations. The skills introduced in this section will give you powerful tools for analyzing the data that we have been working with in this workbook and will highlight how Excel is used to make key decisions in virtually any career. Additionally, Excel Spreadsheet Guidelines for format and appearance will be introduced as a format for the course and spreadsheets submitted.

FORMATTING DATA AND CELLS

Enhancing the visual appearance of a worksheet is a critical step in creating a valuable tool for you or your coworkers when making key decisions. There are accepted professional formatting standards when spreadsheets contain only currency data. For this course, we will use the following Excel Guidelines for Formatting. The first figure displays how to use Accounting number format when ALL figures are currency. Only the first row of data and the totals should be formatted with the Accounting format. The other data should be formatted with Comma style. There also needs to be a Top Border above the numbers in the total row. If any of the numbers have cents, you need to format all of the data with two decimal places.

Excel Guidelines

For Correct Accounting Format & Chart Range

Sunny Escapes Travel Agency
Sales Report
For January 2013

	Week 1	Week 2	Week 3	Week 4	Total
Belize	$ 16,000.50	$ 14,530.00	$ 1,500.00	$16,050.85	$ 48,081.35
Costa Rica	4,500.22	1,350.00	3,500.20	6,599.00	15,949.42
Florida	9,500.00	10,500.75	14,080.35	7,065.99	41,147.09
Hawaii	20,000.99	6,010.00	15,000.00	17,865.00	58,875.99
Mexico	1,550.00	2,000.99	1,700.00	1,499.00	6,749.99
Total	$ 51,551.71	$ 34,391.74	$35,780.55	$49,079.84	$170,803.84

Use Accounting Number format ($) on top row and bottom total row only.

Use Comma Style format (,) for middle rows. Format with two decimals when dollar amounts contain cents. Make sure the decimals align.

Use a single border above the total row. Include a Grand Total where total row and total column intersect.

Don't include totals when creating a chart. Chart range is B9:F14. Total row (row 15) and total column (column G) should not be included in chart range.

Destination Sales

Legend: Week 1, Week 2, Week 3, Week 4

Figure 1.31a

Often, your Excel spreadsheet will contain values that are both currency and non-currency in nature. When that is the case, you'll want to use the guidelines in the following figure:

Excel Guidelines
For Units and Dollar Amounts in the Same Worksheet

Use a three line title if the workbook doesn't include a Documentation sheet. The three lines should include:
- Company Name
- Type of Report
- Date

Sunny Escapes Travel Agency
Sales Report
For January 2013

| | Week 1 | | Week 2 | | Week 3 | | Week 4 | |
	Number of Trips	Sales ($)	Number of Trips	Sales ($)	Number of Trips	Sales ($)	Number of Trips	Sales ($)
Belize	15	$ 16,001	12	$ 14,530	1	$ 1,500	15	$ 16,051
Costa Rica	3	$ 4,500	1	$ 1,350	2	$ 3,500	4	$ 6,599
Florida	4	$ 9,500	9	$ 10,501	12	$ 14,080	5	$ 7,066
Hawaii	19	$ 20,001	5	$ 6,010	15	$ 15,000	16	$ 17,865
Mexico	1	$ 1,550	2	$ 2,001	1	$ 1,700	1	$ 1,499
Total	42	$ 51,552	29	$ 34,392	31	$ 35,781	41	$ 49,080

When mixing columns of units with columns of dollars, format entire dollar column with Accounting Number format ($)

Format with no decimals when dollar amounts are whole dollars without cents

Remember to:
✓ Spellcheck your worksheet
✓ Print Preview before printing or submitting
✓ Use common sense when proofreading - do the results make sense?
✓ Make sure the worksheet looks professional

Figure 1.31b

The following steps demonstrate several fundamental formatting skills that will be applied to the workbook that we are developing for this chapter. Several of these formatting skills are identical to ones that you may have already used in other Microsoft applications such as Microsoft® Word® or Microsoft® PowerPoint®.

1. Highlight the range A2:D2 in the **Sheet1** worksheet by placing the mouse pointer over cell A2 and left clicking and dragging to cell D2. Click the Bold button in the Font group of commands in the Home tab of the ribbon.

2. Click the Border button in the Font group of commands in the Home tab of the Ribbon (see **Figure 1.32**). Select the Bottom Border option from the list to achieve the

goal of a border on the bottom of row 2 below the column headings.
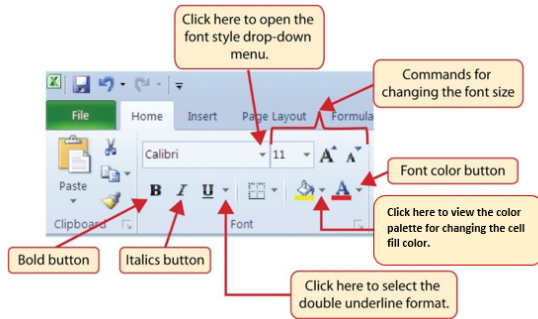
Figure 1.32 Font Group of Commands

Keyboard Shortcuts

Bold Format

- Hold the CTRL key while pressing the letter B on your keyboard.

3. Highlight the range A15:D15 by placing the mouse pointer over cell A15 and left clicking and dragging to cell D15.

4. Click the Bold button in the Font group of commands in the Home tab of the Ribbon.

5. Click the Border button in the Font group of commands in the Home tab of the Ribbon (see **Figure 1.32**). Select the Top Border option from the list to achieve the

goal of a border on the top of row 15 where totals will eventually display.

Keyboard Shortcuts

Italics Format

- ▪ Hold the CTRL key while pressing the letter I on your keyboard.

Keyboard Shortcuts

Underline Format

- ▪ Hold the CTRL key while pressing the letter U on your keyboard.

Why?

Format Column Headings and Totals

Applying formatting enhancements to the column headings and column totals in a

worksheet is a very important technique, especially if you are sharing a workbook with other people. These formatting techniques allow users of the worksheet to clearly see the column headings that define the data. In addition, the column totals usually contain the most important data on a worksheet with respect to making decisions, and formatting techniques allow users to quickly see this information.

1. Highlight the range B3:B14 by placing the mouse pointer over cell B3 and left clicking and dragging down to cell B14.

2. Click the Comma Style button in the Number group of commands in the Home tab of the Ribbon. This feature adds a comma as well as two decimal places. (see **Figure 1.33**).
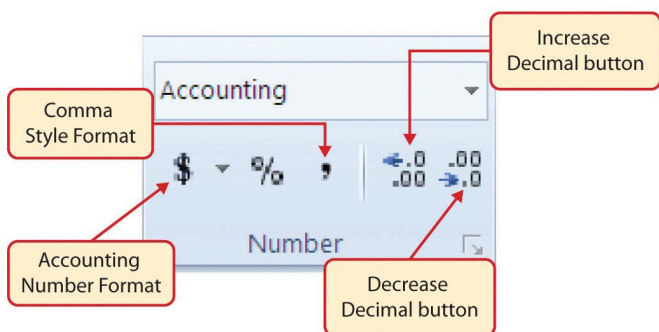
Figure 1.33 Number Group of Commands

3. Since the figures in this range do not include cents, click the Decrease Decimal button in the Number group of commands in the Home tab of the Ribbon two times (see **Figure 1.33**).

4. The numbers will also be reduced to zero decimal places.

5. Highlight the range C3:C14 by placing the mouse pointer over cell C3 and left clicking and dragging down to cell C14.

6. Click the Accounting Number Format button in the Number group of commands in the Home tab of the Ribbon (see **Figure 1.33**). This will add the US currency symbol and two decimal places to the values. This format is common when working with pricing data. As discussed above in the Formatting Data and Cells section, you will want to use Accounting format on all values in this range since the worksheet contains non-currency as well as currency data.

7. Highlight the range D3:D14 by placing the mouse pointer over cell D3 and left clicking and dragging

down to cell D14.

8. Again, select the Accounting Number Format; this will add the US currency symbol to the values as well as two decimal places.

9. Click the Decrease Decimal button in the Number group of commands in the Home tab of the Ribbon.

10. This will add the US currency symbol to the values and reduce the decimal places to zero since there are no cents in these figures.

11. Highlight the range A1:D1 by placing the mouse pointer over cell A1 and left clicking and dragging over to cell D1.

12. Click the down arrow next to the Fill Color button in the Font group of commands in the Home tab of the Ribbon (see **Figure 1.34**). This will prepare the range for a worksheet title.
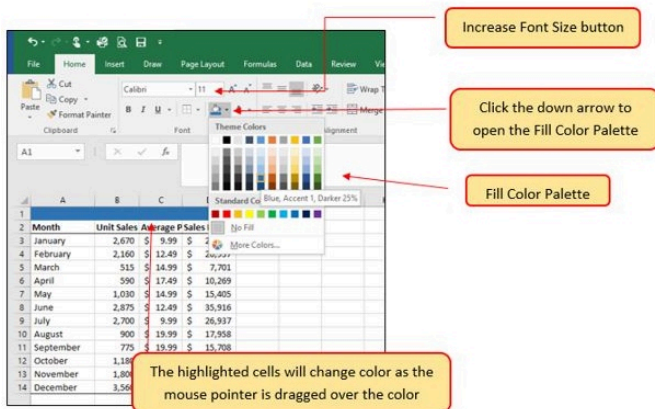
Figure 1.34 Fill Color Palette

13. Click the Blue, Accent 1, Darker 25% color from the palette (see **Figure 1.34**). Notice that as you move the mouse pointer over the color palette, you will see a preview of how the color will appear in the highlighted cells. Experiment with this feature.

14. Click on A1 and enter the worksheet title: General Merchandise World and click on the check mark in the formula bar to enter this information.

15. Since the black font is difficult to read on the blue background, you'll change the font color to be more visible. Click the down arrow next to the Font Color button in the Font group of commands in the Home tab of the Ribbon; select White as the font color for this range (see **Figure 1.32**).

16. Highlight the range A1:D15 by placing the mouse pointer over cell A1 and left clicking and dragging down to cell D15.

17. Click the drop-down arrow on the right side of the Font button in the Home tab of the Ribbon; select Arial as the font for this range. (see **Figure 1.32**).

18. Notice that as you move the mouse pointer over the font style options, you can see the font change in the highlighted cells.

19. Expand the column width of Column D to 14 characters.

Why?

Pound Signs (####) Appear in Columns

When a column is too narrow for a long number, Excel will automatically convert the number to a series of pound signs (####). In the case of words or text data, Excel will only show the characters that fit in the column. However, this is not the case with numeric data because it can give the appearance of a number that is much smaller than what is actually in the cell. To remove the pound signs, increase the width of the column.

Figure 1.35 shows how the Sheet1 worksheet should appear after the formatting techniques are applied.

Figure 1.35 Formatting Techniques Applied

DATA ALIGNMENT (WRAP TEXT, MERGE CELLS, AND CENTER)

The skills presented in this segment show how data are

aligned within cell locations. For example, text and numbers can be centered in a cell location, left justified, right justified, and so on. In some cases you may want to stack multi word text entries vertically in a cell instead of expanding the width of a column. This is referred to as wrapping text. These skills are demonstrated in the following steps:

1. Highlight the range B2:D2 by placing the mouse pointer over cell B2 and left clicking and dragging over to cell D2.

2. Click the Center button in the Alignment group of commands in the Home tab of the Ribbon (see **Figure 1.36**). This will center the column headings in each cell location.
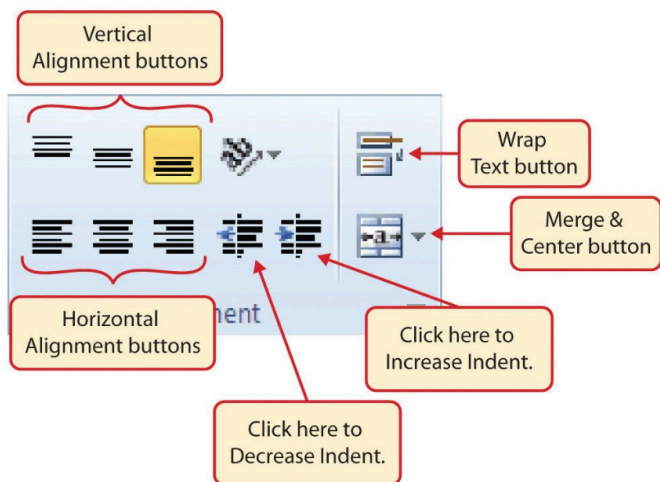
Figure 1.36 Alignment Group in Home Tab

3. Click the Wrap Text button in the Alignment group (see **Figure 1.36**). The height of Row 2

automatically expands, and the words that were cut off because the columns were too narrow are now stacked vertically.

Keyboard Shortcuts

Wrap Text

- ○ Press the ALT key and then the letters H and W one at a time.

Why?

Wrap Text

The benefit of using the Wrap Text command is that it significantly reduces the need to expand the column width to accommodate multi word column headings. The problem with increasing the column width is that you may reduce the amount of data that can fit on a piece of paper or one screen. This makes it cumbersome to analyze the data in the worksheet and could increase the time it takes to make a decision.

4. Highlight the range A1:D1 by placing the mouse pointer over cell A1 and left clicking and dragging over to cell D1.

5. Click the down arrow on the right side of the

Merge & Center button in the Alignment group of commands in the Home tab of the Ribbon.

6. Left click the Merge & Center option (see **Figure 1.37**). This will create one large cell location running across the top of the data set.

Keyboard Shortcuts

Merge Commands

- Merge & Center: Press the ALT key and then the letters H, M, and C one at a time.

- Merge Cells: Press the ALT key and then the letters H, M, and M one at a time.

- Unmerge Cells: Press the ALT key and then the letters H, M, and U one at a time.
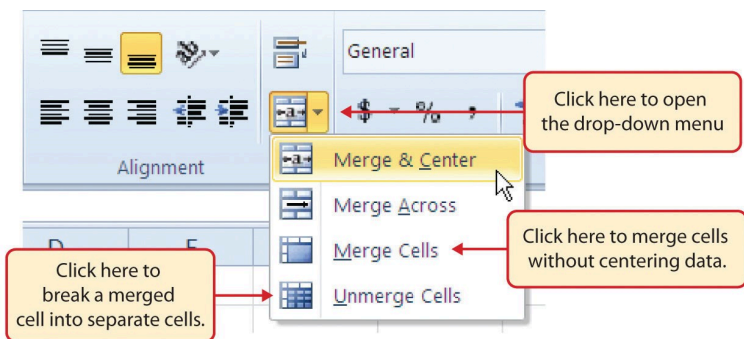
Figure 1.37 Merge Cell Drop-Down Menu

Why?

Merge & Center

One of the most common reasons the Merge & Center command is used is to center the title of a worksheet directly above the columns of data. Once the cells above the column headings are merged, a title can be centered above the columns of data. It is very difficult to center the title over the columns of data if the cells are not merged.

Figure 1.38 shows the Sheet1 worksheet with the data alignment commands applied. The reason for merging the cells in the range A1:D1 will become apparent in the next segment.

Figure 1.38 Sheet1 with Data Alignment Features Added

Skill Refresher

Wrap Text

1. Activate the cell or range of cells that contain text data.
2. Click the Home tab of the Ribbon.
3. Click the Wrap Text button.

ENTERING MULTIPLE LINES OF TEXT

In the Sheet1 worksheet, the cells in the range A1:D1 were merged for the purposes of adding a title to the worksheet. This worksheet will contain both a title and a subtitle. The following steps explain how you can enter text into a cell and determine where you want the second line of text to begin:

1. Activate cell A1 in Sheet1 of the worksheet by placing the mouse pointer over cell A1 and clicking the left mouse button. Since the cells were

merged, clicking cell A1 will automatically activate the range A1:D1. Position your mouse to the end of the title, directly after the "d" in the word "World" and double-click to get a cursor (flashing I-beam).

2. Hold down the ALT key and press the ENTER key. This will start a new line of text in this cell location.

3. Type the text **Retail Sales (in millions)** and press the ENTER key.

4. Select cell A1. Then click the Italics and Bold buttons in the Font group of commands in the Home tab of the Ribbon.

5. Increase the height of Row 1 to 30 points (review previous chapter if you need a refresher). Once the row height is increased, all the text typed into the cell will be visible (see **Figure 1.39**).

Figure 1.39 *Title & Subtitle Added to the Worksheet*

1. Activate a cell location.

2. Type the first line of text.

3. Hold down the ALT key and press the ENTER key.

4. Type the second line of text and press the ENTER key.

BORDERS (ADDING LINES TO A WORKSHEET)

In Excel, adding custom lines to a worksheet is known as adding borders. Borders are different from the grid lines that appear on a worksheet and that define the perimeter of the cell locations. The Borders command lets you add a variety of line styles to a worksheet that can make reading the worksheet much easier. The following steps illustrate methods for adding preset borders and custom borders to a worksheet:

1. Click the down arrow to the right of the Borders button in the Font group of commands in the Home page of the Ribbon to view border options. (see **Figure 1.40**).Figure 1.40 Borders Drop-Down Menu

Figure callouts:
- Click this down arrow to open the Borders drop-down menu.
- Click here to apply vertical and horizontal lines to the highlighted range of cells.
- Click here to apply a Thick Bottom Border.
- Click this down arrow to open the More Borders menu
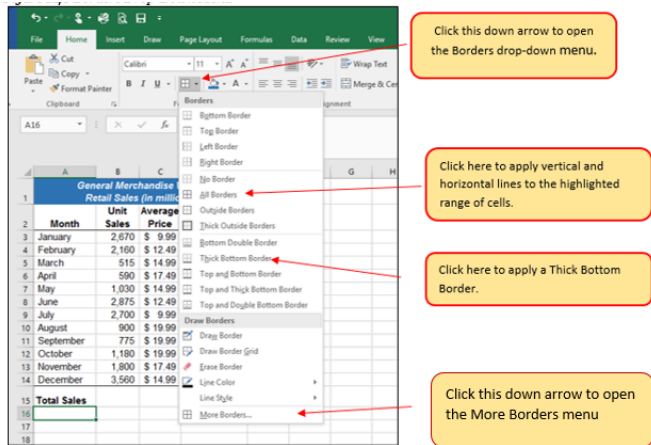
2. Highlight the range A1:D15. Left click the All Borders option from the Borders drop-down menu (see **Figure 1.40**). This will add vertical and horizontal lines to the range A1:D15.

3. Highlight the range A2:D2 by placing the mouse pointer over cell A2 and left clicking and dragging over to cell D2.

4. Click the down arrow to the right of the Borders button.

5. Left click the Thick Bottom Border option from the Borders drop-down menu.

6. Highlight the range A14:D14 and apply a Thick Bottom Border from the drop-down menu. The thick border will help maintain the Excel Formatting Guidelines.

7. Highlight the range A1:D15.

8. Click the down arrow to the right of the Borders button.

9. Click More Borders… at the bottom of the List.

10. This will open the Format Cells dialog box (see **Figure 1.41**). You can access all formatting commands in Excel through this dialog box.

11. In the Style section of the Borders tab, left click the thickest line style (see **Figure 1.41**).

12. Left click the Outline button in the Presets section (see **Figure 1.41**).

13. Click the OK button at the bottom of the dialog box (see **Figure 1.41**).
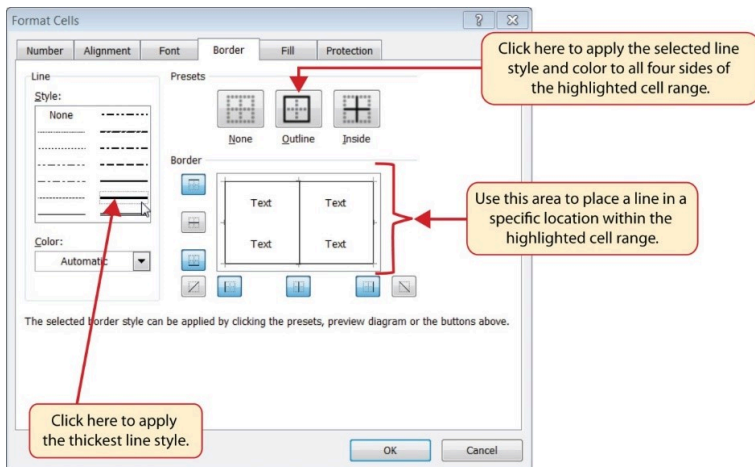
Figure 1.41 Borders Tab of the Format Cells Dialog Box
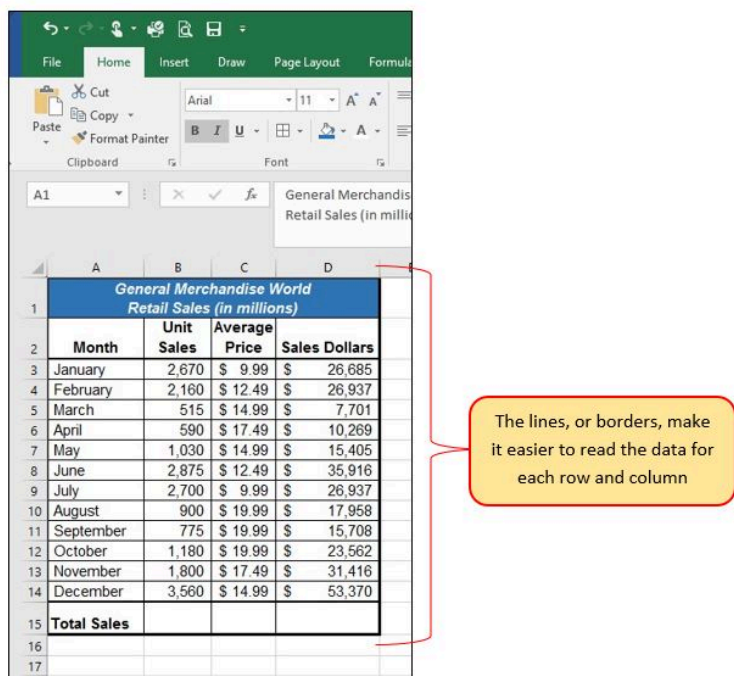
Figure 1.42 Borders Added to the Sheet1 Worksheet

Skill Refresher

Preset Borders

1. Highlight a range of cells that require borders.
2. Click the Home tab of the Ribbon.
3. Click the down arrow next to the Borders button.
4. Select an option from the preset borders list.

Custom Borders

1. Highlight a range of cells that require borders.

2. Click the Home tab of the Ribbon.

3. Click the down arrow next to the Borders button.

4. Select the More Borders option at the bottom of the options list.

5. Select a line style and line color.

6. Select a placement option.

7. Click the OK button on the dialog box.

AUTOSUM

You will see at the bottom of Figure 1.42 that Row 15 is intended to show the totals for the data in this worksheet. Applying mathematical computations to a range of cells is accomplished through functions in Excel. Chapter 2 "Mathematical Computations" will review mathematical formulas and functions in detail. However, the following steps will demonstrate how you can quickly sum the values in a column of data using the AutoSum command:

1. Activate cell B15 in the Sheet1 worksheet.

2. Click the Formulas tab of the Ribbon.

3. Click the down arrow below the AutoSum button in the Function Library group of commands (see **Figure 1.43**). Note that the AutoSum button can also be found in the Editing group of

commands in the Home tab of the Ribbon.
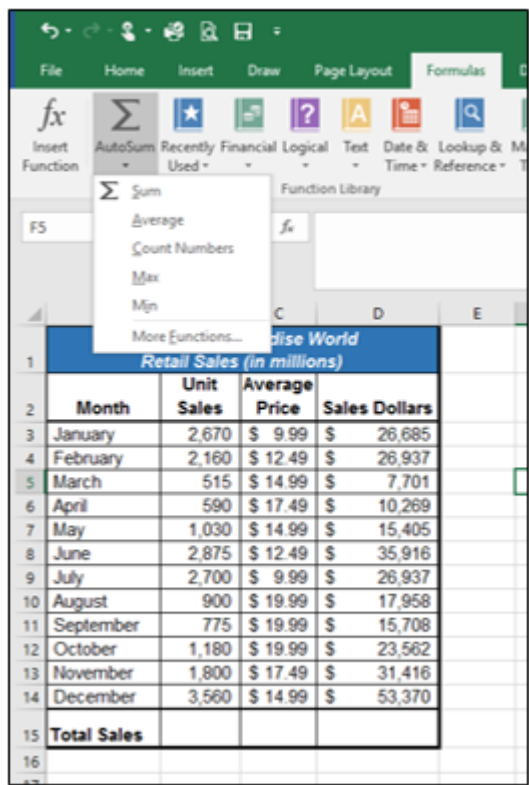
Figure 1.43 AutoSum Drop-Down List

4. Click the Sum option from the AutoSum drop-down menu. The first click will display a flashing marquee around the range. Click the check mark next to the Formula bar to complete the function.

5. Excel will provide a total for the values in the Unit Sales column.

6. Activate cell D15. It would not make sense to total

the averages in column C so C15 will be left blank.

7. Repeat steps 3 through 5 to sum the values in the Sales Dollars column (see **Figure 1.44**).

	A	B	C	D
1	*General Merchandise World* *Retail Sales (in millions)*			
2	**Month**	**Unit Sales**	**Average Price**	**Sales Dollars**
3	January	2,670	$ 9.99	$ 26,685
4	February	2,160	$ 12.49	$ 26,937
5	March	515	$ 14.99	$ 7,701
6	April	590	$ 17.49	$ 10,269
7	May	1,030	$ 14.99	$ 15,405
8	June	2,875	$ 12.49	$ 35,916
9	July	2,700	$ 9.99	$ 26,937
10	August	900	$ 19.99	$ 17,958
11	September	775	$ 19.99	$ 15,708
12	October	1,180	$ 19.99	$ 23,562
13	November	1,800	$ 17.49	$ 31,416
14	December	3,560	$ 14.99	$ 53,370
15	**Total Sales**	**20,755**		**$ 291,864**
16				
17				

Figure 1.44 Totals Added to the Sheet1 Worksheet

Skill Refresher

AutoSum

1.   Highlight a cell location below or to the right

of a range of cells that contain numeric values.

2. Click the Formulas tab of the Ribbon.

3. Click the down arrow below the AutoSum button.

4. Select a mathematical function from the list.

MOVING, RENAMING, INSERTING, AND DELETING WORKSHEETS

The default names for the worksheet tabs at the bottom of workbook are Sheet1, Sheet2, and so on. However, you can change the worksheet tab names to identify the data you are using in a workbook. Additionally, you can change the order in which the worksheet tabs appear in the workbook. The following steps explain how to rename and move the worksheets in a workbook:

1. With the left mouse button, double click the Sheet1 worksheet tab at the bottom of the workbook (see **Figure 1.45**). Type the name **Sales by Month**.

2. Press the ENTER key on your keyboard.

3. With the left mouse button, double click the Sheet2 worksheet tab at the bottom of the workbook.

4. Type the name Unit Sales Rank to prepare the worksheet for future use.

5. Press the ENTER key on your keyboard.

12	October	1,180	$ 19.99	$ 23,562
13	November	1,800	$ 17.49	$ 31,416
14	December	3,560	$ 14.99	$ 53,370
15	*Total Sales*	*20,755*		*$ 291,864*
16				

Click here to add a blank worksheet to the workbook.

Double click here to change the name of the worksheet tab.

Click and drag the worksheet tab to change the order.
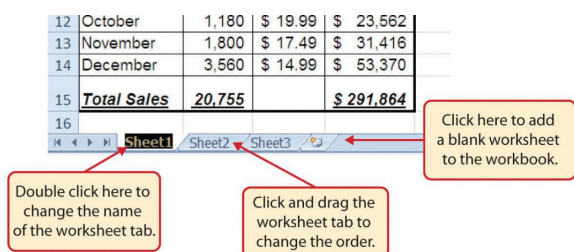
Figure 1.45 Renaming a Worksheet Tab

6. Click the Sheet3 worksheet tab.

7. Click the Home tab of the Ribbon.

8. Click the down arrow on the Delete button in the Cells group of commands.

9. Click the Delete Sheet option from the drop-down list. This removes the unneeded worksheet.

10. Click the Delete button on the Delete warning box (if a warning box appears).

11. Complete the steps above to delete the newly named Unit Sales Rank worksheet since it's decided that worksheet is also unnecessary so that you are left with just one worksheet.

12. Save the changes to your workbook by clicking either the **Save** button on the Home ribbon; or by selecting the **Save** option from the File menu.

Integrity Check

Deleting Worksheets

Be very cautious when deleting worksheets that contain data. Once a worksheet is deleted, you cannot use the Undo command to bring the sheet back. Deleting a worksheet is a permanent command.

Keyboard Shortcuts

Inserting New Worksheets

- Press the SHIFT key and then the F11 key on your keyboard.

Figure 1.46 shows the final appearance of the GMW Sales workbook.

	A	B	C	D
1	General Merchandise World Retail Sales (in millions)			
2	Month	Unit Sales	Average Price	Sales Dollars
3	January	2,670	$ 9.99	$ 26,685
4	February	2,160	$ 12.49	$ 26,937
5	March	515	$ 14.99	$ 7,701
6	April	590	$ 17.49	$ 10,269
7	May	1,030	$ 14.99	$ 15,405
8	June	2,875	$ 12.49	$ 35,916
9	July	2,700	$ 9.99	$ 26,937
10	August	900	$ 19.99	$ 17,958
11	September	775	$ 19.99	$ 15,708
12	October	1,180	$ 19.99	$ 23,562
13	November	1,800	$ 17.49	$ 31,416
14	December	3,560	$ 14.99	$ 53,370
15	Total Sales	20,755		$ 291,864
16				

Figure 1.46 Final Appearance of the GMW Sales Workbook

Skill Refresher

Renaming Worksheets

1. Double click the worksheet tab.
2. Type the new name.
3. Press the ENTER key.

Moving Worksheets

1. Left click the worksheet tab.
2. Drag it to the desired position.

Deleting Worksheets

1. Open the worksheet to be deleted.
2. Click the Home tab of the Ribbon.
3. Click the down arrow on the Delete button.
4. Select the Delete Sheet option.
5. Click Delete on the warning box.

Key Takeaways

- Formatting skills are critical for creating worksheets that are easy to read and have a professional appearance.

- A series of pound signs (####) in a cell location indicates that the column is too narrow to display the number entered.

- Using the Wrap Text command allows you to stack multi word column headings vertically in a cell location, reducing the need to expand column widths.

- Use the Merge & Center command to center the title of a worksheet directly over the columns that contain data.

- Adding borders or lines will make your worksheet easier to read and helps to separate the data in each

column and row.

- You cannot use the Undo command to bring back a worksheet that has been deleted.

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- Formatting
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- 1-3-fig-1-34
- figure_1-35_formatting_techniques_appllied
- figure_1-38_sheet1_with_data_alignment_features_added
- figure-1-39-title-and-subtitle-added
- 1-40
- 1-3-fig-1-42

1.4 PREPARING TO PRINT

> **Learning Objectives**
>
> - Use the Page Layout tab to prepare a worksheet for printing.
> - Add headers and footers to a printed worksheet.
> - Examine how to print worksheets and workbooks.

Once you have completed a workbook, it is good practice to select the appropriate settings for printing. These settings are in the Page Layout tab of the Ribbon and discussed in this section of the chapter.

PAGE SETUP

Before you can properly print the worksheets in a workbook, you must establish appropriate settings. The following steps explain several of the commands in the Page Layout tab of the Ribbon used to prepare a worksheet for printing:

1. Open the **CH1 GMW Sales** workbook, if it is not already open.

2. Click the Page Layout tab of the Ribbon.

3. Click the Margins button in the Page Setup group of commands. This will open a drop-down list of options for setting the margins of your printed document.

4. Click the Wide option from the Margins drop-down list. (see **Figure 1.47**)

5. Click the Orientation button in the Page Setup and select Landscape.

6. Click on the arrow to the bottom right of the Page Setup category to launch the Page Setup options dialog box.

7. Click the Margins tab and locate "Center on Page". Click the boxes to Horizontally and Vertically center the data on the worksheet. Click OK.

Why?

Use Print Settings

Because professionals often share Excel workbooks, it is a good practice to select the appropriate print settings in the Page Layout tab even if you do not intend to print the worksheets in a workbook. It can be extremely frustrating for recipients of a workbook who wish to print your worksheets to find that the necessary print settings have not been selected. This may reflect poorly on

your attention to detail, especially if the recipient of the workbook is your boss.
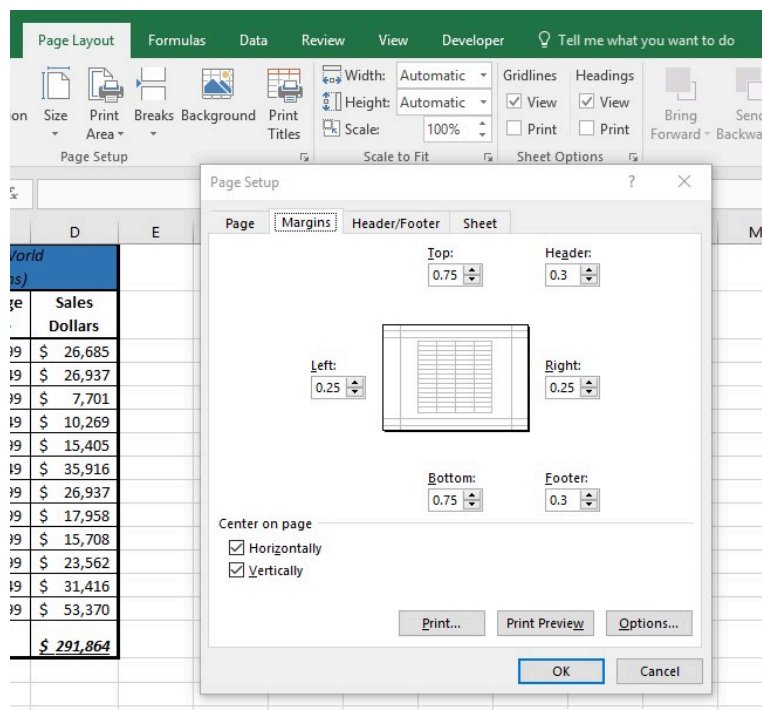
Figure 1.47 Page Layout Commands for Printing

Table 1.2 Printing Resources: Purpose and Use for Page Setup Commands

Command	Purpose	Use
Margins	Sets the top, bottom, right, and left margin space for the printed document	1. Click the Page Layout tab of the Ribbon.
		2. Click the Margin button.
		3. Click one of the preset margin options or click Custom Margins.
Orientation	Sets the orientation of the printed document to either portrait or landscape	1. Click the Page Layout tab of the Ribbon.
		2. Click the Orientation button.
		3. Click one of the preset orientation options.
Size	Sets the paper size for the printed document	1. Click the Page Layout tab of the Ribbon.
		2. Click the Size button.
		3. Click one of the preset paper size options or click More Paper Sizes.
Print Area	Used for printing only a specific area or range of cells on a worksheet	1. Highlight the range of cells on a worksheet that you wish to print.
		2. Click the Page Layout tab of the Ribbon.
		3. Click the Print Area button.
		4. Click the Set Print Area option from the drop-down list.
Breaks	Allows you to manually set the page breaks on a worksheet	1. Activate a cell on the worksheet where the page break should be placed. Breaks are created above and to the left of the activated cell.
		2. Click the Page Layout tab of the Ribbon.
		3. Click the Breaks button.

		4. Click the Insert Page Break option from the drop-down list.
Background	Adds a picture behind the cell locations in a worksheet	1. Click the Page Layout tab of the Ribbon.
		2. Click the Background button.
		3. Select a picture stored on your computer or network.
Print Titles	Used when printing large data sets that are several pages long. This command will repeat the column headings at the top of each printed page.	1. Click the Page Layout tab of the Ribbon.
		2. Click the Print Titles button.
		3. Click in the Rows to Repeat at Top input box in the Page Setup dialog box.
		4. Click any cell in the row that contains the column headings for your worksheet.
		5. Click the OK button at the bottom of the Page Setup dialog box.

HEADERS AND FOOTERS

When printing worksheets from Excel, it is common to add headers and footers to the printed document. Information in the header or footer could include the date, page number, file name, company name, and so on. The following steps explain how to add headers and footers to the GMW Sales Data workbook:

1. Click the Insert Ribbon and click on Header & Footer at the right end of the ribbon (located in the Text group). You will see the Design tab added

to the Ribbon; this is used for creating the headers and footers for the printed worksheet. Also, this will convert the view of the worksheet from Normal to Page Layout (see **Figure 1.48**). This Page Layout view makes adding Headers & Footers easy and provides key features to incorporate.
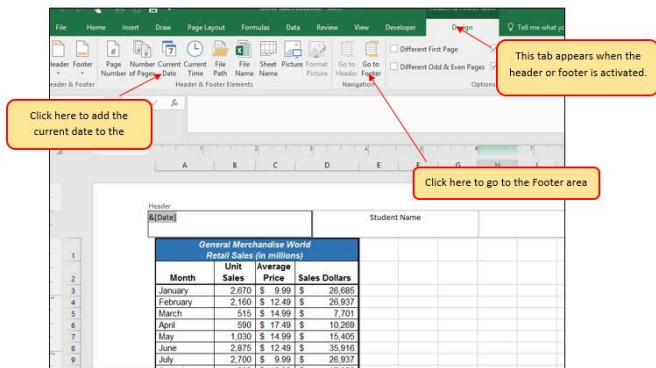
Figure 1.48 Design Tab for Creating Headers and Footers

2. Type your name in the center section of the Header.

3. Place the mouse pointer over the left section of the Header and left click (see **Figure 1.48**).

4. Click the Current Date button in the Header & Footer Elements group of commands in the Design tab of the Ribbon. This view will display as &[Date] until printed or until you return to normal view.

5. Click the Go to Footer button in the Navigation group of commands in the Design tab of the Ribbon.

6. Place the mouse pointer over the far right section of the footer and left click.

7. Click the Page Number button (you may need to click on the Design tab again) in the Header & Footer Elements group of commands in the Design tab of the Ribbon. This view will display as &[Page] until printed or until you return to normal view.

8. Click any cell location outside the header or footer area. The Design tab for creating headers and footers will disappear.

9. Click the Normal view button in the lower right side of the Status Bar (see **Figure 1.49**).
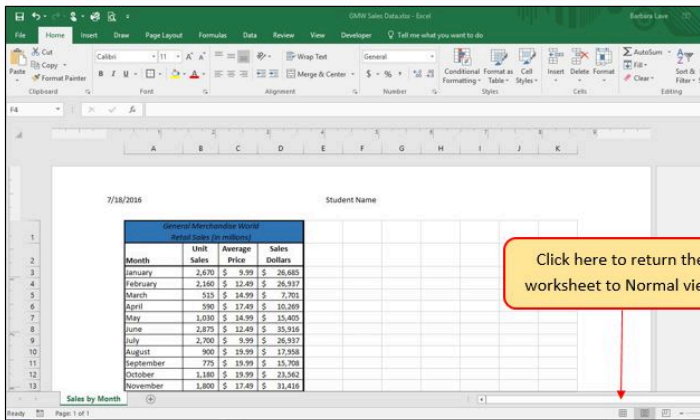
Figure 1.49 Worksheet in Page Layout View

PRINTING WORKSHEETS AND WORKBOOKS

Once you have established the print settings for the worksheets in a workbook and have added headers and

footers, you are ready to print your worksheets. The following steps explain how to print the worksheets in the **GMW Sales** workbook:

1. Click the File tab on the Ribbon.

2. Click the Print option on the left side of the Backstage view (see **Figure 1.50**). On the right side of the Backstage view, you will be able to see a preview of your printed worksheet.
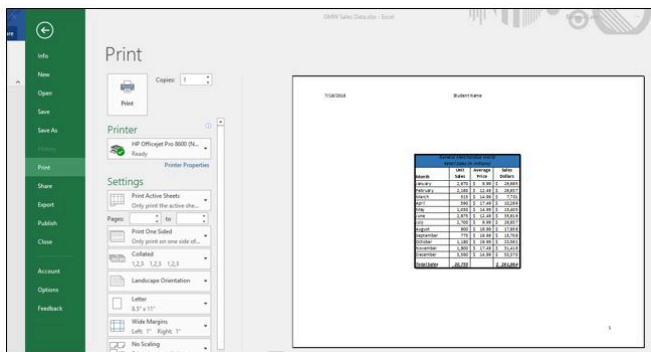
Figure 1.50 Backstage View Print option

3. Click the Print Active Sheets button in the Print section of the Backstage view (see **Figure 1.50**).

4. If your instructor has asked you to print your work, click the Print button.

5. Click the Home tab of the Ribbon.

6. Save and close the **CH1 GMW Sales** workbook.

7. Compare your work with the self-check answer key (found in the Course Files link) and then submit the **CH1 GMW Sales** workbook as directed by your instructor.

> **Key Takeaways**
>
> - The commands in the Page Layout tab of the Ribbon are used to prepare a worksheet for printing.
>
> - You can add headers and footers to a worksheet to show key information such as page numbers, the date, the file name, your name, and so on.
>
> - The Print commands are in the File tab of the Ribbon.

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1.5 CHAPTER PRACTICE

To assess your understanding of the material covered in the chapter, complete the following assignment.

BASIC MONTHLY BUDGET FOR MEDICAL OFFICE

Download Data File: PR1 Data

Creating and maintaining budgets are common practices in many careers. Budgets play a critical role in helping a business or household control expenditures. In this exercise you will create a budget for a hypothetical medical office while reviewing the skills covered in this chapter.

1. Open the file name **PR1 Data**, then Save As **PR1 Medical Office Budget**.

2. Activate all the cell locations in the Sheet1 worksheet by left clicking the Select All button in the upper left corner of the worksheet.

Select All button
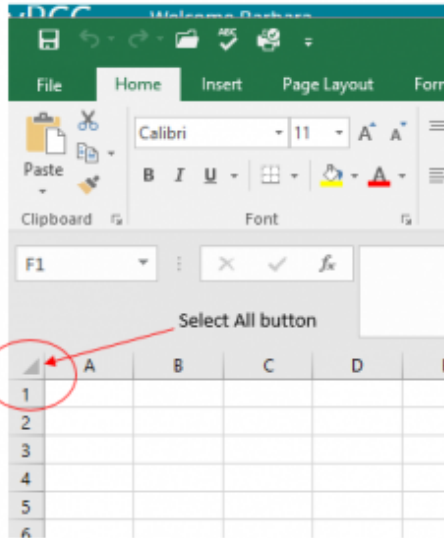
3. In the Home tab of the Ribbon, set the font style to Arial and the font size to 12 points. Then click any cell to Deselect.

4. Increase the width of Column A so all the entries in the range A3:A8 are visible. Place the mouse pointer between the letter A and letter B of Column A and Column B. When the mouse pointer changes to a double arrow, left click and drag it to the right until the character width is approximately 18.00.

5. Enter **Quarter 1** in cell B2.

6. Use AutoFill to complete the headings in the range C2:E2. Activate cell B2 and place the mouse pointer over the Fill Handle. When the mouse pointer changes to a black plus sign, left click and drag it to cell E2.

7. Highlight the range B2:E2 and click the Format button in the Home tab of the Ribbon. Click the Column Width option, type 11.57 in the Column Width dialog box, and then click the OK button in the Column Width dialog box.

8. Enter the words **Medical Office Budget** in cell A1.

9. Insert a blank column between Columns A and B by clicking on any cell in Column B. Then, click the drop-down arrow of the Insert button in the Home tab of the Ribbon. Click the Insert Sheet Columns option.

10. Enter the words **Budget Cost** in cell B2.

11. Adjust the width of Column B to approximately 13.29 characters.

12. Highlight the range A1:F1 and click the Merge & Center button in the Home tab of the Ribbon to merge the cells in that range.

13. Make the following format adjustments to the range A1:F1: bold; italics; change the font size to 14 points; change the cell fill color to Aqua, Accent 5, Darker 50%; and change the font color to white.

14. Increase the height of Row 1 to approximately 24.75 points.

15. Make the following format adjustment to the range A2:F2: bold; and change the cell fill color to Tan, Background 2, Darker 10%. Center the column titles so that they are horizontally centered in each cell.

16. Set the alignment in cell B2 to Wrap Text. Select

B2 and choose the Wrap Text button in the Home tab of the Ribbon.

17. Copy cell C3 and paste the contents into the range D3:F3.

18. Copy the contents in the range C6:C8 by highlighting the range and clicking the Copy button in the Home tab of the Ribbon. Then, highlight the range D6:F8 and click the Paste button in the Home tab of the Ribbon.

19. Calculate the total budget for all four quarters for the salaries. Activate cell B3 and click the down arrow on the AutoSum button in the Formulas tab of the Ribbon. Click the Sum option from the drop-down list. Then, highlight the range C3:F3 and press the ENTER key on your keyboard.

20. Copy the formula in cell B3 and paste them into the range B4:B8.

21. Format the range B3:F8 with Accounting format and zero decimal places.

22. Highlight the range A1:F8 and click the down arrow next to the Borders button in the Home tab of the Ribbon. Select the All Borders option from the drop-down list.

23. Double click the Sheet1 worksheet tab to change the name of Sheet1 to the word **Budget**, and press the ENTER key. Delete any unnecessary worksheets.

24. Change the orientation of the Budget worksheet so it prints landscape instead of portrait.

25. Use Fit to 1 page so the Budget worksheet prints

on one piece of paper, if it does not already.

26. Add a header to the Budget worksheet that shows the date in the upper left corner and your name in the center.

27. Add a footer to the Budget worksheet that shows the page number in the lower right corner.

28. Save **PR1 Medical Office Budget** workbook for your records.

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1.6 CHAPTER ASSESSMENT

THE FOLLOWING ARE **SAMPLE QUESTIONS** TO TEST WHETHER YOU KNOW, UNDERSTAND, AND ARE ABLE TO APPLY YOUR LEARNING FROM THIS CHAPTER

1. Excel has _____ rows:
a) 2,000
b) 16,384
c) 33,000
d) 1,048,57

2. MIS is a possible column heading in Excel:
a) Cell reference
b) Column designation
c) Range reference
d) Row name

3. What is the shortcut/key combination to paste a selection you copied to the clipboard?
a) CTRL+P
b) CTRL+S
c) CTRL+U
d) CTRL+V

4. What is the range reference for the highlighted selection?

	A	B	C	D
1	General Merchandise World Retail Sales (in millions)			
2	Month	Unit Sales	Average Price	Sales Dollars
3	January	2,670	$ 9.99	$ 26,685
4	February	2,160	$ 12.49	$ 26,937
5	March	515	$ 14.99	$ 7,701
6	April	590	$ 17.49	$ 10,269
7	May	1,030	$ 14.99	$ 15,405
8	June	2,875	$ 12.49	$ 35,916
9	July	2,700	$ 9.99	$ 26,937
10	August	900	$ 19.99	$ 17,958
11	September	775	$ 19.99	$ 15,708
12	October	1,180	$ 19.99	$ 23,562
13	November	1,800	$ 17.49	$ 31,416
14	December	3,560	$ 14.99	$ 53,370
15	Total Sales	20,755		$ 291,864

a) A1:B14
b) B1:B14
c) B2:B14

d) B3:B14

5. Enter data as directed in Chapter 1.2, make sure your values appear as they are shown in Figure 1.25. Which of the following formulas is best to return the Average Price from January through December?
   a) =AVERAGE(C3$C14)
   b) =AVERAGE(C3%C14)
   c) =AVERAGE(C3:C14)
   d) =SUM(C3%C14)/12
   e) =SUM(C3:C14)/12

6. Enter data as directed in Chapter 1.2, make sure your values appear as they are shown in Figure 1.25. Which month has the second highest Sales Dollars?
   a) February
   b) June
   c) November
   d) December

7. Enter data as directed in Chapter 1.2, make sure your values appear as they are shown in Figure 1.25. Which month has the third-highest Unit Sales?

a) February

b) July

c) November

d) December

8. Enter data as directed in Chapter 1.2, make sure your values appear as they are shown in Figure 1.25. Which month has the lowest Average Price?

a) January

b) February

c) June

d) December

9. Pound signs (####) appear in columns when:

a) A column is too narrow for a long number.

b) Excel cannot recognize the data type entered.

c) You make a typo when entering data.

d) You misspell a function.

10. Once a worksheet is deleted, you cannot use the Undo command to bring the sheet back. True/False

---

Solutions: ███████████████████████████████
███

ATTRIBUTION

Questions by Emese Felvégi & Lois K. Hamburger based on the chapter practice problems. Edited by Lilliana E. Olmos & Marcella Olmos. [CC BY-NC-SA 3.0](#).

Media Attributions

- Ch1_Range_1

CHAPTER 2 – FORMULAS, FUNCTIONS, CELL REFERENCES

Perhaps the most valuable feature of Excel is its ability to produce mathematical outputs using the data in a workbook. This chapter reviews several mathematical outputs that you can produce in Excel through the construction of formulas and functions. The chapter begins with the construction of formulas for basic and complex mathematical computations. Then, we look at auditing formulas to make sure that our work is accurate, valid, and reliable. The third section reviews statistical functions, such as SUM, AVERAGE, MIN, and MAX, which can be applied to a range of cells. All of the functions and features used in this chapter will return in the rest of our book in some shape or form, so please invest sufficient time in practicing.

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2.1 FORMULAS

This section reviews the fundamental skills for entering formulas into an Excel worksheet. The objective used for this chapter is the construction of a personal cash budget. Most financial advisors recommend that all households construct and maintain a personal budget to achieve and maintain strong financial health. Organizing and maintaining a personal budget is a skill you can practice at any point in your life. Whether you are managing your expenses during college or maintaining the finances of a family of four, a personal budget can be a vital tool when making financial decisions. Excel can make managing your money a fun and rewarding exercise.

Figure 2.1 shows the completed workbook that will be demonstrated in this chapter. Notice that this workbook contains four worksheets. The first worksheet, **Budget Summary**, contains formulas that utilize or reference the data in the other three worksheets. As a result, the **Budget Summary** worksheet serves as an overview of the data that was entered and calculated in the other three worksheets of the workbook. Sheets two through four are ones we will return to later in the semester with our chapter on Financial functions.

	A	B	C	D	E	F	G
1			**Personal Cash Budget**				
2	Net Income			$ 33,000			
3	Expenses		$ 17,950				
4	Mortgage Payments		$ 10,629				
5	Car Lease Payments		$ 2,479				
6	Total Plan Spend			$ 31,058	94.1%		
7	Net Change in Cash			$ 1,942	5.9%		
8							
9							
10							
11					The outputs in this worksheet are created by formulas and functions that reference the data entered in these worksheets.		
12							
13							
14							
15							

⏮ ◀ ▶ ⏭ **Budget Summary** / Budget Detail / Mortgage Payments / Car Lease Payments / ◀

Figure 2.1 Completed Personal Budget Workbook

CREATING A BASIC FORMULA

Download Data File: CH2 Data

Formulas are used to calculate a variety of mathematical outputs in Excel and can be used to create virtually any custom calculation required for your objective. Furthermore, when constructing a formula in Excel, you use cell locations that, when added to a formula, become cell references. This means that Excel uses, or references, the number entered into the cell

location when calculating a mathematical output. As a result, when the numbers in the cell references are changed, Excel automatically produces a new output. This is what gives Excel the ability to create a variety of what-if scenarios, which will be explained later in the chapter.

To demonstrate the construction of a basic formula, we will begin working on the **Budget Detail** worksheet in the Personal Budget workbook, which is shown in **Figure 2.2**. To complete this worksheet, we will add several formulas and functions. **Table 2.1** provides definitions for each of the spend categories listed in the range A3:A11. When you develop a personal budget, these categories are defined on the basis of how you spend your money. It is likely that every person could have different categories or define the same categories differently. Therefore, it is important to review the definitions in **Table 2.1** to understand how we are defining these categories before proceeding.

Figure 2.2 Budget Detail Worksheet

Table 2.1 Spend Category Definitions

Category	Definition
Household Utilities	Money spent on electricity, heat, and water and on cable, phone, and Internet access
Food	Money spent on groceries, toiletries, and related items
Gasoline	Money spent on fuel for automobiles
Clothes	Money spent on clothes, shoes, and accessories
Insurance	Money spent on homeowner's or automobile insurance
Taxes	Money spent on school and property taxes (this example of the personal budget assumes that we own property).
Entertainment	Money spent on entertainment, including dining out, movie and theater tickets, parties, and so on
Vacation	Money spent on vacations
Miscellaneous	Includes any other spending categories, such as textbooks, software, journals, school or work supplies, and so on

The first formula that we will add to the **Budget Detail** worksheet will calculate the Monthly Spend values. The formula will be constructed so that it takes the values in the Annual Spend column and divides them by 12. This will show how much money will be spent per month for each of the categories listed in Column A. The following explains how this formula is created:

1. Open the Data file named **CH2 Data** and use the File/Save As command to save it with the new name **CH2 Personal Budget**.

2. Click the **Budget Detail** worksheet tab to open the worksheet.

3. Click cell C3.

4. Type an equal sign =. When the first character

entered into a cell location is an equal sign, it signals Excel to perform a calculation or produce a logical output.

5. Type **D3**. This adds D3 to the formula, which is now a cell reference. Excel will use whatever value is entered into cell D3 to produce an output.

6. Type the slash symbol /. This is the symbol for division in Excel. As shown in **Table 2.2** the mathematical operators in Excel are slightly different from those found on a typical calculator.

7. Type the number **12**. This divides the value in cell D3 by 12. In this formula, a number, or constant, is used instead of a cell reference because it will not change. In other words, there will always be 12 months in a year.

8. Press the ENTER key.

Table 2.2 Excel Mathematical Operators

Symbol	Operation
+	Addition
–	Subtraction
/	Division
*	Multiplication
^	Power/Exponent

Why Use Cell References?

Cell references enable Excel to dynamically produce new outputs when one or more inputs in the referenced cells are changed. Cell references also allow you to trace how outputs are being calculated in a formula. As a result, you should never use a calculator to determine a mathematical output and type it into the cell location of a worksheet. Doing so eliminates Excel's cell-referencing benefits as well as your ability to trace a formula to determine how outputs are being produced.

Figure 2.3 shows how the formula appears in cell C3 before you press the ENTER key. **Figure 2.4** shows the output of the formula after you press the ENTER key. The Monthly Spend for Household Utilities is $250 because the formula is taking the Annual Spend in cell D3 and dividing it by 12. If the value in cell D3 is changed, the formula automatically produces a new output. We are calculating the spend per month for each category because people often get paid and are billed for these items on a monthly basis. This formula allows you to compare your monthly income to your monthly bills to determine whether you have enough income to pay these expenses.
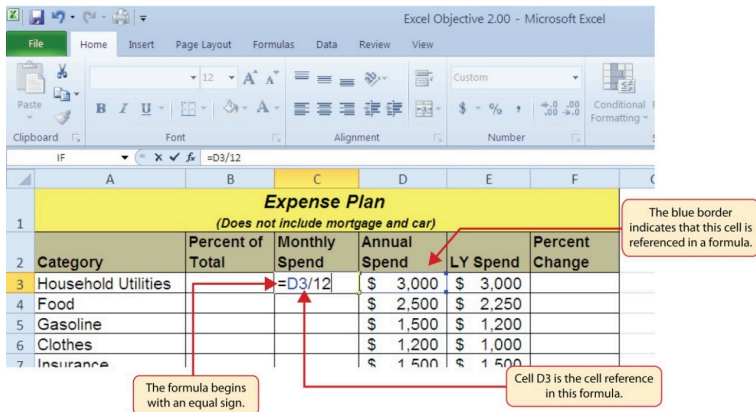
Figure 2.3 Adding a Formula to a Worksheet
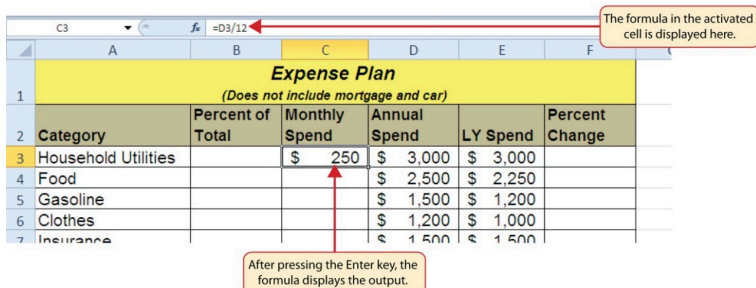
Figure 2.4 Formula Output for Monthly Spend

Why Use Universal Constants?

If you are using constants, or numerical values, in an Excel formula, they should be universal constants

that do not change, such as the number of days in a week, weeks in a year, and so on. Do not type the values that exist in cell locations into an Excel formula. This will eliminate Excel's cell-referencing benefits, which means if the value in the cell location you are using in a formula is changed, Excel will not be able to produce a new output.

RELATIVE REFERENCES (COPYING AND PASTING FORMULAS)

Once a formula is typed into a worksheet, it can be copied and pasted to other cell locations. For example, **Figure 2.4** shows the output of the formula that was entered into cell C3. However, this calculation needs to be performed for the rest of the cell locations in Column C. Since we used the D3 cell reference in the formula, Excel automatically adjusts that cell reference when the formula is copied and pasted into the rest of the cell locations in the column. This is called relative referencing and is demonstrated as follows:

1. Click cell C3.

2. Place the mouse pointer over the Auto Fill Handle.

3. When the mouse pointer turns from a white block plus sign to a black plus sign, click and drag down to cell C11. This pastes the formula into the range C4:C11.

4. Double click cell C6. Notice that the cell reference

in the formula is automatically changed to D6.

5. Press the ENTER key.

Figure 2.5 shows the outputs added to the rest of the cell locations in the Monthly Spend column. For each row, the formula takes the value in the Annual Spend column and divides it by 12. You will also see that cell D6 has been double-clicked to show the formula. Notice that Excel automatically changed the original cell reference of D3 to D6. This is the result of relative referencing, which means Excel automatically adjusts a cell reference relative to its original location when it is pasted into new cell locations. In this example, the formula was pasted into eight cell locations below the original cell location. As a result, Excel increased the row number of the original cell reference by a value of one for each row it was pasted into.

	A	B	C	D	E	F
			Expense Plan			
1			(Does not include mortgage and car)			
		Percent of	Monthly	Annual		Percent
2	Category	Total	Spend	Spend	LY Spend	Change
3	Household Utilities		$ 250	$ 3,000	$ 3,000	
4	Food		$ 208	$ 2,500	$ 2,250	
5	Gasoline		$ 125	$ 1,500	$ 1,200	
6	Clothes		=D6/12	$ 1,200	$ 1,000	
7	Insurance		$ 125	$ 1,500	$ 1,500	This cell reference was automatically changed when the formula was pasted here because of relative referencing.
8	Taxes		$ 292	$ 3,500	$ 3,500	
9	Entertainment		$ 167	$ 2,000	$ 2,250	
10	Vacation		$ 125	$ 1,500	$ 2,000	
11	Miscellaneous		$ 104	$ 1,250	$ 1,558	
12	Totals					
13			Number of Categories			
14			Average Spend			

Figure 2.5 Relative Reference Example

Why Use Relative Referencing?

Relative referencing is a convenient feature in Excel. When you use cell references in a formula, Excel automatically adjusts the cell references when the formula is pasted into new cell locations. If this feature were not available, you would have to manually retype the formula when you want the same calculation applied to other cell locations in a column or row.

Skill Refresher

Trace Dependents

1. Click a cell location that contains a number or formula.

2. Click the Formulas tab on the Ribbon.

3. Click the Trace Dependents button in the Formula Auditing group of commands.

4. Use the arrow(s) to determine where the cell is referenced in formulas and functions.

5. Click the Remove Arrows button to remove the arrows from the worksheet.

- When using numerical values in formulas and functions, only use universal constants that do not change, such as days in a week, months in a year, and so on.

- Relative referencing automatically adjusts the cell references in formulas and functions when they are pasted into new locations on a worksheet. This eliminates the need to retype formulas and functions when they are needed in multiple rows or columns on a worksheet.

- Parentheses must be used to control the order of operations when necessary for complex formulas.

- Formula auditing tools such as Trace Dependents, Trace Precedents, and Show Formulas should be used to check the integrity of formulas that have been entered into a worksheet.

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2.2 CREATING & AUDITING COMPLEX FORMULAS

CREATING COMPLEX FORMULAS (CONTROLLING THE ORDER OF OPERATIONS)

The next formula to be added to the Personal Budget workbook is the percent change over last year. This formula determines the difference between the values in the LY (Last Year) Spend column and shows the difference in terms of a percentage. This requires that the order of mathematical operations be controlled to get an accurate result. **Table 2.3** shows the standard order of operations for a typical formula. To change the order of operations shown in the table, we use parentheses to process certain mathematical calculations first. This formula is added to the worksheet as follows:

1. Click cell F3 in the **Budget Detail** worksheet.
2. Type an equal sign =.
3. Type an open parenthesis **(**.
4. Click cell D3. This will add a cell reference to cell D3 to the formula. When building formulas, you can click cell locations instead of typing them.

5. Type a minus sign **–**.

6. Click cell E3 to add this cell reference to the formula.

7. Type a closing parenthesis **)**.

8. Type the slash / symbol for division.

9. Click cell E3. This completes the formula that will calculate the percent change of last year's actual spent dollars vs. this year's budgeted spend dollars (**see Figure 2.6**).

10. Press the ENTER key.

11. Click cell F3 to activate it.

12. Place the mouse pointer over the Auto Fill Handle.

13. When the mouse pointer turns from a white block plus sign to a black plus sign, click and drag down to cell F11. This pastes the formula into the range F4:F11.

Table 2.3 Standard Order of Mathematical Operations

Symbol	Order
( )	Override Standard Order: Any mathematical computations placed in parentheses are performed first and override the standard order of operations. If there are layers of parentheses used in a formula, Excel computes the innermost parentheses first and the outermost parentheses last.
^	First: Excel executes any exponential computations first.
* or /	Second: Excel performs any multiplication or division computations second. When there are multiple instances of these computations in a formula, they are executed in order from left to right.
+ or –	Third: Excel performs any addition or subtraction computations third. When there are multiple instances of these computations in a formula, they are executed in order from left to right.

Figure 2.6 shows the formula that was added to the **Budget Detail** worksheet to calculate the percent change in spending. The parentheses were added to this formula to control the order of operations. Any mathematical computations placed in parentheses are executed first before the standard order of mathematical operations (see **Table 2.3**). In this case, if parentheses were not used, Excel would produce an erroneous result for this worksheet.

Figure 2.6 Adding the Percent Change Formula

Figure 2.7 shows the result of the percent change formula if the parentheses are removed. The formula produces a result of a 299900% increase. Since there is no change between the LY spend and the budget Annual Spend, the result should be 0%. However, without the parentheses, Excel is following the standard order of operations. This means the value in cell E3 will be divided by E3 first (3,000/3,000), which is 1. Then, the value of 1 will be subtracted from the value in cell D3 (3,000–1), which is 2,999. Since cell F3 is formatted as a percentage, Excel expresses the output as an increase of 299900%.
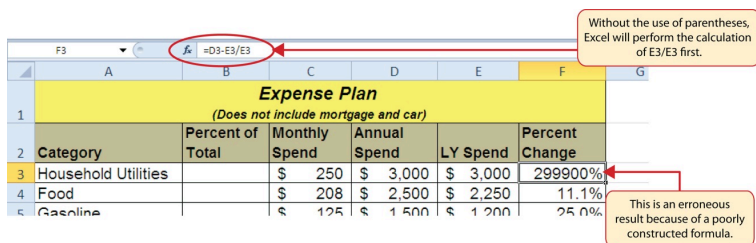
Figure 2.7 Removing the Parentheses from the Percent Change Formula

Integrity Check

Does the Output of Your Formula Make Sense?

It is important to note that the accuracy of the output produced by a formula depends on how it is constructed. Therefore, always check the result of your formula to see whether it makes sense with data in your worksheet. As shown in **Figure 2.7**, a poorly constructed formula can give you an inaccurate result. In other words, you can see that there is no change between the Annual Spend and LY Spend for Household Utilities. Therefore, the result of the formula should be 0%. However, since the parentheses were removed in this case, the formula is clearly producing an erroneous result.

Skill Refresher

Formulas

1. Type an equal sign =.

2. Click or type a cell location. If using constants, type a number.

3. Type a mathematical operator.

4. Click or type a cell location. If using constants, type a number.

5. Use parentheses where necessary to control the order of operations.

6. Press the ENTER key.

AUDITING FORMULAS

Excel provides a few tools that you can use to review the formulas entered into a worksheet. For example, instead of showing the outputs for the formulas used in a worksheet, you can have Excel show the formula as it was entered in the cell locations. This is demonstrated as follows:

1. With the **Budget Detail** worksheet open, click the Formulas tab of the Ribbon.

2. Click the Show Formulas button in the Formula Auditing group of commands. This displays the formulas in the worksheet instead of showing the mathematical outputs.

3. Click the Show Formulas button again. The worksheet returns to showing the output of the formulas.

Figure 2.8 shows the **Budget Detail** worksheet after

activating the Show Formulas command in the Formulas tab of the Ribbon. As shown in the figure, this command allows you to view and check all the formulas in a worksheet without having to click each cell individually. After activating this command, the column widths in your worksheet increase significantly. The column widths were adjusted for the worksheet shown in **Figure 2.8** so all columns can be seen. The column widths return to their previous width when the Show Formulas command is deactivated.
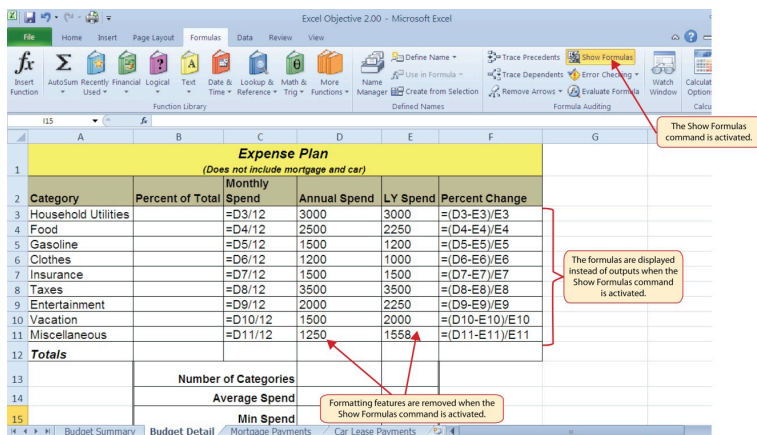
Figure 2.8 Show Formulas Command

Skill Refresher

Show Formulas

1. Click the Formulas tab on the Ribbon.

2. Click the Show Formulas button in the Formula Auditing group of commands.

3. Click the Show Formulas button again to show

formula outputs.

Keyboard Shortcuts

Show Formulas

- Hold down the CTRL key while pressing the accent symbol `.

Two other tools in the Formula Auditing group of commands are the Trace Precedents and Trace Dependents commands. These commands are used to trace the cell references used in a formula. A precedent cell is a cell whose value is used in other cells. The Trace Precedents command shows an arrow to indicate the cells or ranges (precedents) which affect the active cell's value. A dependent cell is a cell whose value depends on the values of other cells in the workbook. The Trace Dependents command shows where any given cell is referenced in a formula. The following is a demonstration of these commands:

1. Click cell D3 in the **Budget Detail** worksheet.

2. Click the Trace Dependents button in the Formula Auditing group of commands in the Formulas tab of the Ribbon. A double blue arrow appears, pointing to cell locations C3 and F3 (see **Figure 2.9**). This indicates that cell D3 is referenced in formulas that are entered in cells C3

and F3.

3. Click the Remove Arrows command in the Formula Auditing group of commands in the Formulas tab of the Ribbon. This removes the Trace Dependents arrow.

4. Click cell F3 in the **Budget Detail** worksheet.

5. Click the Trace Precedents button in the Formula Auditing group of commands in the Formulas tab of the Ribbon. A blue arrow running through cells D3 and E3 and pointing to cell F3 appears (see **Figure 2.10**). This indicates that cells D3 and E3 are references in a formula entered in cell F3.

6. Click the Remove Arrows command in the Formula Auditing group of commands in the Formulas tab of the Ribbon. This removes the Trace Precedents arrow.

7. Save the **Ch2 Personal Budget** file.

Figure 2.9 shows the Trace Dependents arrow on the **Budget Detail** worksheet. The blue dot represents the activated cell. The arrows indicate where the cell is referenced in formulas.
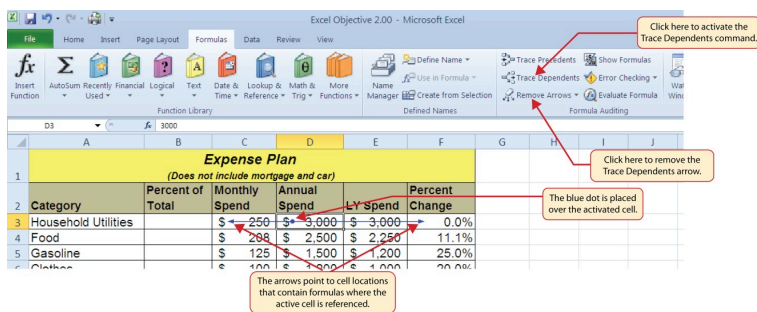
Figure 2.9 Trace Dependents Example

Figure 2.10 shows the Trace Precedents arrow on the **Budget Detail** worksheet. The blue dots on this arrow indicate the cells that are referenced in the formula contained in the activated cell. The arrow is pointing to the activated cell location that contains the formula.
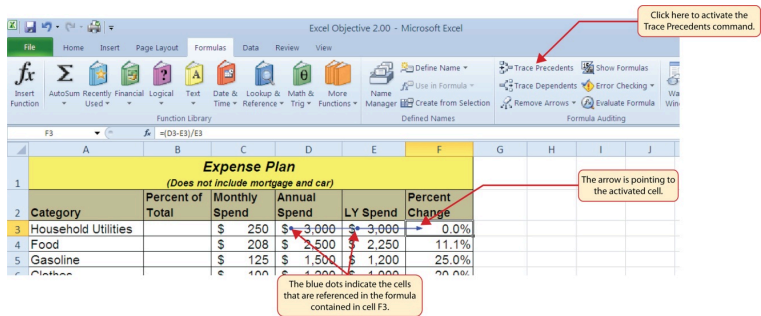
Figure 2.10 Trace Precedents Example

2.3 MATHEMATICAL & STATISTICAL FUNCTIONS

Learning Objectives

1.   Use the SUM function to calculate totals.

2.   Use absolute references to calculate percent of totals.

3.   Use the COUNT function to count cell locations with numerical values.

4.   Use the AVERAGE function to calculate the arithmetic mean.

5.   Use the MAX and MIN functions to find the highest and lowest values in a range of cells.

6.   Learn how to copy and paste formulas without formats applied to a cell location.

7.   Learn how to set a multiple level sort sequence for data sets that have duplicate values or outputs.

In addition to formulas, another way to conduct mathematical computations in Excel is through

functions. Statistical functions apply a mathematical process to a group of cells in a worksheet. For example, the SUM function is used to add the values contained in a range of cells. A list of commonly used statistical functions is shown in **Table 2.4**. Functions are more efficient than formulas when you are applying a mathematical process to a group of cells. If you use a formula to add the values in a range of cells, you would have to add each cell location to the formula one at a time. This can be very time-consuming if you have to add the values in a few hundred cell locations. However, when you use a function, you can highlight all the cells that contain values you wish to sum in just one step. This section demonstrates a variety of statistical functions that we will add to the Personal Budget workbook. In addition to demonstrating functions, this section also reviews percent of total calculations and the use of absolute references.

Table 2.4 Commonly Used Statistical Functions

Function	Output
ABS	The absolute value of a number
AVERAGE	The average or arithmetic mean for a group of numbers
COUNT	The number of cell locations in a range that contain a numeric character
COUNTA	The number of cell locations in a range that contain a text or numeric character
MAX	The highest numeric value in a group of numbers
MEDIAN	The middle number in a group of numbers (half the numbers in the group are higher than the median and half the numbers in the group are lower than the median)
MIN	The lowest numeric value in a group of numbers
MODE	The number that appears most frequently in a group of numbers
PRODUCT	The result of multiplying all the values in a range of cell locations
SQRT	The positive square root of a number
STDEV.S	The standard deviation for a group of numbers based on a sample
SUM	The total of all numeric values in a group

THE SUM FUNCTION

The SUM function is used when you need to calculate totals for a range of cells or a group of selected cells on a worksheet. With regard to the **Budget Detail** worksheet, we will use the SUM function to calculate the totals in row 12. It is important to note that there are several methods for adding a function to a worksheet, which will be demonstrated throughout the remainder of this chapter. The following illustrates how a function can be added to a worksheet by typing it into a cell location:

1. Click the **Budget Detail** worksheet tab to open the worksheet.

2. Click cell C12.

3. Type an equal sign =.

4. Type the function name **SUM**.

5. Type an open parenthesis **(**.

6. Click cell C3 and drag down to cell C11. This places the range C3:C11 into the function.

7. Type a closing parenthesis **)**.

8. Press the ENTER key. The function calculates the total for the Monthly Spend column, which is $1,496.

Figure 2.11 shows the appearance of the SUM function added to the **Budget Detail** worksheet before pressing the ENTER key.

Figure 2.11 Adding the SUM Function to the Budget Detail Worksheet

As shown in **Figure 2.11**, the SUM function was added to cell C12. However, this function is also needed to calculate the totals in the Annual Spend and LY Spend columns. The function can be copied and pasted into

these cell locations because of relative referencing. Relative referencing serves the same purpose for functions as it does for formulas. The following demonstrates how the total row is completed:

1. Click cell C12 in the **Budget Detail** worksheet.

2. Click the Copy button in the Home tab of the Ribbon.

3. Highlight cells D12 and E12.

4. Click the Paste button in the Home tab of the Ribbon. This pastes the SUM function into cells D12 and E12 and calculates the totals for these columns.

5. Click cell F11.

6. Click the Copy button in the Home tab of the Ribbon.

7. Click cell F12, then click the Paste button in the Home tab of the Ribbon. Since we now have totals in row 12, we can paste the percent change formula into this row.

Figure 2.12 shows the output of the SUM function that was added to cells C12, D12, and E12. In addition, the percent change formula was copied and pasted into cell F12. Notice that this version of the budget is planning a 1.7% decrease in spending compared to last year.

Figure 2.12 Results of the SUM Function in the Budget Detail Worksheet

Integrity Check

Cell Ranges in Statistical Functions

When you intend to use a statistical function on a range of cells in a worksheet, make sure there are two cell locations separated by a colon and not a comma. If you enter two cell locations separated by a comma, the function will produce an output but it will be applied to only two cell locations instead of a range of cells. For example, the SUM function shown in **Figure 2.13** will add only the values in cells C3 and C11, not the range C3:C11.

Figure 2.13 SUM Function Adding Two Cell Locations

ABSOLUTE REFERENCES (CALCULATING PERCENT OF TOTALS)

Data file: Continue with CH2 Personal Budget.

Since totals were added to row 12 of the **Budget Detail** worksheet, a percent of total calculation can be added to Column B beginning in cell B3. The percent of total calculation shows the percentage for each value in the Annual Spend column with respect to the total in cell D12. However, after the formula is created, it will be necessary to turn off Excel's relative referencing feature before copying and pasting the formula to the rest of the cell locations in the column. Turning off Excel's relative referencing feature is accomplished through an absolute reference. The following steps explain how this is done:

1. Click cell B3 in the **Budget Detail** worksheet.
2. Type an equal sign =.
3. Click cell D3.

4. Type a forward slash /.

5. Click cell D12.

6. Press the ENTER key. You will see that Household Utilities represents 16.7% of the Annual Spend budget (see **Figure 2.14**).

	A	B	C	D	E	F
			Expense Plan			
1			*(Does not include mortgage and car)*			
2	Category	Percent of Total	Monthly Spend	Annual Spend	LY Spend	Percent Change
3	Household Utilities	16.7%	$ 250	$ 3,000	$ 3,000	0.0%
4	Food		$ 208	$ 2,500	$ 2,250	11.1%
5	Gasoline		$ 125	$ 1,500	$ 1,200	25.0%
6	Clothes		$ 100	$ 1,200	$ 1,000	20.0%
7	Insurance		$ 125	$ 1,500	$ 1,500	0.0%
8	Taxes		$ 292	$ 3,500	$ 3,500	0.0%
9	Entertainment		$ 167	$ 2,000	$ 2,250	-11.1%
10	Vacation		$ 125	$ 1,500	$ 2,000	-25.0%
11	Miscellaneous		$ 104	$ 1,250	$ 1,558	-19.8%
12	**Totals**		**$ 1,496**	**$ 17,950**	**$ 18,258**	-1.7%
13			Number of Categories			
14			Average Spend			
15			Min Spend			

Formula entered into B3

B3 = D3/D12

Household Utilities represents 16.7% of the total Annual Spend in cell D12.

Budget Summary / **Budget Detail** / Mortgage Payments / Car Lease Payments

Figure 2.14 Adding a Formula to Calculate the Percent of Total

Figure 2.14 shows the completed formula that is calculating the percentage that Household Utilities Annual Spend represents to the total Annual Spend for the budget (see cell B3). Normally, we would copy this formula and paste it into the range B4:B11. However, because of relative referencing, both cell references will increase by one row as the formula is pasted into the cells below B3. This is fine for the first cell reference in the formula (D3) but not for the second cell reference (D12). **Figure 2.15** illustrates what happens if we paste the formula into the range B4:B12 in its current state.

Notice that Excel produces the #DIV/0 error code. This means that Excel is trying to divide a number by zero, which is impossible. Looking at the formula in cell B4, you see that the first cell reference was changed from D3 to D4. This is fine because we now want to divide the Annual Spend for Insurance by the total Annual Spend in cell D12. However, Excel has also changed the D12 cell reference to D13. Because cell location D13 is blank, the formula produces the #DIV/0 error code.
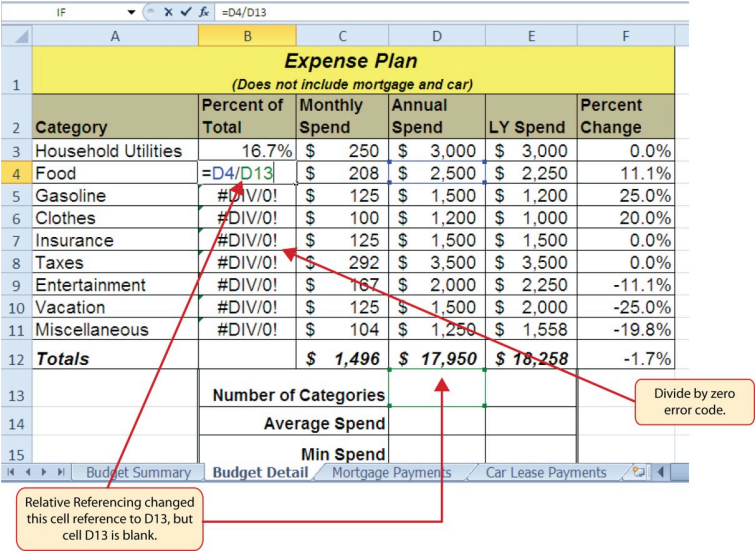
Figure 2.15 #DIV/0 Error from Relative Referencing

To eliminate the divide-by-zero error shown in **Figure 2.15** we must add an absolute reference to cell D12 in the formula. An absolute reference prevents relative referencing from changing a cell reference in a formula. This is also referred to as locking a cell. The following explains how this is accomplished:

1. Double click cell B3.

2. Place the mouse pointer in front of D12 and click. The blinking cursor should be in front of the D in the cell reference D12.

3. Press the F4 key. You will see a dollar sign ($) added in front of the column letter D and the row number 12. You can also type the dollar signs in front of the column letter and row number.

4. Press the ENTER key.

5. Click cell B3.

6. Click the Copy button in the Home tab of the Ribbon.

7. Highlight the range B4:B11.

8. Click the Paste button in the Home tab of the Ribbon.

Figure 2.16 shows the percent of total formula with an absolute reference added to D12. Notice that in cell B4, the cell reference remains D12 instead of changing to D13 as shown in **Figure 2.15**. Also, you will see that the percentages are being calculated in the rest of the cells in the column, and the divide-by-zero error is now eliminated.

Figure 2.16 Adding an Absolute Reference to a Cell Reference in a Formula

---

Skill Refresher

Absolute References

1. Click in front of the column letter of a cell reference in a formula or function that you do not want altered when the formula or function is pasted into a new cell location.

2. Press the F4 key or type a dollar sign $ in front of the column letter and row number of the cell reference.

THE COUNT FUNCTION

Data file: Continue with CH2 Personal Budget.

The next function that we will add to the **Budget Detail** worksheet is the COUNT function. The COUNT function is used to determine how many cells in a range contain a numeric entry. The COUNT function will not work for counting text or other non-numeric entries. For the **Budget Detail** worksheet, we will use the COUNT function to count the number of items that are planned in the Annual Spend column (Column D). The following explains how the COUNT function is added to the worksheet by using the function list:

1. Click cell D13 in the Budget Detail worksheet.

2. Type an equal sign =.

3. Type the letter **C**.

4. Click the down arrow on the scroll bar of the function list (see **Figure 2.17**) and find the word COUNT.

5. Double click the word COUNT from the function list.

6. Highlight the range D3:D11.

7. You can type a closing parenthesis **)** and then press the ENTER key, or simply press the ENTER key and Excel will close the function for you. The function produces an output of 9 since there are 9 items planned on the worksheet.

Figure 2.17 shows the function list box that appears after completing steps 2 and 3 for the COUNT function. The function list provides an alternative method for adding a function to a worksheet.
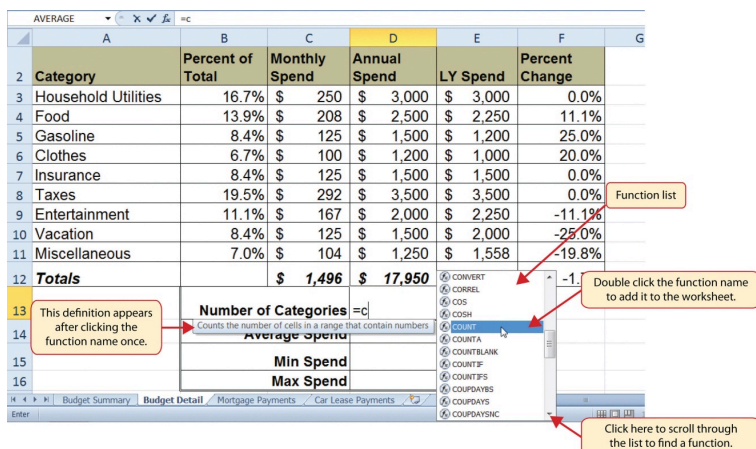
Figure 2.17 Using the Function List to Add the COUNT Function

Figure 2.18 shows the output of the COUNT function after pressing the ENTER key. The function counts the number of cells in the range D3:D11 that contain a numeric value. The result of 9 indicates that there are 9 categories planned for this budget.
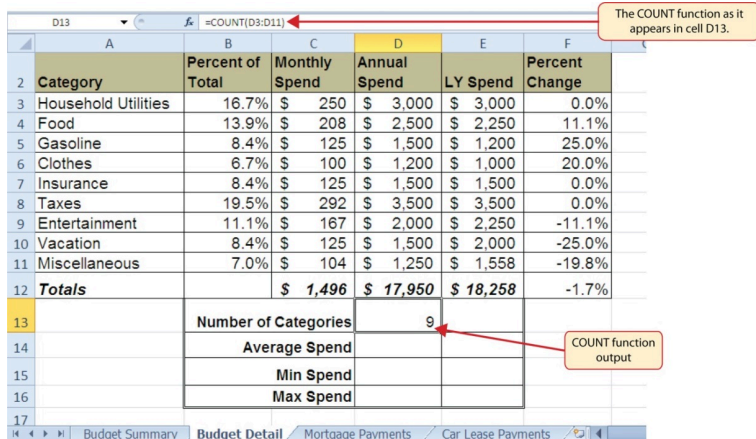
Figure 2.18 Completed COUNT Function in the Budget Detail Worksheet

THE AVERAGE FUNCTION

The next function we will add to the **Budget Detail** worksheet is the AVERAGE function. This function is used to calculate the arithmetic mean for a group of numbers. For the **Budget Detail** worksheet, we will use the function to calculate the average of the values in the Annual Spend column. We will add this to the worksheet by using the Function Library. The following steps explain how this is accomplished:

1. Click cell D14 in the **Budget Detail** worksheet.

2. Click the Formulas tab on the Ribbon.

3. Click the More Functions button in the Function Library group of commands.

4. Place the mouse pointer over the Statistical option from the drop-down list of options.

5. Click the AVERAGE function name from the list of functions that appear in the menu (see **Figure 2.19**). This opens the Function Arguments dialog box.

6. Click the Collapse Dialog button in the Function Arguments dialog box (see **Figure 2.20**).

7. Highlight the range D3:D11.

8. Click the Expand Dialog button in the Function Arguments dialog box (see **Figure 2.21**). You can also press the ENTER key to get the same result.

9. Click the OK button on the Function Arguments dialog box. This adds the AVERAGE function to the worksheet.

Figure 2.19 illustrates how a function is selected from the Function Library in the Formulas tab of the Ribbon.
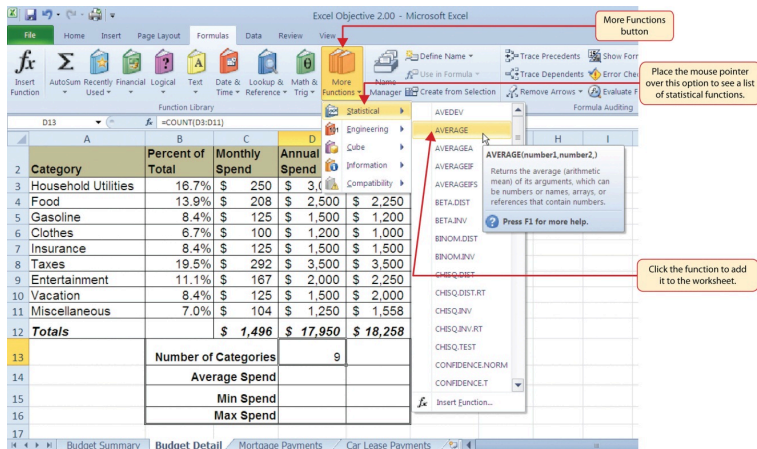
Figure 2.19 Selecting the AVERAGE Function from the Function Library

Figure 2.20 shows the Function Arguments dialog box. This appears after a function is selected from the Function Library. The Collapse Dialog button is used to hide the dialog box so a range of cells can be highlighted on the worksheet and then added to the function.
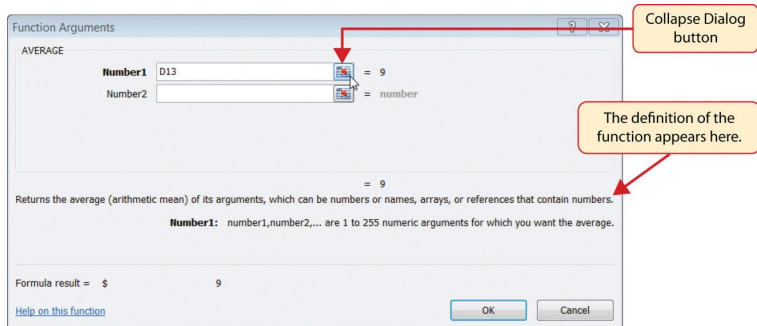
Figure 2.20 Function Arguments Dialog Box

Figure 2.21 shows how a range of cells can be selected

from the Function Arguments dialog box once it has been collapsed.
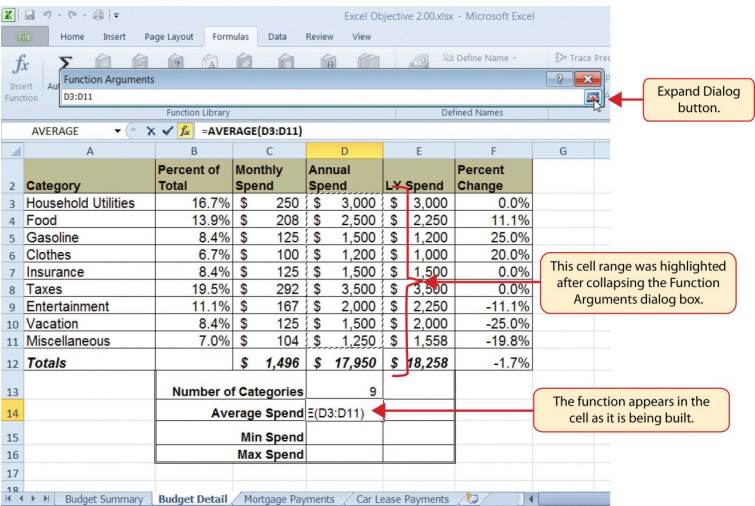
Figure 2.21 Selecting a Range from the Function Arguments Dialog Box

Figure 2.22 shows the Function Arguments dialog box after the cell range is defined for the AVERAGE function. The dialog box shows the result of the function before it is added to the cell location. This allows you to assess the function output to determine whether it makes sense before adding it to the worksheet.
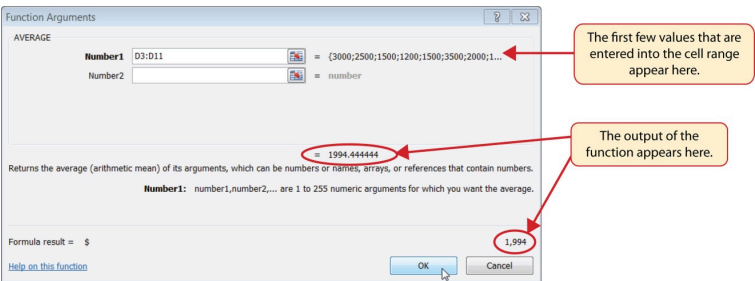
Figure 2.22 Function Arguments Dialog Box after a Cell Range Is Defined for a Function

Figure 2.23 shows the completed AVERAGE function in the **Budget Detail** worksheet. The output of the function shows that on average we expect to spend $1,994 for each of the categories listed in Column A of the budget. This average spend calculation per category can be used as an indicator to determine which categories are costing more or less than the average budgeted spend dollars.

	A	B	C	D	E	F
		Percent of	Monthly	Annual		Percent
2	Category	Total	Spend	Spend	LY Spend	Change
3	Household Utilities	16.7%	$ 250	$ 3,000	$ 3,000	0.0%
4	Food	13.9%	$ 208	$ 2,500	$ 2,250	11.1%
5	Gasoline	8.4%	$ 125	$ 1,500	$ 1,200	25.0%
6	Clothes	6.7%	$ 100	$ 1,200	$ 1,000	20.0%
7	Insurance	8.4%	$ 125	$ 1,500	$ 1,500	0.0%
8	Taxes	19.5%	$ 292	$ 3,500	$ 3,500	0.0%
9	Entertainment	11.1%	$ 167	$ 2,000	$ 2,250	-11.1%
10	Vacation	8.4%	$ 125	$ 1,500	$ 2,000	-25.0%
11	Miscellaneous	7.0%	$ 104	$ 1,250	$ 1,558	-19.8%
12	*Totals*		*$ 1,496*	*$ 17,950*	*$ 18,258*	-1.7%
13			Number of Categories	9		
14			Average Spend	$ 1,994		
15			Min Spend			
16			Max Spend			

Cell reference: D14 = AVERAGE(D3:D11)

The AVERAGE function as it appears in cell D14.

AVERAGE function output

Budget Summary / **Budget Detail** / Mortgage Payments / Car Lease Payments

Figure 2.23 Completed AVERAGE Function

THE MAX AND MIN FUNCTIONS

Data file: Continue with CH2 Personal Budget.

The final two statistical functions that we will add to the **Budget Detail** worksheet are the MAX and MIN functions. These functions identify the highest and lowest values in a range of cells. The following steps explain how to add these functions to the **Budget Detail** worksheet:

1. Click cell D15 in the **Budget Det**ail worksheet.

2. Type an equal sign =.

3. Type the word **MIN**.

4. Type an open parenthesis **(**.

5. Highlight the range D3:D11.

6. Type a closing parenthesis **)** and press the ENTER key, or simply press the ENTER key and Excel will close the function for you. The MIN function produces an output of $1,200, which is the lowest value in the Annual Spend column (see **Figure 2.24**).

7. Click cell D16.

8. Type an equal sign =.

9. Type the word **MAX**.

10. Type an open parenthesis **(**.

11. Highlight the range D3:D11.

12. Type a closing parenthesis **)** and press the ENTER key, or simply press the ENTER key and Excel will close the function for you. The MAX function produces an output of $3,500. This is the highest value in the Annual Spend column (see **Figure 2.25**).

Figure 2.24 MIN Function Added to the Budget Detail Worksheet

Figure 2.25 MAX Function Added to the Budget Detail Worksheet

Skill Refresher

Statistical Functions

1.   Type an equal sign =.

2.	Type the function name followed by an open parenthesis **(** or double click the function name from the function list.

3.	Highlight a range on a worksheet or click individual cell locations followed by commas.

4.	Type a closing parenthesis **)** and press the ENTER key or press the ENTER key to close the function.

COPY AND PASTE FORMULAS (PASTING WITHOUT FORMATS)

Data file: Continue with CH2 Personal Budget.

As shown in **Figure 2.25**, the COUNT, AVERAGE, MIN, and MAX functions are summarizing the data in the Annual Spend column. You will also notice that there is space to copy and paste these functions under the LY Spend column. This allows us to compare what we spent last year and what we are planning to spend this year. Normally, we would simply copy and paste these functions into the range E13:E16. However, you may have noticed the double-line style border that was used around the perimeter of the range B13:E16. If we used the regular Paste command, the double line on the right side of the range E13:E16 would be replaced with a single line. Therefore, we are going to use one of the Paste Special commands to paste only the functions without any of the formatting treatments. This is accomplished through the following steps:

1.	Highlight the range D13:D16 in the **Budget**

Detail worksheet.

2. Click the Copy button in the Home tab of the Ribbon.

3. Click cell E13.

4. Click the down arrow below the Paste button in the Home tab of the Ribbon.

5. Click the Formulas option from the drop-down list of buttons (see **Figure 2.26**).

Figure 2.26 shows the list of buttons that appear when you click the down arrow below the Paste button in the Home tab of the Ribbon. One thing to note about these options is that you can preview them before you make a selection by dragging the mouse pointer over the options. As shown in the figure, when the mouse pointer is placed over the Formulas button, you can see how the functions will appear before making a selection. Notice that the double-line border does not change when this option is previewed. That is why this selection is made instead of the regular Paste option.
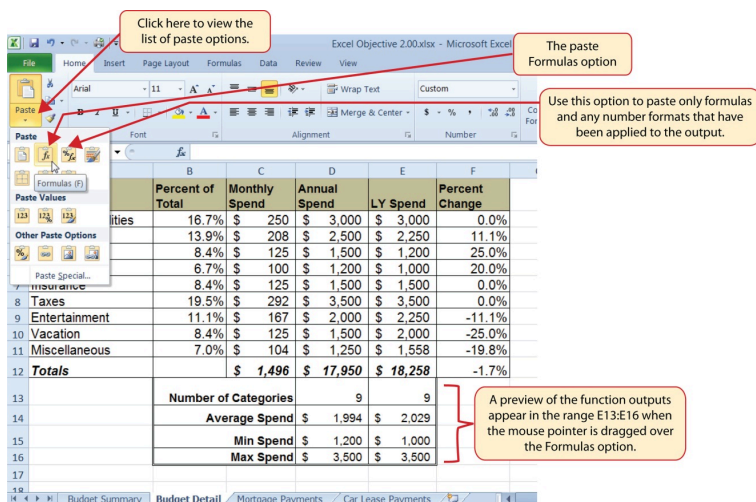
Figure 2.26 Paste Formulas Option

Skill Refresher

Paste Formulas

1.   Click a cell location containing a formula or function.

2.   Click the Copy button in the Home tab of the Ribbon.

3.   Click the cell location or cell range where the formula or function will be pasted.

4.   Click the down arrow below the Paste button in the Home tab of the Ribbon.

5.   Click the Formulas button under the Paste group of buttons.

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2.4 SORTING DATA

SORTING DATA (MULTIPLE LEVELS)

Data file: Continue with CH2 Personal Budget.

The **Budget Detail** worksheet shown in **Figure 2.26** is now producing several mathematical outputs through formulas and functions. The outputs allow you to analyze the details and identify trends as to how money is being budgeted and spent. Before we draw some conclusions from this worksheet, we will sort the data based on the Percent of Total column. Sorting is a powerful tool that enables you to analyze key trends in any data set. Sorting will be covered thoroughly in a later chapter, but will be briefly introduced here. For the purposes of the **Budget Detail** worksheet, we want to set multiple levels for the sort order. This is accomplished through the following steps:

1. Highlight the range A2:F11 in the **Budget Detail** worksheet.

2. Click the Data tab in the Ribbon.

3. Click the Sort button in the Sort & Filter group of commands. This opens the Sort dialog box, as shown in **Figure 2.27**.

4. Click the down arrow next to the "Sort by" box.

5. Click the Percent of Total option from the drop-down list.

6. Click the down arrow next to the sort Order box.

7. Click the Largest to Smallest option.

8. Click the Add Level button. This allows you to set a second level for any duplicate values in the Percent of Total column.

9. Click the down arrow next to the "Then by" box.

10. Select the LY Spend option. Leave the Sort Order as Smallest to Largest

11. Click the OK button at the bottom of the Sort dialog box.

12. Save the **Ch2 Personal Budget** file.
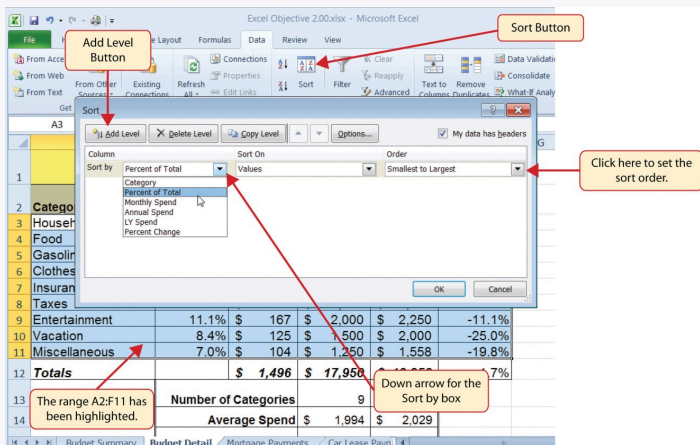
Figure 2.27 Sort Dialog Box

Figure 2.28 shows the **Budget Detail** worksheet after it has been sorted. Notice that there are three identical values in the Percent of Total column. This is why a second sort level had to be created for this worksheet. The second sort level arranges the values of 8.4% based on the values in the LY Spend column in ascending order. Excel gives you the option to set as many sort levels as necessary for the data contained in a worksheet.

Figure 2.28 Budget Detail Worksheet after Sorting

Skill Refresher

Sorting Data (Multiple Levels)

1. Highlight a range of cells to be sorted.
2. Click the Data tab of the Ribbon.

3. Click the Sort button in the Sort & Filter group.

4. Select a column from the "Sort by" drop-down list in the Sort dialog box.

5. Select a sort order from the Order drop-down list in the Sort dialog box.

6. Click the Add Level button in the Sort dialog box.

7. Repeat Steps 4 and 5.

8. Click the OK button on the Sort dialog box.

Now that the **Budget Detail** worksheet is sorted, a few key trends can be easily identified. The worksheet clearly shows that the top three categories as a percentage of total budgeted spending for the year are Taxes, Household Utilities, and Food. All three categories are necessities (or realities) of life and typically require a significant amount of income for most households. Looking at the Percent Change column, we can see how our planned spending is expected to change from last year. This is perhaps the most important column on the worksheet because it allows you to assess whether your plan is realistic. You will see that there are no changes planned for Taxes and Household Utilities. While Taxes can change from year to year, it is not too difficult to predict what they will be. In this case, we are assuming that there are no changes to the tax costs for our budget. We are also planning no change in Household Utilities. These costs can fluctuate from year to year as well. However, you can take measures to reduce costs, such as using less electricity, turning off heat when no one is in the house, keeping track of your wireless minutes so you do not go over the maximum allowed in your plan, and so on. As a result, there is no change in planned spending for Household Utilities because

we will assume that any rate increases will be offset with a decrease in usage. The third item that is planned not to change is Insurance. Insurance policies for cars and homes can change, but as is true for taxes, the changes are predictable. Therefore, we are assuming no changes in our insurance policy.

The first big change that is noticeable in the worksheet is the Food and Entertainment categories in rows 5 and 6 (see definitions in **Table 2.1**). The Percent Change column indicates that there is an 11.1% decrease in Entertainment spending and an 11.1% increase in Food spending. This is logical because if you plan to eat in restaurants less frequently, you will be eating at home more frequently. Although this makes sense in theory, it may be hard to do in practice. Dinners and parties with friends may be tough to turn down. However, the entire process of maintaining a budget is based on discipline, and it certainly takes a significant amount of discipline to plan targets for yourself and stick to them.

A few other points to note are the changes in the Gasoline and Vacation categories. If you commute to school or work, the price of gas can have a significant impact on your budget. It is important to be realistic if gas prices are increasing, and you should reflect these increases in your budget. To compensate for the increased spending for gas, the spending plan for vacations has been reduced by 25%. Budgeting often requires a certain degree of creativity. Although the Vacation budget has been reduced, there is still money you can set aside to make plans for spring break or winter break.

Finally, the budget shows a decrease in Miscellaneous spending of 19.8%. This was defined as a group containing several expenses, such as textbooks, school supplies, software updates, and so on (see **Table 2.1**). You may be able to reduce your spending in this category if you can use items

such as online textbooks. This reduction in spending can free up funds for Clothes, a spend category that has increased by 20%. We will continue to develop the Personal Budget workbook further in Section 2.3 "Functions for Personal Finance".

Key Takeaways

- Statistical functions are used when a mathematical process is required for a range of cells, such as summing the values in several cell locations. For these computations, functions are preferable to formulas because adding many cell locations one at a time to a formula can be very time-consuming.

- Statistical functions can be created using cell ranges or selected cell locations separated by commas. Make sure you use a cell range (two cell locations separated by a colon) when applying a statistical function to a contiguous range of cells.

- To prevent Excel from changing the cell references in a formula or function when they are pasted to a new cell location, you must use an absolute reference. You can do this by placing a dollar sign ($) in front of the column letter and row number of a cell reference.

- The #DIV/0 error appears if you create a formula that attempts to divide a constant or the value in a cell reference by zero.

- The Paste Formulas option is used when you need to paste formulas without any formatting treatments into cell locations that have already been formatted.

- You need to set multiple levels, or columns, in the Sort dialog box when sorting data that contains several duplicate values.

2.5 CHAPTER PRACTICE

HAVE YOU COMPLETED THE PERSONAL
BUDGET SHEET DESCRIBED IN THIS CHAPTER?
DO THAT FIRST, THEN COME BACK AND TEST
YOUR KNOWLEDGE OF TERMS.

QUIZLET

https://quizlet.com/_6s9e99

GIVE THE CROSSWORD VERSION A GO!
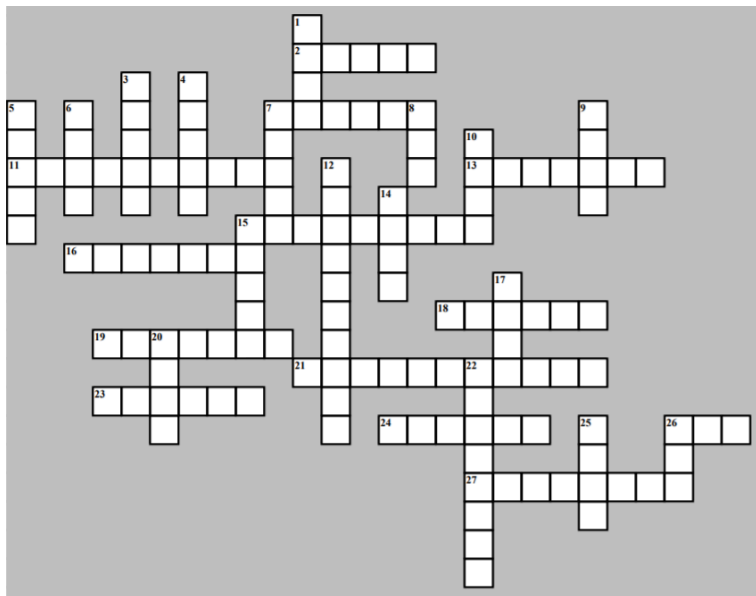
ACROSS

2 Text, dates, and numbers you will use for calculations.

7 The order of mathematical operations.

11 Values affected by a formula.

13 Function to calculate the arithmetic mean.

15 The location of a cell containing data.

16 An expression that calculates values.

18 A plan to spend your money.

19 More advanced than simple things.

21 The output of an information system.

23 The result you get from a calculation.

24 The order of a function that tells you what arguments to add.

26 Returns the highest value in a range of cells.

27 A built-in tool for calculations in Excel.

DOWN

1 A document that contains data.

3 Function to count cell locations with numerical values.

4 Press to return to the next cell/row/paragraph.

5 Check your work.

6 Highlighting and getting content from one location.

7 Insert things you copied.

8 This function will add things up for you.

9 AVERAGE belongs to this function family.

10 A day of the month as a number.

12 Values affecting a formula.

14 The intersection of a column and a row.

15 A collection of cells generally next to one another.

17 Make changes to your work.

20 The SUM function is of this type of function.

22 Automatically populate a range with a formula. (2 words)

25 The input of an information system.

26 Returns the lowest values in a range of cells.

Solution. (Try on your own first, OK?)

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- Ch2_Practice

2.6 CHAPTER ASSESSMENT

THE FOLLOWING ARE **SAMPLE QUESTIONS** TO TEST WHETHER YOU KNOW, UNDERSTAND, AND ARE ABLE TO APPLY YOUR LEARNING FROM THIS CHAPTER.

1. What kind of a cell reference do you need to use in your formula in the Budget Detail to calculate the Monthly Spend amount for Food?
   a) Absolute
   b) Circular
   c) Linking
   d) Relative

2. Based on Figure 2.3 and the Budget Detail sheet, which of the following is the best formula to

calculate the Monthly Spend amount for Gasoline?

  a) =A5/12

  b) =D5/12

  c) =D5/E5

  d) =$1,500/12

3. Based on Figure 2.3 and the Budget Detail sheet, what is the Monthly Spend amount for Entertainment if the Annual Spend is $2,200?

  a) 167

  b) 178

  c) 183

  d) 185

4. Based on Figure 2.6 and the Budget Detail sheet, which of the following is the best formula to calculate the Percent Change for Clothes?

  a) D6-E6/E6

  b) (D6-E6)/E6

c) D6-E6%E6

d) (D6-E6)/12

5. Based on Figure 2.6 and the Budget Detail sheet, what is the Percent Change for Taxes if the Annual Spend is $4,450?

a) 11.1%

b) 27.1%

c) 0%

d) 25%

6. Based on Figure 2.6 and the Budget Detail sheet, which function will return the Average Spend?

a) ADD

b) AVERAGE

c) MEAN

d) TOTAL

7. Based on Figure 2.6 and the Budget Detail sheet, what is the range reference to return the Mininum Annual Spend?

a) (D3:D11)
b) (D3:E12)
c) (A3:E11)
d) (A3:E12)

8. Based on Figure 2.6 and the Budget Detail sheet, what is the best formula to return the average Average Annual Spend?

a) =AVERAGE(D3:D11)
b) =AVERAGE(D3:D12)
c) =AVERAGE(A3:D11)
d) =AVERAGE(A3:D12)

9. What percentage of the LY Spend Total was the Clothes category?

a) 5.5%

b) 5.3%
c) 9.2%
d) 4.5&

10. Based on the Budget Details sheet, what is the best formula to return the percentage of the LY Spend Total for the Insurance category?

a) =E7/E12
b) =$E$7/$E$12
c) =E7/$E$12
d) =$E$7/E12

Solutions: ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮

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- Ch2 Data File

CHAPTER 3 – MORE ON FORMULAS, LOGICAL AND LOOKUP FUNCTIONS

Excel workbooks are designed to allow you to create useful and complex calculations. In addition to doing arithmetic, you can use Excel to look up data, and to display results based on logical conditions. We will also look at ways to highlight specific results. These skills will be demonstrated in the context of a typical gradebook spreadsheet that contains the results for an imaginary Excel class.

In this chapter, we will:

- Use the **Quick Analysis Tool** to find the Total Points for all students and Points Possible.

- Write a division formula to find the Percentage for each student, using an absolute reference to the Total Points Possible.

- Write an **IF Function** to determine Pass/Fail – passing is 70% or higher.

- Write a **VLOOKUP** to determine the Letter Grade

using the Letter Grades scale.

- Review common **Error Messages** using Smart Lookup to get definitions of some of the terms in your spreadsheet.

- Apply **Data Bars** to the Total Points values.

- Apply **Conditional Formatting** to the Percentage, Pass/Fail, and Letter Grade columns.

- **Printing Review –** Change to Landscape, Scale to Fit Columns on One Page and Set Print Area.

Figure 3-1 shows the completed workbook that will be demonstrated in this chapter for the Grades sheet in your Chapter data file.

Notice the techniques used in columns O and R that highlight the results of your calculations. Notice, also that there are more numbers on this version of the file than you will see in your original data file. These are all completed using Excel calculations.

Figure 3.1 Completed Gradebook Worksheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	CAS 170 Grades																	
2	Thursday, August 25, 2016																	
3																		
4	Student Name	CH1	CH2	CH3	Test 1	CH4	CH5	CH6	Test 2	CH7	CH8	CH9	Test 3	Final Exam	Total Points	Percentage	Pass/Fail	Letter Grade
5	Andrews, DeShea	10	10	10	48	10	9	7	50	10	10	10	47		231	59%	Fail	F
6	Coffey, Amber	8	7	8	38	8	7	7	36	8	8	8	39	113	295	76%	Pass	C
7	Denson, Edward	9	8	8	35	6	5	0	30	0	0	0	0	0	101	26%	Fail	F
8	Di, Nina	9	8	9	50	9	8	9	48	8	8	9	45	140	360	92%	Pass	A
9	Gashi, Moesha	10	9	8	49	10	9	10	43	9	9	8	40	129	343	88%	Pass	B
10	Gray, Emanuel	10	5	10	39	10	5	9	41	5	5	9	38	115	301	77%	Pass	C
11	Klein, Tamar	9	10	8	42	9	8	6	33	10	5	0	31	99	270	69%	Fail	D
12	Mansur, Yusuf	10	7	7	48	10	7	8	50	7	7	0	47	150	358	92%	Pass	A
13	Naharro, Claudia	10	10	6	44	10	8	7	46	10	10	9	43	130	343	88%	Pass	B
14	Persson, Thea	6	6	4	26	6	5	4	28	6	6	5	26	78	206	53%	Fail	F
15	Popov, Olga	9	10	8	47	9	7	0	49	10	10	8	46	139	352	90%	Pass	A
16	Prinosil, Jonas	7	5	5	30	7	5	7	31	5	5	6	29	88	230	59%	Fail	F
17	Riley, Jordyn	10	9	9	46	10	6	9	48	9	9	9	45	136	355	91%	Pass	A
18	Smirnov, Yuri	9	9	9	42	9	5	9	44	9	9	8	41	124	327	84%	Pass	B
19	Sokolov, Yegor	10	8	10	48	10	7	10	44	8	8	10	41	130	344	88%	Pass	B
20	Tan, Duong	10	9	8	41	9	9	8	43	9	9	10	40	121	326	84%	Pass	B
21	Taylor, Jaquoya	9	10	9	50	5	10	9	50	10	10	7	50	148	377	97%	Pass	A
22	Trong, Nguyen	9	10	7	44	10	0	7	32	0	0	6	29	101	255	65%	Fail	D
23	Vesely, Katerina	8	6	6	38	8	6	6	40	6	6	0	38	114	282	72%	Pass	C
24	Weller, Elijah	9	10	10	49	8	10	10	49	10	10	8	46	141	370	95%	Pass	A
25	Points Possible	10	10	10	50	10	10	10	50	10	10	10	50	150	390			
26																		
27	Letter Grades																	
28	0%	F																
29	60%	D																
30	70%	C																
31	80%	B																
32	90%	A																

Grades

The other examples for this chapter will be based on subsets of data files you continue to work with throughout the semester from the U.S. Department of Education and the U.S. Energy Information Administration.

ATTRIBUTION

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- figure-3-1

3.1 MORE WAYS TO USE FORMULAS AND FUNCTIONS

Learning Objectives

1. Review the use of the =MIN, MAX, AVERAGE functions.

2. Examine the Quick Analysis Tool to create standard calculations, formatting, and charts very quickly.

3. Create Percentage calculation.
   – Use the Smart Lookup tool to acquire additional information about percentage calculations.
   – Review the use of Absolute cell reference in a division formula.

ANOTHER USE FOR =MAX

Before we move on to the more interesting calculations we will be discussing in this chapter, we need to determine how many points it is possible for each student to earn for each of the assignments. This information will go into Row 25. The =**MAX** function is our tool of choice.

Download Data File: [*Ch-3-Data_File*](#)

1. Open the data file **CH3 Data File** and save the file to your computer as **CH3 Data [Your Name]**. Go to the Grades sheet, which is the second sheet from the left at the bottom of your Excel interface.

2. Make B25 your active cell.

3. Start typing =**MAX** (See **Figure 3.2**) Note the explanation you see on the offered list of functions. You can either keep typing **(** or double click MAX from the list.

17	Riley, Jordyn	10	9	9	46	10	0	9	46	9	9	9	43	130
18	Smirnov, Yuri	9	9	9	42	9	5	9	44	9	9	8	41	124
19	Sokolov, Yegor	10	8	10	48	10	7	10	44	8	8	10	41	130
20	Tan, Duong	10	9	8	41	9	9	8	43	9	9	10	40	121
21	Taylor, Jaquoya	9	10	9	50	5	10	9	50	10	10	7	50	148
22	Trong, Nguyen	9	10	7	44	10	0	7	32	0	0	6	29	101
23	Vesely, Katerina	8	6	6	38	8	6	6	40	6	6	0	38	114
24	Weller, Elijah	9	10	10	49	8	10	10	49	10	10	8	46	141
25	Points Possible	=max												
26		MAX	Returns the largest value in a set of values. Ignores logical values and text											
27	Letter Grades	MAXA												
28	0% F													
29	60% D													
	Grades													

Figure 3.2 Entering a function

4. Select the range of numbers above row 25. Your calculation will be: =**MAX(B5:B24)**

5. Now, use the Fill Handle to copy the calculation from Column B through Column N.
   Note that as you copy the calculation from one column to the next, the cell references change. The calculation in column B reads: =**MAX(B5:B24)**. The one in column N reads: =**MAX(N5:N24)**. These cell references are relative references.

By default, the calculations that Excel copies change their

cell references **relative** to the row or column you copy them to. That makes sense. You wouldn't want column N to display an answer that uses the values in column L.

Want to see all the calculations you have just created? Press **Ctrl** ~ (See **Figure 3.3**.) **Ctrl** ~ displays your calculations (formulas). Pressing **Ctrl** ~ a second time will display your calculations in the default view – as values.

15	Popov, Olga	9	10	8	47	9	7	0	49	10	10	8	46	139
16	Prinosil, Jonas	7	5	5	30	7	5	7	31	5	5	6	29	88
17	Riley, Jordyn	10	9	9	46	10	6	9	48	9	9	9	45	136
18	Smirnov, Yuri	9	9	9	42	9	5	9	44	9	9	8	41	124
19	Sokolov, Yegor	10	8	10	48	10	7	10	44	8	8	10	41	130
20	Tan, Duong	10	9	8	41	9	9	8	43	9	9	10	40	121
21	Taylor, Jaquoya	9	10	9	50	5	10	9	50	10	10	7	50	148
22	Trong, Nguyen	9	10	7	44	10	0	7	32	0	0	6	29	101
23	Vesely, Katerina	8	6	6	38	8	6	6	40	6	6	0	38	114
24	Weller, Elijah	9	10	10	49	8	10	10	49	10	10	8	46	141
25	Points Possible	=MAX(B5:	=MAX(C5:	=MAX(D5	=MAX(E5:E24)	=MAX(F5:	=MAX(G5	=MAX(H5	=MAX(I5:I24)	=MAX(J5:	=MAX(K5:	=MAX(L5:	=MAX(M5:M2	=MAX(N5:N24)
26														

Figure 3.3 Relative References – Displayed as calculations.

QUICK ANALYSIS TOOL

The Quick Analysis Tool allows you to create standard calculations, formatting, and charts very quickly. In this exercise we will use it to insert the Total Points for each student in Column O.

Be sure to press **Ctrl** ~ to return your spreadsheet to the normal view (the formula results should display, not the formulas themselves).

1. Select the range of cells **B5:N25**

2. In the lower right corner of your selection, you will see the Quick Analysis tool (see **Figure 3.4**).
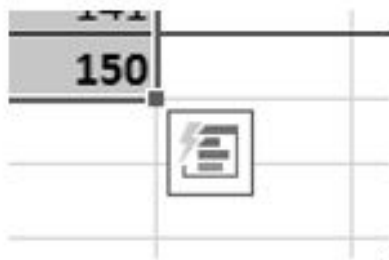
Figure 3.4 Quick Analysis Tool

3. When you click on it, you will see that there are a number of different options. This time we will be using the **Totals** option. In future exercises, we will use other options.

4. Select **Totals**, and then the **SUM** option that highlights the right column (see **Figure 3.5**). Selecting that SUM option places =SUM() calculations in column O.
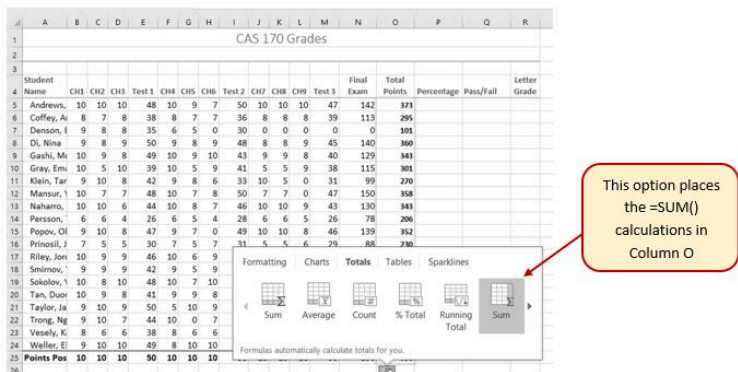
Figure 3.5 Quick Analysis Tool – Totals, Sum Column

PERCENTAGE CALCULATION

Column P requires a Percentage calculation. Before we launch in to creating a calculation for this, it might be handy to know precisely what it is we are looking for. If you are connected to the internet, and are using Excel 2016, you can use the **Smart Lookup** tool to get some more information.

1. Select cell P4.

2. Find the **Smart Lookup** tool on the **Review** tab (see **Figure 3.6**).

3. Press the **Smart Lookup** tool to find more about Percentage calculations.
   If this is the first time you have used the Smart Lookup tool, you may need to respond to a statement about your privacy. Press the **Got it** button.

I think the first Wikipedia article does a pretty good job explaining the calculation, don't you?
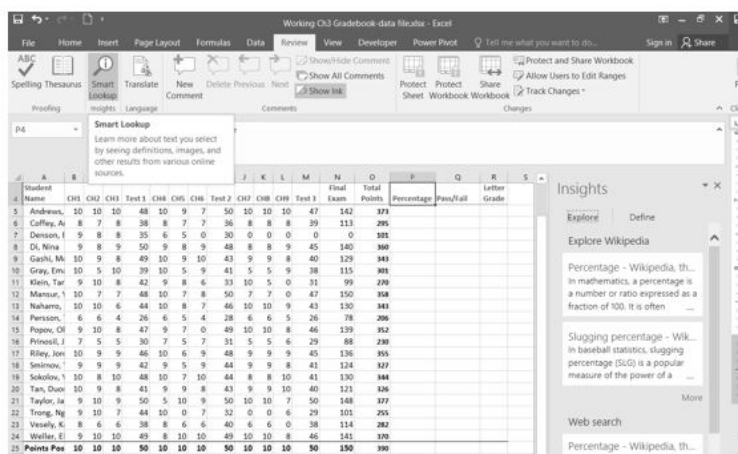
Figure 3.6 Smart Lookup tool

Now that we know what is needed for the Percentage calculation, we can have Excel do the calculation for us. We need to divide the **Total Points** for each student by the **Total Points** of all the **Points Possible**. Notice that there is a different number on each row – for each student. But, there is only one **Total Points Possible** – the value that is in cell **O25**.

1. Make sure that P5 is your active cell.

2. Press = then select cell **O5**. Press /, then cell **O25**. Your calculation should look like this: =**O5/O25**. The result of the formula should be **0.95641026**. (So far, so good. DeShea Andrews is doing well in this class – with a percentage grade of almost 96%. Definitely an "A"!)

3. Next use the Fill handle to copy the calculation down through row 24 to calculate the other students' grades. You should get the error message **#DIV/0!**. This error message reminds us that you

can't divide a number by 0 (zero). And that is just what is happening. If you look at the calculation in P9, the calculation reads: =O9/O29. The first cell reference is correct – it points to Moesha Gashi's total points for the class. But the second reference is wrong. It points to an empty cell – O29.

Before copying the calculation, we have to make the second reference (O25) an **absolute cell reference**. That way, when we copy the formula down, the cell reference for O25 will be locked and will not change.

1. Make P5 your active cell. In the Formula Bar click on O25 (see **Figure 3.7**).

2. Press F4 (on the function keys at the top of your keyboard). That will make the O25 reference absolute. It will not change when you copy the calculation (see **Figure 3.8**). (If you are working on a laptop and do not have an F4 function key, you can type in a $ before the O and another one before the 25.)

3. The calculation now looks like this: =**O5/$O$25.**

4. Use the Fill Handle to copy the formula down through P24 again. Now, when you copy the formula, you will get correct values for all of the students.
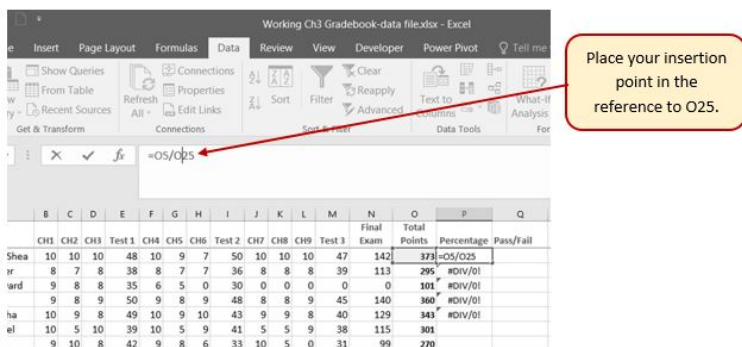
Figure 3.7 Editing a formula
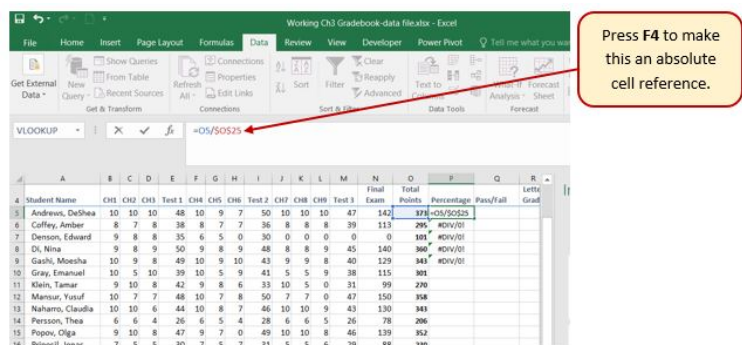
Figure 3.8 Absolute Cell reference – press F4

Those long decimals are a bit nonstandard. Let's change them to % by applying cell formatting.

1. Select the range P5:P24.

2. On the Home tab, in the Number Group, select the % (Percent Style) button.

Skill Refresher

Absolute References

1. Click in front of the column letter of a cell reference in a formula or function that you do not want altered when the formula or function is pasted into a new cell location.

2. Press the F4 key or type a dollar sign ($) in front of the column letter and row number of the cell reference.

Key Takeaways

- Functions can be created using cell ranges or selected cell locations separated by commas. Make sure you use a cell range (two cell locations separated by a colon) when applying a statistical function to a contiguous range of cells.

- To prevent Excel from changing the cell references in a formula or function when they are pasted to a new cell location, you must use an absolute reference. You can do this by placing a dollar sign ($) in front of the column letter and row number of a cell reference or by using the F4 function key.

- The #DIV/0 error appears if you create a formula that attempts to divide a constant or the value in a cell reference by zero.

ATTRIBUTION

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- figure-3-7
- figure-3-8

3.2 THE IF FUNCTION

Learning Objectives

- Use an IF Function to make logical comparisons between a value and what you expect.

- Create a VLOOKUP calculation to look up information in a table.

- Understand error messages.

- Understand how to enter and format Date/Time Functions.

In addition to doing arithmetic, Excel can do other kinds of functions based on the data in your spreadsheet. In this section we will use an =**IF** function to determine whether a student is passing or failing the class. Then, in the next section, we will use a =**VLOOKUP** function to determine what grade each student has earned.

IF FUNCTION

The IF function is one of the most popular functions in Excel. It allows you to make logical comparisons between

a value and what you expect. In its simplest form, the IF function says something like:

If the value in a cell is what you expect (true) – do this. If not – do that.

The IF function has three arguments:

- **Logical test** – Here, we can test to see if the value in a selected cell is what we expect. You could use something like "B7=14" or "B7>12" or "B7<6"

- **Value_if_true** – If the requirements in the logical test are met – if B7 is equal to 14 – then it is said to be true. For this argument you can type text – "True", or "On budget!" Or you could insert a calculation, like B7*2 (If B7 does equal 14, multiply it by 2). Or, if you want Excel to put nothing at all in the cell, type "" (two quotes).

- **Value_if_false** – If the requirements in the logical test are not met – if B7 does not equal 14 – then it is said to be false. You can enter the same instructions here as you did above. Let's say that you type the double quotes here. Then, if B7 does not equal 14, nothing will be displayed in this cell.

In column Q we would like Excel to tell us whether a student is passing – or failing the class. If the student scores **70%** or better, he/she will pass the class. But, if he/she scores less than 70%, he/she is failing.

1. Make sure that Q5 is your active cell.

2. On the Formulas tab, in the Function Library, find the IF function on the Logical pulldown menu (see **Figure 3.9**).
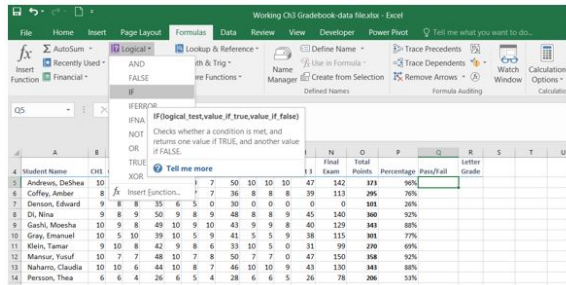
Figure 3.9 IF Function

Now you will see the IF Function dialog box, with a place to enter each of the three arguments.

1. Click in the box for **Logical Test**. We need to test whether a student's score is less than **.7**. So, in this box, type **P5<.7**

2. Click in the box for **Value_if_true**. If the student's score is less than .7, then they are failing the class. In this box, type **Fail**.

3. Click in the box for **Value_if_false**. If the student's score is NOT less than .7, then they are passing the class. In this box, type **Pass**.

4. Make sure that your dialog box matches **Figure 3.10**.
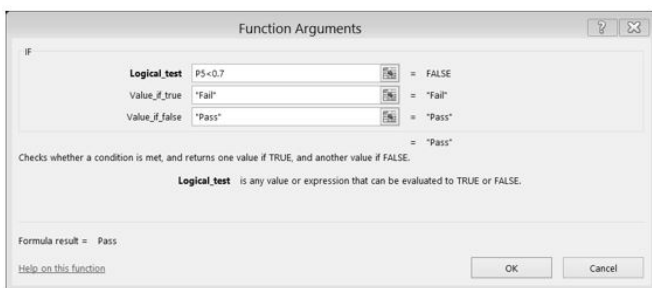
Figure 3.10 IF Function Dialog Box

While we are here, let's take a look at the dialog box. Notice that as you click in each box, Excel gives you a brief explanation of the contents (in the middle below the boxes.) In the lower left hand corner, you can see the results of the calculation. In this case DeShae is passing the class. Below that is a link to **Help on this function**. Selecting this link will take you to the Excel help for this function – with detailed information on how it works.

5. Once you have typed in the required arguments and reviewed to make sure they are correct, press OK. (The text Pass should be displayed in Q5 because DeShae is passing the class.)

6. Use the Fill handle to copy the IF function down through row 24.

7. Click on Q5. When you look in the formula bar, you will see the IF calculation:
   =IF(P5<0.7,"Fail","Pass").

8. Observe the pattern of the formula across your rows. How many students students have passed or failed?

> **Key Takeaway**
>
> - Functions don't always have to be about arithmetic. Excel provides functions that will help you perform logical evaluations, look things up, and work with dates and times.

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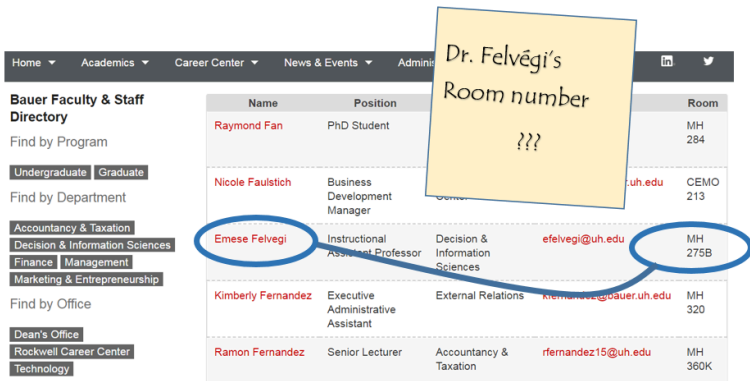
3.3 THE VLOOKUP FUNCTION

Lookup & Reference Functions automate the process of returning values that match your criteria. This means, that if you have a table that is missing some values, but you have another table that has these, you can use it to cross-reference and match what is missing from your original table. Excel will find and return values for you quickly and effectively without you having to manually enter data.

In a lot of ways, this is very similar to looking up information in an online phone book or directory. A directory is a common way of storing corresponding pieces of data in alphabetical or numerical order. There are names or ID numbers or product codes that are used to signify an *entity* you put in a prominent place, usually in the first column of a table. This column is followed by *attributes* or characteristics related to that *entity*, person or product. In your grade book, you are an *entity* signified by your name, your assignment scores are *attributes* that describe your performance. In your bank records, your credit card number or social security number describes you as an *entity*, your purchase date, the purchase amount, the place where you purchased an item are *attributes* that describe your spending habits.

Let's look at the table below to see how we generally find things in lists if we look for one piece of data. If you know your professor's *(entity)* name *(attribute)* and you want to look up their Room number *(another attribute)*. You go to the directory that lists all of your faculty and staff, find your professor's name on that list, then go to the column that has their Room number and then write it on a Post It note or in your class notebook.

We can easily Google a single piece of data. However, VLOOKUP will let us automate this process with a few hundred or a few hundreds of thousands of pieces of data that are stored in a column or *vertical* structure. The overview of the syntax and how the process altogether works in Excel is as follows.

=VLOOKUP(lookup_value,   table_array, col_index_num, [range_lookup])

- **Lookup_value –** It is the piece of data we know, the Professor's name on our original Post It note.

- **Table_array –** This is the range that contains the value that has the data we are looking for and starts with your Lookup_value. In our case with

the directory, it's the table that starts with the Professor's name and ends with the column where the room number is in.

- **Col_index_number –** This is the column in the table array range that includes the information that we are looking up. In our case, the Room is in the 5th column of the table array range.

- **Range_lookup –** There are two options with this argument in our formula: approximate match or exact match. The default value of TRUE means that Excel will look for an approximate match for your value in a range of values and return the lower corresponding value. If you do not enter anything for this argument, it will return based on the default. However, if you are looking for something definite, the FALSE option will return an exact match. Your professors are not interchangeable, so you will need an exact match.

1. Lookup_value = Emese Felvégi

2. Table_array (green)
   Lookup_value repeated in the 1st column

Dr. Felvégi's Room number ???

3. Col_index_num = 5

Col 1   Col 2   Col 3   Col 4   Col 5

Let's try this process next on our grade book from the CH3 practice.

USING VLOOKUP TO RETURN GRADES

For our chapter grade book example, we need to know what grade each student is getting based on their percentage score. You will find the table that defines the scores and the grades in **A28:B32**.

There are four pieces of information that you will need in order to build the VLOOKUP syntax. These are the four arguments of a VLOOKUP function:

- The value you want to look up, also called the **Lookup_value**. In our example, the lookup value will be the student's percentage score in column P.

- The **Table_array** is the range (table) where the lookup values and the values you want returned by the function are located. In our example, this is

the table of percentages and corresponding letter grades in the range A28:B32. The lookup value should always be in the first column in the table array for VLOOKUP to work correctly. For example, in our table_array the lookup value is in cell A28, so the range should start with A.

- The **Col_index_num** is the column number in the range that contains the value to return. In our example, when you specify A28:B32 as the Table_array range, you should count A as the first column (1), B as the second column (2), and so on. You will enter the appropriate column number in this box as 1, 2, or 3 and so on.

- In the **Range_lookup**, you can optionally specify TRUE if you want an approximate match or FALSE if you want an exact match of the return value. If you leave this blank, the default value will always be TRUE, or approximate match.

Let's create the VLOOKUP to display the correct Letter Grade in column R.

1. Make sure that R5 is your active cell.
2. On the Formulas tab, in the Function Library, find the **VLOOKUP** function on the Lookup & Reference pull-down menu (see **Figure 3.12**).
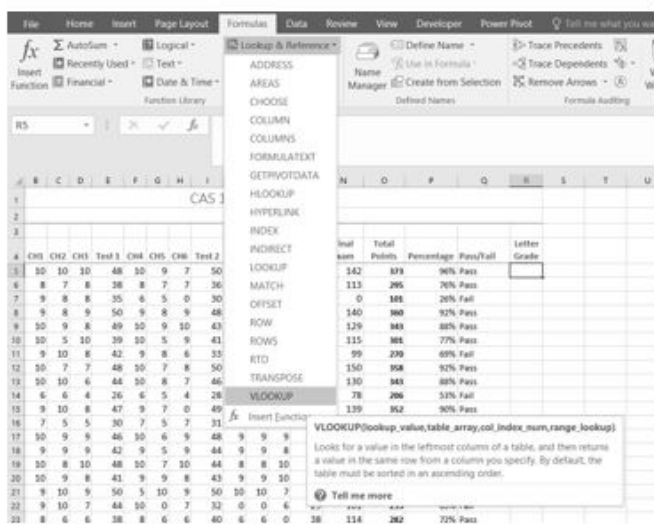
Figure 3.12 VLOOKUP Function

3. Fill in the dialog box so that it looks like the image in **Figure 3.13**.

    ◦ **Lookup_value** – In this case, we will use the Percentage score. So, **P5** for the first look up value.

    ◦ **Table_array** – This is the range that contains the value you want returned by the function. In this case, that range is A28:B32. Note that this range does NOT include the label in row 27; just the actual data. The cell references for the Table_array need to be absolute – $A$28:$B$32. When we copy this function to the other cells, we do not want these cell references to change. It should always be $A$28:$B$32.

- **Col_index_number** – This is the column in the table array range that includes the information that we are looking up. In our case, the actual grades are in the 2nd column of the range. So, the column index will be 2.

- **Range_lookup** – In some cases, you will need something in the Range_lookup box. Since we are looking for an approximate match for the percentages, we want the default value of TRUE, so we do not need to enter anything for this argument.

4. While you are in the dialog box, be sure to look at all the helpful definitions that Excel offers.

5. When you have filled in the dialog box, press OK.

6. The calculation you will see in the formula bar is: =VLOOKUP(P5,$A$28:$B$32,2)

7. Use the fill handle to copy the function down through row 24. The results displayed should match **Figure 3.14**.

Figure 3.13 VLOOKUP completed dialog box

=VLOOKUP(P5,$A$28:$B$32,2)

CAS 170 Grades

CH4	CH5	CH6	Test 2	CH7	CH8	CH9	Test 3	Final Exam	Total Points	Percentage	Pass/Fail	Letter Grade
10	9	7	50	10	10	10	47	142	373	96%	Pass	A
8	7	7	36	8	8	8	39	113	295	76%	Pass	C
6	5	0	30	0	0	0	0	0	101	26%	Fail	F
9	8	9	48	8	8	9	45	140	360	92%	Pass	A
10	9	10	43	9	9	8	40	129	343	88%	Pass	B
10	5	9	41	5	5	9	38	115	301	77%	Pass	C
9	8	6	33	10	5	0	31	99	270	69%	Fail	D
10	7	8	50	7	7	0	47	150	358	92%	Pass	A
10	8	7	46	10	10	9	43	130	343	88%	Pass	B
6	5	4	28	6	6	5	26	78	206	53%	Fail	F
9	7	0	49	10	10	8	46	139	352	90%	Pass	A
7	5	7	31	5	5	6	29	88	230	59%	Fail	F
10	6	9	48	9	9	9	45	136	355	91%	Pass	A
9	5	9	44	9	9	8	41	124	327	84%	Pass	B
10	7	10	44	8	8	10	41	130	344	88%	Pass	B
9	9	8	43	9	9	10	40	121	326	84%	Pass	B
5	10	9	50	10	10	7	50	148	377	97%	Pass	A
10	0	7	32	0	0	6	29	101	255	65%	Fail	D
8	6	6	40	6	6	0	38	114	282	72%	Pass	C
8	10	10	49	10	10	8	46	141	370	95%	Pass	A
10	10	10	50	10	10	10	50	150	390			

Figure 3.14 VLOOKUP Complete

Note: What if it didn't work? What if you get a result

different from the one predicted? In this case, either you have made a previous error, resulting in different % scores than this exercise anticipated, or you made a mistake entering your VLOOKUP function.

To make repairs in the function, make sure that R5 is your active cell. On the Formula bar, press the Insert Function button (see **Figure 3.15**). That will reopen the dialog box so you can make your repairs. Did you forget to make the cell references for the Table_array absolute? Did you use the wrong cell for the Lookup_value? Press OK when you are done and recopy the corrected function.
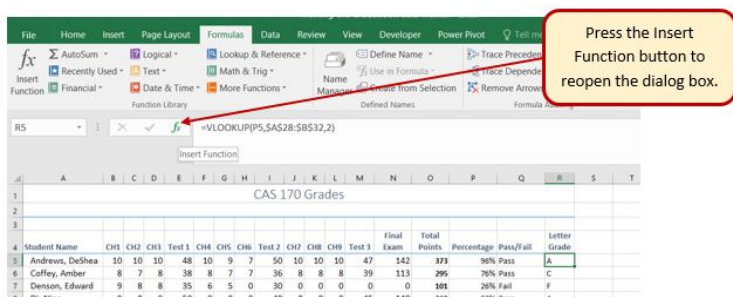
Figure 3.15 Insert Function

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- VLOOKUP_b
- VLOOKUP_c
- figure-3-12
- figure-3-13

- figure-3-14
- figure-3-15

3.4 CONDITIONAL FORMATTING

You now have all the calculations you need in your CAS 170 Grades spreadsheet. There is a lot of data here. To make it easier to pick out the most important pieces of data, Excel provides **Conditional Formatting**. The best thing about Conditional Formatting is that it is flexible, applying specified formatting only when certain conditions are met.

1. Select the values in the Total Points column (**O5:O24**).

2. At the bottom of your selection, click on the Quick Analysis Tool. On the Formatting tab, select Data Bars (see **Figure 3.18**).

Excel places blue bars on top of your values; long blue bars for larger numbers, shorter ones for smaller numbers. This makes it easier to see how well each student did in the class – without having to look at the specific numbers.

Student Name	CH1	CH2	CH3	Test 1	CH4	CH5	CH6	Test 2	CH7	CH8	CH9	Test 3	Final Exam	Total Points	Percentage	Pass/Fail	Letter Grade
Andrews, DeShea	10	10	10	48	10	9	7	50	10	10	10	47	142	173	96%	Pass	A
Coffey, Amber	8	7	8	38	8	7	7	36	8	8	8	39	113	295	76%	Pass	C
Denson, Edward	9	8	8	35	6	5	0	30	0	0	0	0	0	101	26%	Fail	F
Di, Nina	9	8	9	50	9	8	9	48	8	8	9	45	140	360	92%	Pass	A
Gashi, Moesha	10	9	8	49	10	9	10	43	9	9	8	40	129	343	88%	Pass	B
Gray, Emanuel	10	5	10	39	10	5	9	41	5	5	9	38	115	301	77%	Pass	C
Klein, Tamar	9	10	8	42	9	8	6	33	10	5	0	31	99	270	69%	Fail	D
Mansur, Yusuf	10	7	7	48	10	7	8	50	7	7	0	47	150	353	92%	Pass	A
Naharro, Claudia	10	10	6	44	10	8	7	46	10	10	9	43	130	343	88%	Pass	B
Persson, Thea	6	6	4	26	6	5	4	28	6	6	5	26	78	206	53%	Fail	F
Popov, Olga	9	10	8	47	9	7	0	49	10	10	8	46	139	340	90%	Pass	A
Prinosil, Jonas	7	5	5	30	7	5	7	31	5								
Riley, Jordyn	10	9	9	46	10	6	9	48	9								
Smirnov, Yuri	9	9	9	42	9	5	9	44	9								
Sokolov, Yegor	10	8	10	48	10	7	10	44	8								
Tan, Duong	10	9	8	41	9	9	8	43	9								
Taylor, Jaquoya	9	10	9	50	5	10	9	50	10								
Trong, Nguyen	9	10	7	44	10	0	7	32	0								
Vesely, Katerina	8	6	6	38	8	6	6	40	6								
Weller, Elijah	9	10	10	49	8	10	10	49	10								

CAS 170 Grades
Thursday, August 25, 2016

Formatting | Charts | Totals | Tables | Sparklines

Data Bars | Color Scale | Icon Set | Greater Than | Top 10% | Clear Format

Conditional Formatting uses rules to highlight interesting data.

Figure 3.18 Data Bars on the Quick Analysis tool

Another way to apply Data Bars is to:

- Select the range that needs data bars
- On the Home tab, in the Styles group, select Data Bars from the Conditional Formatting tool.
- From there you can select data bars of different colors and opacities (see **Figure 3.19**).
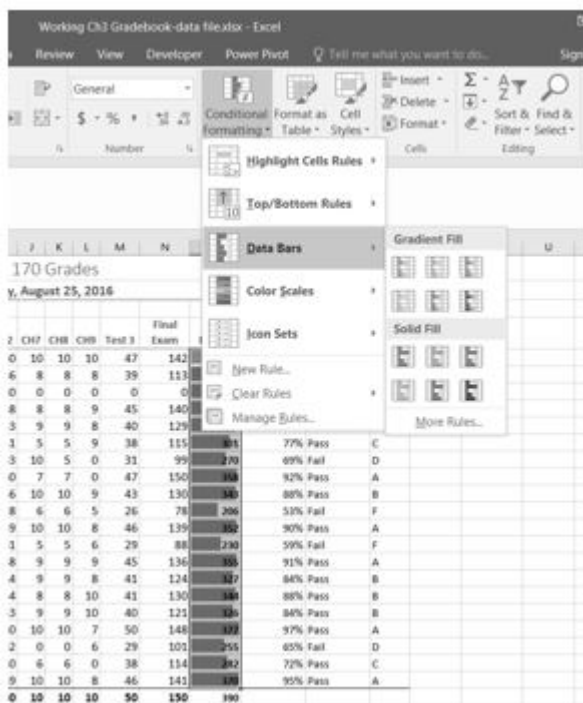
Figure 3.19 Data Bars on the Conditional Formatting tool

It is even more important to highlight the students who are failing in the class. To practice further with Conditional Formatting we will do that in two places, in the Percentages column and on the Letter Grade column. To start with, we want any **F** letter grades to be formatted with a light red fill color and dark red text.

1. Select the Letter Grades (**R5:R24**).

2. On the Home tab, in the Styles group, select **Highlight Cell Rules** from the Conditional Formatting tool (see **Figure 3.20**).

3. Select **Equal To**

4. Fill out the Equal to dialog box so that cells that

are equal to: **F** have **Light Red Fill with Dark Red Text** (see **Figure 3.21**).
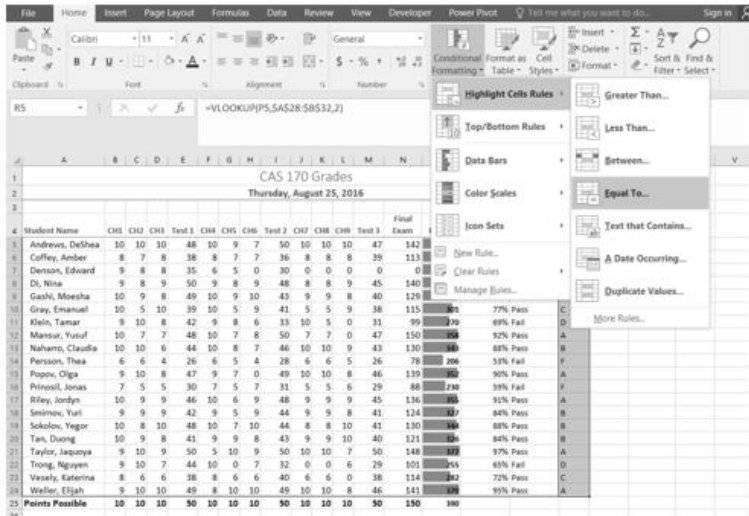
Figure 3.20 Conditional Formatting Equal To
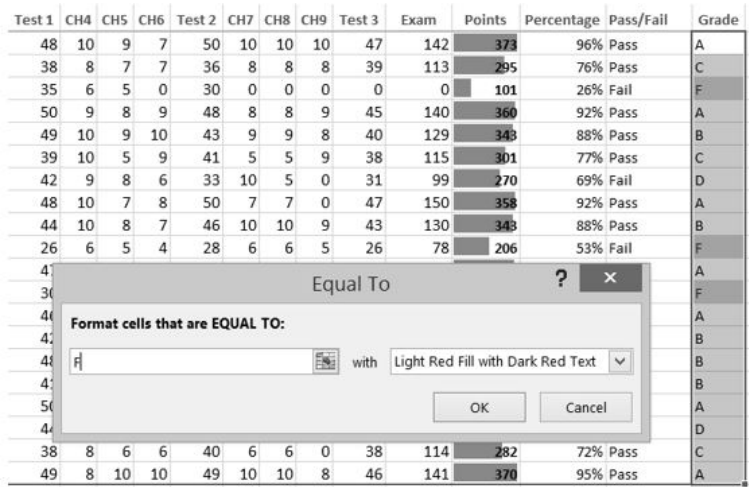
Figure 3.21 Conditional Formatting Equal To Dialog Box

Let's try that one more time – to highlight those students

who are passing the class. This time we will use the Pass/Fail text in the Pass/Fail column. If the text for a student is Pass we want the cell to be formatted with a yellow fill with dark yellow text.

1. Select the Pass/Fail grades (**Q5:Q24**).

2. On the Home tab, in the Styles group, select **Highlight Cell Rules** from the Conditional Formatting tool (see **Figure 3.20**).

3. Select **Equal To**

4. Fill out the Equal to dialog box so that cells that are equal to: **Pass** have **Yellow Fill with Dark Yellow Text**. (To find the Yellow Fill with Dark Yellow text option, click the the down arrow at the end of the last (with) box).

You do not have to use the default styles to make your data stand out. You can set any formatting you want. When you do, it is probably a good idea to include other styling in addition to color. Your spreadsheet might be printed in black and white. You would hate to lose your Conditional formatting. Now we are going to use conditional formatting to display any Percentages that are less than 60% with red text formatted in bold and italic.

1. Select the Percentage grades (**P5:P24**).

2. On the Home tab, in the Styles group, select Highlight Cell Rules from the Conditional Formatting tool (see **Figure 3.20**).

3. Select **Less Than**

4. Fill out the Less Than dialog box so that cells that

are less than **.6** will be have conditional formatting. But, instead of using the default red text on a light red fill, press the down arrow at the end of that box and select **Custom Format**.

5. On the **Font** tab of the Format Cells dialog box, in the Font style box, select **Bold Italic**. In the Color box, select **Red** (see **Figure 3.22**).

6. Press OK. Then press OK again.
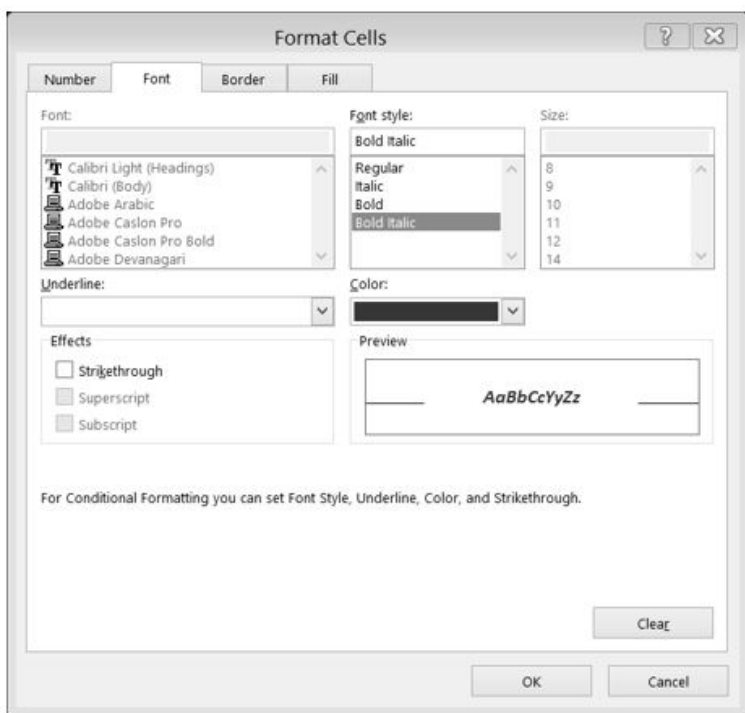
Figure 3.22 Conditional Formatting Custom Format Cells Dialog box

Conditional Formatting is valuable in that it reflects the current data. It changes to reflect changes in the data. To test this, delete DeShea's final exam score. (Select N5. Press Delete on your keyboard.) Suddenly, DeShae is

failing the course and the Conditional Formatting reflects that. This is a little unfair to DeShae – who has worked so hard this quarter. Let's give him back his grade. Press CTRL Z (Undo). His test score reappears and the Conditional formatting reflects that as well.

MAKING CHANGES

What if you have made a mistake with your Conditional Formatting? Or, you want to delete it altogether? You can use the **Conditional Formatting Manage Rules** tool. In our example, we want to remove the conditional formatting rule that formats the **Pass** text with yellow. We are also going to modify the minimum passing percentage for the conditional formatting rule that is applied to the percentages.

1. On the Home Tab, in the Styles Group, select **Manage Rules** at the very bottom of the Conditional Formatting drop-down list.

2. Show formatting rules for: **This Worksheet** (see **Figure 3.23**).

3. We don't really need to highlight the students who are passing the class, so select that rule in the Rules Manager and press the **Delete Rule** button.
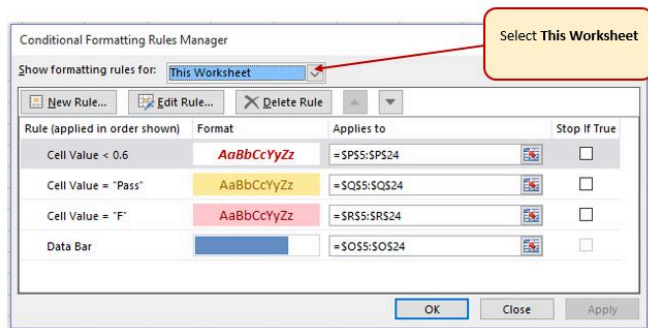
Figure 3.23 Conditional Formatting Manage Rules

In a previous exercise (the IF function), we decided that students were failing if they got a percentage score of less than 70%, so the Conditional Formatting rule in the Percentage column needs repair.

4. Select the rule that reads Cell Value <0.6.

5. Select the Edit Rule button, and change the .6 to .7 (see **Figure 3.24**).

6. Click OK (or Apply) twice. Double check that your completed workbook matches **Figure 3.25**.
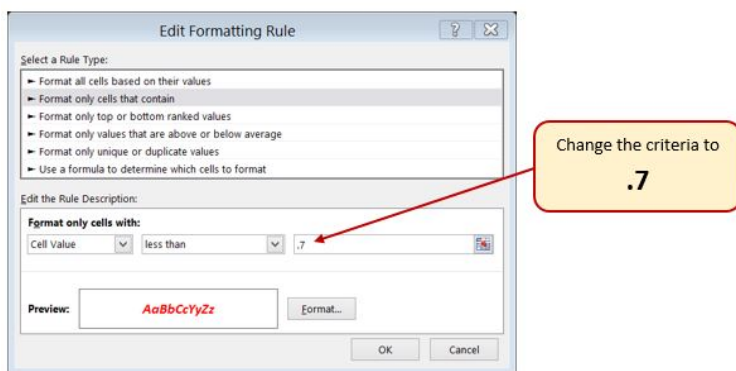
Figure 3.24 Conditional Formatting Edit Formatting Rule Dialog box

Student Name	CH1	CH2	CH3	Test 1	CH4	CH5	CH6	Test 2	CH7	CH8	CH9	Test 3	Final Exam	Total Points	Percentage	Pass/Fail	Letter Grade
CAS 170 Grades																	
Wednesday, September 28, 2016																	
Andrews, DeShea	10	10	10	48	10	9	7	50	10	10	10	47	142	373	96%	Pass	A
Coffey, Amber	8	7	8	38	8	7	7	36	8	8	8	39	113	295	76%	Pass	C
Denson, Edward	9	8	8	35	6	5	0	30	0	0	0	0	0	101	26%	Fail	F
Di, Nina	9	8	9	50	9	8	9	48	8	8	9	45	140	360	92%	Pass	A
Gashi, Moesha	10	9	8	49	10	9	10	43	9	9	8	40	129	343	88%	Pass	B
Gray, Emanuel	10	5	10	39	10	5	9	41	5	5	9	38	115	301	77%	Pass	C
Klein, Tamar	9	10	8	42	9	8	6	33	10	5	0	31	99	270	69%	Fail	D
Mansur, Yusuf	10	7	7	48	10	7	8	50	7	7	0	47	150	358	92%	Pass	A
Naharro, Claudia	10	10	6	44	10	8	7	46	10	10	9	43	130	343	88%	Pass	B
Persson, Thea	6	6	4	26	6	5	4	28	6	6	5	26	78	206	53%	Fail	F
Popov, Olga	9	10	8	47	9	7	0	49	10	10	8	46	139	352	90%	Pass	A
Prinosil, Jonas	7	5	5	30	7	5	7	31	5	5	6	29	88	230	59%	Fail	F
Riley, Jordyn	10	9	9	46	10	6	9	48	9	9	9	45	136	355	91%	Pass	A
Smirnov, Yuri	9	9	9	42	9	5	9	44	9	9	8	41	124	327	84%	Pass	B
Sokolov, Yegor	10	8	10	48	10	7	10	44	8	8	10	41	130	344	88%	Pass	B
Tan, Duong	10	9	8	41	9	9	8	43	9	9	10	40	121	326	84%	Pass	B
Taylor, Jaquoya	9	10	9	50	5	10	9	50	10	10	7	50	148	377	97%	Pass	A
Trong, Nguyen	9	10	7	44	10	0	7	32	0	0	6	29	101	255	65%	Fail	D
Vesely, Katerina	8	6	6	38	8	6	6	40	6	6	0	38	114	282	72%	Pass	C
Weller, Elijah	9	10	10	49	8	10	10	49	10	10	8	46	141	370	95%	Pass	A
Points Possible	10	10	10	50	10	10	10	50	10	10	10	50	150	390			

Letter Grades	
0%	F
60%	D
70%	C
80%	B
90%	A

Grades

Figure 3.25 Completed Ch3 Gradebook

SETTING THE PRINT AREA

Before you consider this workbook finished, you need to prepare it for printing. The first thing you will do is set the Print Area so that the table of Letter Grades in A27:B32 does not print.

1. Select A1:R25. This is the only part of the worksheet that you want to have print.

2. On the **Page Layout** ribbon, click the **Print Area** button. Choose **Set Print Area** from the menu.

Next you will preview the worksheet in Print Preview to check that the print area setting worked, as well as make sure it is printing on one page.

1. View the workbook in Print Preview.

2. Set the page orientation to **Landscape**.

3. Change the page scaling if needed so that the entire worksheet prints on one page.

4. Save and close the **CH3 Gradebook** workbook.

5. Compare your work with the self-check answer key (found in the Course Files link) and then submit the **CH3 Gradebook** workbook as directed by your instructor.

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3.3 Conditional Formatting by Noreen Brown and Mary Schatz, PCC.EDU, is licensed under CC BY 4.0

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- figure-3-18
- figure-3-19
- figure-3-20
- figure-3-21
- figure-3-22
- figure-3-23
- figure-3-24

3.5 CHAPTER PRACTICE

LOGIC AND VLOOKUP PRACTICE

Work with the PR1-3 and VL1-3 sheets in the Ch-3-Data_File based on your class notes or Blackboard recordings.

For additional practice, download the following data file to practice min/max/average, cell references, VLOOKUP, and the IF function. Answer the questions in the Excel file. Save your workbook for your records.

Download Data File: *CH3 Practice A.*

HOUSEHOLD BUDGET

Download Data File: CH 3 Practice B

Elijah and Kelly Williams are a recently married couple living in Portland, Oregon. Elijah works part time and attends the local community college. Kelly works as a marketing manager at a clothing company in North Portland. They are trying to decide if they can afford to move to a better apartment, one that is closer to work and school. They want to use Excel to examine their

household budget. They have started their budget spreadsheet, but they need your help with it.

1. Open the file named **PR3 Data** and then save it as **PR3 Williams**.

2. Insert two new rows at the top of the worksheet.

3. Enter the following text:

A2   Category
B2   Item
C2   January
O2   Yearly Total (adjust column width as needed to fit this text)

1. Using the text in cell C2, use Autofill to fill in the months February through December in cells D2:N2. Adjust column widths as needed to fit the names of the months in these columns.

2. Bold and center align all of the headings in Row 2.

3. Type "**Williams Family Budget**" in A1. Merge & Center A1:O1. Make this text 22 point bold.

4. Next you need to complete the monthly values for some of the income and expense items. In the rows for Income #1, Income #2, Mortgage/Rent, Homeowners/Rent Insurance, Car Insurance, Car Payment, and Gym Fees/Memberships, copy the values for January to the cells for February through December.

5. Use the Totals tab in the Quick Analysis tool to add the SUM to Column O. Delete the formulas from O7, O17, O24, O32, and O38.

6. In C6: N6, use the SUM function to calculate the Total Income for each month.

7. Similar to step 6, use the SUM function to calculate the Total Home Expenses, Total Daily Living Expenses, Total Transportation Expenses, Total Entertainment Expenses, and Total Personal Expenses for each month.

8. Use the SUM function to calculate the Yearly Total Personal Expenses in cell O45.

9. Format the numerical data in Row 3 as Currency with no decimal places. Format all the total rows as Currency with no decimal places and with a top border.

10. Apply the Comma format with no decimal places in all the other rows.

11. In A47, type "**Total Expenses**".

12. In C47, enter a formula that adds together all of the **expense category totals** for January. Copy the formula in C47 to D47:O47.

13. In A49, type "**NET INCOME**". Bold and indent this text.

14. In C49, enter a formula that calculates the difference between Total Income and Total Expenses (=Total Income-Total Expenses) for January. Copy this formula to D49:O49.

15. Format the data in Rows 47 and 49 as Currency with no decimal places. Bold O47 and O49. Add a Top and Double Bottom Border to the data in Row 49.

16. Select C49:N49. Use the Quick Analysis tool to add data bars to this data.

17. In B50, type "**New Apartment?**". Enter an IF statement in C50 that displays the word "No" if the amount in C49 is less than or equal to zero and "Maybe" if the amount is greater than zero. Copy C50 to D50:N50.

18. Check to see if your IF statement worked correctly in row 50. If the cells say "No" when the data bar in the cell above it is red and "Maybe" when the data bar in the cell above it is blue, your IF statement is correct.

19. Review the worksheet in Print Preview. Make any changes needed to make the worksheet print on one page with landscape orientation.

20. Save the **PR3 Williams** workbook for your records.

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3.6 CHAPTER ASSESSMENT

THE FOLLOWING ARE **SAMPLE QUESTIONS** TO TEST WHETHER YOU KNOW, UNDERSTAND, AND ARE ABLE TO APPLY YOUR LEARNING FROM THIS CHAPTER.

1. The fastest way to highlight top 10 values in a range is by:
a) Adding a pie chart next to the data.
b) Applying conditional formatting.
c) Quickly selecting the values and changing the border colors by hand.
d) This will always be a lengthy process, especially if you have a large dataset.

2. When you see this error message, the formula refers to an empty cell or to data that is not found or not available.

a) #N/A
b) #NAME
c) #NUM
d) #REF

3. Answer the following based on your work with the Chapter 3 Gradebook Data file. The ____ is best function to return a value for "Points Possible" for "Test 1"?
a) AVERAGE
b) IF
c) MAX
d) MIN

4. Answer the following based on your work with the Chapter 3 Gradebook Data file. Who has the highest Percentage performance in the class?
a) Andrews, DeShea
b) Mansur, Yusuf
c) Taylor, Jaquoya
d) Weller, Elijah

5. Answer the following based on your work with the Chapter 3 Gradebook Data file. What is the best formula to return the highest score for Test 1?
a) =MAX(A1:E24)
b) =MAX(E5:E24)
c) =MAX(E5:E25)
d) =MAX(A1:R25)

6. Answer the following based on your work with the Chapter 3 Gradebook Data file. What is the best formula to calculate the Test 1 average for Yusuf Mansur?
a) =48/50
b) =96%
c) =E12/E25
d) =Student Name/Points Possible

7. Answer the following based on your work with the Chapter 3 Gradebook Data file. What is the Test 1 average for Yusuf Mansur?
a) 48
b) 44
c) 26
d) 47

8. Answer the following based on your work with the Chapter 3 Gradebook Data file. Which formula determines whether Test 2 scores showed improvement from Test 1 for Yusuf Mansur?
a) =IF(I12E12,"Improved","Did not improve")
b) =IF(I12>E12,"Improved","Did not improve")
c) =IF(I12>E12,Improved,Did not improve)
d) =IF(I12>E12,TRUE,FALSE)

9. In VLOOKUP, "table_array" is:
a) the type of matches that are available based on your lookup value.
b) the column that includes the information that we are looking up.
c) the range that contains the value you want returned by the function.
d) the sheet that contains your data.

10. Answer the following based on your work with the Chapter 3 Gradebook Data file. Which formula returns the letter grade for for Yusuf Mansur?
a) =VLOOKUP($O$12,A28:B32,2,TRUE)
b) =VLOOKUP($P$12,A28:B32,2,TRUE)
c) =VLOOKUP(O12,$A$28:$B$32,2,FALSE)
d) =VLOOKUP(O12,$A$28:$B$32,2,TRUE)

e) =VLOOKUP(P12,$A$28:$B$32,2,FALSE)
f) =VLOOKUP(P12,$A$28:$B$32,2,TRUE)

Solutions: ██████████████████████████

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Questions by Emese Felvégi based on the chapter practice problems. Edited by Lilliana E. Olmos & Marcella Olmos. CC BY-NC-SA 3.0.

CHAPTER 4 – PRESENTING DATA WITH CHARTS

One of the most important things to consider when using charts in Excel is that they are intended to be used for communicating an idea to an audience. Your audience can be reading your charts in a written document or listening to you in a live presentation. In fact, Excel charts are often imported or pasted into Word documents or PowerPoint slides, which serve this very purpose of communicating ideas to an audience. Although there are no rules set in stone for using specific charts for certain data types, some chart types are designed to communicate certain messages better than others. This chapter explores numerous charts that can be used for a variety of purposes. In addition, we will examine formatting charts and using those charts in Word and PowerPoint documents.

The human mind can interpret numbers (and especially larger data sets) easier that are accompanied by images that show trends and relationships that may be present in the data. The principles of data visualization, the way to present a combination of text and numbers in some type

of image format go back centuries. Some of the oldest charts created in the early 19th century. [William Playfair's pie charts](#) and [Florence Nightingale's diagrams](#) were revolutionary means of representing numbers to tell a story. One of the highest impact data visualizations was created by Charles Minard, a French civil engineer in 1845 who made a map of Napoleon's invasion of Russia. (Read more about his map on [Edward Tufte's website](#).)

Charles Minard's map of Napoleon's disastrous Russian campaign of 1812. The graphic is notable for its representation in two dimensions of six types of data: the number of Napoleon's troops; distance; temperature; the latitude and longitude; direction of travel; and location relative to specific dates.[4]
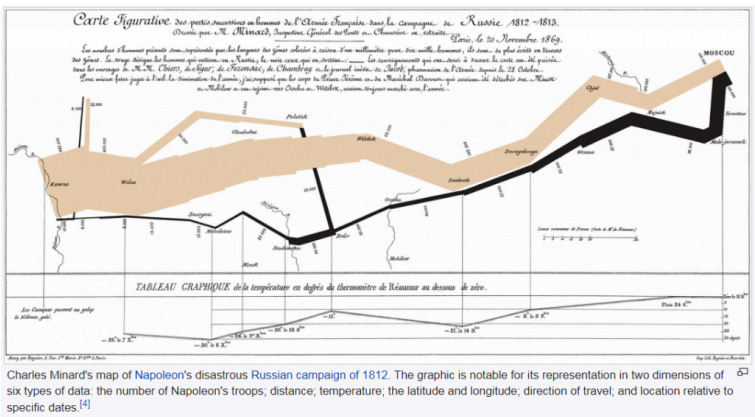
Minard: Napoleon's March on Russia. Image source: [Wikipedia](#).

"Edward Tufte is best known for his trilogy of self-published books on analytical design: *The Visual Display of Quantitative Information* (1983, 2001), *Envisioning Information* (1990) and *Visual Explanations* (1997). Each offers practical advice on aspects of data display and provides a spectacular array of historic and contemporary examples. Regarded as the primary authority on the presentation of information by designers,

information architects, engineers, and scientists, Tufte's work has also generated a strong mainstream interest. One million copies of these books are in print. (AIGA.org)"

A YouTube element has been excluded from this version of the text. You can view it online here: https://uhlibraries.pressbooks.pub/mis3300excel/?p=222

Tufte on "chartjunk"

Read the following article by James Surowiecki about [How Edward Tufte led Bose out of the land of chartjunk](#).

- What does Tufte consider chartjunk?

- What should be your goal when creating a chart?

- Do you agree with the sentiment that "design is the Big Enchilada"?

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- Minard

4.1.1 CHOOSING A CHART TYPE: LINE CHARTS

This section reviews the most commonly used Excel chart

types. To demonstrate the variety of chart types available in Excel, it is necessary to use a variety of data sets. This is necessary not only to demonstrate the construction of charts but also to explain how to choose the right type of chart given your data and the idea you intend to communicate.

CHOOSING A CHART TYPE

Before we begin, let's review a few key points you need to consider before creating any chart in Excel.

1. **The first is identifying your idea or message**. It is important to keep in mind that the primary purpose of a chart is to present quantitative information to an audience. Therefore, you must first decide what message or idea you wish to present. This is critical in helping you select specific data from a worksheet that will be used in a chart. Throughout this chapter, we will reinforce the intended message first before creating each chart.

2. **The second key point is selecting the right chart type**. The chart type you select will depend on the data you have and the message you intend to communicate.

3. **The third key point is identifying the values that should appear on the X and Y axes**. One of the ways to identify which values belong on the X and Y axes is to sketch the chart on paper first. If you can visualize what your chart is supposed to look like, you will have an easier time selecting information correctly and using Excel to

construct an effective chart that accurately communicates your message. **Table 4.1** "Key Steps Before Constructing an Excel Chart" provides a brief summary of these points.

Integrity Check

Carefully Select Data When Creating a Chart

Just because you have data in a worksheet does not mean it must all be placed onto a chart. When creating a chart, it is common for only specific data points to be used. To determine what data should be used when creating a chart, you must first identify the message or idea that you want to communicate to an audience.

Table 4.1 Key Steps before Constructing an Excel Chart

Step	Description
Define your message.	Identify the main idea you are trying to communicate to an audience. If there is no main point or important message that can be revealed by a chart, you might want to question the necessity of creating a chart.
Identify the data you need.	Once you have a clear message, identify the data on a worksheet that you will need to construct a chart. In some cases, you may need to create formulas or consolidate items into broader categories.
Select a chart type.	The type of chart you select will depend on the message you are communicating and the data you are using.
Identify the values for the X and Y axes.	After you have selected a chart type, you may find that drawing a sketch is helpful in identifying which values should be on the X and Y axes. In Excel, the axes are: The "category" axis. Usually the horizontal axis – where the labels are found The "value" axis. Usually the vertical axis – where the numbers are found.

TIME SERIES TREND: LINE CHART 1

The first chart we will demonstrate is a line chart. Figure 4.1 shows part of the data that will be used to create two line charts. This chart will show the trend of the NASDAQ stock index.

Read more: http://www.investopedia.com/terms/n/nasdaq.asp

This chart will be used to communicate a simple message: to show how the index has performed over a two-year period. We can use this chart in a presentation to show whether stock prices have been increasing, decreasing, or remaining constant over the designated period of time.
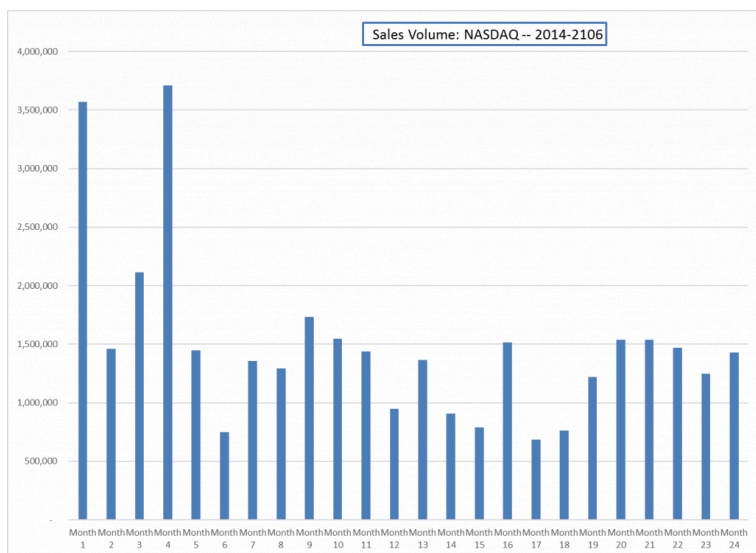
Figure 4.1 Stock Trends

Before we create the line chart, it is important to identify why it is an appropriate chart type given the message we wish to communicate and the data we have. When presenting the trend for any data over a designated period of time, the most commonly used chart types are the line chart and the column chart. With the column chart, you are limited to a certain number of bars or data points. As you increase the number of bars on a column chart, it becomes increasingly difficult to read. As you scroll through the data on the worksheet shown in **Figure 4.1** you will see that there are 24 points of data used to construct the chart. This is generally too many data points to put on a column chart, which is why we are using a line chart. Our line chart will show the volume of sales for the NASDAQ on the Y axis and the Month number on the X axis. The following steps explain how to construct this chart:

Download Data file: [*CH4-Data_File*](CH4-Data_File)

1. Open data file *CH4 Data File* and save a file to your computer as **CH4_YourName**.

2. Navigate to the **Stock Trend** worksheet.

3. Highlight the range **B4:C28** on the Stock Trend worksheet. (Note – you have selected a label in the first row and more labels in column B. Watch where they show up in your completed chart.)

4. Click the Insert tab of the ribbon.

5. Click the **Line** button in the **Charts** group of commands. Click the first option from the list, which is a basic 2D Line Chart (see **Figure 4.2**).
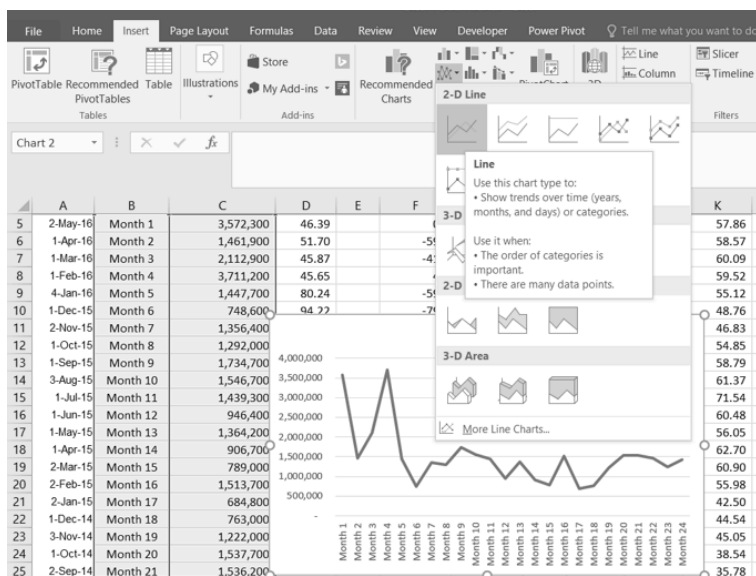
Figure 4.2 Selecting the Basic Line Chart

This adds, or embeds, the line chart to the worksheet, as shown in **Figure 4.3**

Figure 4.3 shows the embedded line chart in the Stock Trend worksheet. Do you see where your labels showed up on the chart?

Notice that additional tabs, or contextual tabs, are added to the ribbon. We will demonstrate the commands in these tabs throughout this chapter. These tabs appear only when the chart is activated.

Note: Excel 2010 uses three contextual tabs for charts. Later versions use only two. Each has all the same tools. They are just organized a little differently.

Stock Trend Comparison
24 Months from May 2014 to May 2016

NASDAQ

Average Clos...

	A	B	C
4	Date	Month	Volume
5	2-May-16	Month 1	3,572,300
6	1-Apr-16	Month 2	1,461,900
7	1-Mar-16		2,112,900
8	1-Feb-16	Y or "value"	3,711,200
9	4-Jan-16	axis	1,447,700
10	1-Dec-15		748,600
11	2-Nov-15		1,356,400
12	1-Oct-15	Month 8	1,292,000
13	1-Sep-15	Month 9	1,734,700
14	3-Aug-15	Month 10	1,546,700
15	1-Jul-15	Month 11	1,439,300
16	1-Jun-15	Month 12	946,400
17	1-May-15	Month 13	1,364,200
18	1-Apr-15	Mo X or	06,700
19	2-Mar-15	Mo "category"	89,000
		axis	

Volume

These sizing handles indicate that the chart is activated.

4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000

	59.5
	55.1
	48.7
	46.8
	54.8
	58.7
	61.3
	71.5
	60.4
	56.0
97.84	-75%	111%	49.77	41.10	62.7
92.52	-78%	99%	49.38	39.55	60.9

Figure 4.3 Embedded Line Chart in the Stock Trend Worksheet

As shown in **Figure 4.3,** the embedded chart is not placed in an ideal location on the worksheet since it is covering several cell locations that contain data. The following steps demonstrate common adjustments that are made when working with embedded charts:

1. **Moving a chart**: Click and drag the upper left corner of the chart to the corner of cell B30.

> Note: Keep an eye on your pointer. It will change into ⤬ when you are in the right place to move your chart.
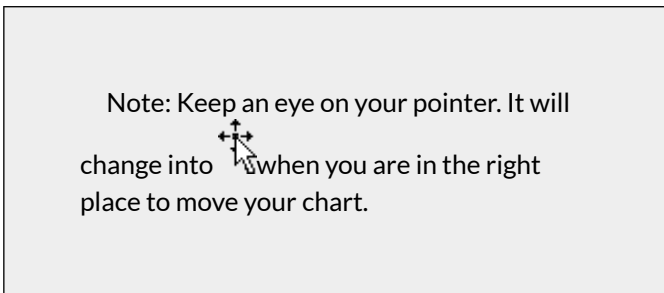
2. **Resizing a chart**: Place the mouse pointer over the right upper corner sizing handle, hold down

the ALT key on your keyboard, and click and drag the chart so it "snaps" to the right side of Column I.

Note: keep an eye on your pointer. It will change into [arrow] when you are in the right place to resize your chart
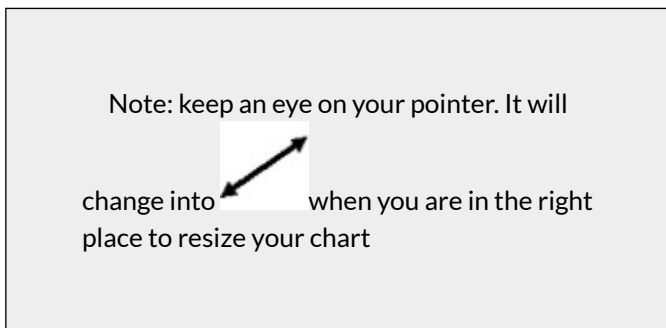
3. Repeat step 2 to resize the chart so the top "snaps" to the top of Row 30, the bottom "snaps" to the bottom of Row 45, and the left side "snaps" to the left side of Column B. Make sure the right side of the chart snaps to the line between column I and J.

4. **Adjusting the chart title**: Click the chart title once. Then click in front of the first letter. You should see a blinking cursor in front of the letter. This allows you to modify the title of the chart.

5. Type the following in front of the first letter in the chart title: **May 2014-2016 Trend for NASDAQ Sales**.

6. Click anywhere outside of the chart to deactivate it.

7. Save your work.

Figure 4.4 shows the line chart after it is moved and resized. You can also see that the title of the chart has been edited to read **May 2014-2016 Trend for NASDAQ Sales**

Volume. Notice that the sizing handles do not appear around the perimeter of the chart. This is because the chart has been deactivated. To activate the chart, click anywhere inside the chart perimeter.

	A	B	C	D	E	F	G	H	I	J
24	1-Oct-14	Month 20	1,537,700	82.59		-57%	78%		43.85	36.
25	2-Sep-14	Month 21	1,536,200	72.65		-57%	57%		39.64	37.
26	1-Aug-14	Month 22	1,467,900	65.49		-59%	41%		38.39	37.
27	1-Jul-14	Month 23	1,246,200	65.00		-65%	40%		39.00	39.
28	2-Jun-14	Month 24	1,428,300	71.33		-60%	54%		38.36	39.
29										
30										

May 2014-2016 Trend for NASDAQ Sales Volume
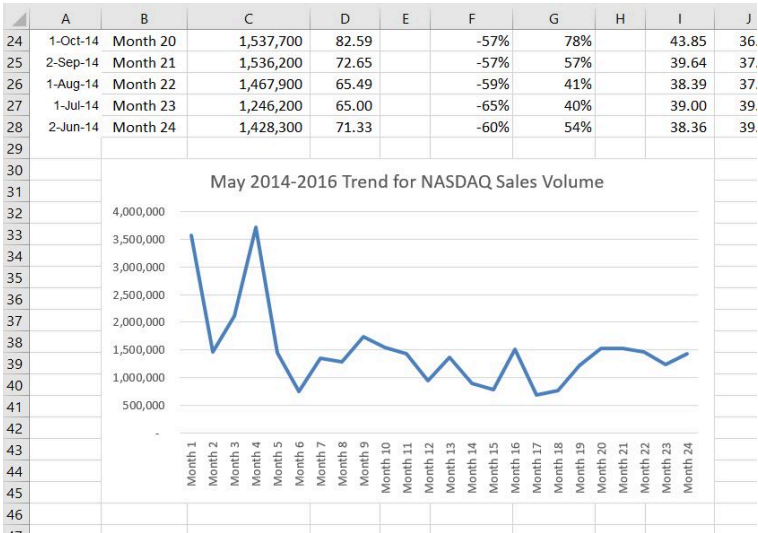
Figure 4.4 Line Chart Moved and Resized

Integrity Check

When using line charts in Excel, keep in mind that anything placed on the X axis is considered a descriptive label, not a numeric value. This is an example of a category axis. This is important because there will never be a change in the spacing of any items placed on the X axis of a line chart. If you need to create a chart using numeric data on the

category axis, you will have to modify the chart. We will do that later in the chapter.

ADJUSTING THE Y AXIS SCALE

After creating an Excel chart, you may find it necessary to adjust the scale of the Y axis. Excel automatically sets the maximum value for the Y axis based on the data used to create the chart. The minimum value is usually set to zero. That is usually a good thing. However, depending on the data you are using to create the chart, setting the minimum value to zero can substantially minimize the graphical presentation of a trend. For example, the trend shown in Figure 4.4 appears to be increasing slightly in

recent months. The presentation of this trend can be improved if the minimum value started at 500,000. The following steps explain how to make this adjustment to the Y axis:

1. Click anywhere on the Y (value or vertical) axis on the **May 2014-2016 Trend for NASDAQ Sales Volume** line chart (Stock Trend worksheet).

2. Right Click and select **Format Axis.** The Format Axis Pane should appear, as shown in **Figure 4.5**.

Note: If you do not see "Format Axis ... on your menu, you have not right clicked in the correct spot. Press "Escape" to turn the menu off and try again
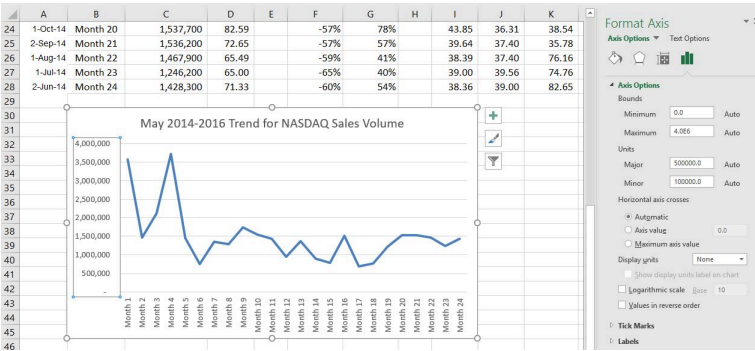
Figure 4.5 Format Axis Pane

1. In the Format Axis Pane, click the input box for the "**Minimum**" axis option and **delete** the zero. Then type the number **500000** and hit Enter. As soon as you make this change, the Y axis on the

chart adjusts.

2. Click the X in the upper right corner of the Format Axis pane to close it.

3. Save your work.

Figure 4.6 shows the change in the presentation of the trend line. Notice that with the Y axis starting at 500,000, the trend for the NASDAQ is more pronounced. This adjustment makes it easier for the audience to see the magnitude of the trend.
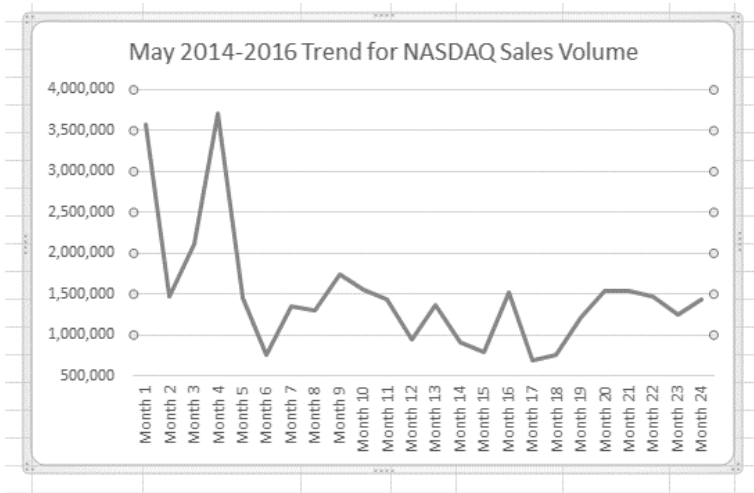
Figure 4.6 Adjusted Y Axis for the S&P 500 Chart

Skill Refresher

Adjusting the Y Axis Scale

1. Click anywhere along the **Y** axis to activate it.

2. Right Click.

(Note, you can also select the Format tab in the Chart Tools section of the ribbon.)

3.   Select **Format Axis** . . .

4.   In the **Format Axis pane**, make your changes to the **Axis Options**.

5.   Click in the input box next to the desired axis option and then type the new scale value.

6.   Click the **Close** button at the top right of the Format Axis pane to close it.

TREND COMPARISONS: LINE CHART 2

We will now create a second line chart using the data in the Stock Trend worksheet. The purpose of this chart is to compare two trends: the change in volume for the NASDAQ and the change in the Closing price.

Before creating the chart to compare the NASDAQ volume and sales price, it is important to review the data in the range B4:D28 on the Stock Trend worksheet. We cannot use the volume of sales and the closing price because the values are not comparable. That is, the closing price is in a range of $45.00 to $115.00, but the data for the volume of Sales is in a range of 684,000 to 3,711,000. If we used these values – without making changes to the chart — we would not be able to see the closing price at all.

The construction of this second line chart will be similar to the first line chart. The X axis will be the months in the range B4:D28.

1. Highlight the range **B4:D28** on the Stock Trend worksheet.

2. Click the **Insert** tab of the ribbon.

3. Click the **Line** button in the **Charts** group of commands.

4. Click the first option from the list, which is a basic line chart.

Figure 4.6.5 shows the appearance of the line chart comparing both the volume and the closing price before it is moved and resized. Notice that the line for the closing price (Close) appears as a straight line at the bottom of the chart. Also, the chart is covering the data again, and the title needs to be changed.
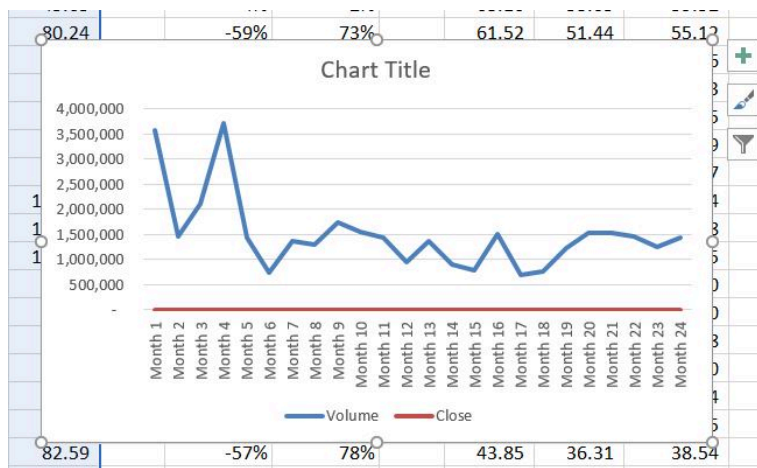
Figure 4.6 Trend Comparison Line Chart

1. Move the chart so the upper left corner is in the middle of cell M3.

Note: The line representing the closing values is flat along the bottom of the chart. This is hard to see and not very useful as is. Fear not. We will fix that.

2. Resize the chart, using the resizing handles and the ALT key, so the left side is locked to the left side of Column M, the right side is locked to the right side of Column U, the top is locked to the top of Row 3, and the bottom is locked to the bottom of Row 17.

3. Click in the text box that says "**Chart Title**." Delete the text and replace it with the following: **24 Month Trend Comparison.**

Good. But, we still cannot really see the Closing Price data. It is the flat red line at the very bottom of the chart.

1. Right click the red line across the bottom of the chart that represents the Closing Price.

2. On the menu, select Format Data Series. This will open the Format Data Series pane.

3. In the Series Options, select Secondary Axis.
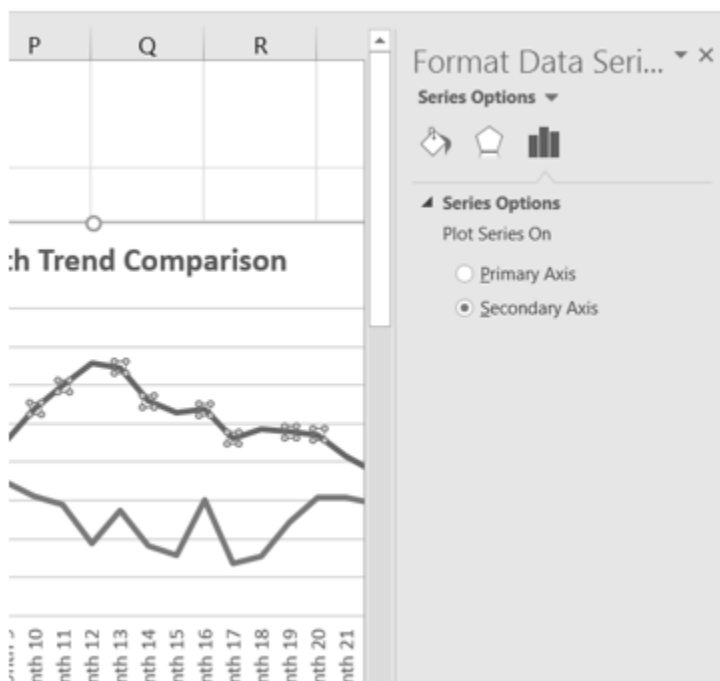
Figure 4.7 Adding a Secondary Axis

Better! But, it would be nice to be able to see that the values on the right represent prices.

1. Right click the Secondary Vertical Axis. (The vertical axis on the right that goes from 0 to 140.)

2. From the menu, select Format Axis.

3. In Axis Options, select Number. (You may have to scroll down to see it.)

4. Use the Symbol list box to add the $.

5. Press the Close button to close the Format Axis pane.

6. Save your work.

Figure 4.8 Modifying the Secondary Axis
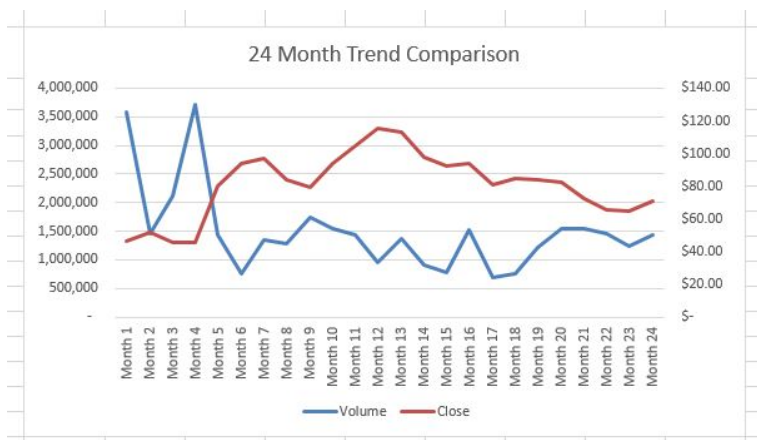
Figure 4.9 Final Comparison Line Chart

"INSTANT" CHART – F11

On the Stock Trend worksheet:

1. Select **A4:A28.**

2. Hold down the **Ctrl key** and select **D4:D28**.
    Figure 4.10 shows what that will look like.

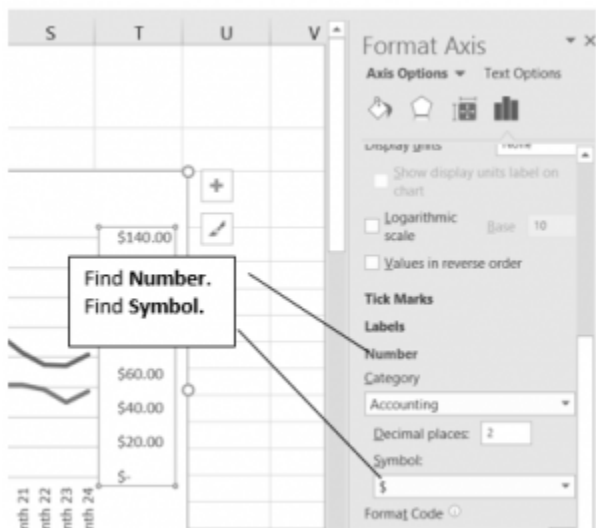|	A	B	C	D	E	F	G	H
3			Average Closing Price			Change in Price		
4	Date	Month	Volume	Close		NASDAQ	% change	
5	2-May-16	Month 1	3,572,300	46.39		0%	0%	
6	1-Apr-16	Month 2	1,461,900	51.70		-59%	11%	
7	1-Mar-16	Month 3	2,112,900	45.87		-41%	-1%	
8	1-Feb-16	Month 4	3,711,200	45.65		4%	-2%	
9	4-Jan-16	Month 5	1,447,700	80.24		-59%	73%	
10	1-Dec-15	Month 6	748,600	94.22		-79%	103%	
11	2-Nov-15	Month 7	1,356,400	97.03		-62%	109%	
12	1-Oct-15	Month 8	1,292,000	83.96		-64%	81%	
13	1-Sep-15	Month 9	1,734,700	79.78		-51%	72%	
14	3-Aug-15	Month 10	1,546,700	94.17		-57%	103%	
15	1-Jul-15	Month 11	1,439,300	104.74		-60%	126%	
16	1-Jun-15	Month 12	946,400	115.30		-74%	149%	
17	1-May-15	Month 13	1,364,200	113.21		-62%	144%	
18	1-Apr-15	Month 14	906,700	97.84		-75%	111%	
19	2-Mar-15	Month 15	789,000	92.52		-78%	99%	
20	2-Feb-15	Month 16	1,513,700	94.01		-58%	103%	
21	2-Jan-15	Month 17	684,800	80.76		-81%	74%	
22	1-Dec-14	Month 18	763,000	84.76		-79%	83%	
23	3-Nov-14	Month 19	1,222,000	83.88		-66%	81%	
24	1-Oct-14	Month 20	1,537,700	82.59		-57%	78%	
25	2-Sep-14	Month 21	1,536,200	72.65		-57%	57%	
26	1-Aug-14	Month 22	1,467,900	65.49		-59%	41%	
27	1-Jul-14	Month 23	1,246,200	65.00		-65%	40%	
28	2-Jun-14	Month 24	1,428,300	71.33		-60%	54%	
29								

Figure 4.10 Range Selection

3. Press **F11**. (The F11 function key is on the top row
    of the keyboard.) If the factory default settings
    haven't been changed, Excel will create a column
    chart and place it on a separate chart sheet. (See
    Figure 4.11).

4. Change the name of the chart sheet by double-
    clicking the worksheet name Chart1. Type
    Closing Prices as the new name and hit Enter.

5. Save your work.
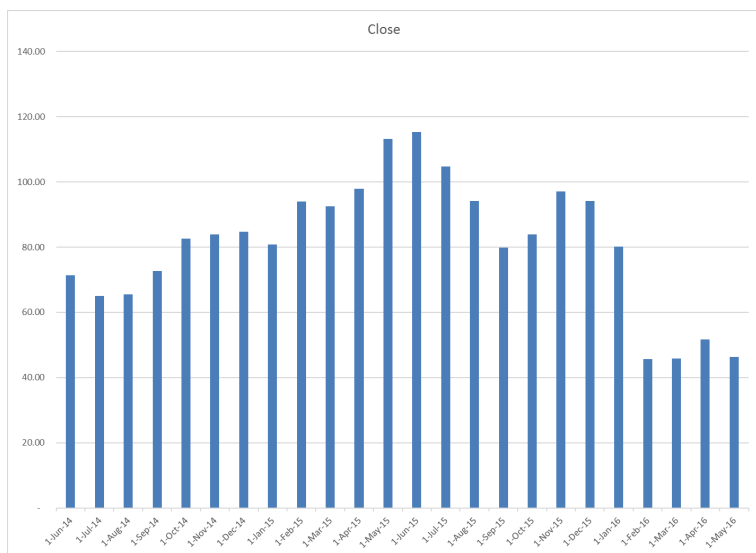
ATTRIBUTION

Media Attributions

- 4_1
- fig4.2
- fig4-3
- image4
- image5
- Figure-4-4
- Figure 4-5

- Figure 4-6

- fig4-7

- fig4-8

- Figure 4-9

- fig10

4.1.2 CHOOSING A CHART TYPE: COLUMN CHARTS

FREQUENCY DISTRIBUTION: COLUMN CHART 1

A column chart is commonly used to show trends over time, as long as the data are limited to approximately twenty points or less. A common use for column charts is frequency distributions. A frequency distribution shows the number of occurrences by established categories. For example, a common frequency distribution used in most academic institutions is a grade distribution. A grade distribution shows the number of students that achieve each level of a typical grading scale (A, A–, B+, B, etc.). The Grade Distribution worksheet contains final grades for some hypothetical Excel classes. To show the grade frequency distribution for all the Excel classes in that year, the numbers of students appear on the Y axis and the grade categories appear on the X axis. The number of students for this chart is in Column C. The labels for grades are in Column A. The following steps explain how to create this chart:

1. Select the Grade Distribution worksheet in your CH4-Data_File.

2. Change the years in Row3 to the current academic term and year.

3. Highlight the range **A3:A8** on the **Grade Distribution** worksheet. Column A shows the grade categories.

4. Hold down the **Crtl key**.

5. Without letting go of the **Ctrl key**, select **C3:C8**

6. Click the **Column** button in the **Charts** group section on the **Insert** tab of the ribbon. Select the first option in the 2-D Column section, which is the **Clustered Column** format.

7. Click and drag the chart so the upper left corner is in the middle of cell **H2**.

8. Resize the chart so the left side is locked to the left side of Column H, the right side is locked to the right side of Column O, the top is locked to the top of Row 2, and the bottom is locked to the bottom of Row 16.

9. If Excel displays a legend, delete it by clicking the legend one time and pressing the **DELETE** key on the keyboard. Since the chart presents only one data series, the legend is not necessary.

10. Add the text **Final Grades for** to the chart title. The chart title should now be **Final Grades for All Excel Classes 2016/2017** (or whichever academic year you are using).

11. Click any cell location on the **Grade Distribution** worksheet to deactivate the chart.

12. Save your work.

Figure 4.12 shows the completed grade frequency distribution chart. By looking at the chart, you can immediately see that the greatest number of students earned a final grade in the B+ to B– range.

	A	B	C	D	E	F	G
1		Grade Distribution					
2		Number of Students			Percent Comparison		
3	Grade	Excel Classes Spring 2017	All Excel Classes 2016/17		Excel Classes Spring 2017	All Excel Classes 2016/17	
4	A to A-	16	500				
5	B+ to B-	26	600				
6	C+ to C-	25	500				
7	D+ to D-	10	300				
8	F	5	100				
9	Total						
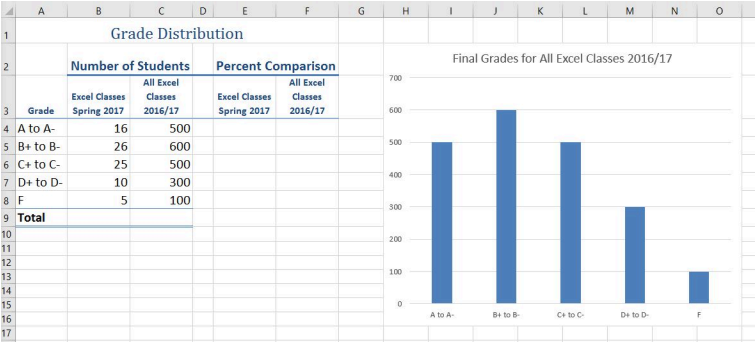
Figure 4.12 Grade Frequency Distribution Chart

Why?

Column Chart vs. Bar Chart

When using charts to show frequency distributions, the difference between a column chart and a bar chart is really a matter of preference. Both are very effective in showing frequency distributions. However, if you are showing a trend over a period of time, a column chart is preferred over a bar chart. This is because a period of time is typically shown horizontally, with the oldest date on the far left and the newest date on the far right. Therefore, the descriptive categories for the chart would have to fall on the horizontal – or category axis, which is the configuration of a column chart.

On a bar chart, the descriptive categories are displayed on the vertical axis.

CREATING A CHART SHEET

 The charts we have created up to this point have been added to, or embedded in, an existing worksheet (with the exception of the Instant Chart we created using F11). Charts can also be placed in a dedicated worksheet called a chart sheet. It is called a chart sheet because it can only contain an Excel chart. Chart sheets are useful if you need to create several charts using the data in a single worksheet. If you embed several charts in one worksheet, it can be cumbersome to navigate and browse through the charts. It is easier to browse through charts when they are moved to a chart sheet because a separate sheet tab is added to the workbook for each chart. The following steps explain how to move the grade frequency distribution chart to a dedicated chart sheet:

1. Click anywhere on the **Final Grades for All Excel Classes** chart on the Grade Distribution worksheet.

2. Right click on the chart. Select **Move Chart . . .** This opens the Move Chart Dialog box.

3. Click the **New sheet** option on the Move Chart dialog box. (The top option.)

4. The entry in the input box for assigning a name to the chart sheet tab should automatically be

highlighted once you click the New sheet option. Type **All Excel Classes.** This replaces the generic name in the input box (see **Figure 4.13**).

5. Click the **OK** button at the bottom of the Move Chart dialog box. This adds a new chart sheet to the workbook with the name **All Excel Classes**.

6. Save your work.
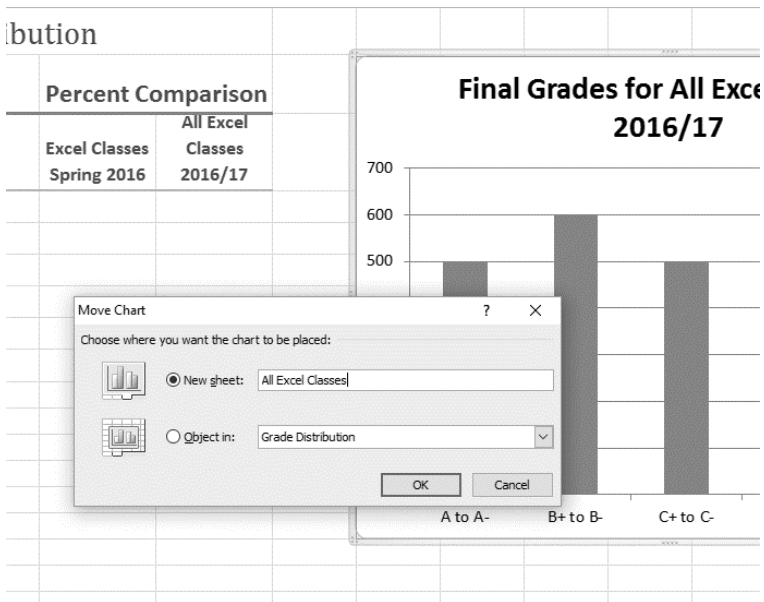
Figure 4.13 Moving a Chart to a Chart Sheet

Figure 4.14 shows the Final Grades for the all the Excel Classes column chart is in a separate chart sheet. Notice the new worksheet tab added to the workbook matches the New sheet name entered into the Move Chart dialog box. Since the chart is moved to a separate chart sheet, it no longer is displayed in the Grade Distribution worksheet.
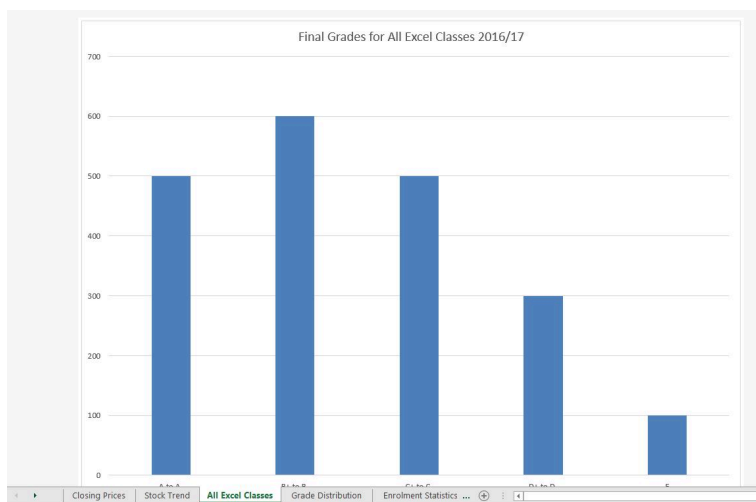
Figure 4.14 Chart Sheet Added to the Workbook

FREQUENCY COMPARISON: COLUMN CHART 2

We will create a second column chart to show a comparison between two frequency distributions. Column B on the Grade Distribution worksheet contains data showing the number of students who received grades within each category for the Spring Quarter. We will use a column chart to compare the grade distribution for Spring (Column B) with the overall grade distribution for the whole year (Column C).

However, since the number of students in the term is significantly different from the total number of students in the year, we must calculate percentages in order to make an effective comparison. The following steps explain how to calculate the percentages:

1. Highlight the range **B9:C9** on the **Grade Distribution** worksheet.

2. Click the **AutoSum** button in the Editing group of

commands on the Home tab of the ribbon. This automatically adds SUM functions that sum the values in the range B4:B8 and C4:C8.

3. Activate cell **E4** on the Grade Distribution worksheet.

4. Enter a formula that divides the value in cell **B4** by the total in cell **B9**. Add an absolute reference to cell **B9** in the formula =**B4/$B$9**.

5. Copy the formula in cell **E4** and paste it into the range **E5:E8** using the Paste command.
Or, use the Fill Handle to copy the calculation in **E4** all the way down to **E8**.

6. Activate cell **F4** on the Grade Distribution worksheet.

7. Enter a formula that divides the value in cell **C4** by the total in cell **C9**. Add an absolute reference to cell **C9** in the formula =**C4/$C$9**.

8. Copy the formula in cell **F4** and paste it into the range **F5:F8** using the Paste command.
Or, use the Fill Handle to copy the calculation in **F4** all the way down to **F8**.

	F4	▾	fx	=C4/$C$9		

	A	B	C	D	E	F	G
1			Grade Distribution				
2			Number of Students		Percent Comparison		
3	Grade	Excel Classes Spring 2016	All Excel Classes 2016/17		Excel Classes Spring 2016	All Excel Classes 2016/17	
4	A to A-	16	500		20%	25%	
5	B+ to B-	26	600		32%	30%	
6	C+ to C-	25	500		30%	25%	
7	D+ to D-	10	300		12%	15%	
8	F	5	100		6%	5%	
9	Total	82	2000				
10							
11							

Figure 4.15 Completed Grade Distribution Percentages

Figure 4.15 shows the completed percentages added to the Grade Distribution worksheet.

The column chart we are going to create uses the grade categories in the range A4:A8 on the X axis and the percentages in the range E4:F8 on the Y axis. This chart uses data that is not in a contiguous range, so we need to use the Ctrl key to select the ranges of cells.

1. Select **A3:A8,** hold down the **Ctrl** key and select **E3:F8.**

2. Click the **Insert** tab of the ribbon.

3. Click the **Column** button in the **Charts** group of commands. Select the first option from the drop-down list of chart formats, which is the **Clustered Column**.

4. Click and drag the chart so the upper left corner is in the middle of cell **H2**.

5. Resize the chart so the left side is locked to the left side of Column H, the right side is locked to the right side of Column N, the top is locked to the top of Row 2, and the bottom is locked to the bottom of Row 16.

6. Change the chart title to **Grade Distribution Comparison**. If you do not have a chart title, you can add one. On the **Design** tab, select **Add Chart Element**. Find the **Chart Title**. Select the **Above Chart** option from the drop-down list.

7. Save your work.
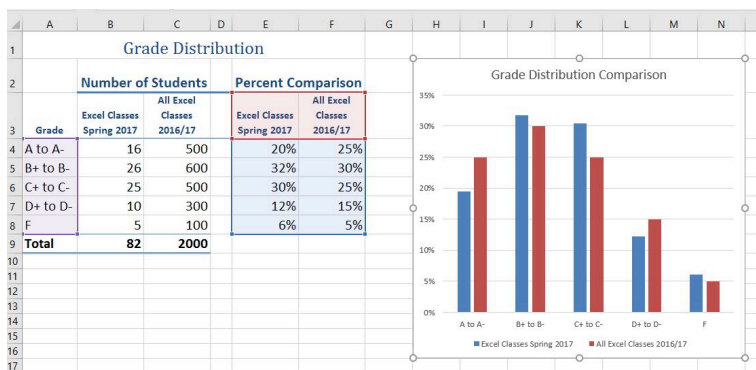
Figure 4.16 Completed Data Series for the Class Grade Distribution

Figure 4.17 shows the final appearance of the column chart. The column chart is an appropriate type for this data because there are fewer than twenty data points and we can easily see the comparison for each category. An audience can quickly see that the class issued fewer As compared to the college. However, the class had more Bs and Cs compared with the college population.
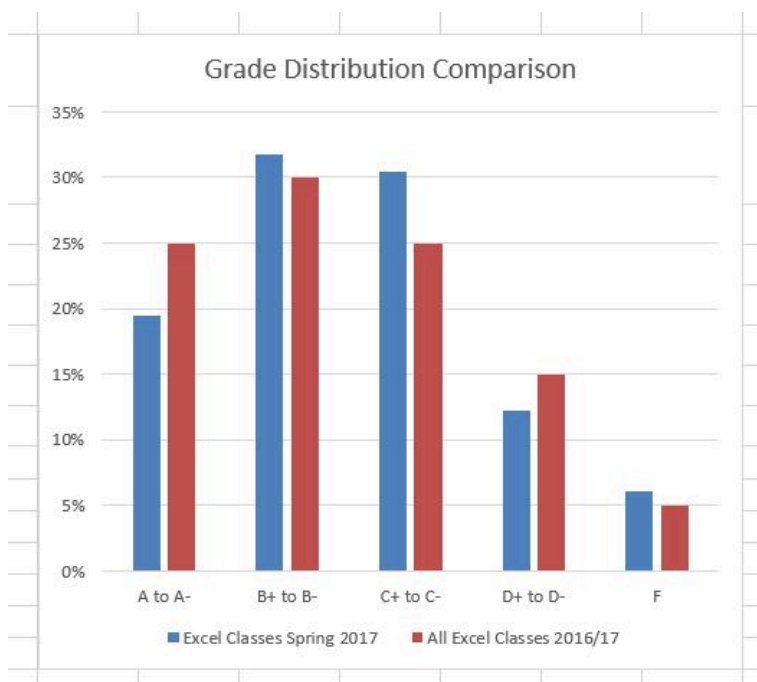
Figure 4.17 Completed Grade Distribution Column Chart

Integrity Check

Too Many Bars on a Column Chart?
Although there is no specific limit for the number of bars you should use on a column chart, a general rule of thumb is twenty bars or less. **Figure 4.18** contains a total of thirty-two bars. This is considered a poor use of a column chart because it is difficult to identify meaningful trends or comparisons. The data used to create this chart might be better used in two

or three different column charts, each with a distinct idea or message.
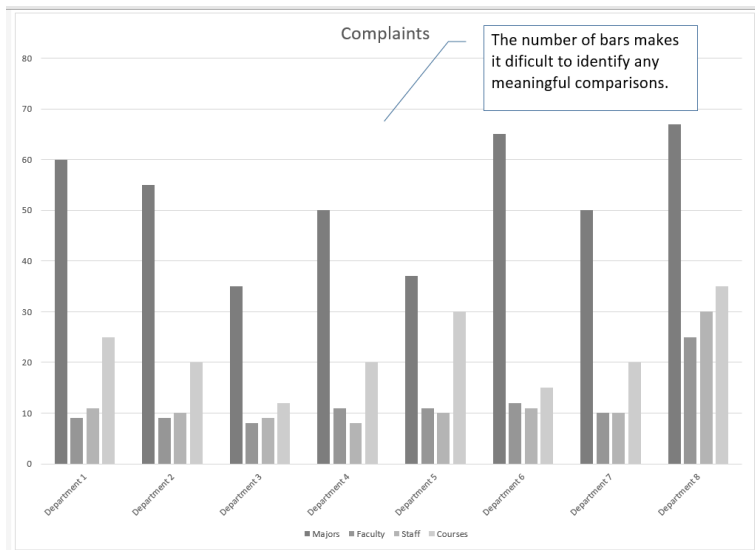
Figure 4.18 Poor Use of a Column Chart

ATTRIBUTION

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- Figure 4-12
- Figure 4-14
- Figure 4-16
- Figure 4-17
- fig4-18

4.1.3 CHOOSING A CHART TYPE: PIE CHART

PERCENT OF TOTAL: PIE CHART

The next chart we will demonstrate how a pie chart works. A pie chart is used to show a percent of total for a data set at a specific point in time. The data we will use to demonstrate a pie chart is related to enrollment data for Portland Area Community Colleges for Fall of 2014. You will find that data on the Enrollment Statistics sheet in your CH4-Data_File.

1. Highlight the range **A2:B6** on the **Enrollment Statistics** worksheet.

2. Click the **Insert** tab of the ribbon.

3. Click the **Pie** button in the **Charts** group of commands.

4. Select the first "**2-D Pie**" option from the drop-down list of options.

5. To make the "slices" stand out better, "explode" the pie chart.

   ◦ Click and hold the mouse button down in

any of the slices of the pie.

- ◦ Note that you have selection handles on all of the pie slices.

- ◦ Without letting go of your mouse button; drag one of the slices away from the center.

- ◦ All of the slices "explode" out from the center.

Note: if you let go of the mouse button before dragging, you may only get one slice to move when you drag it out from the center. This can be another option for displaying your data. Use the Undo button to undo this if you want to try again.

1. Click off the slices and into the white canvas to deselect the pie and select the entire chart.

2. Click and drag the pie chart so the upper left corner is in the middle of cell E2.

3. Resize the pie chart so the left side is locked to the left side of Column E, the right side is locked to the right side of Column L, the top is locked to the top of Row 2, and the bottom is locked to the bottom of Row 10 (see **Figure 4.19**).
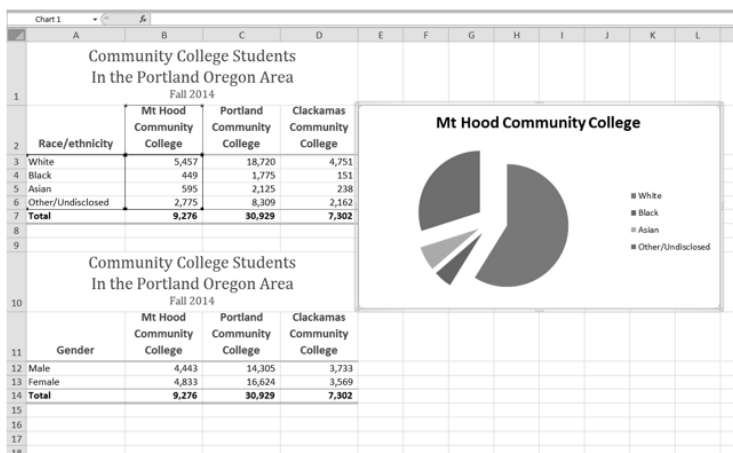
	Chart 1											
	A	B	C	D	E	F	G	H	I	J	K	L

Race/ethnicity	Mt Hood Community College	Portland Community College	Clackamas Community College
White	5,457	18,720	4,751
Black	449	1,775	151
Asian	595	2,125	238
Other/Undisclosed	2,775	8,309	2,162
Total	9,276	30,929	7,302

Community College Students
In the Portland Oregon Area
Fall 2014

Mt Hood Community College

■ White
■ Black
■ Asian
■ Other/Undisclosed

Community College Students
In the Portland Oregon Area
Fall 2014

Gender	Mt Hood Community College	Portland Community College	Clackamas Community College
Male	4,443	14,305	3,733
Female	4,833	16,624	3,569
Total	9,276	30,929	7,302

Figure 4.19 Pie Chart Moved and Resized

1. Click the chart **legend** once and press the **DELETE** key on your keyboard. A pie chart typically shows labels next to each slice. Therefore, the legend is not needed.

2. Right click any of the slices in the pie chart, and select **Add Data Labels** from the list. This will add the values for each of the slices in the pie.

3. Now, you can right click one of the numbers and select **Format Data Labels** from the list. This will open the **Format Data Labels** pane on the right.

4. Check the boxes for **Category Name** and **Percentage** in the **Label Options** section in the **Format Data Labels** pane. This will add the Race/ethnicity labels as well as the percentage data to the pie chart.

5. Uncheck the box next to the **Value** box. This will remove the numbers from the pie chart (see

Figure 4.20).

6. Click the **Close** button at the top of the Format Data Labels pane.

7. Select the data labels again (if needed). Click the **Home** tab of the ribbon and then click the **Bold** button. This will bold the data labels on the pie chart.
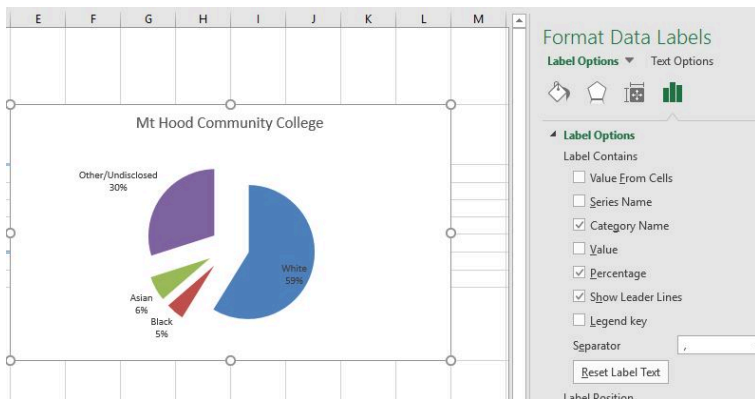
8. Save your work.

Figure 4.20 Final Settings in the Format Data Labels Pane

Although there are no specific limits for the number of categories you can use on a pie chart, a good rule of thumb is ten or less. As the number of categories exceeds ten, it becomes more difficult to identify key categories that make up the majority of the total.
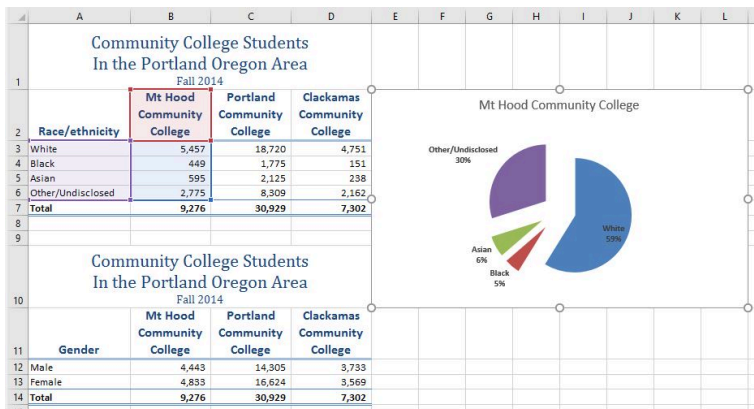
Race/ethnicity	Mt Hood Community College	Portland Community College	Clackamas Community College									
White	5,457	18,720	4,751									
Black	449	1,775	151									
Asian	595	2,125	238									
Other/Undisclosed	2,775	8,309	2,162									
Total	9,276	30,929	7,302									

Community College Students In the Portland Oregon Area Fall 2014

Gender	Mt Hood Community College	Portland Community College	Clackamas Community College
Male	4,443	14,305	3,733
Female	4,833	16,624	3,569
Total	9,276	30,929	7,302

Figure 4.21 Final Enrollment Statistics Pie Chart

Skill Refresher

Inserting a Pie Chart

1. Highlight a range of cells that contain the data you will use to create the chart.

2. Click the Insert tab of the ribbon.

3. Click the Pie button in the Charts group.

4. Select a format option from the Pie Chart drop-down menu.

Key Takeaways

- Identifying the message you wish to convey to an audience is a critical first step in creating an Excel

chart.

- Both a column chart and a line chart can be used to present a trend over a period of time. However, a line chart is preferred over a column chart when presenting data over long periods of time.

- The number of bars on a column chart should be limited to approximately twenty bars or less.

- When creating a chart to compare trends, the values for each data series must be within a reasonable range. If there is a wide variance between the values in the two data series (two times or more), the percent change should be calculated with respect to the first data point for each series.

- When working with frequency distributions, the use of a column chart or a bar chart is a matter of preference. However, a column chart is preferred when working with a trend over a period of time.

- A pie chart is used to present the percent of total for a data set.

- A stacked column chart is used to show how a percent total changes over time.

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- fig19
- Figure 4.20 Final Settings in the Format Data Labels Pane
- Figure 4-21

4.1.4 CHOOSING A CHART TYPE: STACKED COLUMN CHART

PERCENT OF TOTAL: STACKED COLUMN CHART

The last chart type we will demonstrate is the stacked column chart. We use a stacked column chart to show a percent of a total . For example, the data on the Enrollment Statistics worksheet shows student enrollment by race for several colleges. We would like to see all of the data on all of the colleges.

1. Highlight the range **A2:D6** on the **Enrollment Statistics** worksheet.

2. Click the **Insert** tab of the ribbon.

3. Click the **Column** button in the **Charts** group of commands. Select the **100% Stacked Column** format option from 2-D Column section in the drop-down list (see **Figure 4.22**).
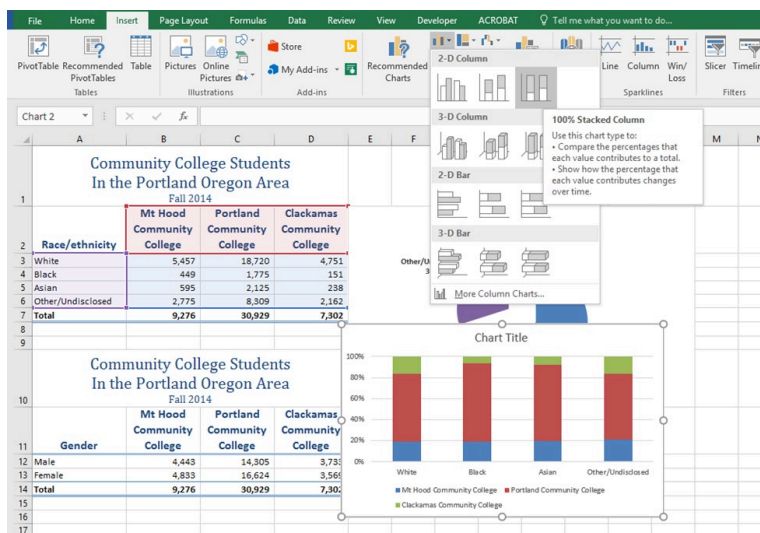
Figure 4.22 Selecting the 100% Stacked Column Chart

Figure 4.23 shows the column chart that is created after selecting the 100% Stacked Column format option. As mentioned, the goal of this chart is to show the enrollment of students by race. However, notice that Excel places the racial categories on the X axis. It would be more useful if the different colleges were there instead.
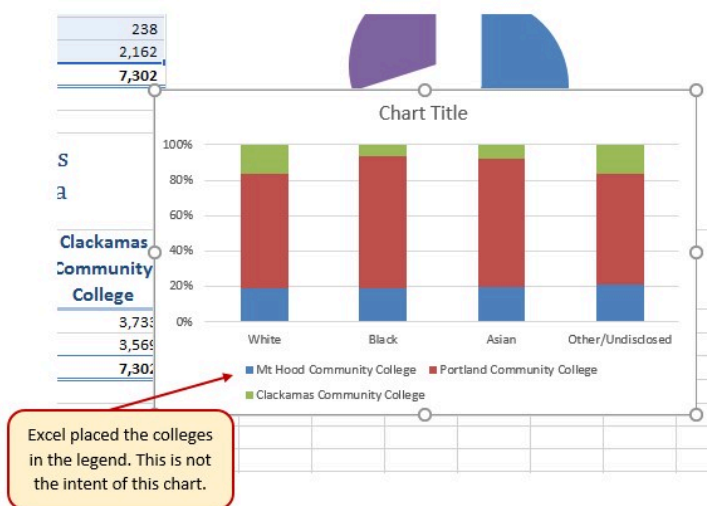
Figure 4.23 Initial Construction of the 100% Stacked Column Chart

The reason that Excel organized the data this way is that there are more Race/ethnicity categories (data in column A) than there are colleges (data in row 2). Not a bad guess. But, not what we wanted in this case.

The remaining steps explain how to correct this problem and complete the chart:

1. Click the **Switch Row/Column** button in the **Design** tab on the **Chart Tools** section of the ribbon. This reverses the legend and current X axis categories.
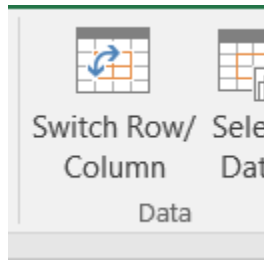
Figure 4.24 Switch Row/ Column.

2. Click and drag the chart so the upper left corner is in the middle of cell **E12**.

3. Resize the chart so the left side is locked to the left side of Column E, the right side is locked to the right side of Column N, the top is locked to the top of Row 12, and the bottom is locked to the bottom of Row 30.

4. Click the **legend** one time and press the **DELETE** key on your keyboard.

5. **Add a Data Table**. This is another way of displaying a legend for a column chart along with the numerical values that make up each component.

    ◦ In earlier versions of Excel, find the **Labels** group of commands and select the **Show Data Table** with **Legend Keys** option from the drop-down menu.

    ◦ In Excel 2016, find the **Add Chart Element** tool on the **Design** tab, select **Data Table With Legend Keys**

6. Change the Chart Title to **Enrollment by Race**.

- If there is no chart title, you will need to add one using the **Add Chart Element** tool on the **Design** tab.

7. Save your work.

Figure 4.25 shows the final stacked column chart. Notice the similarities and differences in the enrollment at the local community colleges.
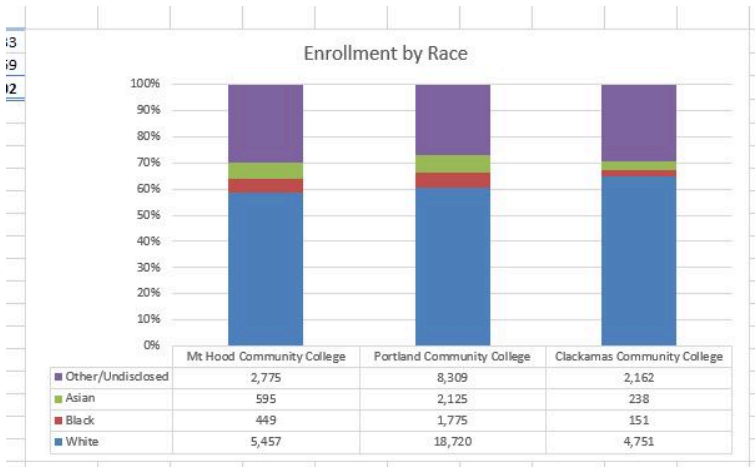

	Mt Hood Community College	Portland Community College	Clackamas Community College
Other/Undisclosed	2,775	8,309	2,162
Asian	595	2,125	238
Black	449	1,775	151
White	5,457	18,720	4,751

Figure 4.25 Final 100% Stacked Column Chart

Skill Refresher:

Inserting a Stacked Column Chart

1. Highlight a range of cells that contain data that will be used to create the chart.
2. Click the Insert tab of the ribbon.
3. Click the Column button in the Charts group.

4. Select the Stacked Column format option from the Column Chart drop-down menu to show the values of each category on the Y axis. Select the 100% Stacked Column option to show the percent of total for each category on the Y axis.

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- Figure 4-22
- Figure 4-23
- fig
- Figure 4-24

4.2 FORMATTING CHARTS

Learning Objectives

1. Apply formatting commands to the X and Y axes.

2. Enhance the visual appearance of the chart title and chart legend by using various formatting techniques.

3. Assign titles to the X and Y axes that clarify labels and numeric values for the reader.

4. Apply labels and formatting techniques to the data series in the plot area of a chart.

5. Apply formatting commands to the chart area and the plot area of a chart.

6. Employ series lines and annotations to enhance trends and provide additional information on a chart.

You can use a variety of formatting techniques to enhance the appearance of a chart once you have created it. Formatting commands are applied to a chart for the same reason they are applied to a worksheet: they make the

chart easier to read. However, formatting techniques also help you qualify and explain the data in a chart. For example, you can add footnotes explaining the data source as well as notes that clarify the type of numbers being presented (i.e., if the numbers in a chart are truncated, you can state whether they are in thousands, millions, etc.). These notes are also helpful in answering questions if you are using charts in a live presentation. We will demonstrate these formatting techniques using the column chart and stacked column chart from the previous section.

X AND Y AXIS FORMATS

There are numerous formatting commands we can apply to the X and Y axes of a chart. Although adjusting the font size, style, and color are common, many more options are available through the Format Axis pane. The following steps demonstrate a few of these formatting techniques on the **Grade Distribution Comparison** chart:

1. Switch to the **Grade Distribution** worksheet and click anywhere along the X axis (horizontal axis) of the Grade Distribution Comparison chart.

2. Right click and select Font.

3. Change the font to Arial, the Font Style to Bold, and the Size to 11 (see **Figure 4.26**).
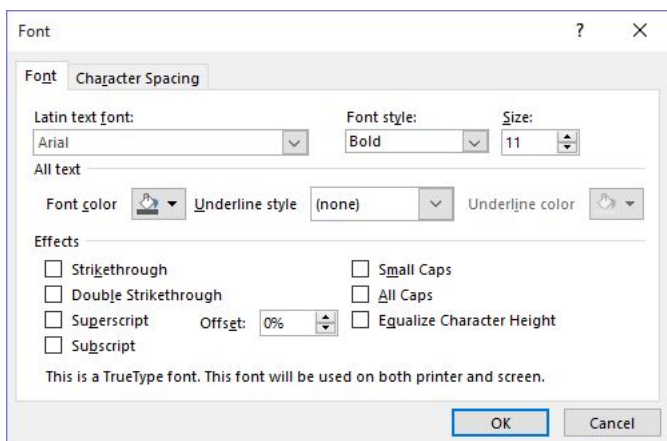
Figure 4.26 Font Dialog Box

4. Click anywhere along the Y axis to activate it and repeat steps 2 and 3.

5. Click on the chart title and repeat steps 2 and 3, but set the Size to 14.

6. The final appearance of the axes is shown in Figure **4.27 Formatted X & Y Axes.**
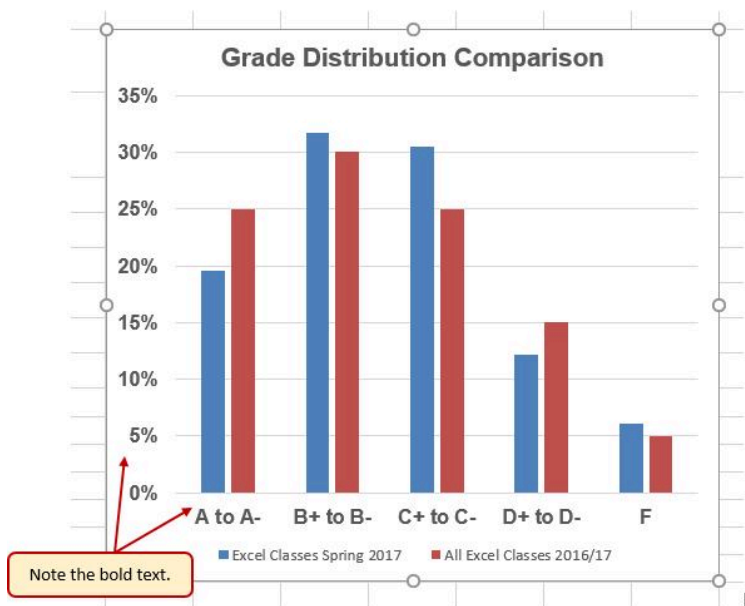
Figure 4.27 Formatted X and Y Axes

Next we want to make some changes to the percentage numbers on the Y (vertical) axis.

1. Right click the vertical (value) axis. Select **Format Axis**. This opens the **Format Axis** pane.

2. Click **Number** from the list of options. The commands in this section of the **Format Axis** pane are used to format numbers that appear on the selected axis of the chart.

3. Click in the Decimal places input box and change the value to **1.**

4. Select **Axis Options**. Change the **Minimum Bound** to **.05** to make the differences in the columns more dramatic. The Format Axis pane

should match **Figure 4.28**.

5. Click the **Close** button at the top of the Format Axis pane.
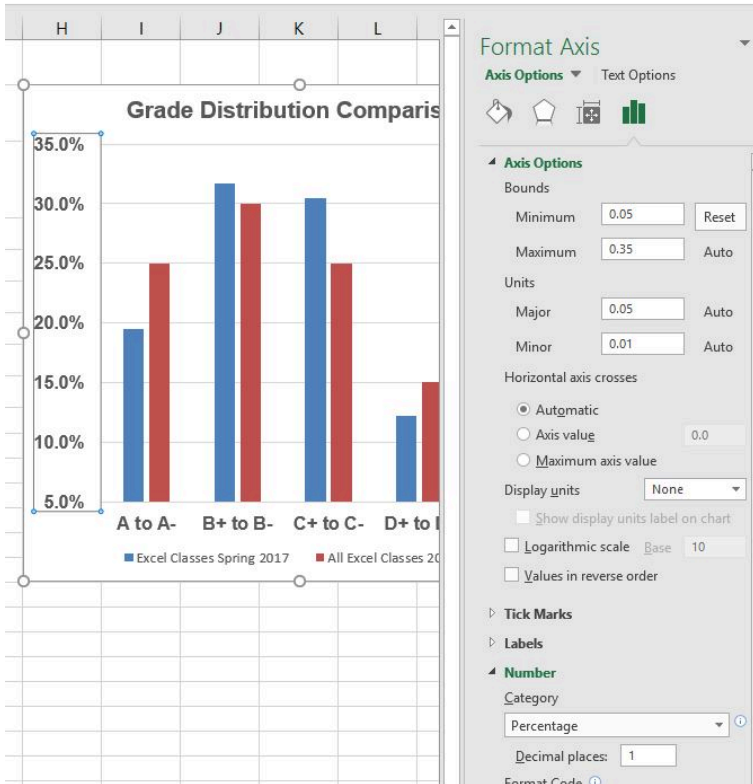
6. Save your work.

Figure 4.28 Format Axis Pane changes

Note: Experiment! You can also change font styling using shortcut keys and the buttons on the **Home tab**.

Formatting the X and Y Axes

1.   Click anywhere along the X or Y axis to activate it.

2.   Click either the Home tab or Design tab of the ribbon.

3.   Select any of the available formatting commands in these tabs.

X and Y Axis Number Formats

1.   Click anywhere along the X or Y axis to activate it.

2.   Click the Layout tab in the Chart Tools section of the ribbon.

3.   Click the Format Selection button in the Current Selection group of commands.

4.   Click Number from the list of options on the left side of the Format Axis dialog box.

5.   Select a number format and set decimal places on the right side of the Format Axis dialog box.

6.   Click the Close button in the Format

Axis pane.

CHART LEGEND AND TITLE FORMATS

The next items we will format on the Grade Distribution Comparison chart are the chart legend and title. Similar to the how we formatted the X and Y axes, we can format these items by activating them and using the formatting commands in the Home tab or the Format pane. The following steps explain how to add these formats:

1. Right click the legend on the **Grade Distribution Comparison** chart and select **Format Legend**.

2. Select **Right** in the Legend Position options. Close the Format Legend pane.

3. Move the legend by placing your cursor – shaped like a little plus sign with four arrows – on the edge of the selection box. Click and drag the legend so the top of the legend aligns with the 35% line next to the plot area (see **Figure 4.29**).
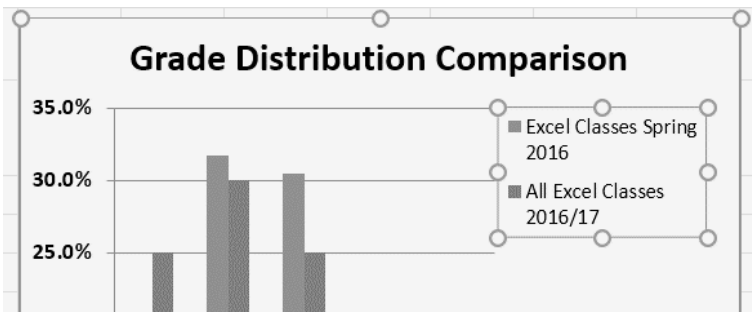

Figure 4.29 Moving the Legend

1. While the legend is still selected, change the font style in the Home tab of the ribbon to Arial.

2. Change the font size to 12 points.

3. Click the bold and italics commands in the Home tab of the ribbon.

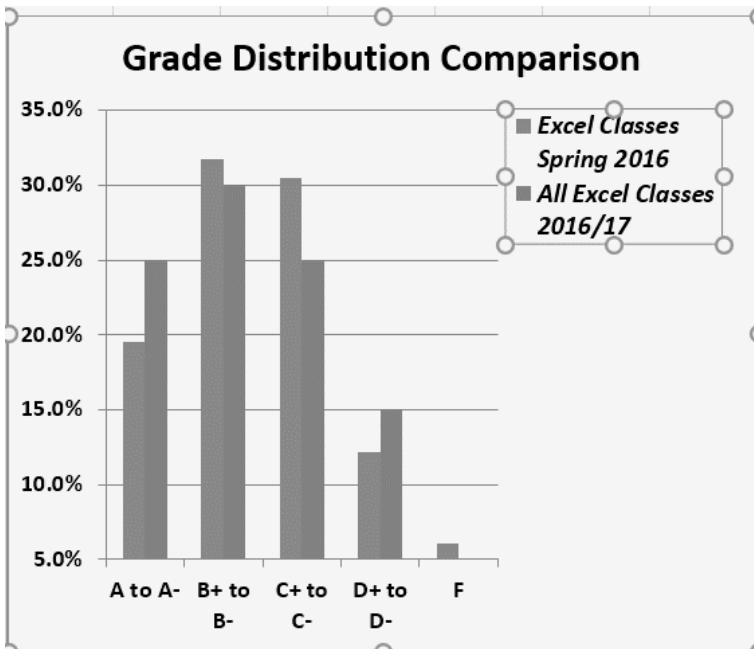4. Click and drag the left sizing handle so the legend is against the plot area (see **Figure 4.30**).

Figure 4.30 Legend Formatted and Resized

1. Click the chart title to activate it.

2. Right click on the chart title and select **Format Chart Title** to open the **Format Chart Title** pane.

3. Under **Title Options** , in the **Effects** group (the option in the middle) give your title one of the

Preset shadows. Change the color, if you like.
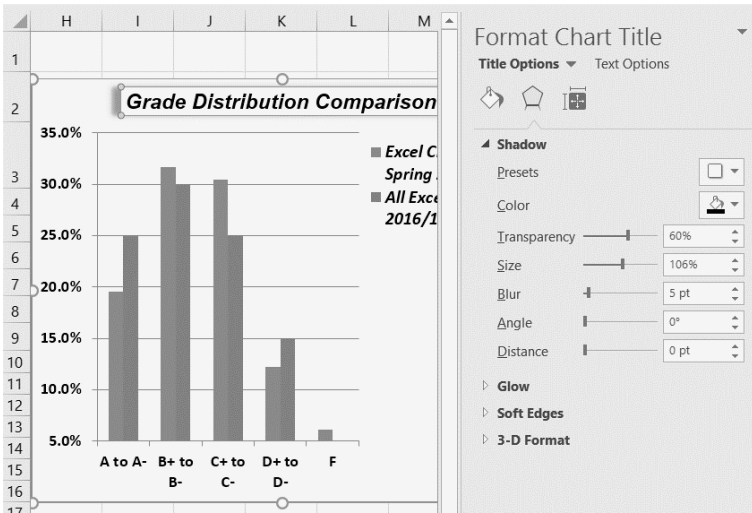
4. Close the Format Chart Title pane.

5. Save your work.

Figure 4.31 Format Chart Title Pane

Skill Refresher

Formatting the Chart Legend

1. Click the Legend to activate it.

2. Click either the Home tab or right click to activate the appropriate formatting pane.

3. Select any of the available formatting commands.

4. Click and drag the legend to move it.

5. Click and drag any of the sizing handles to adjust the size of the legend.

X AND Y AXIS TITLES

Titles for the X and Y axes are necessary for defining the numbers and categories presented on a chart. For example, by looking at the Grade Distribution Comparison chart, it is not clear what the percentages along the Y axis represent. The following steps explain how to add titles to the X and Y axes to define these numbers and categories:

1. Click anywhere on the Grade Distribution Comparison chart in the Grade Distribution worksheet to activate it.

2. On the **Design** tab on the ribbon select the Add Chart Element button, then Axis Titles, then Primary Vertical. (See **Figure 4.32**)
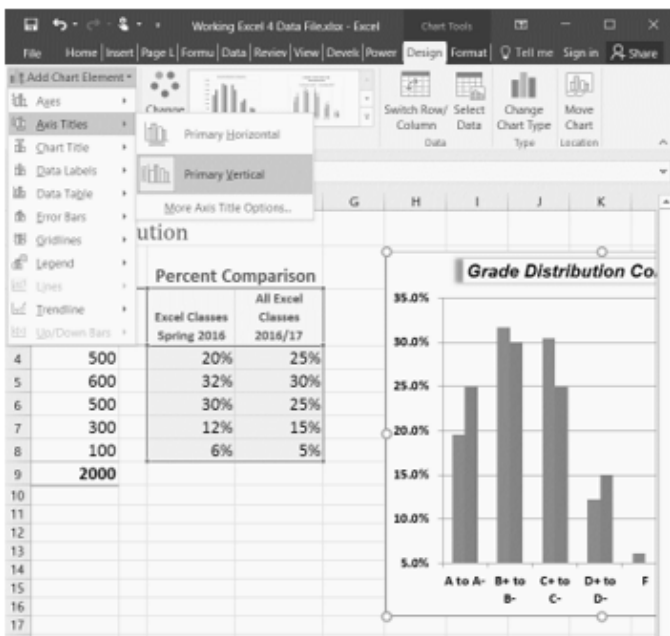
Figure 4.32 Selecting a Title for the Y Axis

3. Using the Home ribbon, change the font of the axis title to Arial, Bold, size 11.

4. Click in the beginning of the Y axis title and delete the generic title. Type Percent of Enrolled Excel Students.(see **Figure 4.33**).

Figure 4.33 Adding and Formatting the Y Axis Title

Next we will add the title for the X axis.

1. On the **Design** tab select the **Add Chart Element** button, then **Axis Titles**, then **Primary**

Horizontal.

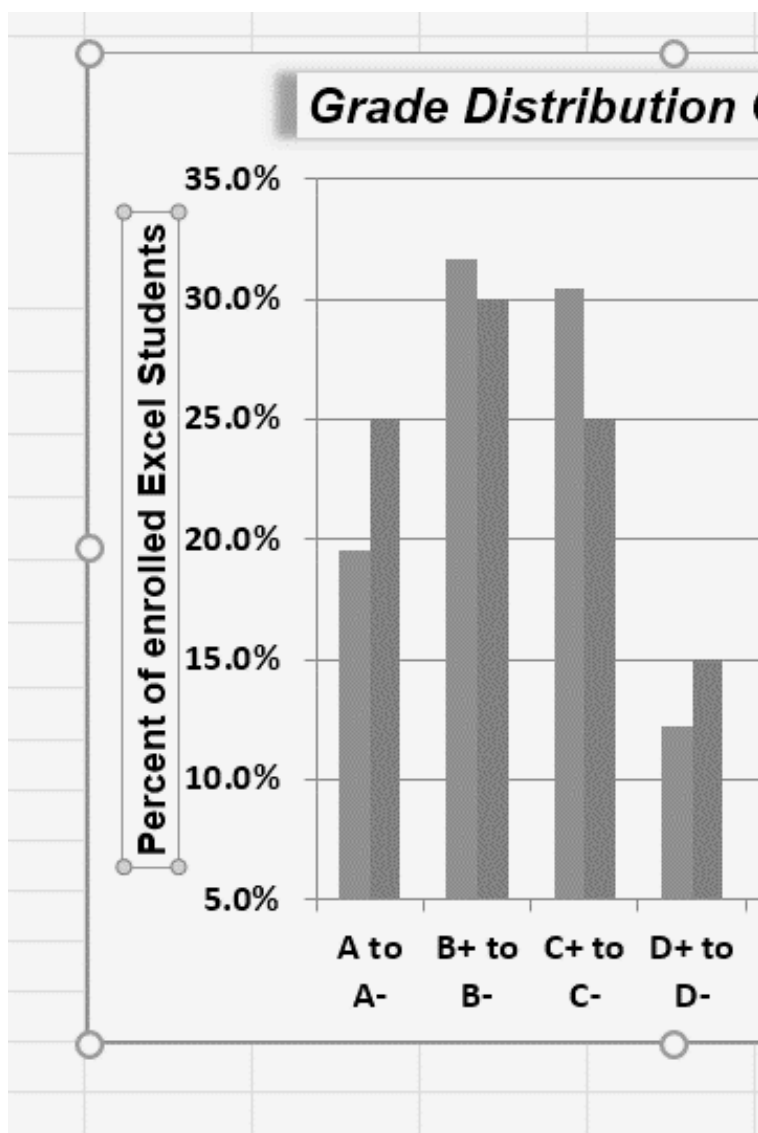2. Using the Home ribbon, change the font of the axis title to Arial, Bold, size 11.

3. Click in the beginning of the X axis title and delete the generic title. Type **Final Course Grade**. **Figure 4.34** shows the added titles for the X and Y axes. The titles provide definitions for the grade categories along the X axis as well as the percentages on the Y axis.

4. Save your work.

Grade Distribution Comparison

Percent of enrolled Excel Students

■ Excel Classes Spring 2016
■ All Excel Classes 2016/17

A to A- | B+ to B- | C+ to C- | D+ to D- | F

Final Course Grade
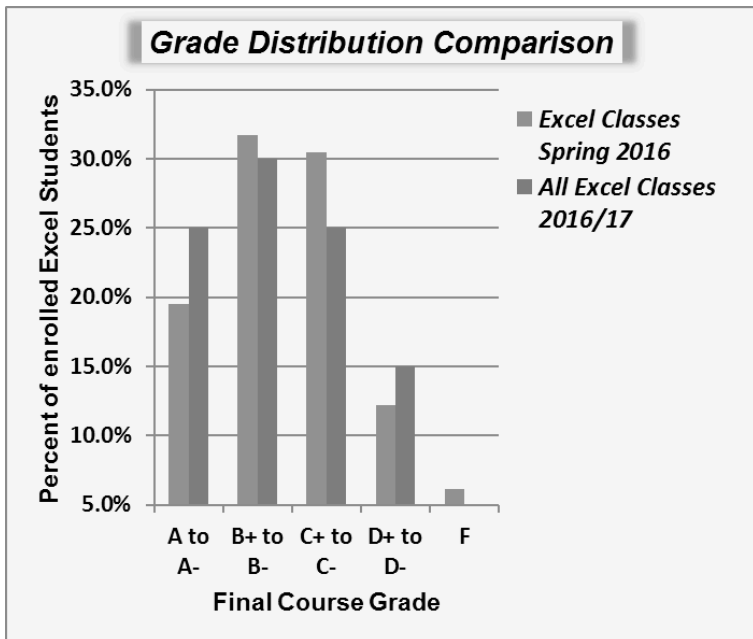
Figure 4.34 X and Y Axis Titles Added

> ### Skill Refresher
>
> **X and Y Axis Titles**
>
> 1. On the **Design tab** select the **Add Chart Element** button.
> 2. Click anywhere on the chart to activate it.
> 3. Select one of the options from the second drop-down list.
> 4. Click in the axis title to remove the generic title and type a new title.

ATTRIBUTION

Media Attributions

- Figure 4-26
- Figure 4-27
- Figure 4-28
- figure-4-30-selecting-a-title-for-the-y-axis

4.3 THE BEAUTY OF DATA VISUALIZATION

A TED element has been excluded from this version of the text. You can view it online here:
https://uhlibraries.pressbooks.pub/mis3300excel/?p=1134

Recommended Reading

Visit the following websites to learn more about the value of data visualization and see how others make infographics

- https://informationisbeautiful.net/
- https://venngage.com/
- The 56 Best Infographics

4.4 PREPARING TO PRINT

<div style="border:1px solid #000;">

Learning Objectives

1. Review each worksheet in a workbook in Print Preview.

2. Modify worksheets as needed to professionally print data and charts.

</div>

In this section we will take a look at each of the worksheets created in the previous sections. Since these worksheets contain a combination of data and charts, there are specific things to watch for if you will be printing the sheets.

We will start by looking at each worksheet in Print Preview in Backstage View. We will then make any changes necessary, such as changing the orientation and scaling, or moving charts around on the worksheet. To make sure we don't miss any worksheets, we are going to review the worksheets in the order they appear in the tabs.

PREVIEWING CHART SHEETS FOR PRINTING

Data file: Continue with CH4 Charting.

The first worksheet, Closing Prices, is a chart sheet. This means that it does not contain any data; remember that chart sheets just contain charts. We still need to review it in Print Preview.

1. Click on the **Closing Prices** worksheet tab.

2. Go to Print Preview by clicking Print in Backstage View.

3. Notice that the chart will print on the entire page, in Landscape orientation.

4. There is nothing to change. Exit Backstage View.

PRINTING WORKSHEETS WITH DATA AND CHARTS

The next worksheet (Stock Trend) has a lot of data and multiple charts. We need to print the data and the charts, which will require some modifications of the page setup.

1. Click on the **Stock Trend** worksheet tab.

2. Go to Print Preview by clicking Print in Backstage View.

3. Notice that this worksheet is currently printing on seven pages.

4. As you click through each page you should make the following observations:

   ◦ The data is split between the first and third pages.

- The line chart starts on the first page, but part of it is also on the second page.

- The double-line chart starts on the third page, and then finishes on the fifth page.

- The fourth and sixth pages are blank.

- The last page has a column of seemingly random numbers.

5. Exit Backstage View.

The first thing we are going to do is remove the numbers that are appearing on page 7. To do this, we will **hide** the column where they are being stored. We are going to hide the column, instead of deleting the numbers, in case the numbers are being utilized somewhere else in the workbook.

1. Scroll to the right on the worksheet until you find the numbers in column AH.

2. Click anywhere in column AH.

3. On the Home ribbon, click the **Format** button in the Cells group.

4. In the Visibility section, select **Hide & Unhide** then select **Hide Columns** (see **Figure 4.64**).

5. The visible column headings should now go from AG to AI.

6. Return to Print Preview in Backstage View to see the changes to the printed worksheet.

7. Notice that there are now five pages. The data and charts are still splitting across multiple pages,

but the numbers in column AH are no longer going to print.

8. Remain in Backstage View for the next steps.
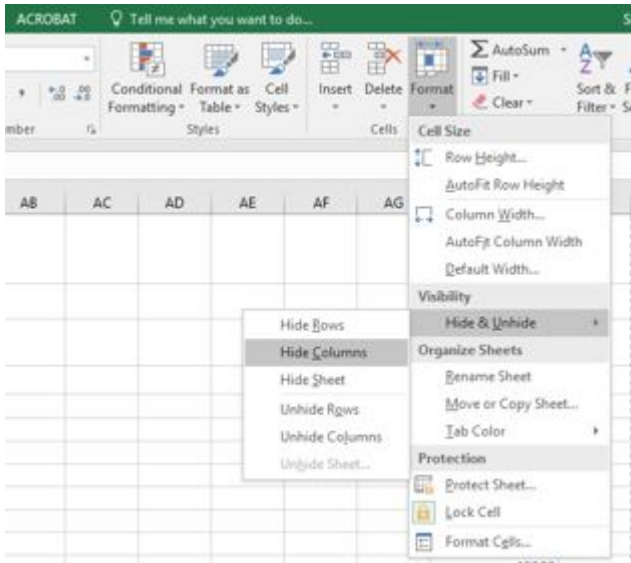
Figure 4.64 Hide Columns in Format Menu

The data is still split between pages 2 and 3, and the charts are splitting oddly as well. The first step we will try to fix these issues is to change the page orientation and scaling.

1. While still in Backstage View, change the **page orientation** to Landscape (use the Orientation drop-down menu in the Settings section).

2. This puts all of the data on one sheet, but the charts are still split between multiple pages.

3. Change the **page scaling** to Fit Sheet on One Page (use the Scaling drop-down menu in the Settings section).

4. This fits everything on one page, but it is too small to be able to read.

5. Change the page scaling back to No Scaling.

The next thing we will try is moving one, or both, of the charts. In order to move the charts, we need to exit out of Backstage View.

1. Exit Backstage View.

2. Switch to the View ribbon and then select Page Break Preview. Your screen should look similar to **Figure 4.65**. (Remember that the dotted blue lines indicate automatic page breaks.)

3. Move the 24 Month Comparison (double-line) chart closer to the top of its page.

4. Move the May 2014-2015 Trend for NASDAQ Sales Volume (line chart) so that it is under the 24 Month Comparison chart.

5. The link to the data source is still at the bottom of page 2 (in A50:A51) so you need to move it as well. Using your preferred method, move the text from A50:A51 to M31:M32.

6. Now your screen should look similar to **Figure 4.66**.
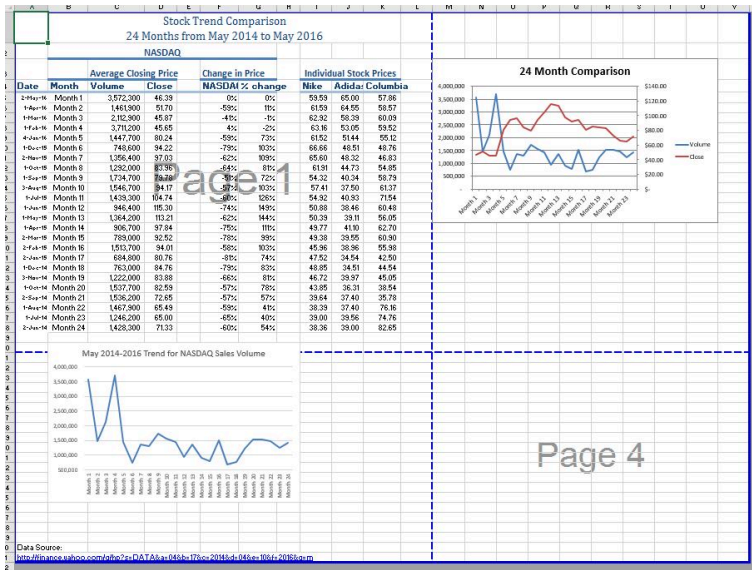
Figure 4.65 Page Break Preview before moving the charts in Step 3
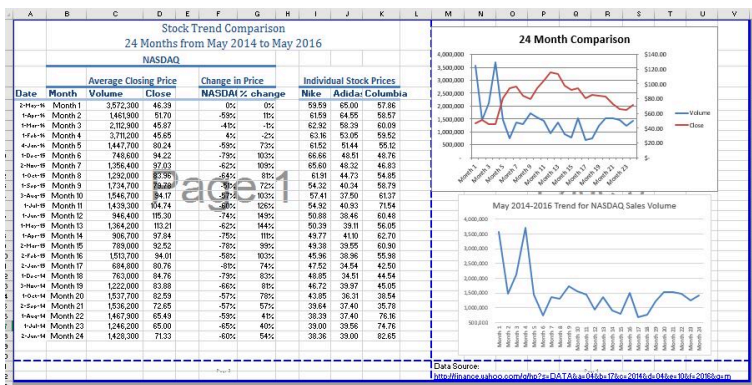
Figure 4.66 Page Break Preview after moving the charts and text

We don't want the data source link text to print on its own page, but there is no room to move it onto the same page as the charts. To fix this, we are going to remove the automatic page break between the charts and the text in M31:M32.

1. Place your pointer on the horizontal blue dashed line (automatic page break) between the line chart and the Data Source link text.

2. When your pointer changes to the double arrow (pointing up and down), drag the page break down into the gray area. This removes the page break.

3. If your vertical automatic page break between columns L and M moves, drag it back between columns L and M. This will make it a solid blue line, which will no longer adjust automatically.

4. Your screen should now look like **Figure 4.67**.

Figure 4.67 Page Break Preview after removing a page break

Now you need to do one final check of this worksheet in Print Preview.

1. Go to Print Preview and look at both pages. Page 1 should contain just the data and page 2 should have both charts and the Data Source link text.

2. Exit Backstage View and save the file.

PREVIEW REMAINING WORKSHEETS FOR

PRINTING

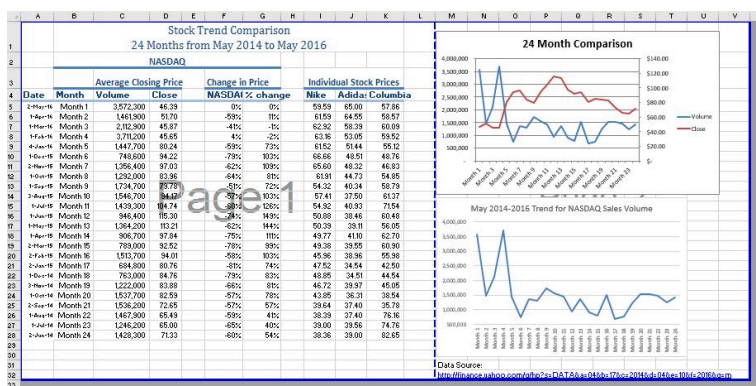There are four remaining worksheets to be reviewed. Some of them will need minor changes and some will not need any changes. You will need to preview each one and then make the specified changes. In the following steps you will preview and modify the next three worksheets.

1. **All Excel Classes –** this is a chart sheet, so it should not need any changes.

2. **Grade Distribution –** the chart is split across two pages. Fix this by changing the orientation (Landscape) and scaling (Fit Sheet on One Page).

3. **Enrollment by Race Chart –** this is a chart sheet, so it should not need any changes.

PRINTING A CHART ONLY

Sometimes you might have a worksheet that has data and a chart, but you only want the chart to print. That is the case with the **Enrollment Statistics** worksheet.

1. Switch to the **Enrollment Statistics** worksheet.

2. Select the chart.

3. Go to Print Preview. Only the chart is printing. *(If it shows the data printing along with the chart, exit Backstage View and be sure to select just the chart on the worksheet.)*

4. If needed, change the orientation to Landscape. This orientation looks better when printing just a chart.

5. Exit Backstage View.

HIDING A WORKSHEET

You have actually decided that you do not want the **Enrollment by Race Chart** sheet to be visible at all, but you do not want to delete it. We are going to hide it from anyone looking at the workbook.

1. Right-click on the **Enrollment by Race Chart** tab.

2. Select **Hide** from the menu that appears. The Enrollment by Race Chart sheet should no longer be visible.

3. Now you want to bring the worksheet back. To unhide it, right-click on any other worksheet tab and select Unhide from the menu. A list of hidden worksheets will be displayed. Select the Enrollment by Race Chart and click OK.

4. Save the **CH4 Charting** workbook.

5. Compare your work (on all of the worksheets) with the self-check answer key (found in the Course Files link).

6. Submit all three files from this chapter (**CH4 Charting.xlsx, CH4 Diversity in Enrollment in Community Colleges.docx**, and **CH4 Diversity in Enrollment in Community Colleges.pptx**) as directed by your instructor.

ATTRIBUTION

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- figure-4-64
- figure-4-65
- figure-4-66
- figure-4-67

4.5 CHAPTER PRACTICE

To assess your understanding of the material covered in the chapter, complete the following assignment.

U.S. ENERGY INFORMATION ADMINISTRATION – CRUDE OIL IMPORTS

The data you will be working is from the U.S. Energy Information Administration (EIA) website. The EIA "collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment (Source: EIA.gov)." EIA content is often among the data sets that analysts with backgrounds in accounting, finance, supply chain, and management information systems work with in energy-related industries.

Step 1: Download the Ch4_Practice which is an archived copy of the EIA's Company Level Imports page for March 2019 Import Highlights.

Step 2: Go to **the EIA website to read a few of the brief summaries** describing their data tables. **Note** how the summary matches the data points in the table below it. This is how data is generally reported on this website:

they provide a summary of the data as a narrative, then they provide a table.

When you download the chapter practice file, your table will include the top ten countries and should have no countries listed below Brazil. Delete any countries if present.

	A	B	C	D	E	F
1	Crude oil imports (Top 15 countries)					
2						
3	(thousand barrels per day)					
4	Country	19-Mar	19-Feb	YTD 2019	18-Mar	YTD 2018
5	Canada	3,710	3,651	3,778	3,532	3,639
6	Mexico	658	667	622	699	653
7	Saudi Arabia	640	577	645	748	697
8	Colombia	391	345	364	331	408
9	Iraq	275	422	374	708	677
10	Nigeria	135	19	107	126	270
11	Kuwait	129	106	84	131	133
12	Ecuador	124	154	173	130	136
13	Russia	94	86	96	57	20
14	Brazil	88	53	69	50	135

Step 3: **Examine** the simple formatting elements of the

table used to illustrate the hierarchy of the data starting with the title, column headings, row headings, the use of borders, font-weight, and alignment. Observe the data type for 19-Mar, 19-Feb, etc.

Step 4: **Rename** your sheet to Crude Imports and save your file as Ch4_Practice_[YourInitials].xlsx.

Step 5: Type "Total" into A14. **Calculate the Total** for columns B through F. Which column has the highest/ lowest totals? What does this mean? Observe how the import values change over time.

Step 6: Type "Average" into A15. **Calculate the Average** for columns B through F. Which column has the highest/ lowest average? What does this mean? Observe how the import value averages change over time.

Step 7: **Select non-adjacent ranges** A3:A13 and D3:D13. **Insert** a 3-D Pie chart based on your selection. (Go to Insert > Charts > Pie Chart > 3-D Pie.)
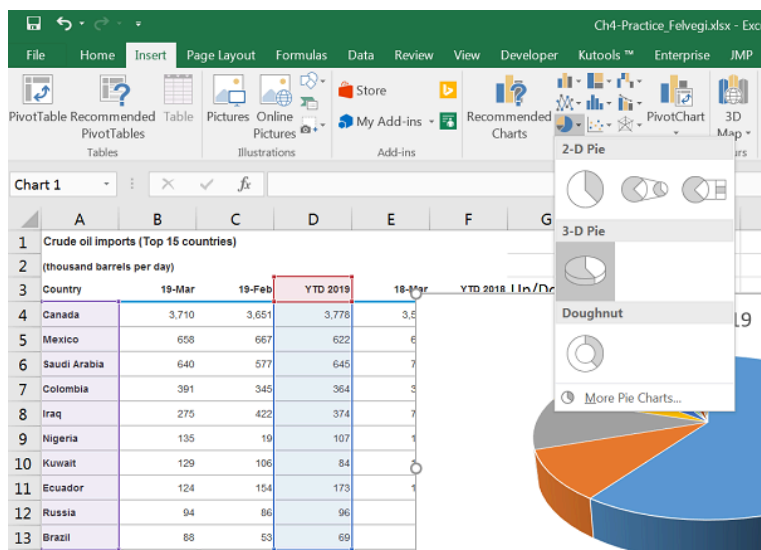
Step 8: **Move** your chart into a new sheet, change the name of the sheet to 3-D Pie.

Step 9: **Add Data Callouts** to show "Percentages" in the "Outside End" style. Observe the comparative percentages for the countries crude oil is imported from.
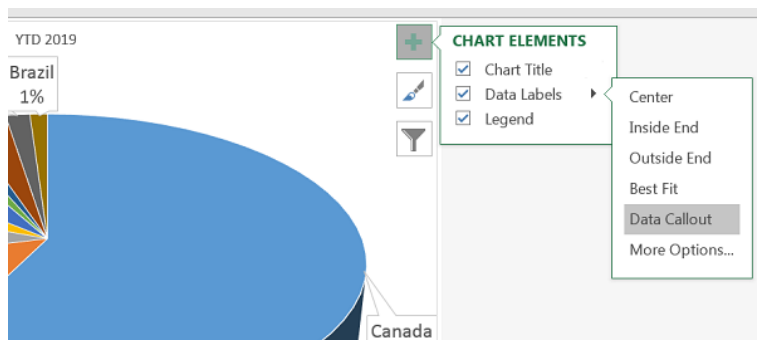
Step 10: **Manipulate** the type and placement of Chart elements. How can you make data for Nigeria, Kuwait, and Ecuador to read?

Step 11: Go back to your Crude Imports sheet. **Change the value** for Mexico to 900 from 622. Examine changes to percentage values in your pie chart.

Step 12: Save your work for your records, your chapter assessment will refer to this practice set.

ATTRIBUTION

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- Step_1
- Crude_March
- 3-D_Pie

- Callouts

4.6 CHAPTER ASSESSMENT

THE FOLLOWING ARE **SAMPLE QUESTIONS** TO TEST WHETHER YOU KNOW, UNDERSTAND, AND ARE ABLE TO APPLY YOUR LEARNING FROM THIS CHAPTER.

1. The line chart is best to illustrate _____.
a) comparisons
b) trends over a period of time
c) interrelationships between large data sets
d) correlations between pairs of values

2. A pie chart can depict _____ data series
a) 1
b) 2
c) 3

d) 4

e) depends on the number of slices in the pie

---

3. You cannot change the source of your data once you have inserted it, you have to start from scratch.

a) True

b) False

---

4. Based on Step 5 of your Chapter 4 practice problem. The total for the top ten sources of U.S. crude oil imports for YTD 2019 is:

a) 6,080

b) 6,312

c) 6,450

d) 6,512

---

5. Based on Step 6 of your Chapter 4 practice problem. Crude oil imports for the top 10 averaged _____ b/d in March 2019:

a) 608

b) 624

c) 651

d) 677

6. After step 9 of your Chapter 4 practice problem, your pie chart shows that crude imports from Colombia were _____ of YTD 2019.

a) 4%

b) 6%

c) 10%

d) 12

7. After step 11 of your Chapter 4 practice problem, your pie chart shows that crude imports from Colombia were _____ of YTD 2019.

a) 5%

b) 7%

c) 17%

d) 20%

8. The pioneer of data visualization is:

a) Alan Turing

b) Edward Tufte
c) Grace Hopper
d) Michael Porter

9. The pioneer of data visualization calls unnecessary chart elements:
    a) clutter
    b) fluff
    c) junk
    d) trash

10. This is a _____.

M&Ms by Color
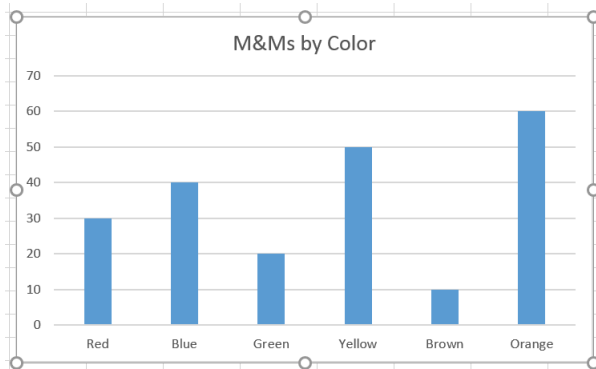
a) Bar graph
b) Column chart

c) Pie chart
d) Line chart

Solutions: ███████████████████████████

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- MMs

CHAPTER 5 – EXCEL TABLES

Excel workbooks are designed to store lots of information. Organizing this information so that they display meaningful data can be challenging! Excel has many features that can help you organize your data and find what you need efficiently. Setting up your data as a table from the onset will allow you to sort, filter, total, and subtotal your data. In Excel, a table is a collection of data about a particular subject stored in adjacent rows and columns. Tables can improve the look and feel of your workbook. This chapter explores how to best set up Excel tables, how to edit them, and then how to work with them effectively. These skills will be demonstrated in the context of a multi-sheet file that shows national average weather for two very different cities in the United States. Weather data is often voluminous and difficult to summarize since we collect weather data every hour of every day. Providing meaningful summaries of such data is a useful skill to have.The skills learned with this data can easily be transferred to data specific to your professional and personal needs.

ATTRIBUTION

5.1 TABLE BASICS

Learning Objectives
1. Understand table structure.
2. Plan, create, and edit a table.
3. Freeze rows and columns.
4. Sort data in a table.

This section reviews the fundamental skills for setting up and maintaining an Excel table. The objective used for this chapter is the construction of a multi-sheet file to keep track of two cities' national weather data for the month of January. Organizing, maintaining, and reporting data are essentials skills for employees in most industries.

Figure 5.1 shows the completed workbook that will be demonstrated in this chapter. Notice that this workbook contains three worksheets. The first worksheet lists average weather for January in Portland, Maine. The second sheet lists average weather data for January in a

very different climate – Portland, Oregon. The third sheet adds a weekly column to the Portland, Oregon data so that it can be subtotaled by week.

Day	Week	High (°F)	Low (° F)	Rain (inches)	Snow (inches)
Sunday	1	45.0	34.9	0.16	0.00
Sunday	2	45.8	35.4	0.20	0.00
Sunday	3	46.8	35.9	0.16	0.11
Sunday	4	47.9	36.2	0.15	0.00
Sunday	5	48.8	36.2	0.16	0.00
Sunday Average		46.9	35.7	0.17	0.02
Monday	1	45.1	35.0	0.19	0.00
Monday	2	46.0	35.5	0.16	0.08
Monday	3	47.0	36.0	0.16	0.00
Monday	4	48.0	36.2	0.16	0.00
Monday	5	49.0	36.2	0.11	0.12
Monday Average		47.0	35.8	0.16	0.04
Tuesday	1	45.2	35.0	0.16	0.12
Tuesday	2	46.1	35.6	0.15	0.00
Tuesday	3	47.1	36.0	0.15	0.00
Tuesday	4	48.1	36.2	0.16	0.00
Tuesday	5	49.1	36.1	0.16	0.00
Tuesday Average		47.1	35.8	0.16	0.02
Wednesday	1	45.3	35.1	0.16	0.00

Portland ME   Portland OR   Weekly OR   **Subtotal OR**

Figure 5.1 Completed National Weather Workbook

CREATING A TABLE

Download Data file: CH5 Data

When data is presented in long lists or columns, it helps if the table is set up well. Here are some rules of data-entry etiquette to follow when creating a table from scratch:

1. Whenever you can, organize your information using adjacent (neighboring) columns and rows.

2. Start the table in the upper-left corner of the worksheet and work your way down the sheet.

3. Don't skip columns and rows just to "space out"

the information. (To place white space between information in adjacent columns and rows, you can widen columns, heighten rows, and change the alignment.)

4. Reserve a single column at the left edge of the table for the table's row headings or identifying information.

5. Reserve a single row at the top of the table for the table's column headings.

6. If your table requires a title, put the title in the row(s) above the column headings.

Following these rules will help insure that the sorts, filters, totals, and subtotals you apply to your table with give you the desired results.

With these rules in mind, we will begin working on the **Portland ME** worksheet in the **National Weather workbook**. Notice that the data is in adjacent columns and rows. The upper-left corner of the table is in A5 and the titles are above the column headings in Row 5. Since the set-up of our data looks good, we are ready to turn our data range into an Excel table:

1. Open data file *CH5 Data* and save a file to your computer as **CH5 National Weather**.

2. Click on A5 in the **Portland ME** sheet.

3. Click the Table button in the Insert tab of the Ribbon.
   Figure 5.2 will appear on your screen.
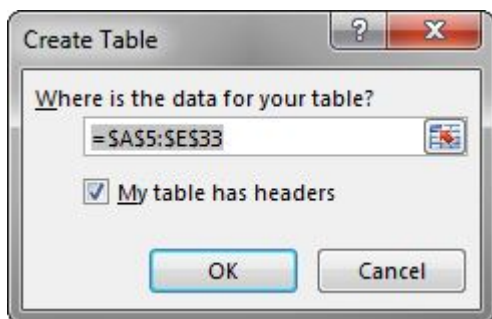
Figure 5.2 Create Table

1. Make sure "My table has headers" is checked. Click OK.

2. Click in A5 again.

3. Adjust your columns widths so that you can see the complete headings in row 5 with the filter arrows showing. The filter arrows are the down-arrow buttons that will appear in row 5 when you create your table. We will learn how to use these to sort and filter later in this chapter.

After this, your spreadsheet will look like **Figure 5.3**.

	A	B	C	D	E
1		National Weather Data			
2		January Daily Normals			
3		Portland, Maine			
4					
5	Day	High (°F)	Low (° F)	Rain (inches)	Snow (inches)
6	1	32.5	15.1	0.12	0.59
7	2	32.3	14.8	0.12	0.59
8	3	32.1	14.6	0.11	0.73
9	4	31.9	14.4	0.08	0.49
10	5	31.8	14.2	0.12	0.71
11	6	31.6	14.0	0.12	0.59
12	7	31.4	13.9	0.12	0.59
13	8	31.3	13.7	0.12	0.59
14	9	31.2	13.6	0.07	0.63
15	10	31.1	3.4	0.12	0.67
16	11	31.0	13.3	0.12	0.63
17	12	30.9	13.2	0.12	0.71
18	13	30.8	13.1	0.12	0.67

Figure 5.3 Weather Table

Notice that a new ribbon tab, Table Tools Design, appears when you click inside your table. This ribbon tab allows you to edit, style, and add functionality to your table.

Let's try these steps again in the following steps:

1. Click on the **Portland OR** sheet and click in cell A5.

2. Click the Table button in the Insert tab of the Ribbon.

3. Make sure "My table has headers" is checked. Click OK.

4. Click in A5 again.

5. Adjust your columns widths so that you can see the complete headings in row 5 with the filter arrows showing.

FORMATTING TABLES

There are many ways to format an Excel table. There are preset colored Table Styles with Light, Medium, and Dark colors. There are also a variety of Table Style Options listed in **Table 5.1**.

Table 5.1 Table Style Options

Table Style	Description
Header Row	Top row of the table that includes column headings
Total Row	Row added to the bottom that applies column summary calculations
First Column	Formatting added to the left-most column in the table
Last Column	Formatting added to the right-most column in the table
Banded Rows	Alternating rows of color added to make it easier to see rows of data
Banded Columns	Alternating columns of color added to make it easier to see columns of data
Filter Button	Button that appear at the top of each column that lists options for sorting and filtering

We'll add some formatting to both of our Portland weather tables in the following steps:

1. Click on the **Portland ME** sheet in your file.

2. In the Table Tools Design tab, in the Table Styles group, click the More button.

A gallery of table styles will appear as in **Figure 5.4**.
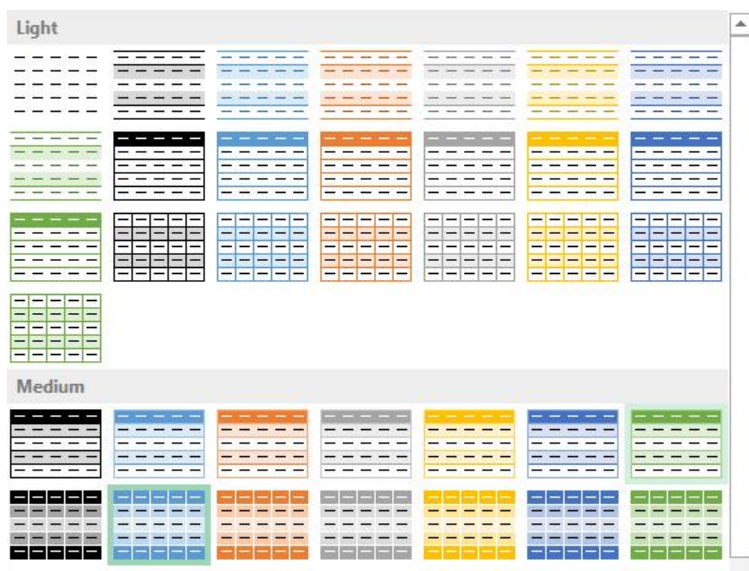
Figure 5.4 Table Styles

3. In the Table Styles gallery, in the Medium Section, click Table Style Medium 7.

4. In the Table Style Options group in the Ribbon, click Banded Rows.

The alternating colored rows will disappear. The data in the table is now more difficult to read.

5. Try out some of the other options in the Table Style Options group. Once you're finished, check just Header Row, Banded Rows, and Filter Button as in **Figure 5.5** below.
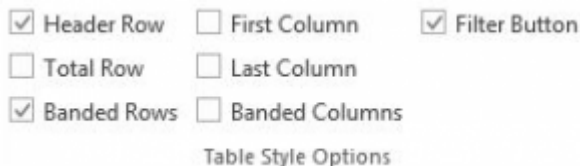
Figure 5.5 Ribbon Table Style Options

ADDING DATA TO TABLES

Over time, you will need to add new data to an Excel table. You will add the data to the table in a blank row. The easiest way to do this is to enter the data in the first blank row below the last row in the table. You can then rearrange the data in the table by sorting it. If you need to add data in a specific place in the middle of a table, you can insert a blank row in the middle and add your data there.

We need to add the last three days of the months to both our Portland, Maine and Portland, Oregon tables. The following steps will walk you through doing this.

1. Click on the **Portland ME** worksheet.

2. Click on A34 (the left-most cell below the last row in the table).

3. Enter the following data:

Table 5.2 Portland, Maine data

Day	High (°F)	Low (°F)	Rain (inches)	Snow (inches)
29	31.4	13.3	0.12	0.59
30	31.6	3.4	0.08	0.47
31	31.7	13.5	0.12	0.63

Notice that the banded row formatting continues as additional rows are added to the tables.

1. Click on the **Portland OR** worksheet.

2. Click on A34 (the left-most cell below the last row

in the table).

3. Enter the following data:

Table 5.3 Portland, Oregon data

Day	High (°F)	Low (°F)	Rain (inches)	Snow (inches)
29	48.8	36.2	0.16	0
30	49.0	36.2	0.11	0.32
31	49.1	36.1	0.16	0

FINDING AND EDITING DATA

It is inevitable that you will find data errors in your table and need to correct them. While you can visually scan through a table to find your errors, this can be a tedious and tiresome process. Excel can help with this through the Find command. When you use Find, the best practice is to start at the top of the table to ensure that all your data is included in the search.

We know that a temperature of 3.4 degrees (brrr!) was entered erroneously in the **Portland Maine sheet**. It should have been 13.4. To fix this error, complete the following steps.

1. Click on the **Portland ME** sheet.

2. Press the CTRL+HOME keys together to go to the top of the sheet (A1).

3. In the Home tab of the ribbon, click on Find & Select in the Editing Group and then click Find.

4. In the Find box, type **3.4,** and then click Find Next.
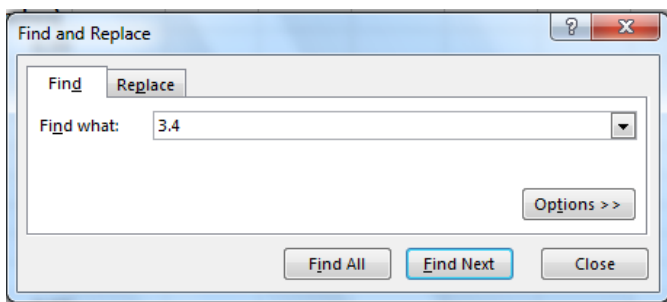
Figure 5.6 Find and Replace

5. Click the Close button.

6. Replace 3.4 in the Low column for Day 10 with **13.4.**

7. Now switch to the **Portland Oregon** sheet and find the Snow error of .32. Change it to **0.12**. You should find the error in Day 3.

Skill Refresher

Finding and Replacing Data

1. In the Home tab of the ribbon, click on Find & Select in the Editing Group and then click Find.

2. In the Find box, type what you want to find, and then click Find Next.

3. Continuing click Find Next until you find.what you are looking for.

4. Click Close and edit your data.

FREEZE ROWS AND COLUMNS

When you freeze panes, Microsoft Excel keeps specific rows or columns visible in your table when you scroll through it on your screen. For example, if the first row in your spreadsheet contains labels, you might freeze that row to make sure that the column labels remain visible as you scroll down in your spreadsheet. When we scroll through our weather data, it would be nice to keep our column headings visible on the screen.

To freeze your headings:

1. Click in A6, the left-most cell below the headings row.

2. Click the View tab in the ribbon.

3. Select Freeze Panes and then Freeze Panes again.

4. Scroll up and down the sheet and notice that the headings are always displayed at the top of the table.
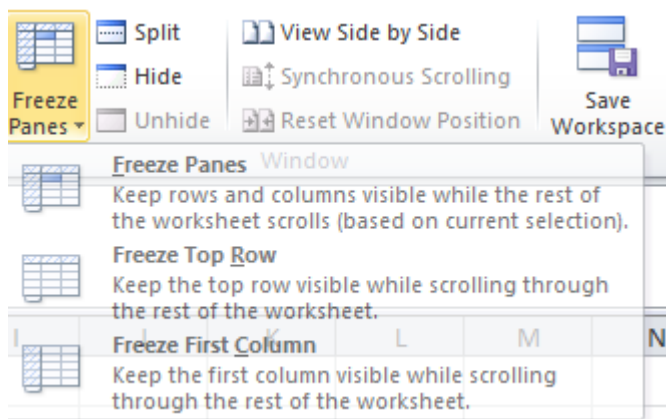
Figure 5.7 Freeze Pane

To unfreeze your headings:

1. Click on the View tab in the ribbon.
2. Select Unfreeze Panes.

SIMPLE SORT

Content in a table can be sorted alphabetically, numerically, and in many other ways. Sorting helps organize data by one or more columns in your table. **Table 5.4** describes the different sort orders available for each column of data.

Table 5.4 Sort Options

Sort Order	Text	Numbers	Dates
Ascending	Alphabetical (A-Z)	Smallest to Largest Lowest to Highest	Chronological (oldest to newest)
Descending	Reverse Alphabetical (Z-A)	Largest to Smallest Highest to Lowest	Reverse Chronological (newest to oldest)

Let's say we want to know what the snowiest day was in January in Portland, Maine; so we want to sort the Snow column in Descending order so that the snowiest day ends up at the top of the table.

1. Click on the filter Click arrow to the right of the header Snow (inches) in the **Portland ME** worksheet.

2. Click on the choice Click ZA↓ Sort Largest to Smallest. See **Figure 5.8** below.

	A	B	C	D	E
1		**National Weather Data**			
2		**Daily Normals**			
3		**Portland, Maine**			
4					
5	Day ▼	High (°F) ▼	Low (° F) ▼	Rain (inches) ▼	Snow (inches) ▼
6	1	32.5	↕ Sort Smallest to Largest 0.12		0.55
7	2	32.3	↕ Sort Largest to Smallest 0.12		0.55
8	3	32.1	Sort by Color 0.11		0.73
9	4	31.9	⊼ Clear Filter From "Snow (inches)" 0.08		0.45
10	5	31.8	14.2 0.12		0.71
11	6	31.6	Filter by Color 14.0 0.12		0.55
12	7	31.4	Number Filters 0.12		0.55
13	8	31.3	Search 3.7 0.12		
14	9	31.2	☑ (Select All) 0.07		0.68
15	10	31.1	☑ 0.47 0.12		0.67
16	11	31.0	☑ 0.49 0.12		0.68
17	12	30.9	☑ 0.59 0.12		0.71
18	13	30.8	☑ 0.63 0.12		0.67
19	14	30.7	☑ 0.67 0.08		0.68
20	15	30.7	☑ 0.71 0.11		0.55
21	16	30.7	☑ 0.73 0.12		0.71
22	17	30.7	12.9 0.08		0.55
23	18	30.6	12.8 OK Cancel		
24	19	30.7	12.8 0.12		

Figure 5.8 Sort by One Column

If you did this correctly, you'll see that the snowiest day at the top of the list in January 3rd (in row 6) with 0.73 inches of snow! Notice the filter arrow changes in the snow column to a downward pointing arrow to indicate you sorted that column in descending order (largest to smallest).

	A	B	C	D	E
		National Weather Data			
1					
2		**January Daily Normals**			
3		**Portland, Maine**			
4					
5	Day ▾	High (°F) ▾	Low (° F) ▾	Rain (inches) ▾	Snow (inches) ↵
6	3	32.1	14.6	0.11	0.73
7	5	31.8	14.2	0.12	0.71
8	12	30.9	13.2	0.12	0.71
9	16	30.7	12.9	0.12	0.71
10	18	30.6	12.8	0.12	0.71
11	22	30.8	12.8	0.08	0.71
12	10	31.1	13.4	0.12	0.67

Figure 5.9 Snowiest Days in Maine

3. Now switch to the **Portland Oregon** sheet and repeat these sort steps to find the snowiest day in Oregon. Check your answers with **Figure 5.10**.

	A	B	C	D	E
1		**National Weather Data**			
2		**January Daily Normals**			
3		**Portland, Oregon**			
4					
5	Day ▾	High (°F) ▾	Low (° F) ▾	Rain (inches) ▾	Snow (inches) ↵
6	30	49.0	36.2	0.11	0.32
7	3	45.2	35.0	0.16	0.12
8	15	46.8	35.9	0.16	0.11
9	9	46.0	35.5	0.16	0.08
10	25	48.3	36.2	0.12	0.08
11	1	45.0	34.9	0.16	0.00
12	2	45.1	35.0	0.19	0.00

Figure 5.10 Snowiest Days in Oregon

Sort a Column

1. Click on the filter Click arrow to the right of the header in the column you want to sort.

2. Click on the choice AZ! or ZA↓ to sort your data by that column.

MULTI-LEVEL SORT

Sometimes you will need to sort your table by more than one column at a time in order to efficiently analyze your data. For example, if you were looking at several different types of loans from several bank offices, you would need to sort by the type of loan and then by bank office name to clearly see the different groups of loans. If you had a list of grades for students over their time in high school, you'd want to sort first by student name, but then also by grade level (freshman, sophomore, junior, and senior) so that each student's grades would appear in chronological order.

For our weather data, let's look at the snow days in Oregon and see how cold they were!

1. Click on the **Portland OR** sheet, then click on a cell in the table.

2. Click on the Data tab in the ribbon and then click the Sort button.

3. Click the down-arrow for Column and select

Snow (inches).

4. Click the down-arrow for Order and select Largest to Smallest.

5. To add 2nd level sort, click on the Add Level button in the top left corner of the dialog box.

6. In the new Then by row, click the down-arrow for Column and select Low (°F).

7. In the same row, click the down-arrow for Order and select Smallest to Largest. Your dialog box should look like **Figure 5.11**.
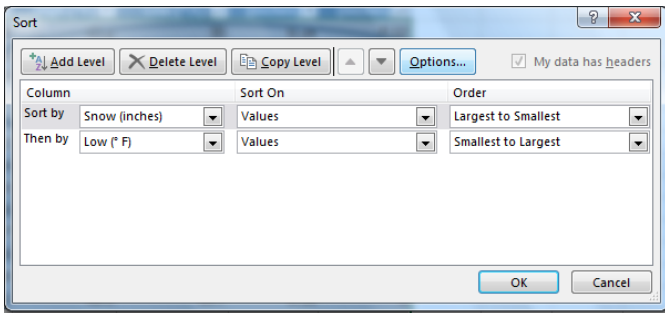

Figure 5.11 Multi-Level Sort

8. Click OK. Your table sort results should look like **Figure 5.12**. Notice for the two days with 0.08 inches of snow, the low temp of 35.5 on Day 9 is displayed before the low temp of 36.2 on Day 25. The lowest of the two was listed first. Also notice that the filter arrows changed on the sorted columns to show you how they are sorted.

	A	B	C	D	E
1		National Weather Data			
2		January Daily Normals			
3		Portland, Oregon			
4					
5	Day	High (°F)	Low (° F)	Rain (inches)	Snow (inches)
6	30	49.0	36.2	0.11	0.32
7	3	45.2	35.0	0.16	0.12
8	15	46.8	35.9	0.16	0.11
9	9	46.0	35.5	0.16	0.08
10	25	48.3	36.2	0.12	0.08
11	1	45.0	34.9	0.16	0.00
12	2	45.1	35.0	0.19	0.00
13	4	45.3	35.1	0.16	0.00
14	5	45.4	35.2	0.20	0.00

Figure 5.12 Multi-Level Sort Results

CUSTOM SORTS

In most cases, we want our data sorted in "typical" sort order: numbers sorted highest to lowest, words sorted alphabetically, etc. Some data in our everyday lives; however, does not make sense when sorted this way. For example, if you sorted the days of the week alphabetically, you'd get: Friday, Monday, Saturday, Sunday, Thursday, Tuesday, and Wednesday. This order would be of no use to anyone! Similarly, the months of the year would not make sense alphabetically. Can you think of a number that would not make sense in either highest to lowest or lowest to highest order? (This is a good brain teaser!)

In our weather data, we've added a column for the week in the **Weekly OR** sheet and changed the days to Sunday through Saturday. This sheet lets us further analyze Portland, Oregon's data to see if there are weekly trends

in the weather. Let's see if we can sort the **Weekly OR** sheet by Week and then by Day.

1. Click on the **Weekly OR** worksheet.

2. Click on A5 and insert a table.

3. Click on Sort in the Data tab in the ribbon.

4. Click the down-arrow for Column and select Week.

5. Click the down-arrow for Order and select Smallest to Largest.

6. To add 2nd level sort, click on the Add Level button in the top right corner of the dialog box.

7. In the new Then by row, click the down-arrow for Column and select Day.

8. Click the down-arrow for Order and select Custom List. The dialog box in **Figure 5.13** will appear on your screen.

9. Click on Sunday, Monday, Tuesday, etc. in the Custom lists on the left-side of the dialog box. NOTE: Make sure you select the days of the week spelled out, not the abbreviations for the days of the week.

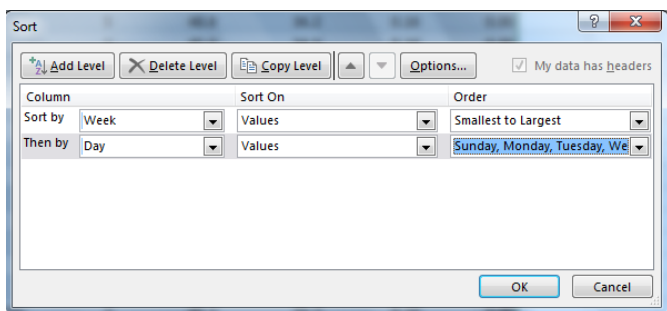10. Click OK. Your Sort dialog box should look like **Figure 5.14**.

Figure 5.14 Sort Dialog Box

11. Click OK again. Your sorted table should now look like **Figure 5.15**. Notice the data is in Week order and, within each week, in Day order.

Figure 5.15 Custom Sort

12. Save your work.

> **Key Takeaways**
>
> - Tables are made up of adjacent rows and columns of data with a single row of column headings at the top.
> - You can create a table by clicking in the top left-most cell in your data and selecting Table in the Insert tab of the ribbon.
> - There are a gallery of styles, as well as, style options to choose from to format a table.
> - When you need to add data, it is best to add it one row below the bottom of the table. You can then sort to reorganize your data.
> - Freezing heading keeps your column headings displayed while you scroll through your table data.
> - You can use the filter arrows in the table headings to sort by a single column. Use Sort in the Data tab in the ribbon to sort by two or more columns at a time.
> - Custom Sorts can be used when data needs to be sorted in a special way (i.e. – Days of the Week).

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5.2 FILTERING & SLICERS

Learning Objectives
• Filter table data.
• Add a total row to a table.
• Use slicers to filter data

FILTERING DATA

When you first create an Excel table, filter arrows appear in all the column headings. We have seen that you can use those arrows to sort your data by a single column. You can also use these same arrows to filter or limit the data you see by narrowing the displayed data within a column. There are many ways to filter data within a column depending on whether the data in the column is text or numeric. **Table 5.5** gives you some filter examples:

Table 5.5 Filter Examples

Text Filters

Desired Results	Filter Column	Text Filter	Checkbox Selected
Data for the State of New Jersey (NJ)	State	Equals NJ	NJ
Data for Books that Have Gardening in Their Title	Title	Contains Gardening	
Data for Weather on the Weekend	Day	Equals Saturday OR equals Sunday	Saturday and Sunday

Numeric Filters

Desired Results	Filter Column	Number Filter	Checkbox Selected
Data for Income Greater Than $1,000	Income	Greater than 1,000	
Data for Amount Paid Equal to Zero	Amount Paid	Equals 0.00	0.00
Data for Mortgage and Auto Loans	Loan Type	Equals Mortgage OR equals Auto	Mortgage and Auto

Notice there are sometimes more than one way to filter data (i.e. – with a filter choice or a checked box). There are also single criteria filters, as well as, multi-criteria filters. We will explore all of these next.
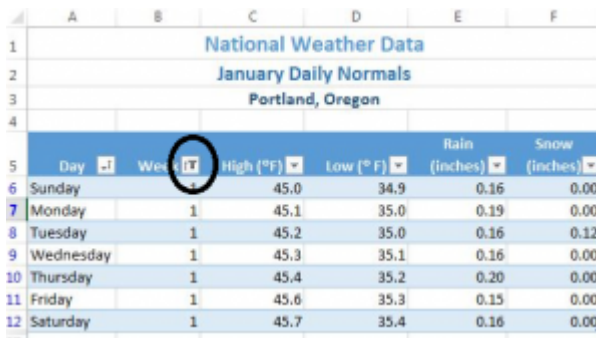
To start filtering, let's look at just the first week of data in the **Weekly OR** sheet:

1. Click on the **Weekly OR** sheet and click on a cell in the table.

2. Click the filter arrow to the right of the Week heading.

3. Click the Select All checkbox to deselect all of the

checkbox choices.

4. Click on 1 to select Week 1.

5. Click OK.

Your table should look like **Figure 5.16**. You should see only 7 rows of Week 1 data in your table. Notice in your Status Bar at the bottom of your screen the message "7 of 31 records found". Also notice that the filter arrow in the Week heading has changed to a funnel which indicates that this column is currently filtered.

Figure 5.16 Filter

To remove your filter:

1. Click the funnel next to the Week heading.

2. Select "Clear filter from Week".

2. Click the Select All checkbox to deselect all of the checkbox choices.

3. Click on the checkboxes you want to filter by.

4. Click OK.

Un-Filter a Column

1. Click the funnel to the right of the heading in the column you filtered.

2. Select Clear filter.

Now let's try a numeric filter. We want to find days in Portland ME when it's warmer than 32 degrees in January:

1. Click in the **Portland ME** sheet, then click on a cell in the table.

2. Click on the filter arrow next to the High heading.

3. Click on Number filters, then select Greater than. The Custom AutoFilter dialog box will appear on your screen.

4. Enter **32** in the space to the right of "is Greater than". Your Custom AutoFilter dialog box should now match **Figure 5.17.**
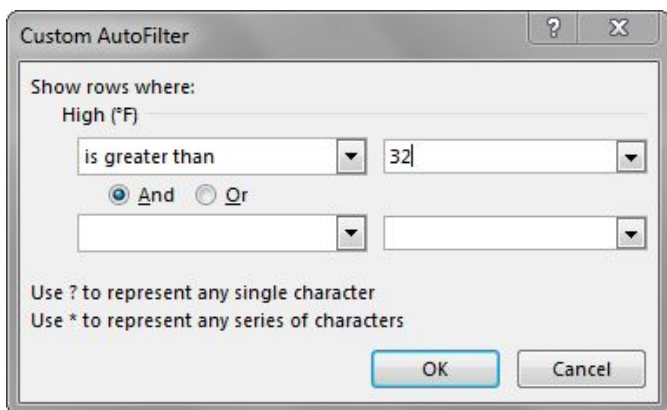
Figure 5.17 AutoFilter Dialog Box

5. Click OK.

You should see that it was only above 32 degrees three days in January in Maine – the first three! Check your table against **Figure 5.18**.

Figure 5.18 Filter Results

Let's review sorting and filtering in the following steps:

1. Click on the **Weekly OR** sheet and clear the Day column filter.

2. Sort the table by Week (smallest to largest).

3. Filter the table to only show Mondays.

4. Compare your table results to **Figure 5.19**.

	A	B	C	D	E	F
1			National Weather Data			
2			January Daily Normals			
3			Portland, Oregon			
4						
5	Day	Week	High (°F)	Low (° F)	Rain (inches)	Snow (inches)
7	Monday	1	45.1	35.0	0.19	0.00
14	Monday	2	46.0	35.5	0.16	0.08
21	Monday	3	47.0	36.0	0.16	0.00
28	Monday	4	48.0	36.2	0.16	0.00
35	Monday	5	49.0	36.2	0.11	0.12
17						

Figure 5.19 Filter Results

FILTERING USING THE SLICER

Beginning in Excel 2013, slicers were added to the software as another way to filter your table data. A slicer is really useful because it clearly indicates what data is shown in your table after you filter your data.

Let's try using the Slicer to filter our Portland OR data table:

1. Click on the **Portland OR** sheet and click in the table.

2. In the ribbon's Table Tools Design tab, click Insert Slicer.

3. Click on Day in the Insert Slicers dialog box, and then click OK.

4. Drag the slicer so that the upper left-hand corner lines up with the top corner of cell G5.

5. Notice that when you insert a Slicer, a Slicer Options tab appears on the ribbon. This tab lets you change the style and size of the entire slicer or the individual slicer buttons.

6. Click on the Slicer options tab, then click on the More button next to Slicer Styles. The choices in **Figure 5.20** will show on your screen.

Figure 5.20 Slicer Styles

1. Select the first choice under Dark.

2. In the Size group on the Slicer Options ribbon (NOT the Buttons group), change the width to 1".

3. Click in the table and scroll down to Day 15 and click the 15 button to show only the data for January 15th in the table.

4. Hold down the CTRL key and click on the Slicer buttons for Days 10 through 14. Your table should now show the data from Days 10-15.

5. Sort the Day column in Ascending order to show the days in order as in **Figure 5.21**.

Figure 5.21 Slicer Results

TOTAL ROWS

By adding a total row to the bottom of your table, you can quickly see summary data for one or more of the columns in your table. Total rows can be added to tables as a whole, or those that are filtered. Total rows can easily be toggled on and off as the need for summary data arises.

1. Click on the **Portland ME** sheet and clear the filter from the High column.

2. Click on the Total Row check box in the Table Style Options group in the Table Tools Design tab in the ribbon.

3. Scroll to the bottom of your table to the Total Row. Notice the total for the Snow data.

4. Click on D37 (in the Rain column), and then click the down-arrow that appears to the right of the cell.

5. Choose Sum to add a sum to the Total Row in the

Rain column.

6. To see the Average rainfall for the month of January, click on the arrow again and choose Average.

7. Repeat this step in E37 to see the Average snowfall.

8. Use the Decrease Decimal button in the Home tab of the ribbon to change the decimal places in D37 and E37 to 2. Compare your Total Row to **Figure 5.22**.

	A	B	C	D	E
26	15	30.7	13	0.11	0.59
27	17	30.7	12.9	0.08	0.59
28	19	30.7	12.8	0.12	0.59
29	20	30.7	12.8	0.11	0.59
30	21	30.7	12.8	0.12	0.59
31	23	30.9	12.9	0.12	0.59
32	25	30.9	13	0.22	0.59
33	26	31.0	13	0.11	0.59
34	27	31.2	13.1	0.08	0.59
35	4	31.9	14.4	0.08	0.49
36	30	31.6	3.4	0.08	0.47
37	Total			0.11	0.62

Figure 5.22 Total Row

1. Now switch to the **Weekly OR sheet** and see if you can successfully add a Slicer and Total Row to this table:

2. Clear the filter from the Day column.

3. Add a Slicer for the Day column to the sheet.

4. Move the top left corner of the slicer to H5. Resize it as needed and choose a Slicer Style.

5. Select Monday through Friday in the Slicer so that Saturday and Sunday data do NOT show in your

table.

6. Add a Total Row that averages the High and Low columns. Your averages should be High: 47.0 and Low: 35.8. Change the label "Total" to "Average" by clicking A37 and typing **Average**.

Skill Refresher

Add a Total Row

1. Click on the Total Row check box in the Table Style Options group in the Table Tools Design tab in the ribbon.

2. Scroll to the bottom of your table to find the Total Row.

3. Click in one of the columns in the Total Row, and then click the down-arrow that appears to the right of the cell.

4. Choose Sum to add a sum to the Total Row in the column.

5. To see the Average for column, click on the arrow again and choose Average.

Some other choices in the Total Row are Count (for words), Count Numbers, Max, and Min.

Add a Slicer

1.   Click on Insert Slicer in the Table Tools Design tab in the ribbon.
2.   Check the box for the column to which you want to add a Slicer.
3.   Click OK.

Key Takeaways

- Filtering is an easy way to see a subset of your data. Filtering arrows appear to the right of each column heading when you insert a table with a header row.

- You can filter by text or numerically.

- A slicer is another way to filter in Excel that provides a set of filtering buttons on your sheet.

- Adding a total row to a table is a quick, efficient way to see summary statistics for one or more columns in a table.

ATTRIBUTION

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- figure-5-16-filter

- FIgure 5.18 Filter Results

- figure-5-18-custom-autofilter

- figure-5-22-total-row

5.3 SUBTOTALS & GRAND TOTALS

Learning Objectives

- Subtotaling.
- Display levels.
- Hiding and expanding subtotaled data.

SUBTOTALING

You can automatically calculate subtotals and grand totals in a table for a column. This is a powerful tool that allows you to quickly display multiple levels of summary data within your table. This can provide Management with a report of higher level summary data one minute, and then can be easily switched back to detailed data the next minute. It is important to save often during this process and follow the steps carefully. It is recommended that you make a copy of the data you want to subtotal and

place it in a new sheet, so that you can save the summary subtotaled data separately if desired.

In order to subtotal successfully, you always need to do the following in order:

1. Sort by the column you want to subtotal on.

2. Convert the table back to a normal Excel range. You cannot subtotal inside a table.

3. Subtotal in the Data tab in the ribbon.

4. If you want to limit your displayed data further, Filter in the Data tab in the ribbon.

We want to find out what the weather looks like for each day of the week, so we'll need to save our data to a new sheet, sort by the days of the week, and then convert the table in order to get ready to see the subtotal.

1. Click on the **Weekly OR** sheet.

2. Point at the **Weekly OR** sheet tab at the bottom of the screen, hold the CTRL key down, and left-drag the sheet to the right until you are past all the existing sheets.

3. When you see a sheet icon with a + sign, let go of the mouse button and then the CTRL key. A **Weekly OR (2)** sheet will appear.

4. Right-click on the new Sheet tab, select Rename, type **Subtotal OR**, and then press ENTER.

5. Save your file before you start Subtotaling!

6. Remove all filters in the table by clicking the Data tab and then choosing Clear.

7. Now we want to Sort the table by the Day column using a Custom Sort in the Sort button in the ribbon to sort in the order Sunday, Monday, Tuesday, etc. (See **Figure 5.13 through 5.15** for a review of Custom Sorting.)

8. Before you can subtotal, you must convert your table back to a regular range. To do this, click Convert to Range in the Table Tools Design tab on the ribbon. (See **Figure 5.23**)
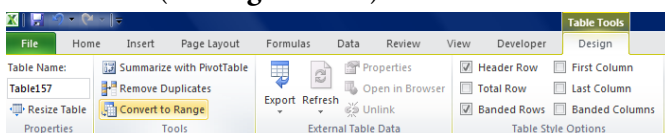
Figure 5.23 Convert to Range

9. When asked if you want to convert the table, click Yes.

10. Because your data is no longer formatted as a table, your slicer will disappear; and you will no longer have access to the Table Tools Design tab in the ribbon.

11. Under the Data tab in the ribbon, click Subtotal.

12. In the Subtotal Window, make the choices shown in the **Figure 5.24**. It is essential that you select the column you sorted by in the "At each change in" field at the top of the window. Click OK.
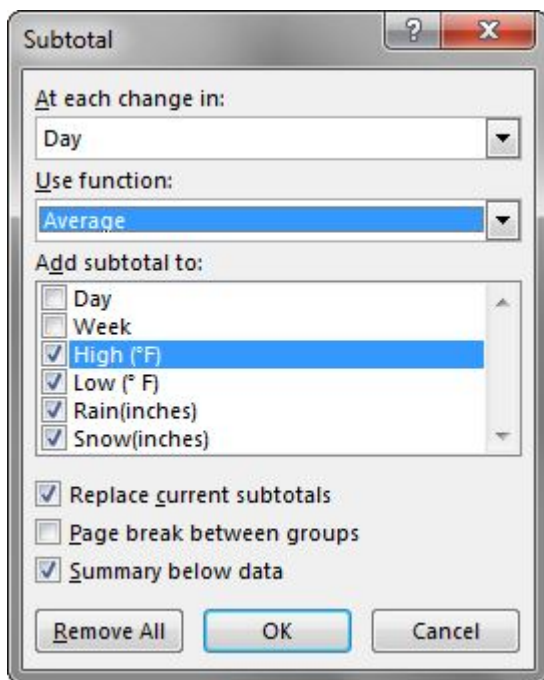
Figure 5.24 Subtotal Window

Your data should look like **Figure 5.25**. Successful subtotaling shows only one subtotal for each group in the column you sorted by. (HINT: If you end up with more than one Subtotal for the same group (i.e – one of the days of the week in our example), you did not sort before subtotaling. Remove your subtotals using the Remove All button in **Figure 5.24**, sort your table, and then try subtotaling again.)

Figure 5.25 Subtotal Results

Notice the three Outline buttons circled in the upper-left corner of the spreadsheet. These allow you to control the amount of subtotaled data that is displayed. **Table 5.5** describes the different Outline buttons.

Table 5.5 Subtotal Outline Buttons

Button	Content Displayed
Level 1	Only grand total
Level 2	Subtotals and grand total
Level 3	Individual records, subtotals, and grand total

Let's try the three Outline buttons to see the difference in the data displayed:

1. Click on the 1 Outline button in the upper left-hand corner of the sheet.

2. You should see only the Grand Average row with averages for High, Low, Rain, and Snow.

3. Click on the 2 Outline button.

4. Now you'll see the average for each day of the week along with the Grand Average.

5. Click on the + Sign button to the left of the Sunday Average row.

6. This expands just the Sunday Day data and displays the individual records for this subset of the data. Clicking on + Sign buttons will expand a portion of the data at a time. Clicking on – Sign buttons hide a portion of the data at a time.

7. Click on the 3 Outline button.

8. All the individual records along with the subtotals, and Grand Average should be displayed.

9. Save your Excel file.

Key Takeaways

- Filtering is an easy way to see a subset of your data. Filtering arrows appear to the right of each column heading when you insert a table with a header row.

- You can filter by text or numerically.

- A slicer is another way to filter in Excel that provides a set of filtering buttons on your sheet.

- Adding a total row to a table is a quick, efficient way to see summary statistics for one or more columns in a table.

- Subtotaling provides a way to quickly add totals to groups within a column along with providing a grand total at the bottom of the table.

- Subtotal Outline buttons allow users to see add of the subtotaled data, just the totals and grand total, or simply the grand total.

- Plus and minus buttons within subtotaling allow a user to expand and hide portions of the subtotaled data.

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5.4 PREPARING TO PRINT

Learning Objectives
1.   Review options for professional page setup for printing.
2.   Understand how to insert a picture to enhance the visual appearance of a worksheet.
3.   In this section, we will preview the worksheets containing tables to ensure they will print in a professional manner. We will make any formatting and page setup changes that are needed, as well as add a picture to one of the worksheets to enhance its appearance.

PREVIEWING A WORKSHEET

Data file: Continue with CH5 National Weather

Now that the weather data has been sorted, filtered, and subtotaled as needed, it is time to print the worksheets. You are going to start with the **Portland ME** worksheet.

1. Click on the **Portland ME** worksheet. If needed,

use Ctrl-Home to move to cell A1.

Notice that cells A1, A2, and A3 are not merged and centered over the entire table of data. To fix this, you need to unmerge each of the merged cells, and then merge them again, making sure to include E1, E2, and E3 in the selection.

1. Select cell A1 and click the Merge & Center button. This should split A1 into four cells (A1:D1).

2. Select the range A1:E1 and click the Merge & Center button. Cell A1 should now be merged across A1:E1.

3. Repeat steps 1 and 2 for A2 and A3.

Next you need to preview the worksheet in Print Preview and determine what page setup options need to be set.

1. Go to Backstage view and select Print from the menu.

Notice that the table is to the far left of the page, with quite a bit of white space on the left. You decide that it would look better centered on the page.

1. In the Settings section, click the link for Page Setup. This opens the Page Setup dialog box. See **Figure 5.26**.
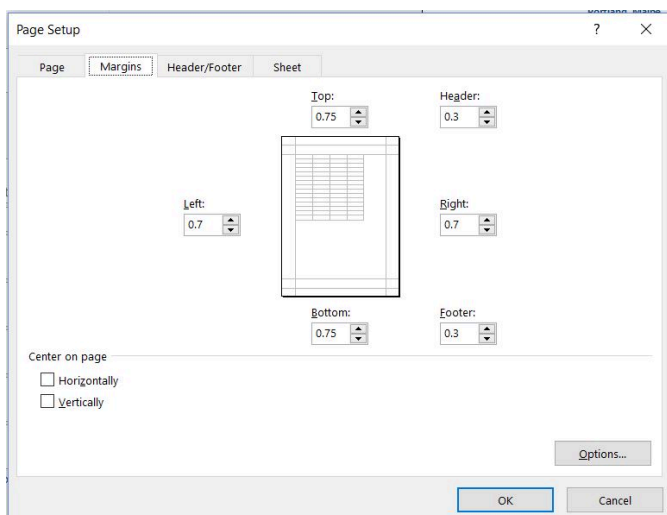
Figure 5.26 Page Setup

2. Click on the Margins tab.

3. In the Center on page section, check the box for Horizontally.

4. Click OK. The table should now be centered horizontally on the page.

5. Next you need to add a footer with the workbook filename as well as the worksheet name.

6. Open the Page Setup dialog box again (see Step 1 above).

7. Click the Header/Footer tab then click the Custom Footer button.

8. In the Left section: box type **File:**.

9. Making sure to leave a space after the colon, click the Insert File Name button.

10. In the Right section: box type **Worksheet:**.

11. Making sure to leave a space after the colon, click the Insert Sheet Name button.

12. The Footer dialog box should look like **Figure 5.27**. Click the OK button twice to return to Print Preview. Confirm that the footer appears correctly, then exit Backstage View.
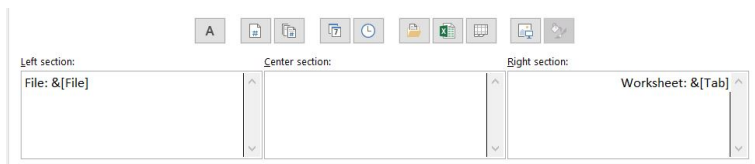
Figure 5.27 Custom Footer

Inserting an Image to Enhance a WorksheetNext you are going to add a small weather related graphic to the worksheet to enhance its appearance. In Excel you can either insert an image file that you have saved or you can search for one online within Excel. In this example, there is a graphic saved in the data files for this chapter that you will use.

1. Click the Insert tab on the ribbon.

2. Click the Pictures button from the Illustrations group. (This allows you to insert an image you have saved. If you wanted to search for an image online, you would click the Online Pictures button.) (See **Figure 5.28**.)
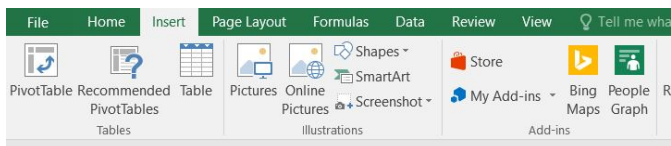
Figure 5.28 Insert Pictures

3. Navigate to the location where your data files for Chapter 5 are located and double-click on the Weather image file.

The image now appears on your worksheet, but not in the location you want. It is also slightly larger than you would like. (See **Figure 5.29**.) You are going to move the image to cell E1, then resize it so it does not cover up part of the table.

Figure 5.29 Inserted Image

1. Place your pointer in the image so that the ⬍ appears. Drag the image so that the top left corner is in cell E1.

2. Using the resizing handle in the bottom right corner of the image, resize the image so that it does not cover any of the table. Hint: drag diagonally to the left and up.

3. Check Print Preview again to make sure the worksheet with the image added looks good.

4. Exit Backstage View and save the Excel file.

PREVIEWING THE REMAINING WORKSHEETS

Before considering this workbook complete finished, you

need to confirm that the remaining worksheets are all printing appropriately.

1. Click the **Portland OR** worksheet and go to Print Preview. No changes need to be made to this worksheet. Exit Backstage View.

2. Click the **Weekly OR** worksheet and go to Print Preview. Notice that the Slicer is printing on a second page. To fix this, set the Page Scaling to Fit All Columns on One Page.

Notice that the last Slicer button (Saturday) is being cut off. This is because the Slicer height needs to be adjusted.

1. Exit Backstage View.

2. Resize the Slicer so that all of the buttons display.

3. Return to Print Preview and confirm the worksheet, including the slicer, is printing appropriately. Exit Backstage View.

4. Click the **Subtotal OR** worksheet and go to Print Preview.

5. Using the Page Setup dialog box, center this worksheet horizontally on the page.

6. Exit Backstage View.

7. Save the **CH5 National Weather** workbook.

8. Compare your work with the self-check answer key (found in the Course Files link) and then submit the **CH5 National Weather** workbook as directed by your instructor.

> **Key Takeaways**
>
> - When working with Excel workbooks, the final step should always be to review the worksheets in Print Preview to make sure they are printing appropriately.
>
> - You can add images you have saved, or images you find online, to a worksheet to enhance its appearance. Be sure to resize and move them appropriately so they do not detract from the data.

ATTRIBUTION

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5.5 CHAPTER PRACTICE

TABLES FOR A TOURISM COMPANY

Download Data File: [*PR5 Data*](#)

Travel and tour companies need to keep track of client data, as well as, travel/tour options and tour guides. Keeping up-to-date, accurate records is essential to their bottom line. To run a tour company, employees must be able to manipulate their data quickly and easily. This exercise illustrates how to use the skills presented in this chapter to generate the data needed on a daily basis by a tourism company. See **Figure 5.30** above.

    1. Open the data file **PR5 Data** and save the file to

your computer as **PR5 Canyon Trails**.

2. Insert a table based on A3:J53 (Excel will automatically select the range, you just need to confirm it).

3. In Column J, calculate Total Cost (number of Guests *Per Person Cost).

4. Format Columns I and J with Currency number format and no decimal places.

5. Center all headings in Row 3.

6. Adjust column widths within the table so that all the headings are completely visible.

7. Rename Sheet 1 **Current Tours**. Sort this sheet alphabetically (A to Z) by Last Name.

8. Make a copy of the Current Tours sheet and rename it **Tours by Canyon**. Place the Tours by Canyon sheet to the right of the Current Tours sheet. Sort this sheet by Tour Canyon (A to Z), then Home Country (A to Z), and then Last Name (A to Z). Insert subtotals by **Tour Canyon** for numbers of **Guests**.

9. Make another copy of the Current Tours sheet and rename it **US Guests**. Place the US Guests sheet to the right of the Tours by Canyon sheet. Filter this sheet so that only guests with a Home Country of the United States show. Sort the filtered data alphabetically (A to Z) by Tour State. Add a Total Row that sums the **Guests** and **Total Cost** columns.

10. Make another copy of the Current Tours sheet and rename it **European Guests**. Place the

European Guests sheet to the right of the US Guests sheet. Hide the Average Age column.

11. Insert a slicer in the **European Guests** sheet for Home Country. Move the top left corner of the slicer to the top left-hand corner of cell K3. Change the width of the entire slicer to 1.65".

12. Select both Germany and the United Kingdom on the slicer. Sort the filtered sheet by Home Country (A to Z) and then Last Name (A to Z).

13. Make one more copy of the Current Tours sheet and rename it **Tours by State**. Place the Tours by State sheet to the right of the European Guests sheet. Convert to a range. Subtotal the sheet by State, summing the Total Cost column.

14. Change the name of the **Tours by State** sheet to **5-7 Day Tours by State**. Filter out 3-day tours in the table.

15. On each worksheet, make the following print setup changes:

    1. Add a footer with the **worksheet** name in the center.

    2. Change to Landscape Orientation

    3. Set the scaling to Fit All Columns on One Page

16. For any worksheets that print on more than one page, add **Print Titles** to repeat the first three rows at the top of each page.

17. Save the **PR5 Canyon Trails** workbook.

18. Make sure your sheets are in the following order

from left to right: Current Tours, Tours by Canyon, US Guests, European Guests, and 5-7 Day Tours by State.

19. Use your file to answer the practice assessment questions.

20. Save your work for your records.

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5.6 CHAPTER ASSESSMENT

THE FOLLOWING ARE SAMPLE QUESTIONS TO TEST WHETHER YOU KNOW, UNDERSTAND, AND ARE ABLE TO APPLY CONCEPTS FROM THIS CHAPTER.

1. You can insert a _____ row at the end of your table to quickly add functions via a dropdown.
   a) Function
   b) Pivot
   c) Sum
   d) Total

2. _____ is an easy way to see a subset of your data.
   a) Deleting
   b) Filtering
   c) Resizing

d) Sorting

3. When you filter your data, data is:
a) Frozen
b) Deleted
c) Hidden
d) Resorted

4. An object you insert next to your table to filter it using buttons is called a:
a) Filter
b) Developer
c) Slicer
d) Sorter

5. How many of the guests are from Canada?
a) 9
b) 13
c) 22
d) 31

6. What is the subtotal for Guests to Black Canyon of the Gunnison National Park?
  a) 12
  b) 15
  c) 17
  d) 22

7. What is the total for Guests after Step 9 in US Guests?
  a) 9
  b) 13
  c) 26
  d) 37

8. What is the average age of Guests for all tours after Step 9 in US Guests?
  a) 52.44
  b) 57.25
  c) 60.1
  d) 62

Solutions:

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CHAPTER 6: PIVOTTABLES & PIVOTCHARTS

The PivotTable function in Microsoft Excel allows users to see massive amounts of data condensed into a manageable format. The data sets we will be analyzing throughout this chapter are information gathered by the U.S. Department of Education surveying all institutions of higher learning in the United States and data about the movement of crude oil and other imports into the U.S. by the U.S. Energy Information Administration. These data sets viewed in a raw, uninterpreted manner could be considered difficult to understand or take any meaningful information from. However, taking data and using a PivotTable in Excel will allow the user to manipulate and view attributes of the information in different ways to generate something that anyone can easily interpret and understand.

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6.1 CREATING PIVOTTABLES

Learning Objectives

1. Understanding the US College Scorecard data sets.

2. Interpreting a Data Dictionary.

3. Creating a PivotTable.

4. Manipulating PivotTable Fields.

5. Using Slicers.

Chapter Downloads:
CollegeScorecard_Data (Excel Spreadsheet)
CollegeScorecard_Data Dictionary (Word Document)

This section covers the fundamental skills for setting up and utilizing PivotTables in an Excel spreadsheet. The objective of this chapter is accessing and interpreting data

from Department of Education on every college and university in the United States. Critical thinking, interpreting and manipulating data are critical tasks for companies of every size and shape. More specifically, in all jobs today employees are required to manipulate data and make informed decisions, the skills practices in this Chapter are applicable to everyone regardless of career-path.

Figure 6.1 shows a zoomed out view of the data that we will be exploring in this chapter. There are (123) columns and (7594) rows in this spreadsheet, totaling to (934,062) individual points of data. With data of this magnitude, it can be difficult to create a table and sort and filter columns to determine a desired piece of information. The scale of the data makes it difficult to interpret it quickly. A PivotTable is a tool in Excel that allows users to visualize, compare and manipulate information quickly and efficiently. In this chapter, we will learn the basics of using this tool to process large amounts of data into useful information

Figure 6.1 CollegeScorecard_Data.xlsx showing all columns

SETTING UP YOUR ENVIRONMENT

While this textbook has explored data from the US Department of Education in the previous chapter practice, the data from the full College Scorecard dataset has not been reviewed in its entirety without edits or filters applied.

Follow these steps to set up your work-space for this file.

1. Create a folder in your Documents folder on your PC or Mac. If you have a working folder for other files from this class or textbook, create a separate space/folder for this chapter project.

2. Download CollegeScorecard_Data and save to your project folder.

3. Download CollegeScorecard_Dictionary and save to your project folder.

4. While this file is not *that* big, it is recommended that you close all other windows or applications running on your computer before opening the Data file.

UNDERSTANDING A DATA DICTIONARY

Open CollegeScorecard_Data.xlsx file.

When you open the College Scorecard Data file for the first time, take time to review the field names (column headings) of each column. For instance, there are terms such as "STABBR", which combined with the field entries in the column, you could easily surmise that the information in that column represents a U.S. State Abbreviation. You could do this perhaps with column headings such as "INSTNM" or "SAT_AVG", but it is not the case for all headings. Without looking at the Data Dictionary, what would you suppose that "C150_4_POOLED_SUPP" could mean?

This is the purpose of a Data Dictionary: helping the end-user interpret the meanings of individual fields and column headings in collections of data that are unfamiliar to them. We have provided a Data Dictionary to accompany the College Scorecard data available from the Chapter Downloads text box above. This Data Dictionary is a simplified version of the full Data Dictionary provided by the Department of Education alongside a handbook explaining the process behind the data collection and calculation of the fields. Our Data Dictionary selects fields with the most relevance for inclusion in this chapter to assist us in creating PivotTables.

Open CollegeScorecard_Dictionary.docx
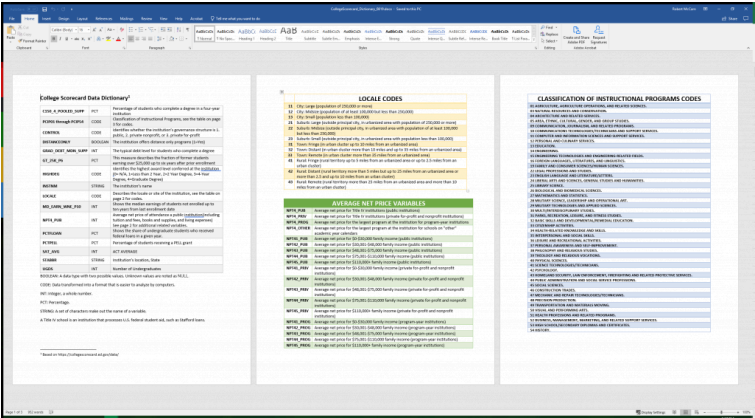
Figure 6.2 College Scorecard Data Dictionary

In the first row on the first page, you can see that the data in the column "C150_4_POOLED_SUPP" represents the percentage of students who complete a degree in a four-year institution. There are two things that can be taken from that definition:

1. The data will be presented in a particular format, specifically a percentage.

2. This data will be dependent on whether the institution this row of data represents is a four-year institution.

Remember, the rows of the College Scorecard represent reporting data from every institution of higher education in the United States, so, some aspects of information in this table will be determinant on other aspects of information; it is up to the end-user how they will consider this. Large data-sets often are not easily interpreted. They might need to be merged, cleaned, or

interpreted in a specific way to receive useful information.

> ## Key Takeaways
>
> Types of Data
>
> - BOOLEAN: A data type with two possible values. Unknown values are noted as NULL.
>
> - CODE: Data transformed into a format that is easier to analyze by computers.
>
> - INT: Integer, a whole number.
>
> - PCT: Percentage.
>
> - STRING: A set of characters make out the name of a variable.

Before beginning data interpretation with PivotTables, let's look at encoded data. In the Data table, look for the "LOCALE" column. Notice that it has repeating information such as "12", "32", "41", etc. This is because, within this column, the data is encoded to represent a more complicated piece of information with a smaller character. So, "12" indicated that the institution represented by this row of data is located in a midsize city (population of at least 100,000 but less than 250,000). Since that idea is too large to be typed into a cell, it is represented by the number 12 and it is left to the end-user to know what that represents.

CREATING A PIVOTTABLE

If we know what the data in each column represents and we understand how to decipher it, then we can start making conclusions about the data and begin turning it into useful information. But, nearly a million points of data is still a lot to interpret, even if we understand what it represents. PivotTables help us organize and group the information into more manageable chunks. A PivotTable essentially creates a summary function of the data (such as AVERAGE, SUM, MIN, MAX, and COUNT) and allows the end-user to select what view of this data that they wish to see with tools to sort, filter, and analyze these summary functions.

But first, we must create a PivotTable.

Begin with an original, unmanipulated range of data, such as an original copy of CollegeScorecard_Data.xlsx downloaded from the Chapter Downloads textbox above. It may help computer performance if you do NOT turn your data into an Excel table.

1. Select any cell in the range of data. (Note: Do NOT select the entire sheet, allow Excel to select the source automatically, otherwise, you may select too much data for the application to handle causing it to slow down or freeze.)

2. Go to the Insert tab on the ribbon, select 'Insert PivotTable' (Figure 6.3).

3. A window titled 'Create PivotTable' will pop-up, the Table/Range automatically populates with a selection of your data table as shown in Figure 6.4.

4. Confirm that your PivotTable will be inserted into

a New Worksheet.

5. Select 'OK'

6. A new worksheet will be created with an empty PivotTable (Figure 6.5).

Figure 6.3 Insert a PivotTable
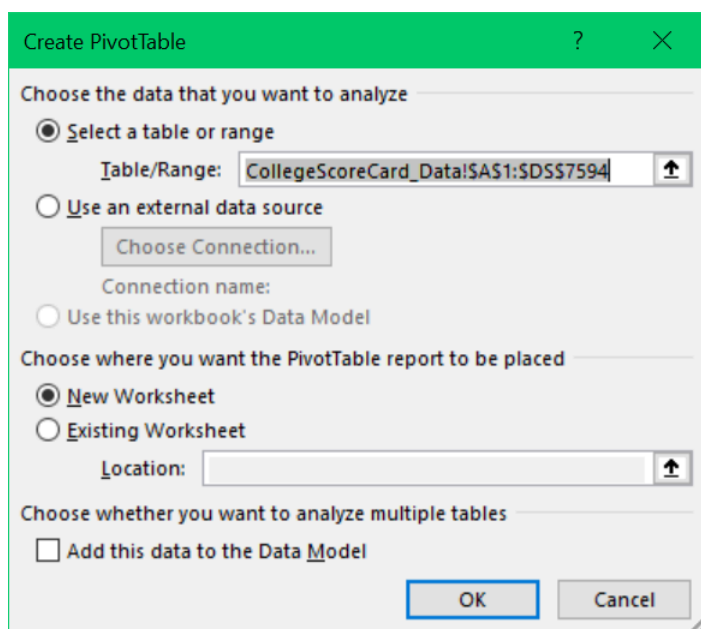
Figure 6.4 Create PivotTable pop-up
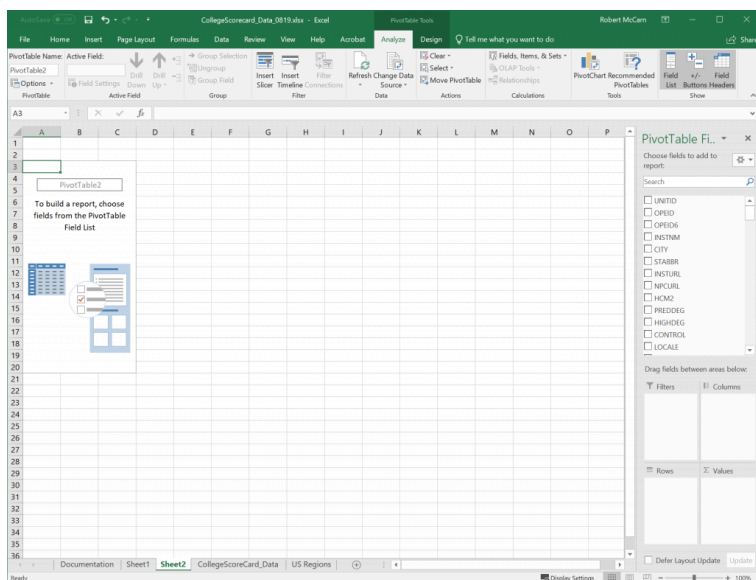
Figure 6.5 An empty PivotTable

MANIPULATING PIVOT TABLE FIELDS

Now that we have created a Pivot Table, we must now tell it what information we would like to see, and how we would like to see it displayed. On the right-hand side of the Excel window, you will see a new pane called "PivotTable Fields". The PivotTable Fields pane shows a condensed summary view of the column headings from the source table or range of data. Each Field represents one column from that data. You will have to scroll if there are too many field names are in your data or you can use the Search bar to choose fields to add to your report. To get a summary view of the data from the source table, we must select a Field or Fields.

You will notice that there are four Areas below the Field List in which a field can be enabled:

AREAS	DESCRIPTION
Rows	Fields enabled in this area will be Row headers going top to bottom of the Pivot Table. Each unique instance of data will be displayed as a Row.
Columns	Fields enabled in this area will be Column headers going left to right on the top of the Pivot Table. Each unique instance of data will be displayed as a Column.
Filters	Fields enabled in this area will be a top-level filter above the Pivot Table. Selecting one or more values in the filter will show only data that matches that value.
Values	Fields enabled in this area are summarized as numbers as the result of a function such as SUM, COUNT, MIN, MAX, or AVERAGE

There are two ways to enable fields in a PivotTable:

1. **ENABLING CHECKBOXES**: Click on the box beside "STABBR" to automatically populate Rows with the State Abbreviations. Depending on the data values in the column, it will enable the Field in Rows or Values. If you do not like the automatic sorting of your value under Areas labeled Rows, Columns, Filters, or Values, then you can always change the placement of the Field by manually assigning them as described below.

2. **MANUALLY ASSIGNING FIELDS**: Drag (click, hold, and move) "INSTNM" to Values Area to receive a COUNT of the number of institutions, sorted by State. Depending on the data values in the column, Excel will determine a default Summary of the information: Either COUNT,

SUM, or AVERAGE. In the next section of this Chapter, we will discuss how to change the Field Value settings.
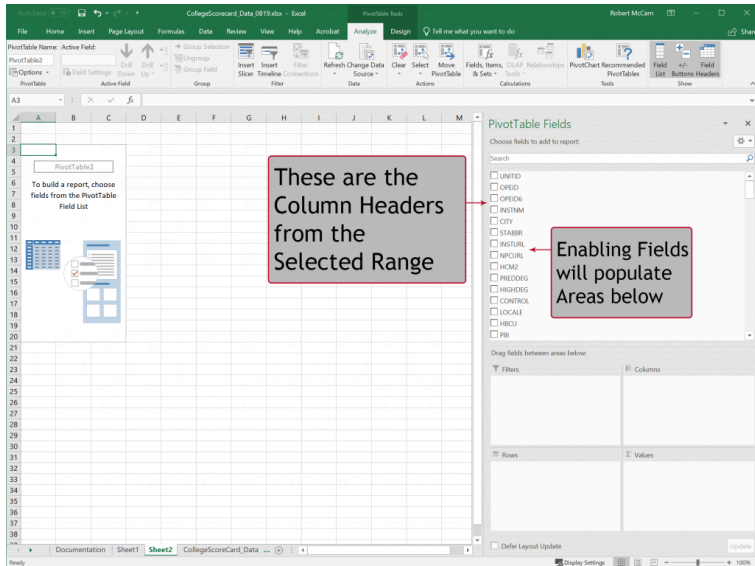
Figure 6.6 PivotTable Fields

Exercise

Figure 6.7 below shows a PivotTable with State Abbreviations as Row Labels, the Count of Institution Names as Values in a corresponding column.

Answer the following questions:
What does this output show?
Which State has the highest count?
Which State the lowest?

Let's examine this output further using tools in our next chapter!
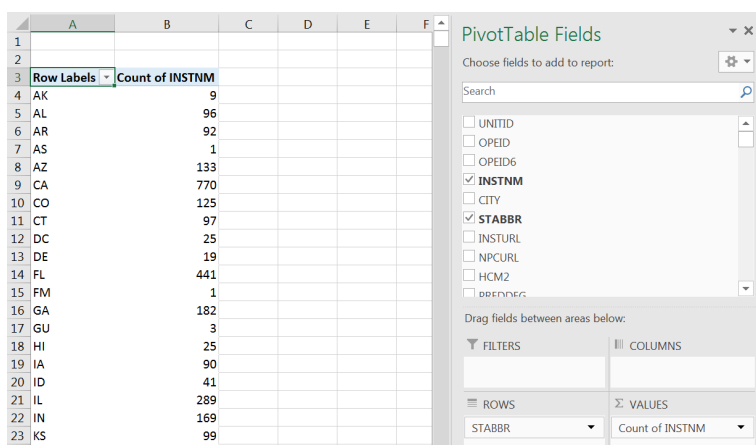
Figure 6.7 PivotTable Output.

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- Figure1.1
- Figure6.2
- Figure6.3
- Figure6.4
- Figure6.5
- Figure6.6
- CountINSTNM

6.2 SORT & FILTER PIVOTTABLE DATA

Learning Objectives

1. Sort and filter data in a PivotTable.
2. Manipulate Value Field Settings.
3. Use slicers.
4. Interpret outputs.

In the previous part of this chapter, we learned how to create a PivotTable from a range of data and enable Fields to output useful information. In this part, we will be diving deeper into how to make the most of this data and learning how to manipulate the output in various ways to get more and more impactful information.

By placing the "STABBR" Field in the Rows Area of the Pivot Table Fields Tab, we were able to get a list of all unique State abbreviations in the STABBR column. Subsequently, by placing the "INSTNM" Field in the Value Area of the PivotTable Fields Tab, we were able to derive the number of institutions in each State. Using

these two Fields in conjunction, we can see valuable information not easily derived from a large data-set. (Consider much faster using a PivotTable is than using an Excel Table and Subtotals.)

SORT AND FILTER DATA IN A PIVOTTABLE

Like with normal Excel Tables, PivotTables share the ability to sort data in columns. We can use this function to easily visualize information from smallest to largest or in alphabetical order (in ascending or descending order based on number, dates, or text). The easiest way to do this is shown in Figure 6.8: by right-clicking on the column of data that you wish to sort by and hovering over the sort tab and selecting how you wish to sort.
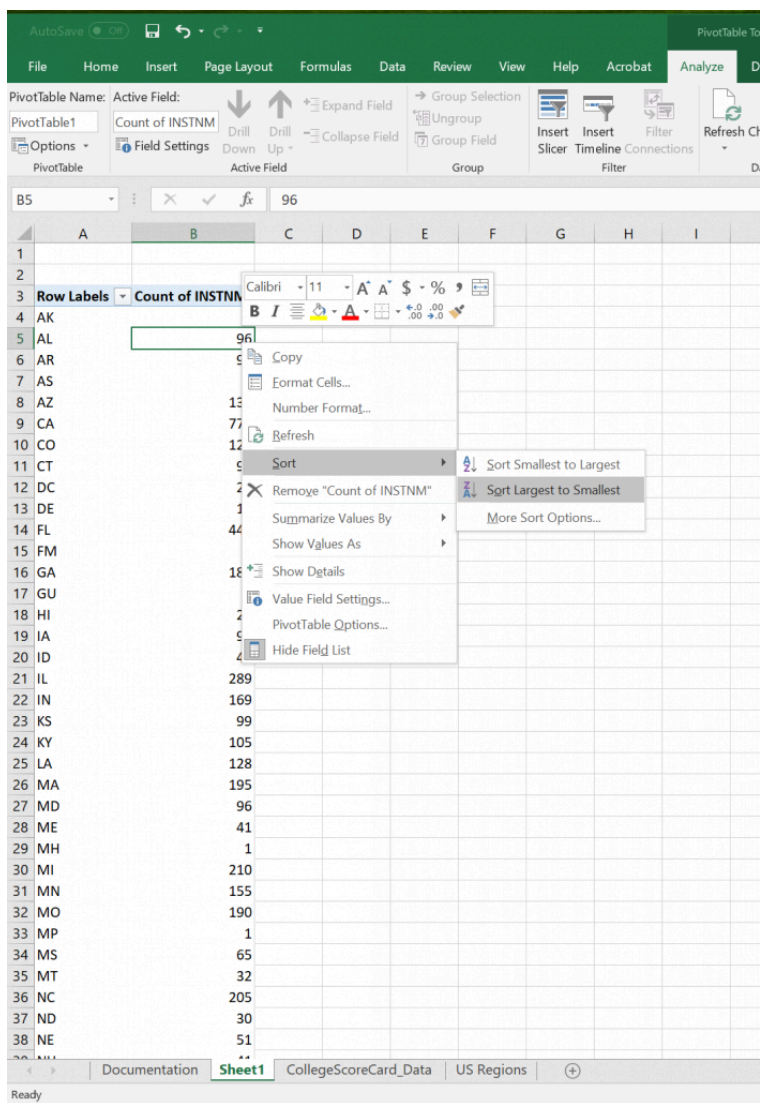
Figure 6.8 Sorting a Pivot Table

Filtering

There are instances in which we will not want to see the results of the entire data-set at one time. In these

cases, we are usually looking for information restricted by one or more variables to see how the information changes with those variables. For now, try for yourself to see how the PivotTable changes when you add a Field to the Filters Area.

Start by dragging the Field "DISTANCEONLY" into the Filters Field. At the top of the PivotTable, you will see a new box with a dropdown menu that says "(All)". This means that no data is being restricted yet. Click on the downward facing arrow and look at the parameters it shows you. You should see (All), 1, 0, and NULL. (All) is the current selection of every option the column contains. NULL is an indicator that Excel uses to state that there is no information in a cell – Sometimes in large datasets the creators do not or cannot collect any relevant information. In such cases, they show they have made an attempt and have come up with a value that would translate to Not Applicable or Unavailable rather than leave that entry blank. For meanings of 1 and 0 refer to the Data Dictionary or last Chapter Part for the definition of a Boolean.

> ## Key Takeaways
>
> 1 – A Boolean parameter meaning TRUE
>
> 0 – A Boolean parameter meaning FALSE

- DISTANCEONLY: Set the Filter to only display TRUE values. This means that ONLY institutions classified as a Distance Only institutions will be displayed. You will see that this drastically

changes the output of the Pivot Table.
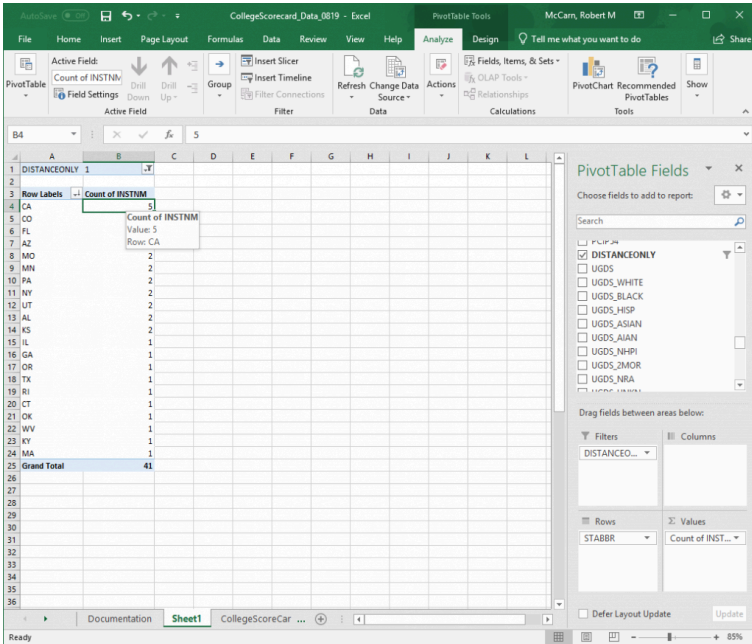
Figure 6.9 Filter for Distance Only

Remove the "DISTANCEONLY" Field from the Filter Area by dragging it out of the box or clicking the arrow beside the Field and selecting "Delete Field". This will reset the Pivot Table to the previous state. Now change the Field to the Fields listed below.

- HIGHDEG: The Filter values for this Field list 0-4. See the Data Dictionary for the meanings of each value. We will be looking at '4' or the highest degree offered an institution is a Graduate Degree.
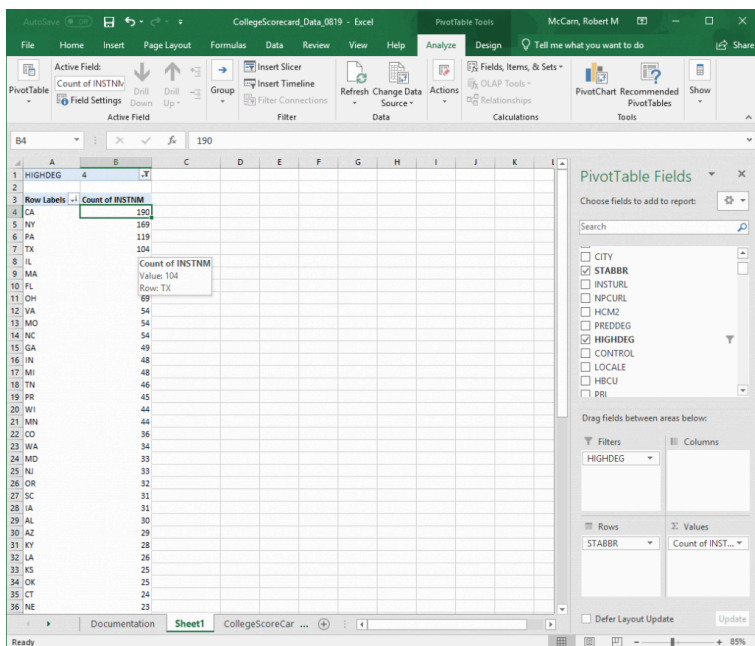
Figure 6.10 Filter for High Degree

- LOCALE: This Field in an encoded field, so you will need to know the meanings of the values before interpreting the information. See the chart in the Data Dictionary for a detailed description. For now, we are looking at '11' or Large Cities.
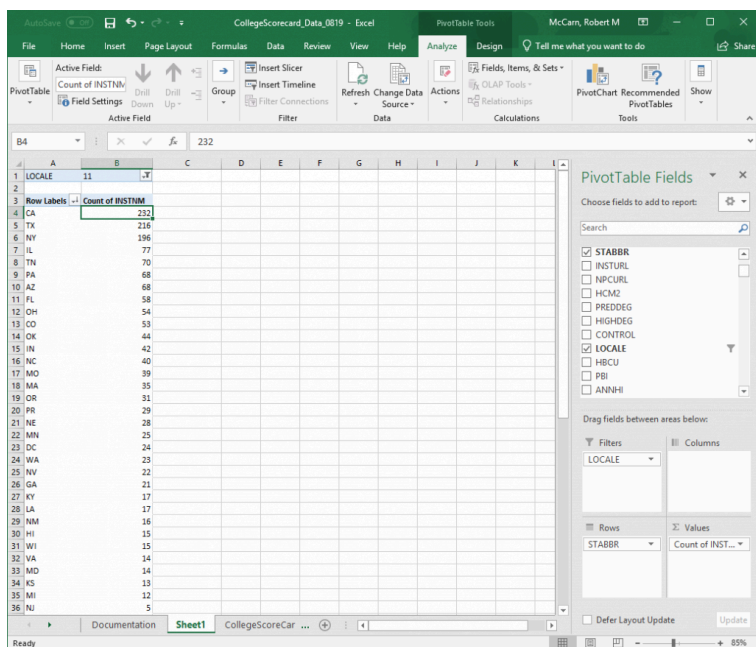
Figure 6.11 Filter for Locale

As you can see, by restricting the number of results to a given parameter, we can get more information out of this data than by just looking at a raw table. However, in each of these examples, we have consistently been looking at the number of institutions broken down by state. The ROW and VALUE fields have not changed in any of these examples. Take a moment and change the VALUE field to "SAT_AVG" or "MD_EARN_WNE_P10". How does this impact the output of the PivotTable? What other ways can you manipulate the Fields shown to get a different set of information? The great impact of a PivotTable comes from its flexibility to show data summarized in many various ways.

Using Slicers

In Chapter 5, we looked at using slicers as another way of filtering data. A slicer is an object we can insert next to our data and use buttons to select items we wish to filter for (or filter out) of our data. Let's try using the Slicer to filter our PivotTable by LOCALE:

1. Insert a PivotTable that uses State Abbreviations as Rows, the number of Institutions as Values.

2. Go to PivotTable Tools > Analyze > Insert Slicer (Figure 6.12).

3. Select Locale from the field names by clicking its checkbox.

4. Filter your data for all types of Cities by using your slicer by clicking the corresponding codes under the LOCALE heading in your slicer. Use SHIFT to select multiple adjacent items. (Figure 6.13).

5. Adjust the width, height, or color of your slicer to as you like using the Slicer Tools > Options tab when the Slicer is active.
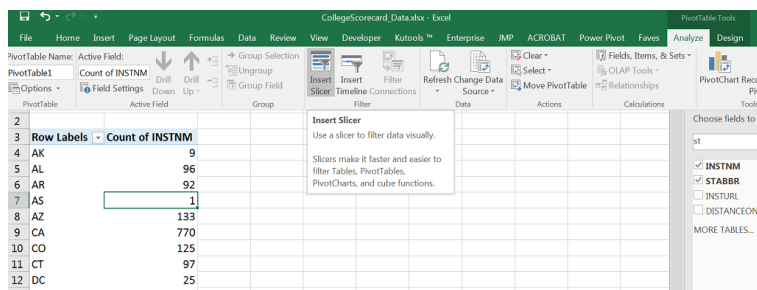
Figure 6.12. Inserting a Slicer from the Ribbon.

	A	B	C	D	E	F
1						
2						
3	Row Labels ↓	Count of INSTNM		LOCALE		
4	CA	406		11		
5	TX	311		12		
6	NY	248		12		
7	FL	158		13		
8	IL	140		13		
9	PA	125		21		
10	TN	116		22		
11	NC	102		22		
12	AZ	97		23		
13	LA	87		23		
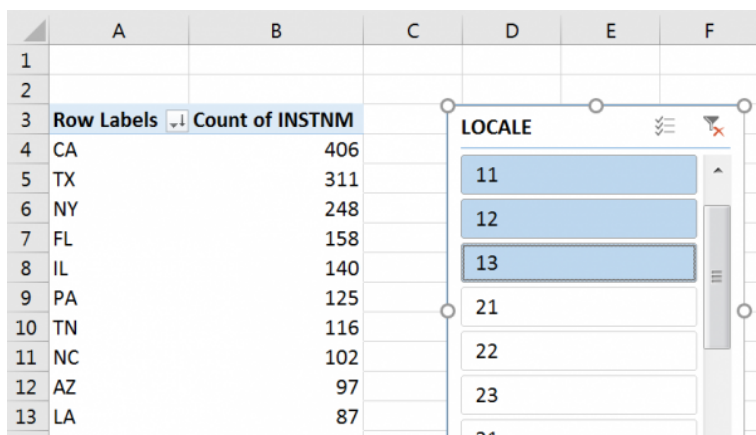
Figure 6.13. Inserting a Slicer from the Ribbon.

Whether you use a slicer side by side with your data table or filter your data via the Filter area in the PivotTable field selector, the result is the same. You can use slicers with charts, Excel tables, and PivotTables. You can clear them to show all of your data once you are done with your analyses. Helpful hint: If you process data using a PivotTable, it's best to save your output as a new sheet and start a new process in a new sheet. This way you can conserve your outputs and revisit them later as needed.

Exercises

Take a minute and try to answer the following questions by changing the Fields in the ROW, FILTER, and VALUE areas.

1. How many **institutions** in **Midsize cities** in the **State of North Dakota** have a **Graduate**

Program? How about **California**? What can you infer from this information?

2. What are the **median earnings of former students** of institutions located in **Remote Towns**? How about **Large Cities**? What can you infer from this information?

MANIPULATE VALUE FIELD SETTINGS

If you tried to answer question number 2 above and were left confused, don't worry. Excel will often summarize the Field you drag into the Values Area as a function that you might not want. In this case we are looking at the median earnings of former students in all institutions, so we do not want a COUNT of all values, as that will return the same information as if we did a COUNT of all institution names. No, in this case, an AVERAGE would better summarize our data and give us something to analyze. To do that we must change the Value Field Settings.

1. Start by right-clicking the Field in the Values Area – it should say COUNT of INSTNM currently.

2. Click on the icon at the bottom where it says Value Field Setting… **Figure 6.14**

3. Underneath where it says **Summarize value field by**, you will see a list of functions to apply to the Field.

4. Select AVERAGE from that list. **Figure 6.15**

5. Click OK.

After you apply the Value Field Setting, the Pivot Table will change from a COUNT of the Field, to an Average of the Field, returning different summary information.
Figure 6.16
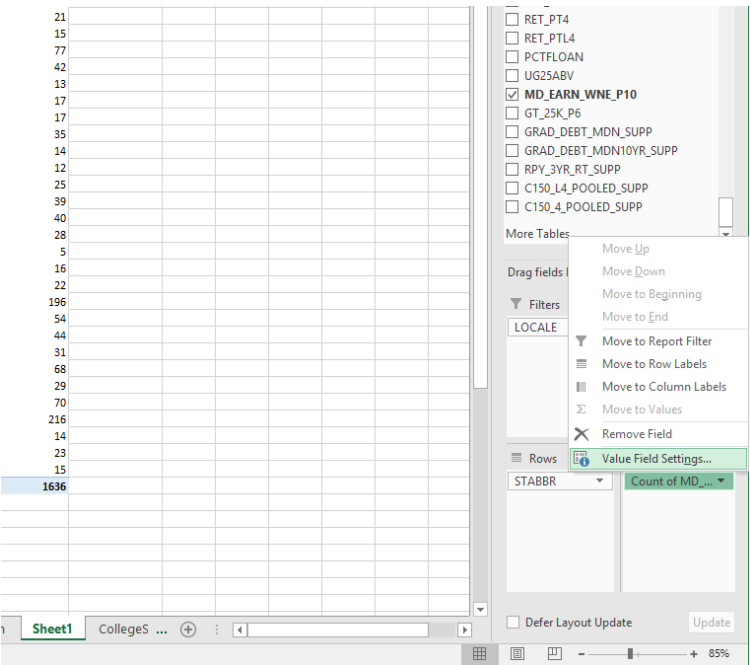
Figure 6.14 Change Value Field Settings
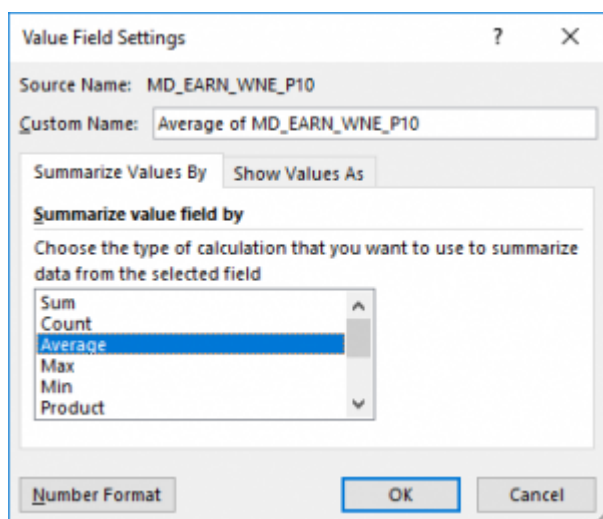
Figure 6.15 Value Field Settings
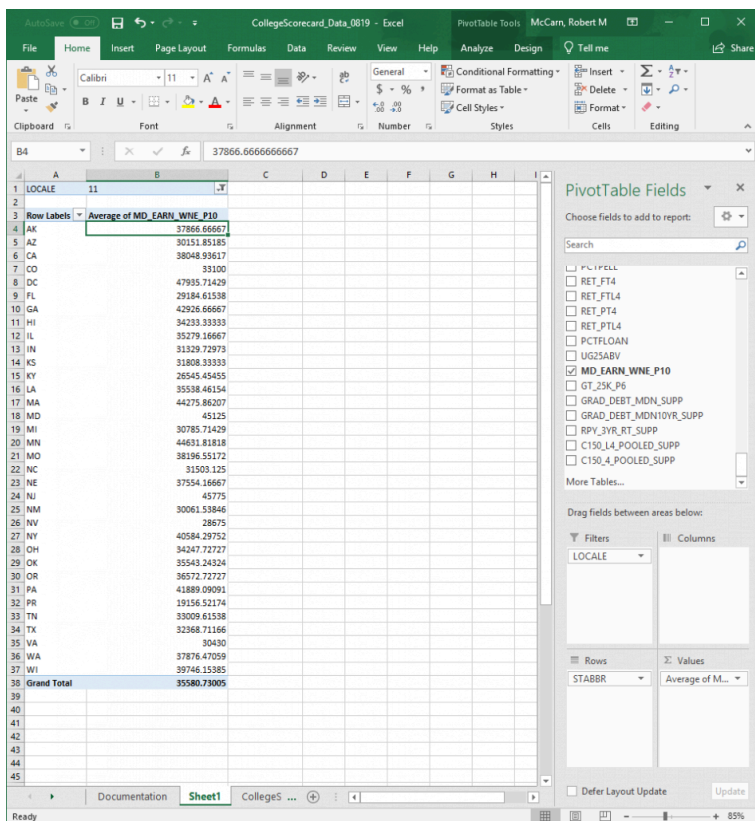
Figure 6.16 AVERAGE of column

From here you can make the information easier to visualize.

6. Right click on the **Average of** column.

7. Select Sort.

8. Click Sort Largest to Smallest

9. Select all Values in Column B

10. Change the Number Style from **General** to **Currency**. **Figure 6.17**
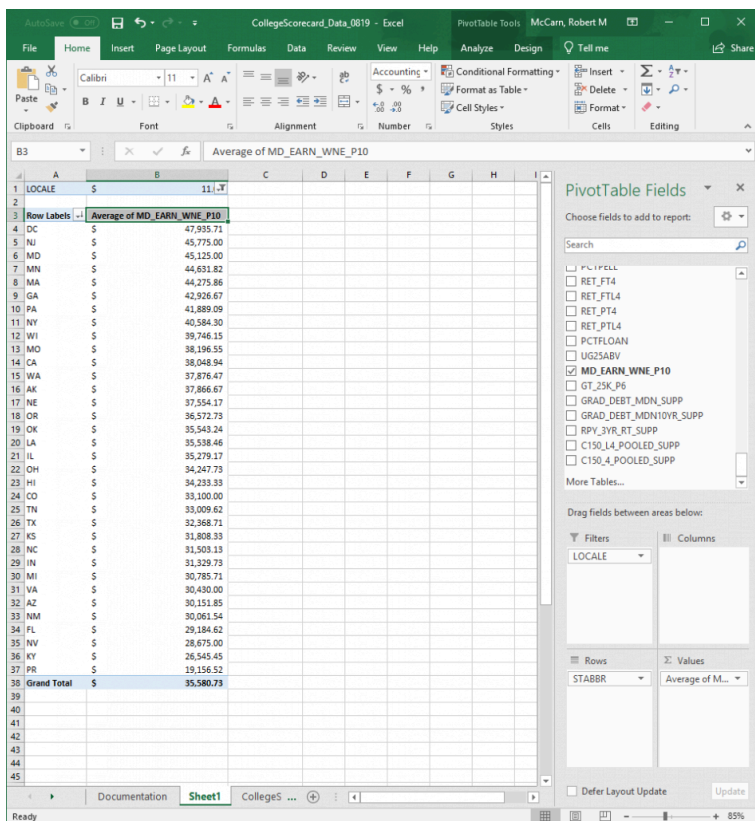
Figure 6.17 Final Value Field Settings

Displaying as Percentages

Another way to visualize information is to see the value of each column as a percentage of the total. The easiest way to ask yourself this is "What percentage of all institutions in the United States are those in Texas?" To do this we need to reset our Pivot Table.

11. Remove the Fields from Filters and Values. Leaving only "STABBR" in Rows.

12. Insert "INSTNM" into the Values Area. It should

display as COUNT of INSTNM

Now we have the number of institutions in each State and we have the Grand Total of all institutions in the United States, sure we could do some simple math to figure our question out, but what if we wanted to know the percentage for every State?

13. Right click the Count of INSTNM column.

14. Select Show Values as.

15. Click on % of Grand Total. **Figure 6.18**

16. Right click on Count of INSTNM column

17. Select Sort

18. Click on Sort Largest to Smallest

You will see that the answer to our question is "Texas has 6.33% of all institutions in the United States".
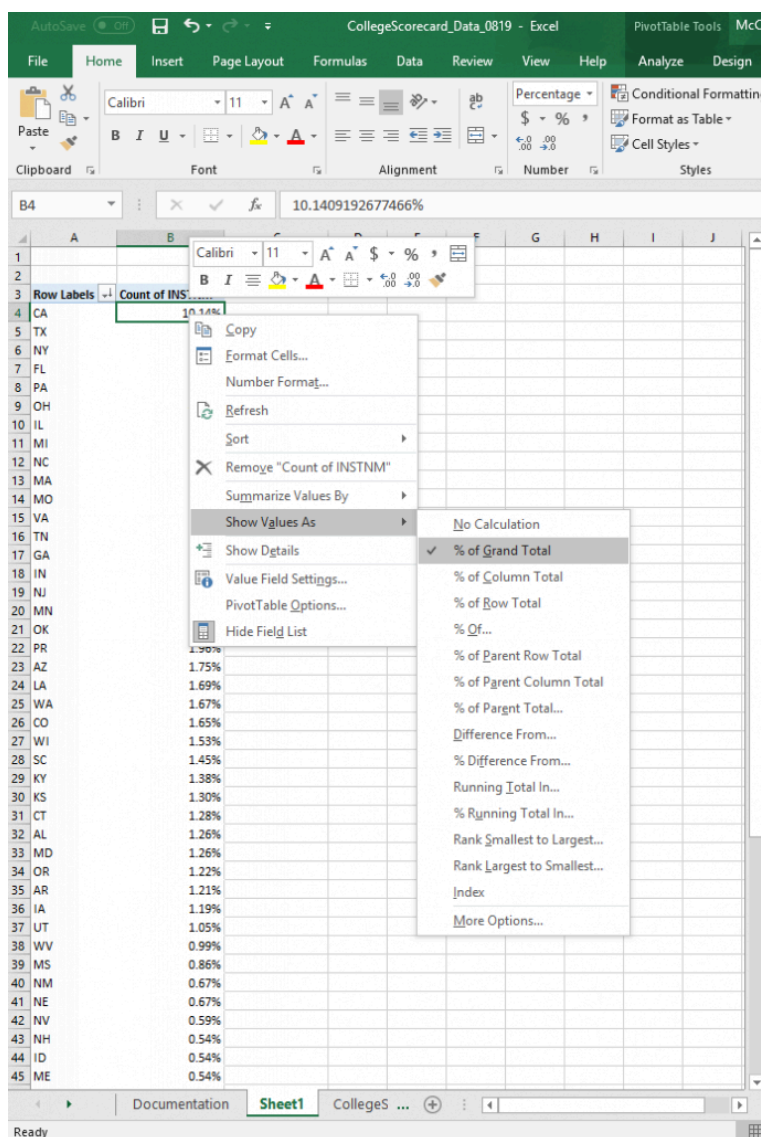
Figure 6.18 Percentage of Grand Total

INTERPRET OUTPUTS

| C5 | | | | f_x | 10.140 |

	A	B	C	D
4	Row Labels	Sum of UGDS	Count of INSTNM	
5	CA	14.40%	10.14%	
6	TX	8.05%	6.33%	
7	NY	6.17%	6.16%	
8	FL	5.80%	5.81%	
9	PA	3.70%	5.33%	
10	IL	3.56%	3.81%	
11	OH	3.24%	4.68%	
12	AZ	3.08%	1.75%	
13	MI	3.03%	2.77%	
14	NC	2.83%	2.70%	
15	GA	2.73%	2.40%	
16	VA	2.68%	2.48%	
17	MA	2.26%	2.57%	
18	NJ	2.24%	2.17%	
19	IN	2.03%	2.23%	
20	MO	1.83%	2.50%	
21	MD	1.74%	1.26%	
22	WI	1.71%	1.53%	
23	TN	1.69%	2.44%	
24	CO	1.65%	1.65%	
25	MN	1.65%	2.04%	
26	WA	1.61%	1.67%	
27	AL	1.54%	1.26%	
28	UT	1.49%	1.05%	
29	PR	1.39%	1.96%	
30	SC	1.33%	1.45%	
31	IA	1.24%	1.19%	
32	LA	1.23%	1.69%	
33	OR	1.20%	1.22%	
34	KY	1.19%	1.38%	
35	OK	1.17%	1.96%	
36	CT	1.02%	1.28%	
37	KS	1.01%	1.30%	
38	MS	0.91%	0.86%	
39	AR	0.82%	1.21%	
40	WV	0.73%	0.99%	
41	NM	0.64%	0.67%	
42	NV	0.62%	0.59%	

EXCEL 401

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- Figure6.8
- Figure6.9
- Figure6.10
- Figure6.11
- Slicer
- Cities
- Figure6.13
- Figure6.14
- Figure6.15
- Figure6.16
- Figure6.17
- Figure6.18

6.3 PIVOTCHARTS

CREATE A PIVOTCHART

Larger data sets make it impossible for Excel to create a basic chart or graph for you. If your data source or selection has too many cells, the recommended chart types will have no items to show, nor will you be able to select any items from the *All Charts* tab.

Even though we can use PivotTables to summarize large data sets, it is often helpful to use data visualization tools to give us a quick and high impact visual of our results. PivotCharts are a great way of getting an

overview of general trends, comparisons, or proportions of your data in a visual format.

INSERT A PIVOTCHART

1. Select any ONE cell in your range of data. (Note: Do NOT select the entire sheet, allow Excel to select the source automatically, otherwise, you may select too much data for the application to handle causing it to slow down or freeze.)

2. Go to the Insert tab on the ribbon, select the 'PivotCharts' icon (Figure 6.3.1).
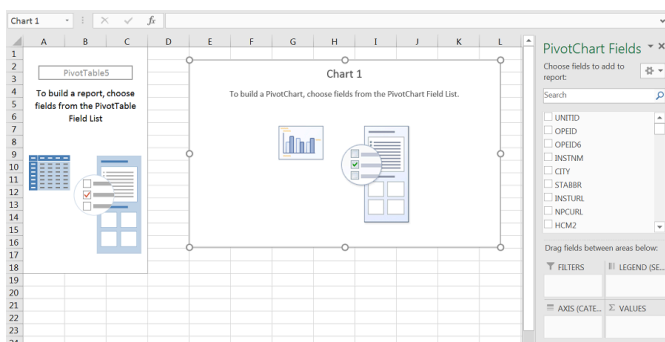
6.3.1. PivotChart in a worksheet.

3. A dialogue box titled 'Create PivotCharts' will pop-up, the Table/Range automatically populates with a selection of your data (Figure 6.3.2).
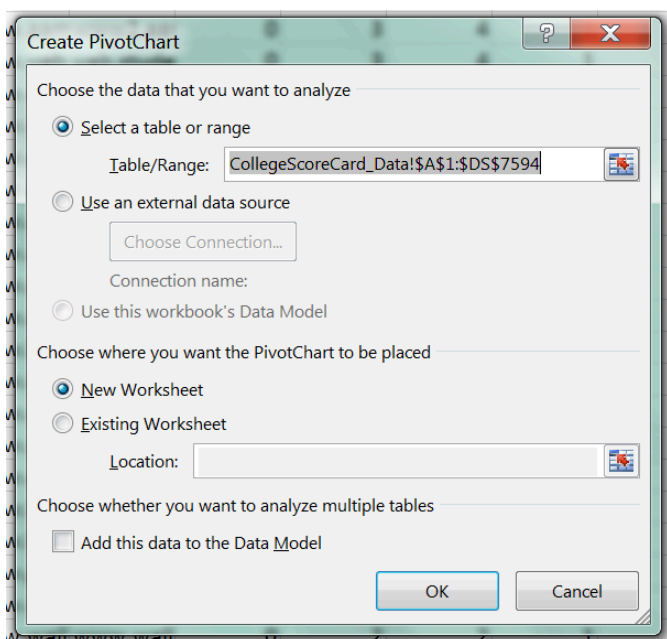
6.3.2. Create a PivotChart.

4. Confirm that your PivotTable will be inserted into a New Worksheet.

5. Select and click 'OK'.

6. A new worksheet will be created in your workbook. Observe the blank canvas in front of you after you click OK confirming the source of your data (Figure 6.3.3). Now you have space on the left for your PivotTable, your PivotChart in the middle and your PivotChart Field including the field names and areas are in the pane on the right.
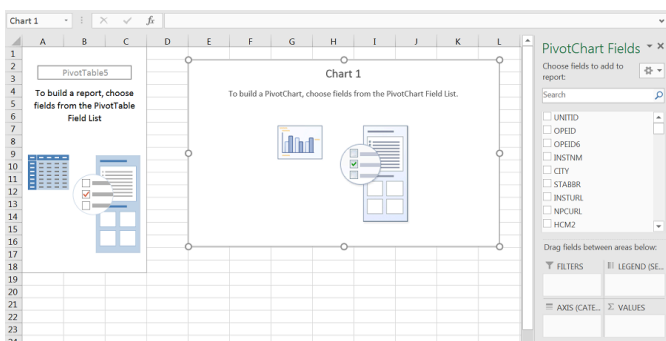
Figure 6.3.3. PivotTable, PivotChart, Fields Pane.

Once you start adding fields to your PivotChart field selector into one or more of the four possible areas (Filters, Columns, Rows, Values), your sheet will start filling in your currently blank PivotTable range and PivotChart object with summary data. Building your PivotChart works just as building your PivotTable did. Review the "Manipulating Pivot Table Fields" section in Chapter 6.1 if you need a refresher about how to add fields.

Exercises

Create a PivotChart using State Abbreviations as Row Labels, the Count of Institution Names as values in a corresponding column. Your output should match Figure 6.3.4 below.
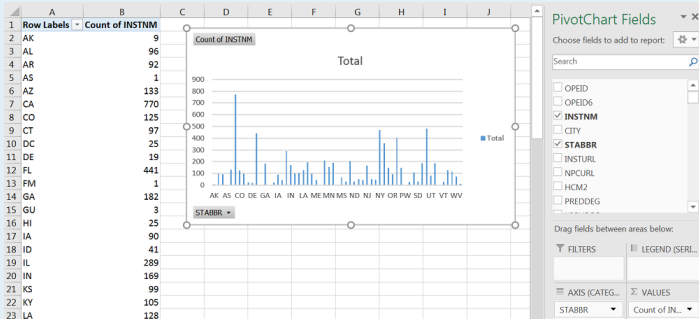
Figure 6.3.4. PivotChart setup.

Answer the following questions:

- Is the chart easier to read than the data table?

- Is it clear from the chart which column corresponds with which state? Adjust the width of the chart to see the state names under each column.

- What type of chart is this? Click PivotChart Tools > Design > Change chart type that you have a clustered column chart.

- Are there any other chart types that would allow you to visualize this data better?

SORT AND FILTER A PIVOTCHART

It can be hard to pick a good chart type even if you have summarized records for over seven thousand institutions by fifty categories in our case with the College Scorecard Data and the State Abbreviations. However, we can always sort our data to show items in a different order

or show only those fields and values that meet certain criteria.

SORTING

One way to make your data have a higher impact is to reorder it. Right-click the clustered column chart you created in the earlier section of this chapter and sort the Count of INSTNM column in descending order (from Largest to Smallest). The easiest way to do this is how we have done so in Chapter 6.2, by right-clicking on the column of data that you wish to sort by and hovering over the sort tab and selecting how you wish to sort (Figure 6.3.5A).
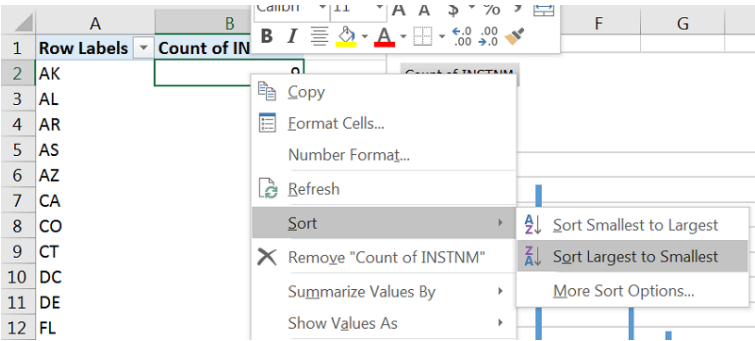
Figure 6.3.5A. Sorting a PivotChart.

You can also sort by clicking the STABBR dropdown in the lower right corner of the PivotChart. In the dialogue box that pops up, adjust the Sort Options to sort in Descending order by Count of INSTNM (Figure 6.3.5B).
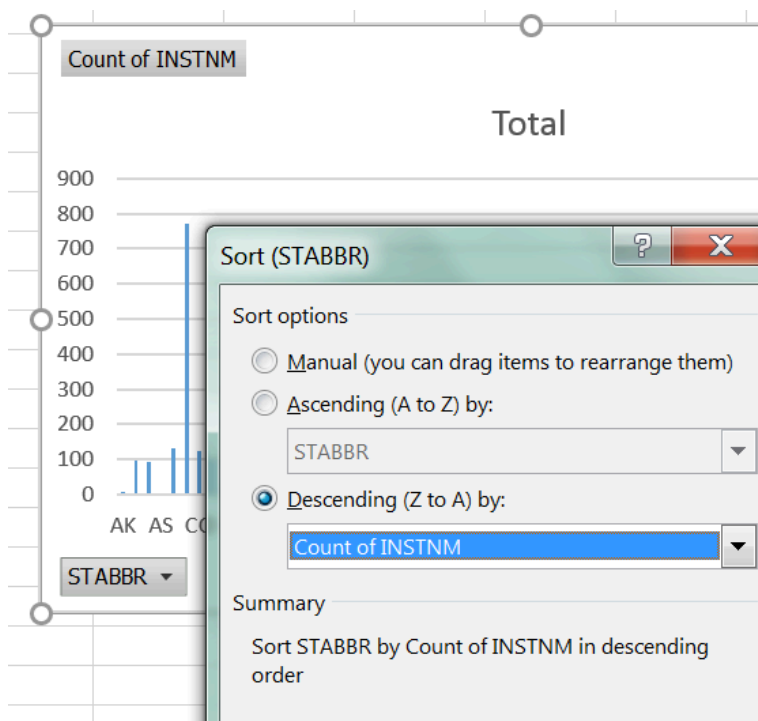
Figure 6.3.5B. PivotChart sort dialogue box.

Observe how the output now has a clean line from highest to lowest values from left to right (Figure 6.3.6) instead of what may be a confusing zig-zag of values all around when using the alphabetical order of states.
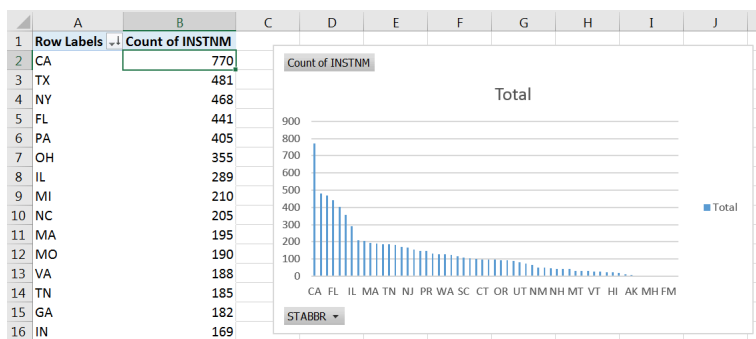
Figure 6.3.6. PivotChart output.

Furthermore, when you look at the PivotChart, you may notice that there are groups of columns with somewhat similar values followed by other groups with much lower, but still similar to one another.

Even a cursory glance at the PivotChart allows us to see patterns much faster in our data than if we observed the changes in the numerical values. We can use the visible drops or changes in values across to go back to our groups and narrow down our inquiry to a smaller subset of our data (Figure 6.3.7).
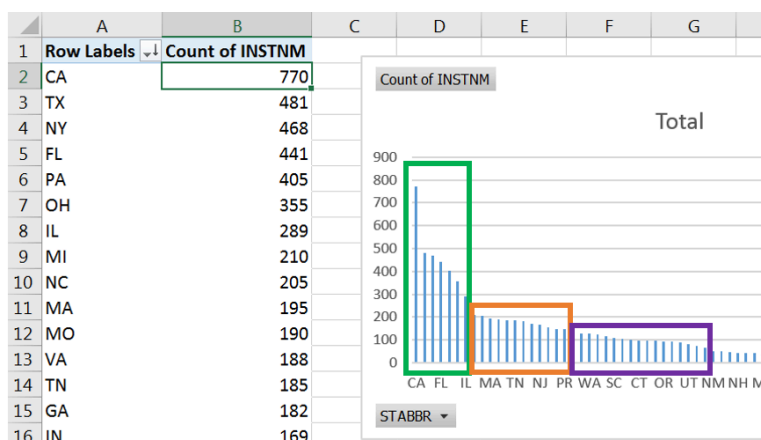
Figure 6.3.7. Possible groups emerging in data.

While we can make the width of our PivotChart take up our entire screen; but it may still be hard to see which value belongs with which state depending on your screen size or resolution. At this point, it would make sense for us to focus on a subset of our data by filtering it.

FILTERING

Focusing on a subset of your data allows you to examine a smaller group of items in detail. It is good practice to start any report by an overall description of your data points, noting general trends in your data, and the sorting allowed you to do that. However, filtering will let you zoom in on items you may want to highlight.

From the clustered column PivotChart and the corresponding data table we can see that there are five to seven states that have a high number of colleges. Convert the Count of Institutions to show as Percentages of Grand Total (Figure 6.3.8), then add up the values you find.
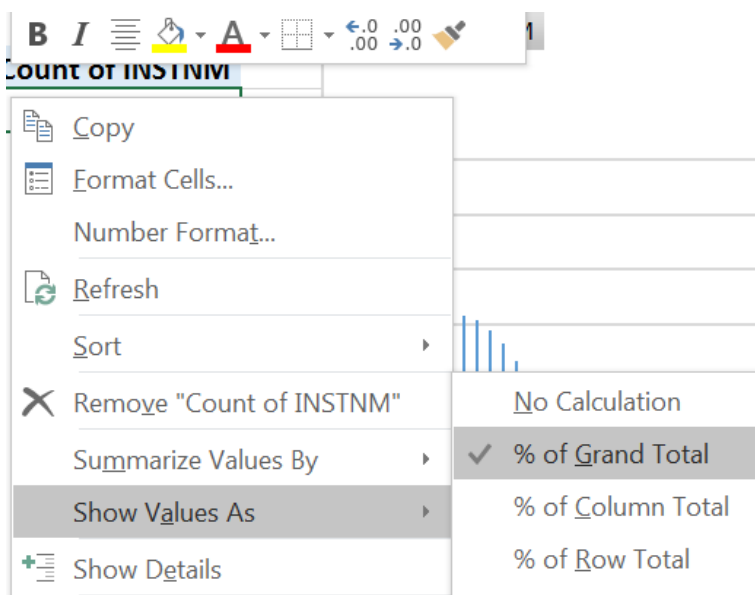
Figure 6.3.8. PivotChart field settings.

These quick steps will reveal that one-third of institutions are in five states at the top of our list (CA, TX, NY, FL, PA), with over forty percent of institutions in the top seven states (add OH and IL). There are differences within this group too, therefore, we want to find a chart type that would highlight his.

Convert the clustered column PivotChart into a Pie to show contributions to the highest volume group.

Right-click the PivotChart > Change Chart Type OR Go to Design > Change Chart Type. Your output will show all the states with the legend on the right having space for the states with the highest values (Figure 6.3.9).
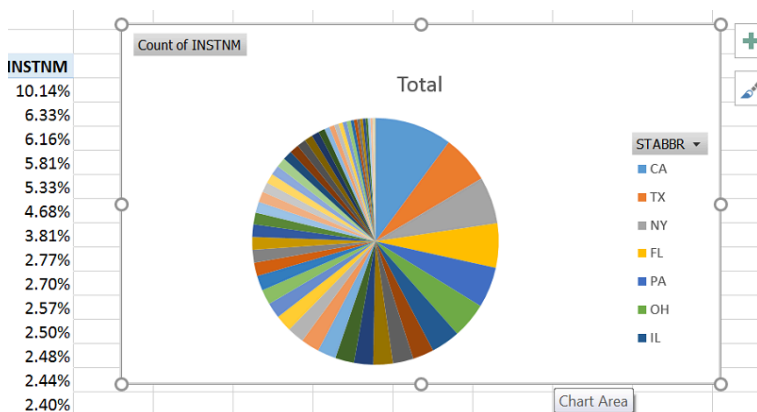
Figure 6.3.9. Pie Chart based on pivoted data.

We could make our chart area much bigger to show all the states, but then it would be a huge color wheel on our screen and we would have a hard time identifying which slice is which state, even if we added callouts.

Exercises

Filter your Pie chart to show CA, TX, NY, FL, PA.

Add Inside End Data Labels to show the State name and percentages on the slices of the pie.

Which college or colleges stand out and which colleges have a roughly similar portion among the top five?

What would be a fitting title for this chart?

USE SLICERS

In Chapter 5 and earlier in Chapter 6, we looked at using

slicers as another way of filtering data. A slicer is an object we can insert next to our data and use buttons to select items we wish to filter for (or filter out) of our data. Let us try using the Slicer to filter a PivotChart by LOCALE, then by the value in the Count of Institutions column:

1. Insert a PivotChart that uses State Abbreviations as Rows, the number of Institutions as Values (Count, not SUM).

2. Go to PivotTable Tools > Analyze > Insert Slicer.

3. Select LOCALE from the field names by clicking its checkbox.

4. Filter your data for all types of Cities by using your slicer by clicking the corresponding codes (11, 12, 13) under the LOCALE heading in your slicer. Use SHIFT to select multiple adjacent items.

5. Add another filter from the PivotChart's STABBR filter dropdown and match the selections from the dialogue box below (6.3.10).
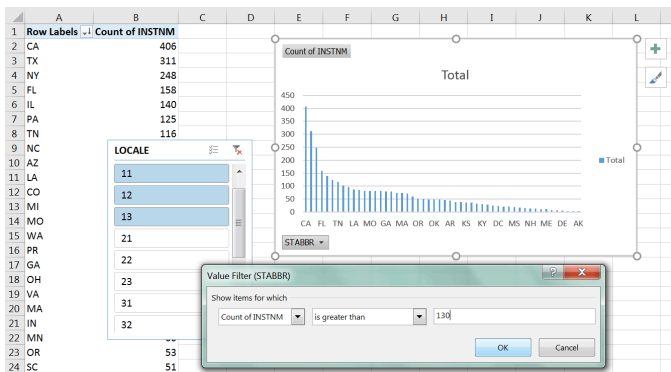
Figure 6.3.10. PivotChart with slicer and an additional filter.

6. Match your output to what is shown for the Exercise below.
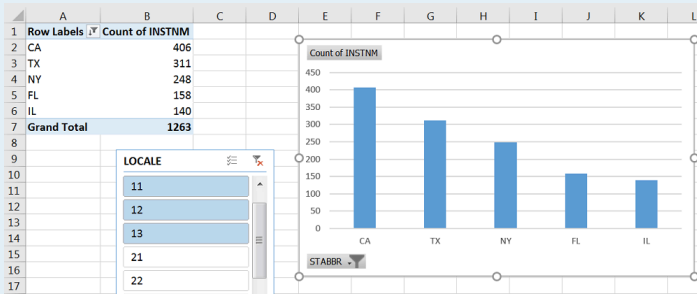
The figure above (Figure 6.3.11) shows the output of the previous section.

Change the values to show as Percentages of the Grand Total.

Is there a change from the previous filtering of the data set by LOCALE for each state?

What would be a good title for this chart?

ATTRIBUTION

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- 6-3-3_PivotChart_Canvas
- 6-3-2_Create_Box
- 6-3-4_PivotChart_STABBR_INSTNM
- 6-3-5_PivotChart_Sorted
- 6-3-5_PivotChart_SortedB
- 6-3-6_PivotChart_Sorted_Output
- 6-3-7_PivotChart_Sorted_Output_B
- 6-3-8_PivotChart_Percentage
- 6-3-9_PivotChart_Percentage
- 6-3-10_PivotChart_Locale_Filter
- 6-3-11_PivotChart_Locale_Filter_B

6.4 CHAPTER PRACTICE

U.S. ENERGY INFORMATION ADMINISTRATION – COMPANY LEVEL IMPORTS DATA

The data you will be working with is a larger data set from the U.S. Energy Information Administration (EIA) website. The EIA "collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment (Source: EIA.gov)." EIA content is often among the data sets that analysts with backgrounds in accounting, finance, supply chain, and management information systems work within energy-related industries.

Go to the EIA website and review information shared about Petroleum Administration for Defense Districts (PADDs). Read about the history of PADDs and how these abbreviations are used to describe movements through a variety of means of transportation (pipeline, tanker, barge, and rail) between districts today. Bookmark, save or print this page for your records in order to quickly access information and answer questions regarding

PADD regions as you work with your data following the steps below.

1. Create a folder on your computer for "EIA Data Project".

2. Download the following files shared below:

    ◦ Explanatory notes: EIA_DataDictionary (PDF file)

    ◦ Data file: EIA_2016_Company_Level_Imports (Excel file, archived from EIA.org for educational purposes)

3. Open the EIA_2016_Company_Level_Imports file. There are four sheets in this workbook. The documentation notes the source of the data, the IMPORTS sheet contains 20 columns and 24618 rows, totaling to 492,360 individual points of data. As you look at the header row, there are field names that make sense at once, but there are field names we need explanations for. Therefore, you should open the explanatory notes contained in your EIA_DataDictionary to find out what fields like R_S_NAME or PCOMP_RNAM mean. The two sheets in your workbook that follow the IMPORTS sheet are tables listing World Regions and US Regions with corresponding countries or states listed next to them. You will be using the contents of IMPORTS. *(The World and US Regions sheets can be used to make observations about your data based on regional origin or processing to serve as a higher level category above states or PADDs.)*

4. Open your data file and rename it to EIA_2016_Company_Level_Imports_YourName.xlsx.

5. Take some time to familiarize yourself with the PADD regions, the data file and the data dictionary.

6. Insert a PivotTable based on the contents of the IMPORTS sheet into a new worksheet. Confirm the source range as IMPORTS!$A$1:$T$24618.

7. Move the inserted sheet after IMPORTS, rename it to Processing Facilities.

8. Look up the field names for Processing Facility Name and Processing Company State in your Data Dictionary. Use these field names to create a PivotTable showing how many (COUNT) processing facilities are in each state. You can use your output to answer questions such as: How many processing facilities are in the US? Which state has the least/most processing facilities? How many processing facilities are there in Texas?

9. Add the field name for the country name to the Filters PivotTable field. Use the filter to show changes in the numbers of processing facilities by country. What is the breakdown of the top five states if you filter for Canada? What is the breakdown if you filter for Mexico? Consider the connection between the changes in outputs based on geographic location.

10. Clear the country filter for now, but leave it in place. Add the field name for Product Name to the Filters PivotTable field. Add Quantity for Values.

Filter for Crude Oil. Which state processes the most crude oil overall? Which state is second or third?

11. Filter for Canada, Mexico, Venezuela. Observe how the outputs for crude oil imported from certain countries changes the order of states.

12. Go back to the IMPORTS sheet. Insert a PivotTable based on its contents into a new worksheet. Confirm the source range as IMPORTS!$A$1:$T$24618.

13. Move the inserted sheet after the Processing Facilities sheet and rename it to PADDs.

14. Use the field names for Processing Company PADD and Processing Company Name to create a PivotTable. Use the output to determine which Processing Company PADD has the most processing companies.

15. Add a filter for the Product Name field and determine which Processing Company PADD has the most processing companies for Crude Oil.

16. Drag Product Name and Processing Company PADD under the Filter fields, filter for Crude Oil and for PCOMP_PADD 3. Move Processing Company Name under Rows, Processing Facility Name under Values (COUNT). What does this output show? What do the highest and lowest values in this output represent?

17. Save your work for your records.

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ATTRIBUTION

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6.5 CHAPTER ASSESSMENT

THE FOLLOWING ARE SAMPLE QUESTIONS TO TEST WHETHER YOU KNOW, UNDERSTAND, AND ARE ABLE TO APPLY CONCEPTS FROM THIS CHAPTER.

COMPLETE WORK WITH BOTH THE CHAPTER WALKTHROUGH AND THE CHAPTER PRACTICE EXCEL DATA FILES TO ANSWER THE QUESTIONS BELOW.

1. Use the College Scorecard Data Dictionary to answer the following question. What does "CIP" mean?
   a) Custom Institution Profile
   b) Classification of Instructional Programs
   c) Categorical Information Program
   d) COUNT of Institutional Program

2. Based on Chapter 6 College Scorecard data file, how many colleges offer ONLY Distance Education programs in California?

a) 2
b) 3
c) 4
d) 5

3. Based on Chapter 6 College Scorecard data file, how many academic institutions are in the East South Central Sub-Region?

a) 451
b) 518
c) 1038
d) 1139

4. Based on Chapter 6 College Scorecard data file, how many academic institutions offer 4 different types of degrees in California ("Highest degree awarded" category in your data dictionary).

a) 15
b) 25
c) 29
d) 190

5. Based on Chapter 6 College Scorecard data file, how many academic institutions are in Midsize Cities in the Northeast region?
a) 90
b) 157
c) 235
d) 346

6. The object towards the lower left corner of screenshot below shows a/an:
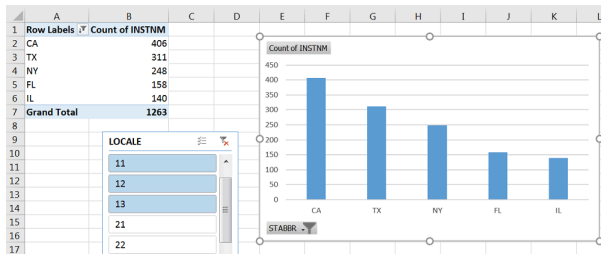
a) Filter
b) Developer
c) Slicer
d) Sorter

7. The PivotChart has been filtered for specific:

	A	B	C	D	E	F	G	H	I	J	K	L
1	Row Labels	Count of INSTNM										
2	CA	406										
3	TX	311										
4	NY	248										
5	FL	158										
6	IL	140										
7	Grand Total	1263										
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												

LOCALE: 11, 12, 13, 21, 22

Count of INSTNM (chart, CA, TX, NY, FL, IL) — STABBR
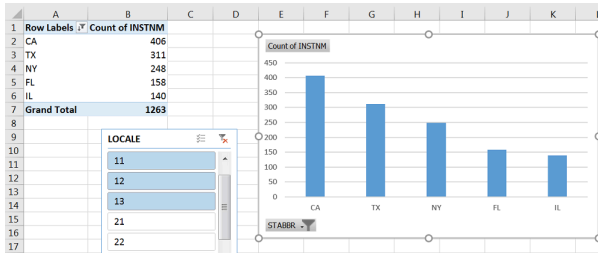
a) States
b) LOCALEs
c) Both
d) Neither

8. Answer the following based on your work with Chapter 6 Practice, Step 8. Which of the following states has the fifth highest number of processing facilities?

a) CALIFORNIA
b) INDIANA
c) LOUISIANA
d) WASHINGTON

9. Answer the following based on your work with Chapter 6 Practice, Step 9. How many processing facilities in Texas process products from Canada?

a) 898

b) 1006
c) 1440
d) 1378

10. Answer the following based on your work with Chapter 6 Practice, Step 16. Which of the following processing companies is NOT in the top five regarding the number of processing facilities in Processing Company PADD 3?
a) EXXONMOBIL REFINING & SPLY CO
b) HOUSTON REFINING LP
c) MARATHON PETROLEUM CO LP
d) VALERO REFINING – TEXAS LP

Solutions: ███████████████████████████

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- 6-3-11_PivotChart_Locale_Filter_B

CHAPTER 7 – MULTIPLE SHEET FILES

Excel workbooks often contain a large amount of data, and worksheets can quickly become overwhelming.When one worksheet becomes cumbersome, data can be broken out into smaller subsets and placed in separate worksheets within the same Excel file. Separating out spreadsheet data into smaller pieces can lead to better data organization within a file and increase its ease of use.When a retail company needs to track overall sales, as well as, individual store sales, it makes sense to place each store's sales data in a separate sheet within a file. Adding a summary sheet that sums across all the sheets will allow for total company sales data in the same file! This chapter will show how to set up a workbook to make multi-sheet formulas quick and easy.

Other examples of when multiple sheets make the most sense are when you are comparing regional data, data for a salesforce and wish to evaluate individual salesperson performance along with overall sales, and data over a period of time where sheets can be broken out by year or by month. When comparing data across several sheets,

it is essential that all the sheets are laid out in the same way. To facilitate this, a template can be used. A template is the basic pattern for each new sheet that can be used repeatedly to make sure each new sheet has the same setup, formatting, formulas, etc. as the existing sheets in a file. In this chapter, we will use both pre-made, Microsoft Excel templates, as well as, ones we will create from scratch to meet the specific needs of our work.

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7.1 MULTIPLE SHEET BASICS

Learning Objectives
1. Navigating through a multiple sheet file.
2. Adding, deleting, copying, and moving sheets.
3. Grouping and ungrouping sheets.

Throughout our textbook, we have worked with Excel files that have included multiple sheets. Depending on the version of Excel you are using, a new Excel file starts with several sheets. In this chapter, we will be working with a personal budget file that contains income and expenses for an entire year. Our file contains a sheet for each month of the year, as well as, a Summary sheet that will add all twelve monthly sheets of data together. To begin with, we'll get comfortable with moving through the sheets, organizing them, and making sure that all twelve monthly sheets are consistent.

Figure 7.1 shows the January sheet in the Personal Budget file along with all the sheet tabs along the bottom of the window.

Figure 6.1 Personal Budget File

NAVIGATING THROUGH A MULTIPLE SHEET FILE

Download Data file: [CH7-Data](#)

1. Open the data file **CH7 Data** and save the file to your computer as **CH7 Personal Budget**. Notice that the file has a **Expenses Summary** sheet at the far left followed by monthly sheets.

2. Click on the different sheets at the bottom of the screen to move through the sheets. Notice that the **Expenses Summary** sheet is formatted differently from the monthly sheets. Notice also that all the monthly sheets are identical in layout and format.

3. Take a second look at the months at the end of the year. Not all the data has been entered for September through October… and there is no sheet for December. We will enter the remaining data and add an additional sheet for December.

4. Add the following data in the **September, October, and November** sheets:

	September	October	November
Power	$135	$135	$135
Water	$30	$30	$30
Groceries	$300	$325	$400
Miscellaneous	$100	$50	$100
Bonus			
Freelance	$500		$150
Other		$100	

COPYING A SHEET

1. To make a **December** sheet, we are going to copy the **November** sheet.

2. Point your mouse at the **November** sheet tab at the bottom of the screen.

3. Hold down your left mouse button and then press and hold down the CTRL key.

4. At this point, you will see a black down-pointing arrow to the left of the **November** sheet tab and your mouse cursor will become a small piece of paper with a plus sign on it.

5. Drag your mouse to the right (still holding down the left-mouse button and the CTRL key) until the black down-pointing arrow is to the right of the **November** sheet tab.

6. Let go of the mouse button and then the CTRL key. You should now have a **November (2)** sheet to the right of the **November** sheet as shown in

Figure 7.2.

Figure 7.2 Additional November Sheet

Next, we'll update the **November (2)** sheet to turn it into
our **December** sheet.

1. Right-click on the November (2) sheet name at the
   bottom of the screen and choose Rename.

2. Type "December" and press Enter.

3. Click on the December sheet.

4. Click on B1 and change "November" to
   "December".

5. Make the following data changes:

   ◦ Miscellaneous: **$300**

- ◦ Bonus: **$250** (it's the holidays!)
- ◦ Freelance: delete amount

6. Save your work.

7. Point your mouse at the **December** sheet tab at the bottom of the screen.

8. Hold down your left mouse button and then press and hold down the CTRL key.

9. Drag your mouse to the right (still holding down the left-mouse button and the CTRL key) until the black down-pointing arrow is to the right of the **December** sheet.

10. Let go of the mouse button and then the CTRL key. You should now have a **December (2)** sheet to the right of the **December** sheet.

11. Rename the **December(2)** sheet **Practice**.

<div style="border: 1px solid; border-radius: 8px;">

Skill Refresher

Copying a Sheet

1. Point your mouse at the **sheet you want to copy** at the bottom of the screen.

2. Hold down your left mouse button and then press and hold down the CTRL key.

3. Drag your mouse to the right (still holding down the left-mouse button and the CTRL key) until the black down-pointing arrow is to the right of **your existing sheet**.

4. Let go of the mouse button and then the CTRL

</div>

MOVING AND DELETING SHEETS

Sometimes your sheets do not end up in the right order, and you need to move them in order to fix this. Let's try moving our "Practice" sheet to see how this is done.

1. Point to the **Practice** sheet and hold down your left mouse button.

2. Notice this time that there is still a black arrow to the left of the **Practice** sheet, but the piece of paper is blank. It does not have a plus sign (+) because we are moving, instead of copying, the sheet.

3. Left-drag the mouse to the right until the black arrow marker is between the **October and November** sheets.

4. Release the mouse button.

5. Try moving the **Practice** sheet back to the right of the **December** sheet.

Since our **Practice** sheet is not a sheet we will need in our Budget file, we'll go ahead and delete it now.

1. Right-click on the **Practice** sheet tab at the bottom of the screen.

2. Click Delete. **Figure 7.3** shows the warning

message box that will appear on your screen. Your message box might look slightly different depending on the version of Excel you are using. It is important to note that you cannot Undo once you delete a sheet!
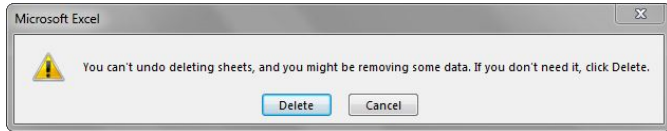
Figure 7.3 Warning Message Box

3. Click Delete.

GROUPING AND UNGROUPING SHEETS

Take a look at our monthly sheets again. Notice that there is a place in each of these sheets to calculate three pieces of Summary data: Income, Expenses, and Balance; but there aren't any formulas in these cells. There is also a place for the % of Income Spent, but we need a formula in I6:I7 to calculate this. If we entered these formulas individually in each of the 12 month sheets, it would take a long time! Because this task would be very repetitive, it would also be fairly likely that we would make some mistakes along the way entering the same formulas over and over again. By grouping all the month sheets together, we can enter each of the formulas once and have them appear in all the sheets.

1. Click on the **January** sheet to make it active.

2. Hold the SHIFT key down and click on the **December** sheet.

Now all 12 sheets should be selected. You can tell this in

two ways: the sheet tabs that have been selected are now bold at the bottom of your screen. Notice in the Title bar at the top of the screen the word [Group] added to the end of the title. You can see both of these in **Figure 7.4**.
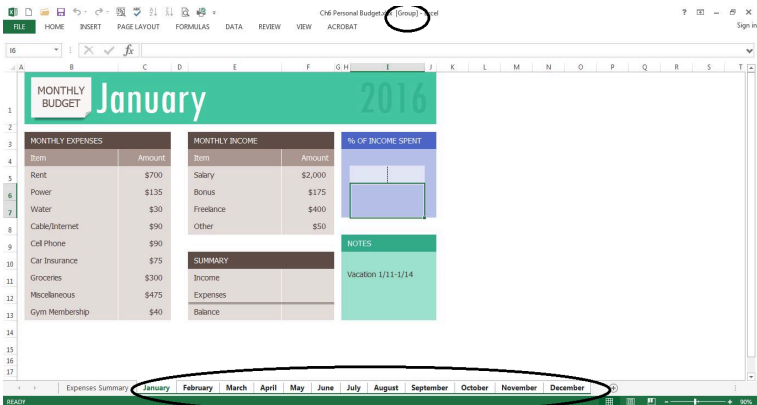
Figure 7.4 Grouped Sheets

IT IS IMPORTANT TO REMEMBER THAT ANY CHANGES WE MAKE TO THE JANUARY SHEET WILL BE MADE TO ALL THE SHEETS!! This is a very good thing when we want to make changes to all the sheets at once, but we need to be sure to ungroup them when we're done making these changes.Let's go ahead and add the formulas to all twelve of the sheets at once:

1. Click in F11 in the **January** grouped sheet.

2. Enter the formula =**SUM(F5:F8)**.

3. In F12, enter the formula =**SUM(C5:C13).**

4. In F13, subtract Expenses from Income. In the **January** sheet, your balance should be $690.
    HINT: if your answer is negative, you subtracted Income from Expenses.

5. Click on I6. (I6 and I7 are formatted and merged together – this is fine.)

6. Enter a formula that divides Expenses (F12) by Income (F11). Your answer will show as a percentage since this cell has already been formatted to do this. HINT: If you percentage is greater than 100%, you have your numbers reversed.

Notice that a data bar was set up in I5 to visually show the income spent. Do you remember how to do this from earlier in our textbook? Your January sheet should now look like **Figure 7.5**.

Figure 7.5 January Sheet with Formulas

7. Now that we are done making changes to all the monthly sheets at once, we need to ungroup them. Right-click on one of the grouped sheets and choose Ungroup Sheets.

Notice the sheets tabs are no longer bold and the word [Group] is no longer in the title bar.

8. Click on several of the month sheets to see that all the formulas have been added.

9. Click on the **December** sheet. Your sheet should now look like Figure 7.6.
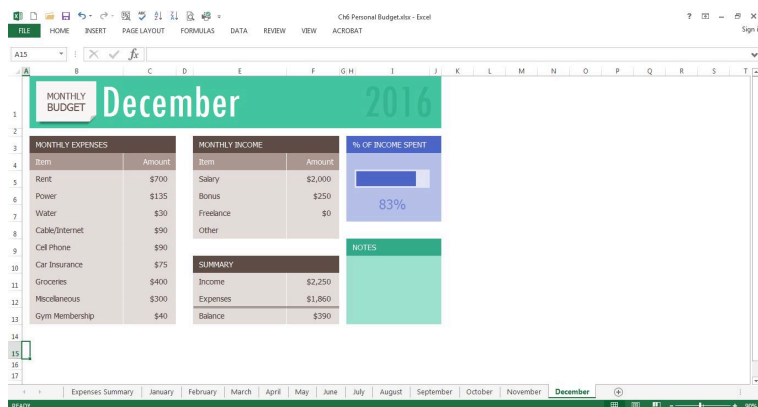
Figure 7.6 December Sheet with Formulas

1. Take a look at the Notes in the September sheet. It says that the rent was raised in September, so we need to cancel our Gym Membership and show $0 for the Gym amount in October, November, and December.

2. Group the **October, November, and December** sheets. If you do this successfully, these three sheet names should be bold and the word [Group] will appear in the Title bar.

3. Click on C13 and change the amount to **$0**. Press Enter.

4. Ungroup the sheets.The balances should be: October $605, November $530, and December $430.

Key Takeaways

- You can easily move, copy, delete, and rename sheets in your Excel file.
- Grouping sheets allows you to change a group of identically formatted sheets at the same time.

ATTRIBUTION

7.2 FORMULAS WITH 3-D REFERENCES

The Summary sheet in many multiple sheet workbooks is utilized to present totaled information from the other sheets in the file. This is done to give a quick synopsis of all the other sheets in one convenient location. For this reason, the Summary sheet is usually the first sheet in multiple sheet files. Summary sheets "pull" data from the other sheets using three-dimensional (3-D) cell references. In order to distinguish between A3 in the Summary sheet, A3 in the January sheet, A3 in the February sheet, etc.; a 3-D cell reference includes the sheet name along with the cell reference. The syntax to reference a cell in a different sheet is =SheetName!CellRange. So, the cell reference for A15 in the March sheet would be =March!A15.

Let's start working on our summary sheet by trying out some 3-D formulas:

1. Click on the **Expenses Summary** sheet **tab** at the bottom of the screen.

2. Click on C5 and enter the formula =**January!C5**. Press Enter.
    This will get the amount $700 from cell C5 in the **January** sheet.

3. Delete the formula in C5 in the **Expenses Summary** sheet.

4. This time, click on C5 and type =. Then click on the **January** sheet, and then click on C5.

5. Press Enter. This will put the same formula, =January!C5, in cell C5 in the **Expenses Summary** sheet and will return the value $700.

6. In cell C6 in the **Expenses Summary** sheet, try entering a formula for the Power amount in the **April** sheet. You should get $135 as the Power amount.

7. Delete the formulas in cells C5 and C6 in the **Expenses Summary** sheet.

For the Annual Amounts in C5:C13 in the **Expenses Summary** sheet, we don't need the amount from a single month's sheets; instead, we need the sum of all the entries in all the monthly sheets. So, we need to sum three-dimensionally through all twelve month sheets. Here's a helpful hint on the steps you need to follow to add through multiple sheets:

To SUM across sheets:

1. Click on the cell where you want the 3-D SUM to appear.

2. Type **=SUM(**

3. Click on the leftmost sheet in the group of sheets you want to sum.

4. Hold the SHIFT key down and click on the rightmost sheet in the group of sheets you want to sum.

5. Click on the cell in the sheet you're in that you want to sum.

6. Press ENTER.

Let's try adding up all the monthly amounts in our Expenses Summary sheet:

1. Click in C5 in the **Expenses Summary** sheet.

2. Type =**SUM(**. (Make sure to type the open parentheses!)

3. Click on the **January** sheet.

4. Hold the SHIFT key down and click on the **December** sheet.

5. Click on C5 again and press ENTER. Cell C5 should display the sum amount of $8,400.

6. Click on C5 in the **Expenses Summary** sheet. In the formula bar, you should see the following

formula: =SUM(January:December!C5). This means SUM C5 in the sheets January through December.

7. Let's try another 3-D SUM together. Click on C6.

8. Type =**SUM(**. (Make sure to type the open parentheses!)

9. Click on the **January** sheet.

10. Hold the SHIFT key down and click on the **December** sheet.

11. Click on C6 again and press ENTER. Cell C6 should now display the sum amount of $1,610.

12. Click on C6 in the **Expenses Summary** sheet. In the formula bar, you should see the following formula: =SUM(January:December!C6).

If you feel comfortable with these 3-D formulas, you can copy C6 down through C13 to fill in the rest of the formulas. If you're not quite comfortable yet, keep practicing the above steps to add 3-D formulas to cells C7:C13. When you're done, your Expenses Summary sheet should match **Figure 7.7**.

ANNUAL EXPENSES (TO DATE)	
Item	Amount
Rent	$8,400
Power	$1,610
Water	$360
Cable / Internet	$1,080
Cell Phone	$1,080
Car Insurance	$900
Groceries	$4,175
Miscellaneous	$2,535
Gym Membership	$360

Figure 6.7 Complete Expenses Summary Formulas

While our 3-D formulas are complete in the Expenses Summary sheet, our summary feels like it is lacking something. Let's add a visual representation of our summary numbers to the sheet.

1. Highlight cells B5:C13 in the **Expenses Summary sheet**.

2. Click on Pie Chart in the Insert tab in the ribbon and select the 2-D pie.

3. Move and resize the pie chart so that it fills cells D3:J15.

4. Delete the chart title.

5. Move the legend to the right side of the chart. Resize the legend as needed.

6. Add percentage data labels to the pie slices. Format the data labels to be bold with white font color. Your complete Expenses Summary sheet should look like **Figure 7.8** below.

7. Save your file. If you're printing your assignment at this point, print ONLY the Summary sheet in regular and formula view. Close your file.
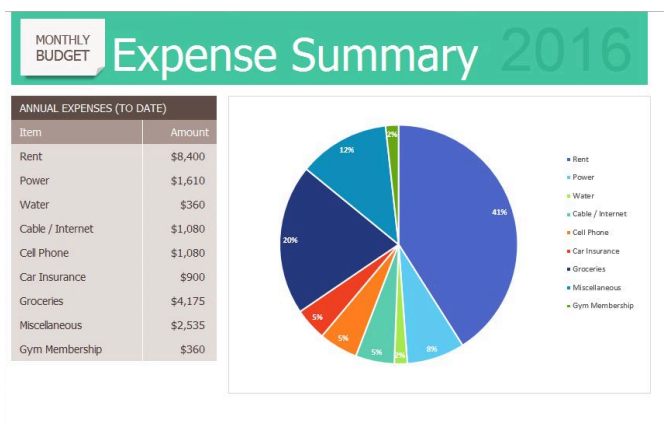
Figure 7.8 Completed Expenses Summary Sheet

> 3.   Click on the cell in the sheet you want and press ENTER.

> **Key Takeaways**
>
> - 3-D references in formulas allow you to use data from one or more sheets on another sheet.

ATTRIBUTION

7.3 TEMPLATES

Learning Objectives

1. Use an existing Microsoft Excel template to create a new spreadsheet.

2. Create a custom template to create new spreadsheets.

A template is a predefined pattern for a spreadsheet that has already been created for you. Hundreds of templates, already created by Microsoft, are available for you to use inside Excel. These templates are very helpful if you have limited time to get a new task done in Excel, and you don't know where to start. Templates do a lot of the work for you! Templates include all the formulas, formatting, etc. needed in a professional Excel spreadsheet. All that's left to do is enter the data. Predefined Microsoft templates include everything from billing statements to blood pressure trackers to business cards. Categories include: Business, Personal, Industry, Financial Management, Logs, Calculators, and Lists.

Sometimes you need a very specific template that hasn't

already been created by Microsoft. Taking the time to create your own template will allow you to use this spreadsheet pattern to create files from it over and over again. If you need to create a new version of a spreadsheet on a regular basis, templates will make this work much easier. In this chapter we will explore using existing Microsoft templates, as well as, creating our own templates.

Let's start by trying out a predefined, Microsoft template:

1. Click the **File tab** in the ribbon.

2. Click New in the Backstage View.

3. Click in the Search box for Online template.

4. Type **Travel** and press ENTER.

5. Click on the Travel Expense Report and click Create. NOTE: If this template is not available, ask your instructor which template you should choose.

Your screen should look like **Figure 7.9** below. Notice the design, layout, and formulas have already been set up for you.
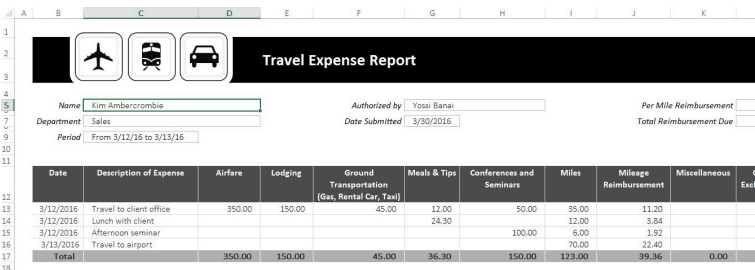
Figure 7.9 Travel Expenses Report Template

Try using the template by doing the following:

1. Change the Name to **your name**.

2. Change the Department to **CAS**.

3. Press CTRL+~ to see where the formulas are in the sheet. Working in the formula view helps you see where the formulas are, so you won't delete them.

4. In formula view, carefully delete just the data. Don't delete any formulas!

5. Press CTRL+~ again to return to Normal view.

6. Enter dates and expenses for a trip of your imagining in the first three rows under the column headings.

7. Save the completed file as **CH6 Travel Expenses**. Close the file.

Now let's shift to creating our own template. Sometimes you create a blank template first and then create spreadsheets from it. Other times, you have an existing spreadsheet that you realize you need a template for, so

that you can recreate the file with new data over and over again. We'll turn our existing CH6 Personal Budget file into a template now, and in the assignments at the end of the chapter, we'll start templates from scratch before a filled-in spreadsheet is created.

1. Open your **CH6 Personal Budget.xlsx** file.

2. Group the month sheets (**January through December**).

3. Press CTRL+~ to switch to Formula view.

4. We only want to delete data from these sheets – not labels or formulas. The only data is in C5:C13, F5:F8, and in the Notes in H11:J13.

5. Highlight C5:C13 (with all the sheets still grouped) and press DELETE.

6. Highlight F5:F8 (with all the sheets still grouped) and press DELETE.

7. Highlight H11:J13 (with all the sheets still grouped) and press DELETE.

8. Press CTRL+~ to switch back to Normal view.

9. Ungroup the sheets. Look through the sheets to check that only the data has been deleted. Notice the error message #DIV/O appears in I6:I7 since the data for this formula has been deleted. Your January sheet should look like **Figure 7.10**.
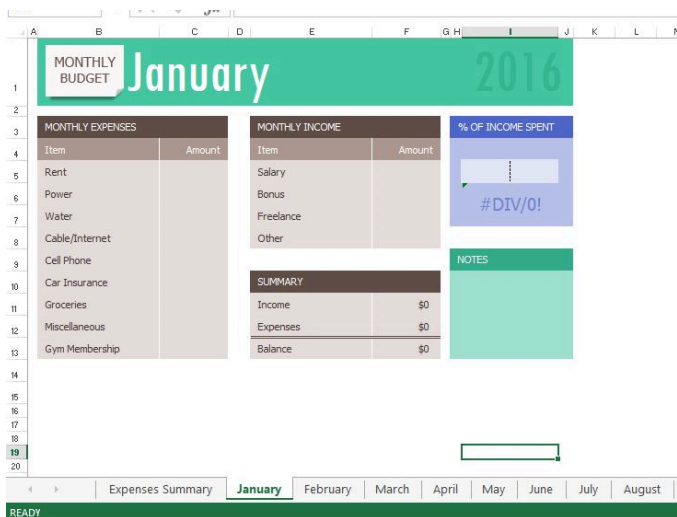
Figure 6.10 January Template Sheet

NOTE: There are only formulas and the pie chart in the Expenses Summary sheet, so nothing needs to be deleted from this sheet to setup your template.

1. Click the File tab in the ribbon and then click Save As.

2. Choose the location where you want to save the file.

3. In the Save as type pull-down list, select Excel Template (*.xltx).

4. At the top of the screen, double-check that the location you want to save the file to has not changed. If it has, use the pull-down list to find the location where you want to save your file. BE CAREFUL HERE! By default, Excel will try to save this to a default template file location on your hard drive.

5. Type in the file name **CH6 Personal Budget Template.xltx**. Check your screen carefully with **Figure 6.11**. Keep in mind that you may be saving your template file to a different place on your computer. By default, Excel will save the template to your hard drive assuming you always work on the same computer.
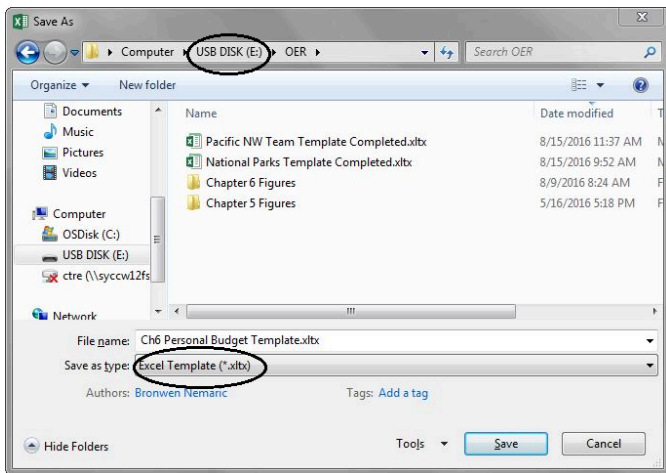
Figure 7.11 Save As Template

6. Click Save.

Skills Refresher

To save a file you created as a template:

1. Click the File tab in the ribbon and then click Save As.

2. Choose the location where you want to save the file.

3. In the Save as type pull-down list, select Excel

Template (*.xltx).

4.   At the top of the screen, double-check that the location you want to save the file to has not changed. If it has, use the pull-down list to find the location where you want to save your file. BE CAREFUL HERE! By default, Excel will try to save this to a default template file location on your hard drive.

5.   Type in the file name

6.   Click Save.

We are now going to use our new budget template to start a Personal Budget file for 2017. We want to use the Ch6 Personal Budget Template to create the new file, but we don't want to overwrite the template. We want to keep it clean to use to start each new year's file. To do this, we'll save the file to our new 2017 file name before we start filling in any data.

1. With the **CH6 Personal Budget Template** open, click the File tab in the ribbon.

2. Choose Save As and choose the location where you want to save the 2017 version of the file.

3. Change the Save as Type back to Excel Workbook (*.xlsx).

4. Enter the File name **CH7 2017 Personal Budget.** Compare your screen to **Figure 7.12**.
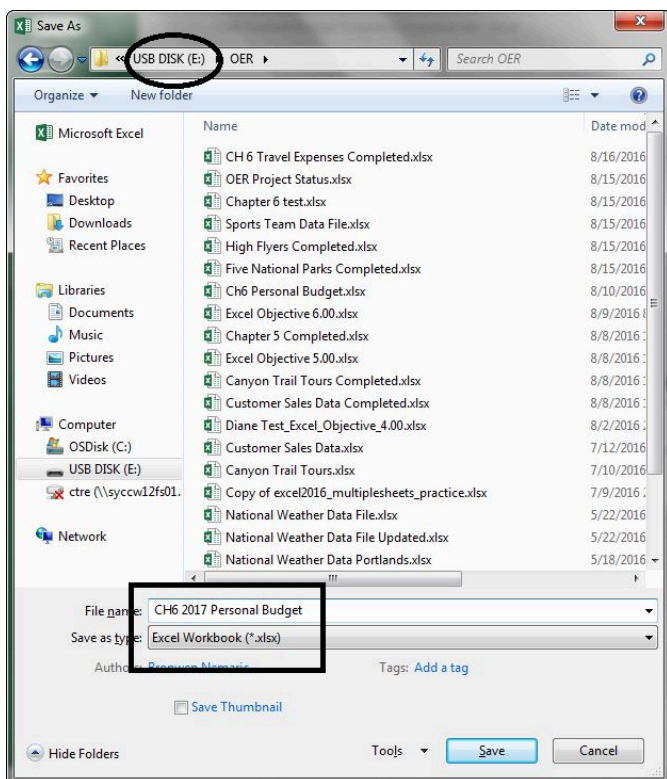
Figure 7.12 Save As 2017 Budget File

5. Click Save.

6. Group all the sheets together including the **Expenses Summary** sheet.

7. Click on H1. Type 2017 and press ENTER.

8. Ungroup the sheets.

9. Click on the **January** sheet. Enter the following data in **Figure 6.13**:

MONTHLY EXPENSES		MONTHLY INCOME	
Item	Amount	Item	Amount
Rent	$700	Salary	$2,000
Power	$135	Bonus	
Water	$30	Freelance	$150
Cable/Internet	$90	Other	
Cell Phone	$90		
Car Insurance	$75	SUMMARY	
Groceries	$275	Income	$2,150
Miscellaneous	$0	Expenses	$1,395
Gym Membership	$0	Balance	$755

Figure 7.13 January 2017 Data

10. Click on the **Expenses Summary sheet –** the data and the pie chart should show the January data since that is all the data in the twelve month sheets for now. Your sheet should look like **Figure 7.14.**

11. Figure 7.14 Expense Summary Sheet

12. Save your file for your records.

> ### Key Takeaways
>
> - There are many pre-designed templates in Excel developed in Excel that you can use. This will save you the time and effort of designing and creating these files from scratch.
> - You can create your own template files in Excel that you can use over and over again.

ATTRIBUTION

Media Attributions

- figure-6-13-january-2013-data
- Figure 6.14 2017 Expenses Summary Sheet

7.4 PREPARING TO PRINT

Learning Objectives

1.	Printing all of the worksheets in a workbook at one time.

2.	Preparing multiple worksheets for printing using grouping.

Just like consistency in formatting is important when working with workbooks containing multiple worksheets with the same type of data, so is consistency in page setup. Now that the Personal Budget 2017 workbook is complete, you are going to prepare it for printing by changing the page orientation and adding a header. You will also print all 13 worksheets at one time.

APPLYING PAGE SETUP OPTIONS TO GROUPED WORKSHEETS

Data file: Continue with CH7 2017 Personal Budget.

As always, you need to review your workbook in Print Preview before considering it complete. When you do that with this workbook, you notice that the worksheets

are each printing on two pages. You decide to switch all the worksheets to Landscape orientation to see if that helps. You will also add a footer with the worksheet name to each of the worksheets.

1. Go to Print Preview. To view all of the worksheets at one time, select Print Entire Workbook in the first box in the Settings section. You should now have 26 pages to scroll through in Print Preview. If you were to click the Print button, all of the worksheets would print, not just the active sheet.

2. Exit Backstage View. You want to change the page orientation of all the sheets, but you cannot change all of them at one time in Print Preview.

3. Group all of the worksheets together, including the **Expenses Summary sheet through the December sheet.**

4. Click on the Page Layout tab on the ribbon, then select Landscape using the Orientation button in the Page Setup group.

5. Click the Page Setup dialog box launcher arrow in the Page Setup group then click the Header/ Footer tab.

6. Click the Custom Footer button. In the center section, insert the worksheet name using the Insert Sheet Name button. The Footer dialog box should look like **Figure 7.15**.

7. Click OK to close the Footer dialog box. Click OK again to close the Page Setup dialog box.
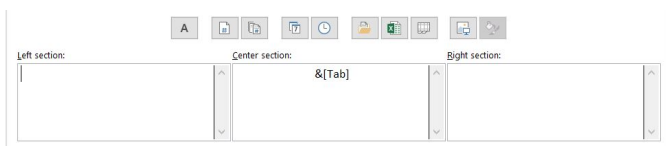
Figure 6. 15 Insert Worksheet Name

8. Return to Print Preview to confirm that each worksheet is printing on one page, in landscape orientation, with the correct worksheet name appearing in the footer.

In Print Preview you notice that the **Expenses Summary** sheet is not set to print correctly. Part of the chart is appearing on a second page. You can easily fix this by changing the Scaling, but you only want to change the scaling of the **Expenses Summary** sheet, not the entire workbook. If you make the change in Print Preview while the worksheets are grouped it will change all of the worksheets.

1. Exit Backstage View.

2. Ungroup the worksheets by right-clicking on any of the worksheet tabs and selecting Ungroup Sheets.

3. If needed, click on the **Expenses Summary** worksheet tab to make it the active worksheet.
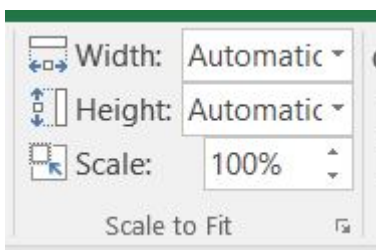
Figure 6.16 Scale to Fit

4. Click on the Page Layout tab on the ribbon and locate the Scale to Fit group of commands. (See **Figure 6.16** above.)

5. Click the drop-down arrow for Width: and select 1 page. This has the same result as selecting Fit All Columns on One Page in the Scaling setting in Print Preview.

6. Return to Print Preview to confirm that the **Expenses Summary** worksheet is now printing on one page only.

7. Exit Backstage View.

8. Save the **CH7 2017 Personal Budget** workbook.

Key Takeaways

- To print all of the worksheets in a workbook at one time select Print Entire Workbook in the Print Settings.

- You can apply page setup options, such as scaling, orientation, and headers/footers, to multiple worksheets at one time by grouping the worksheets.

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7.5 CHAPTER PRACTICE

A MULTIPLE SHEET TEMPLATE FOR A SPORTS TEAM

Data file: PR6 Data

You have just gotten a job with the Pacific Northwest Soccer Club, and you quickly realize that there isn't a consistent way for all the coaches to keep track of their team statistics. To help with this, you decide to make a template for Season Stats for each team. Since you are also the coach of the High Flyers this season, you will need to use the template to enter your team's statistics into a team spreadsheet.

1. Open the data file **PR6 Data** and save the file to your computer as **PR6 Pacific NW Sports Team**.

2. Copy the range B11:G22 in the **Season Stats** sheet to the same range in the **Player Stats** sheet.

3. Group the sheets and add the following formulas to both sheets:

4. In C22 and D22, you'll need to count the Xs in rows 12 through 21. To do this, use a COUNTA formula.

5. In E22 and F22, sum rows 12 through 21.

6. In G12, calculate Goal Percentage by dividing the number of Shots by the number of Goals. This will display an error message because there are zeros in column F. We don't want to display error messages in the file, so an IF statement that tests the value of column F will solve this problem.

7. Change the formula in G12 with the following three pieces:

   ◦ Test – is F12 greater than zero

   ◦ If the Test is True – divide the number of Goals by the number of Shot

   ◦ If the Test is False – enter a zero

8. Copy G12 down the column through G22. Format these cells as percentages.

9. For an extra challenge, put the "banded row" format back in G12:G22.

10. Ungroup the sheets.

11. Save the file as a template called **PR6 Pacific NW Team Template.xltx**. Make sure to save your template to your USB and not the default folder for templates on your hard drive!

12. Make a new file using the **PR6 Pacific NW Team Template** and save it as **PR6 High Flyers.xlsx**.

13. In the **Season Stats sheet**, enter the following data:

   ◦ D3 – High Flyers

- D4 – Fall and the current year (i.e. – Fall 2016)

- D5 – Pacific Northwest Soccer

14. Enter your name, phone number, and email address in row 8.

15. Make four copies of the **Player Stats** worksheet. Rename the player worksheets **Player 1, Player 2, Player 3, Player 4, and Player 5**.

16. Group the Player sheets. Enter the following formulas:

17. A formula in D4 that points to cell D3 in the **Season Stats** sheet. Note: Your formula will be ='Season Stats'!D3:G3 instead of ='Season Stats'!D3 because D3:G3 are merged together.

18. A formula in D5 that points to cell D4 in the **Season Stats** sheet.

19. A formula in D6 that points to cell D5 in the **Season Stats** sheet.

20. Ungroup the sheets.

21. Click on the **Player 1** sheet. Enter the Player Name: **Juan Ramirez**. Enter the following data from **Table 1**:
Table 1: Player 1 Sheet

	Played	Started	Shots	Goals
Game 1	x	x	2	1
Game 2	x	x	3	1
Game 3				
Game 4	x			
Game 5	x	x	2	0
Game 6	x			
Game 7				
Game 8	x	x	1	1
Game 9	x	x	4	2
Game 10	x	x	3	3

22. Click on the **Player 2 shee**t. Enter the Player Name: **Zach Johnson**. Enter the following data from **Table 2**:

Table 2: Player 2 Sheet

	Played	Started	Shots	Goals
Game 1	x	x	1	1
Game 2	x	x	2	1
Game 3	x	x	1	1
Game 4	x	x	1	1
Game 5	x	x	2	0
Game 6	x	x	5	2
Game 7	x	x	4	2
Game 8	x	x	1	1
Game 9	x	x	4	1
Game 10	x	x	3	2

23. Click on the **Player 3 sheet**. Enter the Player Name: **Vito Lawrenz**. Enter the following data

from **Table 3**:

Table 3: Player 3 Sheet

	Played	Started	Shots	Goals
Game 1	x	x	0	0
Game 2	x	x	1	1
Game 3	x	x	2	0
Game 4	x		1	1
Game 5	x	x	2	0
Game 6	x	x	3	1
Game 7	x	x	2	1
Game 8	x	x	1	1
Game 9	x	x	1	1
Game 10	x	x	1	1

24. Make up information for the names and data in the **Player 4 and Player 5 sheets.**

25. Go to the **Season Stats** sheet and click on cell C12. Enter a 3-D formula to COUNTA (count text) in C12 through sheets **Player 1 through Player 5**. Copy the formula in C12 through D22 (be sure to preserve the original formatting).

26. Change the formulas in C22 and D22 from COUNTA to SUM.

27. Click on E12. Enter a 3-D formula to SUM E12 in sheets **Player 1 through Player 5**. Copy the formulas through F22 (again, be sure to preserve the original formatting).

28. Preview the worksheets in Print Preview. Notice that only part of the data is printing for each worksheet. This is because a Print Area was

incorrectly set when the file was first created. You need to clear this Print Area for **each worksheet** individually (modifying print areas cannot be done on grouped sheets).

29. Exit Backstage View and for each worksheet, click the **Print Area** button on the Page Layout tab and select **Clear Print Area**.

30. Save the **PR6 High Flyers** workbook for your records.

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7.6 CHAPTER ASSESSMENT

THE FOLLOWING ARE **SAMPLE QUESTIONS** BASED ON THE CHAPTER WALKTHROUGH TO TEST WHETHER YOU KNOW, UNDERSTAND, AND ARE ABLE TO APPLY YOUR LEARNING FROM THIS CHAPTER.

---

1. A collection of sheets that have the same structure can be _____ for faster and more consistent processing.
   a) formulated
   b) grouped
   c) pivoted
   d) tabbed

---

2. To select adjacent sheets in a workbook, use:
   a) ALT
   b) CTRL

c) DEL
d) SHIFT

3. If you delete a cell from a sheet that is a part of 12 sheets grouped together, the cell contents from all 11 other sheets will be deleted.
True/False

4. The syntax to add contents from cell B5 from Sheet1 through Sheet12 is:
a) =SUM(Sheet1:Sheet12:B5)
b) =SUM(Sheet1:Sheet12?B5)
c) =SUM(Sheet1:Sheet12!B5)
d) =SUM(Sheet1:B5:Sheet12:B5)

5. Answer based on your work with the Personal Budget workbook from the Chapter 7 Data file. In the February sheet, what is the best formula to enter into F11 to calculate Income?
a) =F5+F6+F7+F8
b) =SUM(F5,F8)

c) =SUM(F5:F8)

d) =SUM(F:F)

6. Answer based on your work with the Personal Budget workbook from the Chapter 7 Data file. In the February sheet, what is the best formula to enter into F12 to calculate Expenses?

a) =ADD(C5:C13)

b) =C5+C6+...+C13

c) =SUM(C5,C13)

d) =SUM(C5:C13)

7. Answer based on your work with the Personal Budget workbook from the Chapter 7 Data file. The best formula to calculate the Rent you have paid between March and August is:

a) =SUM(March!C5+August!C5)

b) =SUM(March!C5+April!C5+...+August!C5)

c) =SUM(March:August!C5)

d) =SUM(March:August?C5)

8. Answer based on your work with the Personal Budget workbook from the Chapter 7 Data file. Your monthly Rent payment increases to $750 for the month of June and on. How much rent will you have paid by the end of the year?

a) $5,800
b) $8,750
c) $8,800
d) $8,850

9. Answer based on your work with the Personal Budget workbook from the Chapter 7 Data file. Your monthly Power payment increases to $148 for the months of June to December. What is the new annual total you pay for Power?

a) $1,620
b) $1,687
c) $1,711
d) $1,850

10. Answer based on your work with the Personal Budget workbook from the Chapter 7 Data file. Your monthly Cable/Internet payment decreases to $68 for the month of June and on. What is the new annual total you pay for Cable/Internet?

a) $860
b) $882
c) $926
d) $1,080

Solutions: ██████████████████████████████████████
████

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Questions by Emese Felvégi based on the chapter practice problems. Edited by Lilliana E. Olmos & Marcella Olmos. CC BY-NC-SA 3.0.

CHAPTER 8: ADVANCED LOGIC & CONDITIONAL FUNCTIONS

In this chapter, we revisit mathematical and statistical functions like SUM, AVERAGE, and COUNT from Chapter 2. We will take another look at setting up logical tests based on our studies of Chapter 3. We will touch upon using Excel to evaluate one or more conditions as we have done in Chapter 5 with Excel tables and PivotTables in Chapter 6. We will combine elements from all previous chapters and continue our work with the College Scorecard dataset we introduced in Chapter 6. In this chapter, we take all our existing knowledge of Excel and combine aspects of functions and formulas to do even more with them.

ATTRIBUTIONS:

Chapter 8 by Emese Felvégi and Robert McCarn.

8.1 NESTED IF FUNCTIONS

THE IF FUNCTION

In [Chapter 3.2, we used the IF function](#) to make logical comparisons between student scores and a threshold for student success. In its simplest form, the IF function translated into something like this: IF the value in a cell is what you expect (TRUE), THEN do this, ELSE If not (FALSE) do something else. Let's say that we are looking for a university with more than 15% of students enrolled in business programs. We can have an IF function evaluate over records for institutions in our [College Scorecard dataset](#) and automate that process for me. Form the Data Dictionary that came with the College Scorecard data, we know that we have to evaluate the contents of the PCIP52 field. Let us use a logical function to do this quickly.

Remember, the IF function has three arguments:

1. **Logical test –** Here, we can test to see if the value in a selected cell is what we expect. Does this institution have more than 15% of its students enrolled in business programs [@PCIP52]>.15?

2. **Value_if_true** – If the requirements in the logical test are met, the value is $[@PCIP52]>.15,$ then it is said to be TRUE. For this argument, you can type in text – "True", or "High Business!" Depending on your value, you could insert a calculation.

3. **Value_if_false** – If the requirements in the logical test are not met, the value is $[@PCIP52]$ is lesser than or equal .5, then it is said to be FALSE. For this argument, you can type in text – "FALSE", or "Not That High." If you want Excel to ouput nothing at all in the cell, then type "" (two quotes) and your result will be a blank cell.

NESTING AN IF FUNCTION

We can use an output such as the above to count fields where our criteria was TRUE for and make a decision based upon that. We can filter for "High Business" or "Not That High". However, if we want more than one outcomes, then we can nest an IF function inside another IF function to have Excel evaluate all our criteria to output values accordingly. We can set criteria based on ranges of values we might find relevant for our category. The following are proprietary ranges that were setup at random.

We want to build an IF function that will have three outcomes: "High", "Some", "None" based on thresholds that align with values such as above 15% for "High", greater than 0% but less than15% for "Some", 0% for "None".

1. Open the College Scorecard Data Excel file you used for Chapter 6. ([You can download a fresh copy from here.](#))

2. Convert your data set into an Excel table so that your formula will use your field names (column headings) and will be easier to check for accuracy or to interpret.

3. Considering you have over 120 columns in this data set, you can select, right-click, and hide columns you do not use for the moment. Insert a column next to the PCIP52 column that shows the percentage of business students. Rename the column BUSINESS %.

4. Start your expression by typing in =IF(and then click into the first cell in the PCIP52 column and set your criteria, then set your output for TRUE ("High"). Next, nest an IF inside your existing IF and add your second logical test followed by the third as the FALSE output for this portion.

5. Click ENTER and see how the formula populates the PCIP52 column.

REMARKS FROM SUPPORT.OFFICECOM REGARDING NESTING IF FUNCTIONS

While Excel will allow you to nest up to 64 different IF functions, it's not at all advisable to do so. Why?

- Multiple IF statements require a great deal of thought to build correctly and make sure that their logic can calculate correctly through each condition all the way to the end. If you don't nest your formula 100% accurately, then it might work 75% of the time, but return unexpected results 25% of the time. Unfortunately, the odds of you catching the 25% are slim.

- Multiple IF statements can become incredibly difficult to maintain, especially when you come back some time later and try to figure out what you, or worse someone else, was trying to do.

If you find yourself with an IF statement that just seems to keep growing with no end in sight, it's time to put down the mouse and rethink your strategy.

For a wide range of examples, visit support.office.com.

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8.2 NESTING AND, OR, NOT FUNCTIONS INSIDE AN IF FUNCTION

Let us suppose you are in the process of deciding which university to attend for your Master Degree Program. You have a list of criteria that must be met, or you will not choose that school. You may have a list similar to the one below:

The university you want to attend:

1. Must have a Graduate program.

2. Must have a Business program.

3. Must not put you into a debt greater than $20,000.

4. Must lead to earnings of at least $60,000 per year after 10 years.

In our data dictionary, we can locate fields in our data set that will provide us with useful information.

1. Graduate program related field and condition: [@HIGHDEG]=4

2. Business program related field and condition: [@PCIP52]>0

3. Debt related field and condition:

[@[GRAD_DEBT_MDN_SUPP]]<20000

4. Earnings-related field and condition:
[@[MD_EARN_WNE_P10]]>60000

If you think about it, these conditions boil down to a few simple logical tests, like ones covered in Chapter 3 when we used the IF function to see if someone has passed or failed a test. Here, we have 4 logical tests that ALL must be TRUE before you can pick from a list of institutions that all meet your criteria. In our College Scorecard dataset and its related Data Dictionary, we have fields that we can use to filter an Excel table or a Pivot Table to narrow down our choices. However, in this chapter, we will look at using logical functions to find an answer.

AND, OR, NOT FUNCTIONS

IF you were fond of using logical functions, THEN you may find the use of the following functions in combination with our IF function. On their own, the AND, OR, NOT are logical functions that will help you evaluate up to 255 conditions and return a TRUE or FALSE value. The AND logical function determines if ALL conditions in a test are TRUE. The OR logical function determines if ANY conditions in a test are TRUE. The NOT logical function makes sure one value is not equal to another.

The syntax for these three functions are as follows:

```
=AND(logical1,[logical2], …)
=OR(logical1,[logical2], …)
=NOT(logical1,[logical2], …)
```

Let us use the AND function to test which institutions meet our the first two conditions from above, namely, that they have a graduate program (HIGHDEG=4) and they have more than 0 under the average % of enrolled students in their business program (PCIP52>0). We will use more criteria as we move along in this chapter.

1. Open the College Scorecard Data Excel file you used for Chapter 6. (You can download a fresh copy from here.)

2. Convert your data set into an Excel table so that your formula will use your field names (column headings) and will be easier to check for accuracy or to interpret.

3. Considering you have over 120 columns in this data set, you can select, right-click, and hide columns you do not use for the moment. Insert a column next to the PCIP52 column that shows the percentage of business students. Rename the column TEST.

4. Start your expression by typing in =AND(, click into the first cell in the HIGHDEG column and set

your criteria, then click into the PCIP52 column, and set your criteria for that field. You will see descriptive names due to the Excel Table structure instead of cell references. Press enter, and the column will autofill with your output as seen in Figure 8.2.1.

Figure 8.1.1. The AND function in use.

5. Alternatively, you can use the function library route of populating your formula with your arguments as seen in Figure 8.2.2 below.

Figure 8.1.2. The AND function in use.

6. You can now filter the data to show those institutions that meet your criteria. Complete the following practice exercises to add more logical tests to your formula.

Insert an AND function that tests to see if ALL four of your criteria are met:

1. Graduate program related field and condition:
   [@HIGHDEG]=4

2. Business program related field and condition:
   [@PCIP52]>0

3. Debt related field and condition:
   [@[GRAD_DEBT_MDN_SUPP]]<20000

4. Earnings-related field and condition:
   [@[MD_EARN_WNE_P10]]>60000

Build an OR function that tests to see if ALL four of your criteria are met:

1. Graduate program related field and condition:
   [@HIGHDEG]=4

2. Business program related field and condition:
   [@PCIP52]>0

3. Debt related field and condition:
   [@[GRAD_DEBT_MDN_SUPP]]<20000

4. Earnings-related field and condition:
   [@[MD_EARN_WNE_P10]]>60000

How many institutions are there that meet ALL your criteria?

What are your criteria for looking at an undergraduate or graduate program?

What other questions would you ask of your data knowing the fields in the data dictionary?

> What other methods can you use to get answers to such questions? Do you a preference for one over another?

NESTING AND, OR, NOT INSIDE AN IF FUNCTION

Using AND, OR, NOT in conjunction with the IF function will let you return custom outputs or run calculations. You can automate the evaluation of logical tests by **NESTING** the AND, OR, NOT functions inside a single IF function. This means that if we have multiple conditions but we want to return a single output, we can nest any of the conjunction functions inside an IF and specify outputs accordingly.

> The syntax for these three functions are as follows:
>
> =IF(AND(Something is True, Something else is True), Value if True, Value if False)
>
> =IF(OR(Something is True, Something else is True), Value if True, Value if False)
>
> =IF(NOT(Something is True), Value if True, Value if False)
> (AND, OR, NOT source: support.office.com.)

Let us use the IF function and nest and AND function inside it to test which institutions meet ALL our four

previous criteria (HIGHDEG=4, PCIP52>0, GRAD_DEBT_MDN_SUPP<20000, MD_EARN_WNE_P10>60000). We nest the AND inside the IF function so that we can have an output other than TRUE or FALSE. In this instance, we want an output that says "This could be it!" if ALL our conditions are met, we want an output that say "No." if any of my conditions are not met.

1. Let us go back to our College Scorecard Data Excel file with an Excel table already inserted in it. Leaving columns from earlier practices will not impact how your formulas work, so there is no need to delete anything.

2. Start your expression by typing in =IF(, then immediately after that, add the AND(and add all your criteria. You will see descriptive names to make adding the criteria you want in your graduate school.
"=IF(AND([@PCIP52]>0.15,[@HIGHDEG]=4,[@[GRAD_DEBT_MDN_SUPP]]<20000,[@[MD_EARN_WNE_P10]]>60000),"This is it!","No")"

3. Press enter, and the column will autofill.

4. You can now filter the data to show those institutions that meet your criteria. Complete the following practice exercises to add more logical tests to your formula.

Exercises

Build a nested function that tests to see if ALL of the following criteria are met and outputs to "Yes!" if all TRUE, and output to a "No." if any of the characters are not true:

1. Graduate program.

2. The program of your choice.

3. The region of your choice.

4. The site of the institution the size of your choice.

5. Earnings of your choice.

6. Debt amount of your choice.

How many institutions are there that meet ALL your criteria?

How do the answers change if you replace the AND with an OR function?

What other questions would you ask of your data knowing the fields in the data dictionary?

What other methods can you use to get answers to such questions? Do you a preference for one over another?

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- AND
- ANDv2

8.3 CONDITIONAL FUNCTIONS

We have used functions beginning with Chapter 2 to return values based on mathematical and statistical functions like SUM, AVERAGE, and COUNT. In Chapter 3 we studied how to set up logical tests, have Excel evaluate our conditions on all items in our ranges, and then process all the values for us. In Chapter 5, we studied how to interpret directions, set up parameters and filter our data depending on a variety of criteria using Excel tables, filters, and slicers.

In this chapter, we continue our work with the College Scorecard dataset we were introduced to in Chapter 6. There, we used PivotTables and PivotCharts to summarize our dataset to gain insights into parameters that describe the cost of education and its return, enrollment trends in different types of programs, the breakdown of the student body, and more. In this chapter, we will look at alternative means of reaching the same answers by using a combination of Excel functions and formulas, we have studied in the earlier chapters.

Table 1 below provides an overview of the functions we will use to return values in Excel. Notice the pattern from SUM to SUMIF to SUMIFS, the combination of SUM + IF, or the combination of SUM + IFS, IF in the plural if

you wish. The structure of these functions implies that we will SUM things up IF they meet *one* condition or criterion. Alternatively, we will SUM things up using the IFS ending when they must meet *multiple* conditions or criteria. The pattern in the composition of the functions is the same across our core mathematical and statistical functions. AVERAGE and COUNT both have so-called conditional versions that allow us to set parameters to base averaging or counting our values based upon.

SUM	Adds values you enter in the formula.
SUMIF	Adds values that meet a single criterion.
SUMIFS	Adds all values that meet multiple criteria.
AVERAGE	Calculates the arithmetic mean of a range of values.
AVERAGEIF	Returns the average of all cells that meet a single criterion.
AVERAGEIFS	Returns the average of all cells that meet multiple criteria.
COUNT	Counts cells using a single criterion.
COUNTIF	Counts cells using multiple criteria.
COUNTIFS	Counts the number of cells that contain numbers.

Table 1: Mathematical and Statistical Functions.

=SUMIF(RANGE, CRITERIA, [SUM_RANGE])

SUMIF essentially asks: what do you want to add up, based on what criteria. The SUMIF syntax starts with our function, then within the parentheses, we must tell Excel what is the *range* of values (text or numbers, blanks will be ignored) we want it to add up based on which *criteria*. Our criteria may be a single value like the number 42,

or ">42", the cell reference for where our criterion is located. If you use text or =, >, >=, etc. operators, then make sure to encase them between " ", or Excel will return an error. The [SUM_RANGE] argument in square brackets indicates that this portion of the argument is optional, we can use it if we want to add up something other than the *range* we specified earlier.

For instance, we want to know how many undergraduates there are in the state of Texas. We have studied a variety of means of answering this question in previous chapters. Now, we want to use our conditional SUM function to return this value.

1. Open your College Scorecard Data Excel file. (<u>You can download a fresh copy from here.</u>)

2. Insert a few additional rows above your data table. Three or four will do.

3. Considering you have over 120 columns in this data set, you can select, right-click and hide columns you do not use for the moment.

4. Convert your range into an Excel table so that your formula will use your field names (column headings)

5. Click into any of the cells above your the first few columns and start on your formula by typing in a = sign.

6. Now, you need to specify to Excel that you want it to look at the *range* of State Abbreviations (STABBR), use TX as your *criteria*, then SUM up values in the column showing the Number of Undergraduates (UGDS). Try this on your own, or

use the Figure below. Note how the Excel table structure makes it easy to see which column you are referencing, as opposed to using range references.

| | × | ✓ | *fx* | =SUMIF(Table1[STABBR],"=TX",Table1[UGDS]) |

	C	D	E	F	CH	CI

The number of undergraduates in Texas.
=SUMIF(Table1[STABBR],"=TX",Table1[UGDS])
SUMIF(range, criteria, [sum_range])

OPEID6	INSTNM	CITY	STABBR	UGDS	UGDS_WHITE
200	1002 Alabama A Normal	AL	4505	0.034
200	1052 University Birmingha	AL	11269	0.5863
400	25034 Amridge U Montgom	AL	308	0.211
500	1055 University Huntsville	AL	5829	0.7024
500	1005 Alabama St Montgom	AL	4740	0.0165

Figure 1. SUMIF Function in use.

7. Note the color-coded borders around each active range in the formula.

8. Now, go ahead, and check the answer using other methods of getting a correct answer. This way, you can confirm that your formula has done its job. You can create an Excel table and filter it for Texas, then use the Total Row, to SUM up the Number of Undergraduates. You can also create a PivotTable using the State Abbreviation and the Number of Undergraduates fields to return an output. Do your answers match?

9. Do a few more variations on this question based on cities, states, regions, types of LOCALE and more!

The SUMIFS function adds all of its arguments that meet multiple criteria (support.office.com).

The syntax for SUMIFS starts with the *range* we want to add up, then we must specify each range with their corresponding criteria.

=SUMIFS(sum_range, criteria_range1, criteria1, [criteria_range2, criteria2], …)

Use your College Scorecard dataset to return the number of undergraduates in the city of Houston, TX enrolled in 2-year-degree programs. Refer to your Data Dictionary to select the fields do you need to include in your calculation. List them on a sheet of paper or on a simple file on your computer you can place next to your College Scorecard data file.

If you get stuck, you can refer to this screenshot. (The table numbers [Table 1, Table 2] will reflect if you convert back to a range to pivot your data and then recreate a table…) When done, use an Excel table or a PivotTable to reach the same answer.

Consider which methods you like the most and practice those to develop not only confidence with Excel but to have multiple avenues of answering questions so that you can double-check your work.

=COUNTIF(RANGE, CRITERIA)

The COUNTIF syntax starts with an equal sign, followed by our function, and then within the parentheses, we

must tell Excel what is the *range* of values we want it to count based on which *criteria*. As with SUMIF, our criteria may be a single value like the number 42, or ">42", the cell reference for where our criterion is located. If you use text or =, >, >=, etc. operators, then make sure to encase them between " ", or Excel will return an error. We do not have an optional argument as we did with SUMIF.

We want to know how many higher educational institutions there are in the state of Texas. Let's use some of the blank cells we inserted into our sheet above our Excel table earlier to find out!

1. Click into any of the cells above your the first few columns and start on your formula by typing in a = sign.

2. Now, you need to specify to Excel that you want it to COUNT. Use the *range* of State Abbreviations (STABBR) and TX as your *criteria.* Try this on your own, or use the Figure below. Note how the Excel table structure makes it easy to see which column you are referencing, as opposed to using range references.
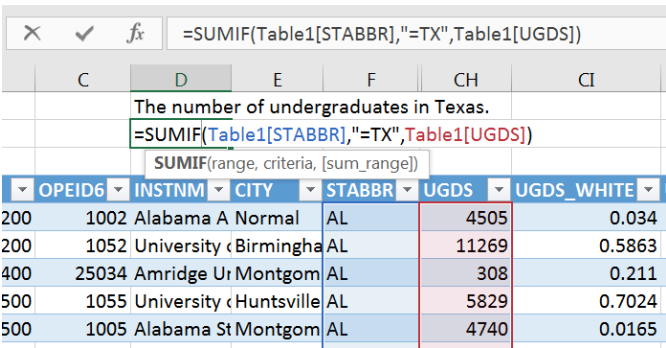
	Number of colleges in TX.						
	=COUNTIF(Table2[STABBR],"=TX")						
	COUNTIF(range, criteria)						
	INSTNM ▾	CITY ▾	STABBR ▾	REGION ▾	HIGHDEG ▾	PCIP52 ▾	P
2	Alabama A	Normal	AL	South	4	0.1479	
2	University (	Birmingha	AL	South	4	0.1837	
4	Amridge U	Montgom	AL	South	4	0.3962	
5	University (	Huntsville	AL	South	4	0.2072	
5	Alabama St	Montgom	AL	South	4	0.0983	
1	The Univer:	Tuscaloos	AL	South	4	0.2886	

Figure 2. COUNTIF Function in use.

3. Note the color-coded borders around each active

range in the formula.

4. Once again, go ahead, and check the answer using other methods of getting a correct answer. This way, you can confirm that your formula has done its job. You can filter your Excel table for Texas, then use the Total Row, to COUNT the Institution Names or the State Abbreviations. You can also create a PivotTable using the State Abbreviation and the Institution Names fields to return an output. Do your answers match?

5. Do a few more variations on this question based on cities, states, regions, types of LOCALE and more!

COUNTIFS Exercise

The **COUNTIFS** function applies criteria to cells across multiple ranges and counts the number of times all criteria are met (support.office.com).

=COUNTIFS(criteria_range1, criteria1, [criteria_range2, criteria2]...)

Use your College Scorecard dataset to return the number of institutions in the city of Houston, TX that offer a 2- year-degree program. Refer to your Data Dictionary to select the fields do you need to include in your calculation. List them on a sheet of paper or on a simple file on your computer you can place next to your College Scorecard data file.

If you get stuck, you can refer to this screenshot. (The table numbers [Table 1, Table 2] will reflect if you convert

back to a range to pivot your data and then recreate a table...) When done, use an Excel table or a PivotTable to reach the same answer.

Again, consider which methods you like the most and practice those to develop not only confidence with Excel but to have multiple avenues of answering questions so that you can double-check your work.

More COUNTIFS Exercises:

- How many online-only education institutions are there in Arizona?

- How many academic institutions are there where more than 50% of students accept a federal loan and more than 50% accept a PELL grant in the state of California?

- How many education institutions are there in the East North Central sub-region in Large Cities?

=AVERAGEIF(RANGE, CRITERIA, [AVERAGE_RANGE])

The AVERAGEIF syntax will behave similarly to SUMIF. Within the parentheses, we must tell Excel what is the *range* of values that have our *criteria,* then in the optional argument in the brackets, we tell which *range* we want it to average if needed. For instance, we want to know what the average % of students enrolled in Business programs in Texas. Let's use some of the remaining blank cells we inserted into our sheet above our Excel table earlier to find out!

1. Click into any of the cells above your the first few columns and start on your formula by typing in a = sign.

2. Now, you need to specify to Excel that you want it to AVERAGE. Use the *range* of State Abbreviations (STABBR) and TX as your *criteria*. Try this on your own, or use the Figure below. Note how the Excel table structure makes it easy to see which column you are referencing, as opposed to using range references.

		Average % students enrolled in Business programs in Texas.				
		=AVERAGEIF(Table2[STABBR],"=TX",Table2[PCIP52])				
		AVERAGEIF(range, criteria, [average_range])				
STABBR	REGION	HIGHDEG	PCIP52	PCIP54	DISTANCEONLY	UGDS
AL	South	4	0.1479	0	0	450!
ha AL	South	4	0.1837	0.0188	0	1126!
m AL	South	4	0.3962	0	1	30:
le AL	South	4	0.2072	0.0117	0	582!
m AL	South	4	0.0983	0.0113	0	474(
ɔs AL	South	4	0.2886	0.0155	0	3100!

Figure 3. AVERAGEIF in use.

3. Note the color-coded borders around each active range in the formula.

4. Once again, go ahead, and check the answer using other methods of getting a correct answer. This way, you can confirm that your formula has done its job. You can filter your Excel table for Texas, then use the Total Row, to COUNT the Institution Names or the State Abbreviations. You can also create a PivotTable using the State Abbreviation and the Institution Names fields to return an output. Do your answers match?

5. Do a few more variations on this question based on cities, states, regions, types of LOCALE and

more!

AVERAGEIFS Exercise

The AVERAGEIFS function returns the average (arithmetic mean) of all cells that meet multiple criteria (source: support.office.com).

=AVERAGEIFS(average_range, criteria_range1, criteria1, [criteria_range2, criteria2], …)

Use your College Scorecard dataset to return the average % of students enrolled in Business programs in Houston, Texas, in 2-year-degree programs. Refer to your Data Dictionary to select the fields do you need to include in your calculation. List them on a sheet of paper or on a simple file on your computer you can place next to your College Scorecard data file.

If you get stuck, you can refer to this screenshot. When done, use an Excel table or a PivotTable to reach the same answer.

More AVERAGEIFS Exercises:

- What is the average % of students enrolled in psychology in the state of California?
- What is the ACT(SAT) average in 4-year-degree institutions in the state of New York?
- What is the average percentage of students who make 25k or more 6 years after they graduate in Arizona from online-only institutions?

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- SUMIF
- COUNTIF
- AVERAGEIF

8.4 CHAPTER PRACTICE

USE THE QUIZLETS BELOW TO TEST YOUR KNOWLEDGE OF THE FORMULAS YOU HAVE JUST PRACTICED IN EXCEL.

Quizlet: Flashcards
https://quizlet.com/413203628/flashcards/embed?i=24veoc&x=1jj1

Quizlet: Matching
https://quizlet.com/413203628/match/embed?i=24veoc&x=1jj1

8.5 CHAPTER ASSESSMENT

THE FOLLOWING ARE SAMPLE QUESTIONS TO TEST WHETHER YOU KNOW, UNDERSTAND, AND ARE ABLE TO APPLY CONCEPTS FROM THIS CHAPTER BASED ON THE CHAPTER 8.1, 8.2, 8.3 WALKTHROUGH PROBLEMS AND THE 8.4 PRACTICE QUIZLET.

1. The _____ function allows you to make a _____ comparison between a value and what you expect by testing for a condition and returning a result if True or False.
   a) IF, Logical
   b) THEN, Conditional
   c) WHATIF, Conditional
   d) IF, Conditional

2. The _____ function determines if ALL conditions in a logical test are TRUE.
   a) IF
   b) AND
   c) OR
   d) NOT

3. You can place multiple AND functions inside an IF function.
   True/False

4. The following formula has a _____ function IF([@PCIP52]>0.15,"High",IF([@PCIP52]>0,"Some","None")).
   a) Conditional
   b) Criteria-based
   c) Nested
   d) Statistical

5. The following formula will output ____ for 0.0683 in the PCIP 52 field.
IF([@PCIP52]>0.15,"High",IF([@PCIP52]>0,"Some",""
None")).
   a) TRUE
   b) FALSE
   c) High
   d) Some

6. Which function will allow you to return the number of colleges in Texas?
   a) COUNTIF
   b) COUNTIFS
   c) SUMIF
   d) SUMIFS

7. How many undergraduates are there in Houston, TX in 2-year-degree programs? Use a conditional function to calculate, use an Excel table or a PivotTable to confirm your answer.
   a) 4472
   b) 47763
   c) 60639
   d) 145204

8. How many students are there in Texas enrolled in 2-year-degree programs? Use a conditional function to calculate, use an Excel table or a PivotTable to confirm your answer.
   a) 4472
   b) 47763
   c) 606845
   d) 145204

9. What is the average % students enrolled in Business programs in Texas? Use a conditional function to calculate, use an Excel table or a PivotTable to confirm your answer.
   a) 8.15%
   b) 12.45%
   c) 15.75%
   d) 30%

10. How many criteria are you evaluating in a conditional function in order to answer the following question? "What is the average % students enrolled in Business programs in Houston, Texas, in 2-year-degree programs?"
   a) 1
   b) 2

c) 3
d) 4

Solutions: ███████████████████████████

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CHAPTER 9: FUNCTIONS FOR PERSONAL FINANCE

In this chapter, we revisit our **Personal Budget** workbook from [Chapter 2](). Notable items that were missing from the **Budget Detail** worksheet are the payments you might make for a car or a home. This section demonstrates Excel functions used to calculate lease payments for a car and to calculate mortgage payments for a house.

THE FUNDAMENTALS OF LOANS AND LEASES

One of the functions we will add to the Personal Budget workbook is the PMT function. This function calculates the payments required for a loan or a lease. However, before demonstrating this function, it is important to cover a few fundamental concepts on loans and leases.

A loan is a contractual agreement in which money is borrowed from a lender and paid back over a specific period of time. The amount of money that is borrowed from the lender is called the principal of the loan. The borrower is usually required to pay the principal of the loan plus interest. When you borrow money to buy a

house, the loan is referred to as a mortgage. This is because the house being purchased also serves as collateral to ensure payment. In other words, the bank can take possession of your house if you fail to make loan payments. As shown in **Table 9.1**, there are several key terms related to loans and leases.

Table 9.1 Key Terms for Loans and Leases

Term	Definition
Collateral	Any item of value that is used to secure a loan to ensure payments to the lender
Down Payment	The amount of cash paid toward the purchase of a house. If you are paying 20% down, you are paying 20% of the cost of the house in cash and are borrowing the rest from a lender.
Interest Rate	The interest that is charged to the borrower as a cost for borrowing money
Mortgage	A loan where property is put up for collateral
Principal	The amount of money that has been borrowed
Residual Value	The estimated selling price of a vehicle at a future point in time
Terms	The amount of time you have to repay a loan

Figure 9.1 shows an example of an amortization table for a loan. A lender is required by law to provide borrowers with an amortization table when a loan contract is offered. The table in the figure shows how the payments of a loan would work if you borrowed $100,000 from a lender and agreed to pay it back over 10 years at an interest rate of 5%. You will notice that each time you make a payment, you are paying the bank an interest fee plus some of the loan principal. Each year the amount of interest paid to the bank decreases and the amount of money used to pay off the principal increases. This is because the bank is charging you interest on the amount

of principal that has not been paid. As you pay off the principal, the interest rate is applied to a lower number, which reduces your interest charges. Finally, the figure shows that the sum of the values in the Interest Payment column is $29,505. This is how much it costs you to borrow this money over 10 years. Indeed, borrowing money is not free. It is important to note that to simplify this example, the payments were calculated on an annual basis. However, most loan payments are made on a monthly basis.

	A	B	C	D
1	**Loan Details**			
2	Annual Interest Rate		5.0%	
3	Terms in Years		10	
4	Loan Principal		$ 100,000	
5	**Annual Payments**		**$12,950**	For each year, the Interest Payment plus the Principle Payment is $12,950.
6				
7	*Amortization Table for Loan*			
8	Year	Interest Payment	Principal Payment	Beginning Principal Balance
9	1	$ 5,000	$ 7,950	$ 100,000
10	2	$ 4,602	$ 8,348	$ 92,050
11	3	$ 4,185	$ 8,765	$ 83,702
12	4	$ 3,747	$ 9,204	$ 74,936
13	5	$ 3,287	$ 9,664	$ 65,733
14	6	$ 2,803	$ 10,147	$ 56,069
15	7	$ 2,296	$ 10,654	$ 45,922
16	8	$ 1,763	$ 11,187	$ 35,267
17	9	$ 1,204	$ 11,746	$ 24,080
18	10	$ 617	$ 12,334	$ 12,334

Total for this column is $29,505.

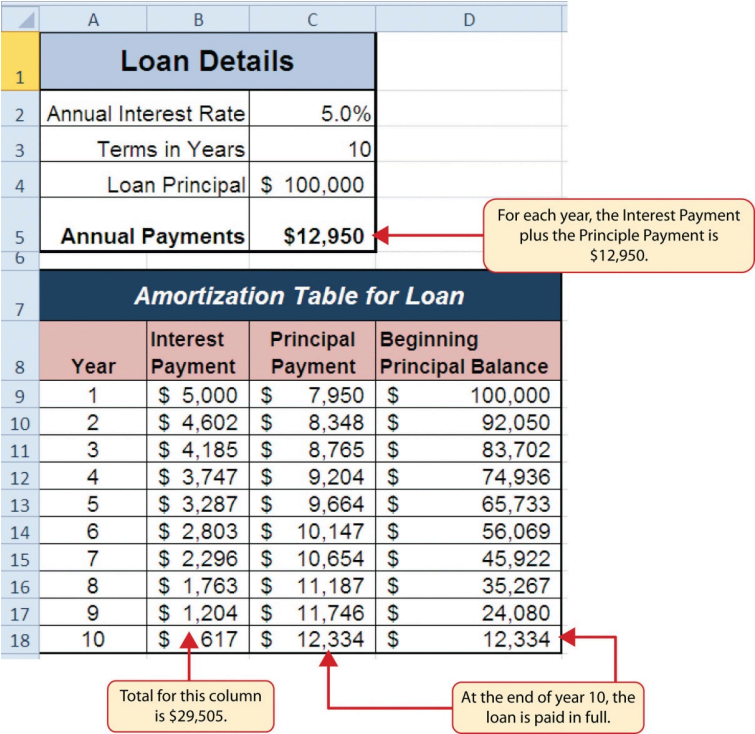At the end of year 10, the loan is paid in full.

Figure 9.1 Example of an Amortization Table

A lease is a contract in which you, the lessee, use an asset such as a car or a piece of equipment and you agree to make regular payments to the owner or the lessor. When

you lease a car, the manufacturer or a leasing company retains ownership of the vehicle and you agree to make regular payments for a specific period of time. The amount of money you pay depends on the price of the car, the terms of the lease contract, and the car's expected residual value at the end of the lease. The calculation of lease payments is similar to the calculation of loan payments. However, when you lease a car, you pay only the value of the car that is used. For example, suppose you are leasing a car that is priced at $25,000. The lease contract is for 4 years at an interest rate of 5%. The residual value of the car is $10,000. This means the car will lose $15,000 of its value over 4 years. Another way to state this is that the car will depreciate $15,000. A lease will be structured so that you pay this $15,000 in depreciation. However, the interest charges will be based on the purchase price of $25,000. We will look at a demonstration of leasing a car as well as buying a home in the next section.

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9.1 THE PMT (PAYMENT) FUNCTION FOR LOANS

Learning Objectives

1. Understand the fundamentals of loans and leases.

2. Use the PMT function to calculate monthly mortgage payments on a house.

3. Use the PMT function to calculate monthly lease payments for an automobile.

4. Learn how to summarize data in a workbook by using worksheet links to create a summary worksheet.

THE PMT (PAYMENT) FUNCTION FOR LOANS

Data file: Continue with CH2 Personal Budget.

If you own a home, your mortgage payments are a major component of your household budget. If you are planning to buy a home, having a clear understanding of

your monthly payments is critical for maintaining strong financial health. In Excel, mortgage payments are conveniently calculated through the PMT (payment) function. This function is more complex than the statistical functions covered in Section 2.2 "Statistical Functions". With statistical functions, you are required to add only a range of cells or selected cells within the parentheses of the function, also known as the argument. With the PMT function, you must accurately define a series of arguments in order for the function to produce a reliable output. **Table 9.1.1** lists the arguments for the PMT function. It is helpful to review the key loan and lease terms below before reviewing the PMT function arguments.

Table 9.1.1Arguments for the PMT Function

Argument	Definition
Rate	This is the interest rate the lender is charging the borrower. The interest rate is usually quoted in annual terms, so you have to divide this rate by 12 if you are calculating monthly payments.
Nper	The argument letters stand for number of periods. This is the term of the loan, which is the amount of time you have to repay the bank. This is usually quoted in years, so you have to multiply the years by 12 if you are calculating monthly payments.
Pv	The argument letters stand for present value. This is the principal of the loan or the amount of money that is borrowed. **When defining this argument, a minus sign must precede the cell location or value.** For leases, this argument is used for the price of the item being leased.
[Fv]	The argument letters stand for future value. The brackets around the argument indicate that it is not always necessary to define it. It is used if there is a lump-sum payment that will be made at the end of the loan terms. This is also used for the residual value of a lease. If it is not defined, Excel will assume that it is zero.
[Type]	This argument can be defined with either a 1 or a 0. The number 1 is used if payments are made at the beginning of each period. A 0 is used if payments are made at the end of each period. The argument is in brackets because it does not have to be defined if payments are made at the end of each period. Excel assumes that this argument is 0 if it is not defined.

By default, the result of the PMT function in Excel is shown as a negative number. This is because it represents an outgoing payment. When making a mortgage or car payment, you are paying money out of your pocket or bank account. Depending on the type of work that you do, your employer may want you to leave your payments negative or they may ask you to format them as positive numbers. In the following assignments, the payments calculated using the PMT function will be made positive to make them easier to work with. To do this, when defining the PV argument (amount of money borrowed)

in the PMT dialog box, a minus sign must precede the cell location or value.

We will use the PMT function in the Personal Budget workbook to calculate the monthly mortgage payments for a house. These calculations will be made in the **Mortgage Payments** worksheet and then displayed in the **Budget Summary** worksheet through a cell reference link. So far we have demonstrated several methods for adding functions to a worksheet. The following steps explain a new method using the Insert Function command for adding the PMT function:

1. Click the **Mortgage Payments** worksheet tab.

2. Click cell B5.

3. Click the Formulas tab on the Ribbon.

4. Click the Insert Function button (see **Figure 9.1.1**). This opens the Insert Function dialog box, which can be used for searching all functions in Excel.

5. In the "Search for a function:" input box at the top of the Insert Function dialog box, type **mortgage payments** (see **Figure 9.1.2**). Note that the current description in the "Search for a function:" input box will already be highlighted. You can begin typing and the description will be replaced with your entry.

6. Click the Go button in the upper right side of the Insert Function dialog box. This adds all the Excel functions that match your description in the "Select a function:" box in the lower half of the Insert Function dialog box (see **Figure 9.1.3**).

7. Click the PMT option in the "Select a function:" box in the lower half of the Insert Function dialog box.

8. Click the OK button at the lower right side of the Insert Function dialog box. This will open the Function Arguments dialog box.
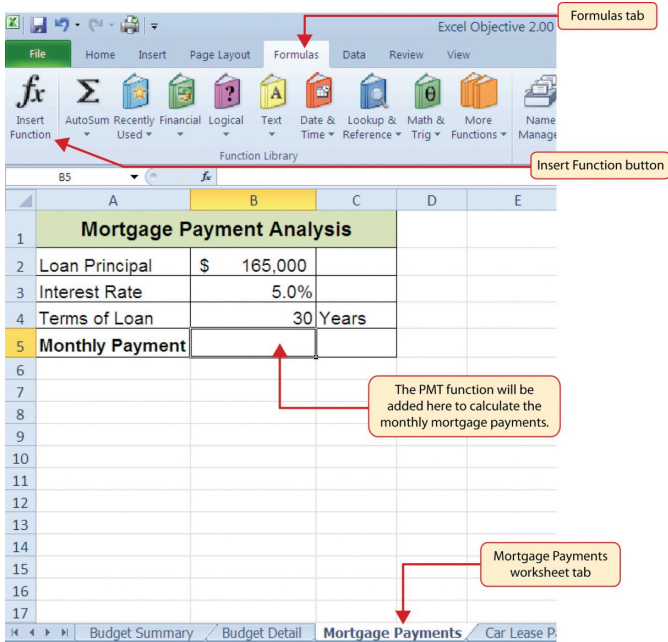

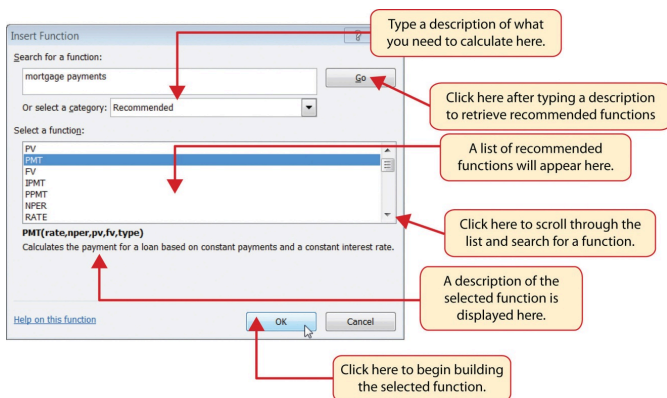Figure 9.1.1 Mortgage Payments Worksheet

Figure 9.1.2 Insert Function Dialog Box

9. Click the Collapse Dialog button next to the Rate argument in the Function Arguments dialog box. This will be the first argument defined for the function.

10. Click cell B3 on the worksheet. This is the rate being charged on the loan.

11. Type a forward slash / for division.

12. Type the number **12**. Since our goal is to calculate the monthly payments for the loan, we need to divide the rate, which is stated in annual terms, by 12. This converts the annual rate to a monthly rate.

13. Press the ENTER key on your keyboard. This returns the Function Arguments dialog box to its expanded form. You will also see that the Rate argument is now defined.

14. Click the Collapse Dialog button next to the Nper argument in the Function Arguments dialog box.

This is the second argument we define in the function.

15. Click cell B4 on the worksheet. This is the term or the amount of time we have to repay the loan.

16. Type an **asterisk** * for multiplication.

17. Type the number **12**. Since our goal is to calculate the monthly payments for the loan, we need to multiply the terms of the loan by 12. This converts the terms of the loan from years to months.

18. Press the ENTER key on your keyboard. This returns the Function Arguments dialog box to its expanded form. You will also see that the Nper argument is now defined.

19. Click the Collapse Dialog button next to the Pv argument in the Function Arguments dialog box. This is the third argument we will define in the function.

20. Type a minus sign **–**. When defining the Pv argument of the PMT function, any cell location or value must be preceded with a minus sign.

21. Click cell B2 on the worksheet. This is the principal of the loan.

22. Press the ENTER key on your keyboard. You will now see the Rate, Nper, and Pv arguments defined for the function.

23. Click the OK button at the bottom of the Function Arguments dialog box. The function will now be placed into the worksheet. Since we are not paying any lump sums of money at the end of the loan, there is no need to define the Fv

argument. Also, we will assume that the monthly mortgage payments will be made at the end of each month. Therefore, there is no need to define the Type argument.

Keyboard Shortcuts

Insert Function

- Hold the SHIFT key while pressing the F3 key.

Function Arguments Dialog Box

- After the equal sign = and function name are typed into cell a location, hold down the CTRL key and press the letter A on your keyboard.

Figure 9.13 shows the completed Function Arguments dialog box for the PMT function. Notice that the dialog box shows the values for the Rate and Nper arguments. The Rate is divided by 12 to convert the annual interest rate to a monthly interest rate. The Nper argument is multiplied by 12 to convert the terms of the loan from years to months. Finally, the dialog box provides you with a definition for each argument. The definition appears when you click in the input box for the argument.
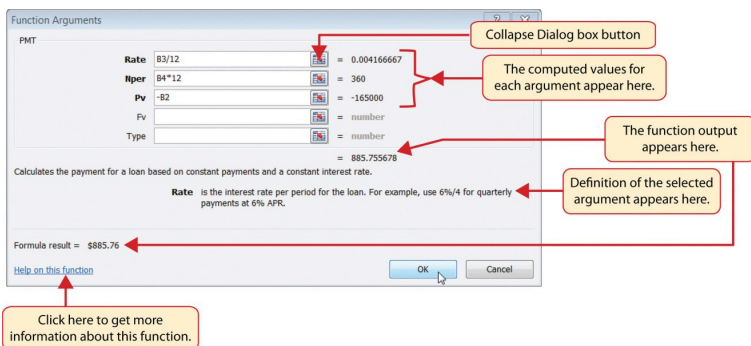
Figure 9.1.3 Function Arguments Dialog Box for the PMT Function

Integrity Check

Comparable Arguments for PMT Function

When using functions such as PMT, make sure the arguments are defined in comparable terms. For example, if you are calculating the monthly payments of a loan, make sure both the Rate and Nper argument are expressed in terms of months. The function will produce an erroneous result if one argument is expressed in years while the other is expressed in months.

Figure 9.1.4 shows the final appearance of the Mortgage Payments worksheet after the PMT function is added. The result of the function in cell B5 will be displayed in the Budget Summary worksheet.

Figure 9.1.4 Mortgage Payments Worksheet with the PMT Function

---

Skill Refresher

PMT Function

1. Type an equal sign =.

2. Type the letters **PMT** followed by an open parenthesis, or double click the function name from the function list.

3. Define the Rate argument with a cell location that contains the rate being charged by the lender for the loan or lease. If the interest rate given is an annual rate, divide it by 12 to convert it to a monthly rate.

4. Define the Nper argument with a cell location that contains the amount of time to repay the

loan or lease. If the amount of time is in years, multiply it by 12 to convert it to number of months.

5.   Define the Pv argument with a cell location that contains the principal of the loan or the price of the item being leased. **Cell locations or values used for this argument must be preceded by a minus sign.**

6.   Define the [Fv] argument with a cell location that contains the residual value of the item being leased or the lump sum payment for a loan.

7.   Define the [Type] argument with a 1 if payments are made at the beginning of each period or 0 if payments are made at the end of each period.

8.   Type a closing parenthesis **)**.

9.   Press the ENTER key.

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9.2 THE PMT (PAYMENT) FUNCTION FOR LEASES

THE PMT (PAYMENT) FUNCTION FOR LEASES

In addition to calculating the mortgage payments for a home, the PMT function will be used in the Personal Budget workbook to calculate the lease payments for a car. The details for the lease payments are found in the **Car Lease Payments** worksheet. Similar to the statistical functions, we can either type the PMT function directly into a cell or use the Insert Function button. However, you must know the definitions for each argument of the function and understand how these arguments need to be defined based on your objective. The terms for loans and leases, and the definitions for the arguments of the PMT function were listed in the previous chapter. The following steps explain how the PMT function is added to the Personal Budget workbook to calculate the lease payments for a car:

1. Click cell B6 in the **Car Lease Payments** worksheet.

2. Click the Formulas tab on the Ribbon.

3. Click the Financial button in the Function Library

group. This opens the Financial Function drop-down list.

4. Scroll down and click on the PMT Function in the drop-down list. This will open the PMT Function Arguments dialog box. See **Figure 9.2.1**.

5. Click the Collapse Dialog button next to the Rate argument in the PMT Function Arguments dialog box. This will be the first argument defined for the monthly car lease payment.

6. Click cell B4. This is the interest rate being charged for the lease.

7. Type the forward slash / for division.

8. Type the number **12**. Since our goal is to calculate the monthly lease payments, we divide the interest rate by 12 to convert the annual rate to a monthly rate.

9. Press the ENTER key on your keyboard. This returns the Function Arguments dialog box to its expanded form. You will also see that the Rate argument is now defined.

10. Click the Collapse Dialog button next to the Nper argument in the Function Arguments dialog box. This is the second argument we define in the function.

11. Click cell B5. This is the term or the length of time for the lease contract. Since the term is already expressed in months, we can just reference cell B5 and move to the next argument. If the term was defined in years, instead of months, we would need to multiply the terms

(years) of the loan by 12 to convert the years to months.

12. Press the ENTER key on your keyboard. This returns the Function Arguments dialog box to its expanded form. You will also see that the Nper argument is now defined.

13. Click the Collapse Dialog button next to the Pv argument in the Function Arguments dialog box. This is the third argument we will define in the function.

14. Type a minus sign **–**. Remember that cell locations or values used to define the Pv argument must be preceded with a minus sign.

15. Click cell B2 on the worksheet, which is the price of the car.

16. Press the ENTER key on your keyboard. You will now see the Rate, Nper, and Pv arguments defined for the function.

17. Click the Collapse Dialog button next to the Fv argument in the Function Arguments dialog box. This is the fourth argument we will define in the function.

18. Click cell B3 on the worksheet. This is the residual value of the car. Note that cell location and values used to define the [Fv] argument are NOT preceded by a minus sign.

19. Press the ENTER key on your keyboard. You will now see the Rate, Nper, Pv and Fv arguments defined for the function.

20. Click the Collapse Dialog button next to the Type

argument in the Function Arguments dialog box. This is the fifth and last argument we will define in the function.

21. Type the number **1**. We will assume that the lease payments will be due at the beginning of each month. For payments made at the beginning of the period, a 1 will be entered in the Type argument box. For payments made at the end of the period, a 0 will be entered in the Type argument box.

22. Press the ENTER key. You will now see the Rate, Nper, Pv, Fv and Type arguments defined for the function. See **Figure 9.2.1**.

23. Click the OK button at the bottom of the Function Arguments dialog box. The function will now be placed into the worksheet.

Figure 9.2.1 shows how the the completed Function Arguments dialog box for the PMT function car lease should appear before pressing the OK button.
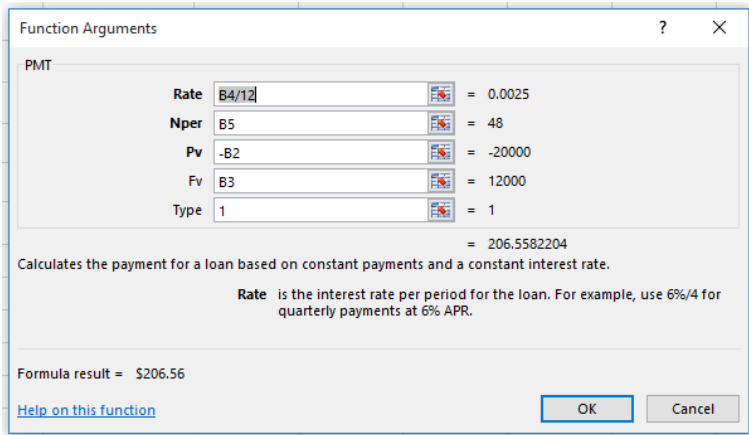
Figure 9.2.1 Function Arguments Dialog Box for the PMT Lease Function

Figure 9.2.2 shows the result of the PMT function for the car lease. The monthly payments for this lease are $206.56. This monthly payment will be displayed in the **Budget Summary** worksheet.
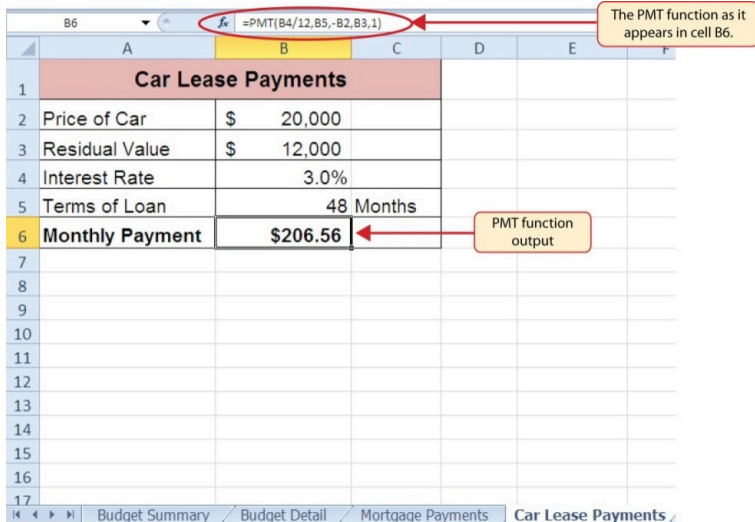

Figure 9.2.2 Results of the PMT Function in the Car Lease Payments Worksheet

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9.3 CREATING A BUDGET SUMMARY WORKSHEET

LINKING WORKSHEETS (CREATING A SUMMARY WORKSHEET)

So far we have used cell references in formulas and functions, which allow Excel to produce new outputs when the values in the cell references are changed. Cell references can also be used to display values or the outputs of formulas and functions in cell locations on other worksheets. This is how data will be displayed on the **Budget Summary** worksheet in the **Personal Budget** workbook. Outputs from the formulas and functions that were entered into the **Budget Detail, Mortgage Payments**, and **Car Lease Payments** worksheets will be displayed on the **Budget Summary** worksheet through the use of cell references. The following steps explain how this is accomplished:

1. Click cell C3 in the **Budget Summary** worksheet.
2. Type an equal sign =.
3. Click the **Budget Detail** worksheet tab.
4. Click cell D12 on the Budget Detail worksheet.

5. Press the ENTER key on your keyboard. The output of the SUM function in cell D12 on the **Budget Detail** worksheet will be displayed in cell C3 on the **Budget Summary** worksheet.

Figure 9.3.1 shows how the cell reference appears in the **Budget Summary** worksheet. Notice that the cell reference D12 is preceded by the **Budget Detail** worksheet name enclosed in apostrophes followed by an exclamation point ('Budget Detail'!) This indicates that the value displayed in the cell is referencing a cell location in the **Budget Detail** worksheet.

Figure 9.3.1 Cell Reference Showing the Total Expenses in the Budget Summary Worksheet

As shown in **Figure 9.3.1**, the **Budget Summary** worksheet is designed to show the expense budget for the mortgage payments and the auto lease payments. However, you will recall that we used the PMT function to calculate the monthly payments. In the **Budget Summary** worksheet, we need to show the

total annual payments. As a result, we will create a formula that references cell locations in the **Mortgage Payments** and **Car Lease Payments** worksheets. The following steps explain how this is accomplished:

1. Click cell C4 in the **Budget Summary** worksheet.

2. Type an equal sign =.

3. Click the **Mortgage Payments** worksheet tab.

4. Click cell B5 in the **Mortgage Payments** worksheet.

5. Type an asterisk * for multiplication.

6. Type the number **12**. This multiplies the monthly payments by 12 to calculate the total payments required for the year. The formula in the formula bar should read: ='Mortgage Payments'!B5*12

7. Press the ENTER key on your keyboard. The value of multiplying the monthly mortgage payments by 12 is now displayed on the **Budget Summary** worksheet.

8. Click cell C5 on the **Budget Summary** worksheet.

9. Type an equal sign =.

10. Click the **Car Lease Payments** worksheet tab.

11. Click cell B6 in the **Car Lease Payments** worksheet.

12. Type an asterisk * for multiplication.

13. Type the number **12**. This multiplies the monthly lease payments by 12 to calculate the total payments required for the year.

14. Press the ENTER key on your keyboard. The value of multiplying the monthly lease payments by 12 is now displayed on the **Budget Summary** worksheet.

Figure 9.3.2 below shows the results of creating formulas that reference cell locations in the **Mortgage Payments** and **Car Lease Payments** worksheets.

Figure 9.3.2 Formulas Referencing Cells in Mortgage Payments and Car Lease Payments Worksheets

We can now add other formulas and functions to the **Budget Summary** worksheet that can calculate the difference between the total spend dollars vs. the total net income in cell D2. The following steps explain how this is accomplished:

1. Click cell D6 in the **Budget Summary** worksheet.

2. Type an equal sign =.

3. Type the function name **SUM** followed by an open

parenthesis (.

4. Highlight the range C3:C5.

5. Type a closing parenthesis) and press the ENTER key on your keyboard or simply press the ENTER key to close the function. The total for all annual expenses now appears on the worksheet.

6. Click cell D7 on the **Budget Summary** worksheet. You will enter a formula to calculate Net Change in Cash in this cell.

7. Type an equal sign =.

8. Click cell D2.

9. Type a minus sign – and then click cell D6.

10. Press the ENTER key on your keyboard. This formula produces an output of $1,942, indicating our income is greater than our total expenses.

Figure 9.3.3 shows the results of the formulas that were added to the **Budget Summary** worksheet. The output for the formula in cell D7 shows that the net income exceeds total planned expenses by $1,942. Overall, having your income exceed your total expenses is a good thing because it allows you to save money for future spending needs or unexpected events.

Figure 9.3.3 Formulas Added to Show Income Is Greater Than Expenses

We can now add a few formulas that calculate both the spending rate and the savings rate as a percentage of net income. These formulas require the use of absolute references, which we covered earlier in this chapter. The following steps explain how to add these formulas:

1. Click cell E6 in the **Budget Summary** worksheet.

2. Type an equal sign =.

3. Click cell D6.

4. Type a forward slash / for division and then click D2.

5. Press the F4 key on your keyboard. This adds an absolute reference to cell D2.

6. Press the ENTER key. The result of the formula shows that total expenses consume 94.1% of our net income.

7. Click cell E6.

8. Place the mouse pointer over the Auto Fill Handle.

9. When the mouse pointer turns to a black plus sign, left click and drag down to cell E7. This copies and pastes the formula into cell E7.

10. Save the **CH2 Personal Budget** file.

11. Compare your work with the self-check answer key (found in the Course Files link) and then submit the **CH2 Personal Budget** workbook as directed by your instructor.

12. Close the **CH2 Personal Budget** file before moving on to 2.4 – Preparing to Print.

Figure 9.3.4 shows the output of the formulas calculating the spending rate and savings rate as a percentage of net income. The absolute reference shown for cell D2 prevents the cell from changing when the formula is copied from cell E6 and pasted into cell E7. The results of the formula show that our current budget allows for a savings rate of 5.9%. This is a fairly good savings rate.

Figure 9.3.4 Calculating the Savings Rate

Key Takeaways

- The PMT function can be used to calculate the monthly mortgage payments for a house or the monthly lease payments for a car.

- When using the PMT function, each argument must be separated by a comma.

- To calculate the monthly payment for a loan using the PMT function, the Rate and Nper arguments must be defined in terms of months. The Rate should be divided by 12 to convert it from an annual rate to a monthly rate. The Nper should be multiplied by 12 to convert the term of the loan from years to months.

- The PMT function produces a negative output if the Pv argument is not preceded by a minus sign. For the purposes of this textbook, a minus sign will be

entered before the PV argument in the PMT dialog box.

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9.4 CHAPTER PRACTICE

FINANCIAL PLAN FOR A LAWN CARE BUSINESS

Download Data File: PR9 Data

Running your own lawn care business can be an excellent way to make money over the summer while on break from college. It can also be a way to supplement your existing income for the purpose of saving money for retirement or for a college fund. However, managing the costs of the business will be critical in order for it to be a profitable venture. In this exercise you will create a simple financial plan for a lawn care business by using the skills covered in this chapter.

1. Open the file named **PR9 Data** and then Save As **PR9 Lawn Care**.

2. Click cell C5 in the **Annual Plan** worksheet.

3. Write a formula that calculates the average price per lawn cut. Do **not** use the AVERAGE function. The formula should be the Price per Acre multiplied by the Average Acreage per Customer.

4. Click cell C8.

5. Enter a formula that calculates the total number of

lawns that will be cut during the year (Number of Customers * Frequency of Lawn Cuts per Customer).

6. Click cell D9.

7. Enter a formula that calculates the total sales for the plan (Average Price per Cut * Total Lawn Cuts).

8. Click cell F3 in the **Leases** worksheet. The PMT function will be used to calculate the monthly lease payment for the first item. For many businesses, leasing (or renting) equipment is a more favorable option than purchasing equipment because it requires far less cash. This enables you to begin a business such as a lawn care business without having to put up a lot of money to buy equipment. The PMT function can be entered using the Insert Function button as seen in Chapter 2, or we can type the PMT function directly into a cell. For this assignment, we will type the function into cell F3 using the following instructions.

9. Type =**PMT(**. Define the arguments of the function as follows:

10. Rate: Click cell B3, type a forward slash / for division, type the number **12**, and type a comma **,**. Since we are calculating monthly payments, the annual interest rate must be converted to a monthly interest rate by dividing by 12.

11. Nper: Click cell C3, type ***12** and then type a comma **,**. Similar to the Rate argument, the terms of the lease must be converted to months by

multiplying by 12 since we are calculating monthly payments.

12. Pv: Type a minus sign **–**, click cell D3, and type a comma **,**. Remember that this argument must always be preceded by a minus sign.

13. Fv: Click cell E3 (Residual Value) and type a comma **,**.

14. Type: Type the number **1**, type a closing parenthesis **)**, and press the ENTER key. We will assume the lease payments will be made at the beginning of each month, which requires that this argument be defined with a value of 1.

15. Copy the PMT function in cell F3 and paste it into the range F4:F6, or use the Autofill handle.

16. Click cell F10 in the **Leases** worksheet. Enter an Autosum function to calculate the total for the monthly lease payments. Make sure that blank rows (7 through 9) were included in the range for the SUM function. If other items are added to the worksheet, they will be included in the output of the SUM function.

17. Highlight the range A2:F6 on the **Leases** worksheet. The data in this range will be sorted, first by Interest Rate and then by Price. Click the Sort button in the Data tab of the Ribbon. In the Sort dialog box, select the Interest Rate option in the "Sort by" drop-down box. Select Largest to Smallest for the sort order. Then, click the Add Level button on the Sort dialog box. Select the Price option in the "Then by" drop-down box. Select Largest to Smallest for the sort

order. Click the OK button in the Sort dialog box.

18. Click cell B11 on the **Annual Plan** worksheet. The monthly lease payments that are calculated in the **Lease** worksheet will be displayed in this cell.

19. Type an equal sign =. Click the **Leases** worksheet, click cell F10, and press the ENTER key.

20. Click cell C12 on the Annual Plan worksheet. Create a formula that calculates the annual lease payments. This should be the Monthly Lease Payments * 12.

21. Click cell C14 on the **Annual Plan** worksheet. Create a formula that calculates the Total Lawn & Equipment Expenses (Lawn & Equipment Expenses per Cut * Total Lawn Cuts).

22. Click cell D16 on the **Annual Plan** worksheet. Enter a SUM function that adds the Expenses for the business in column C. Make sure to add the Expenses only (not the Sales Plan information).

23. Click cell D17 on the **Annual Plan** worksheet. Enter a formula that calculates the annual profit (Operating Income) for the business. This should be the Total Sales – Total Expenses.

24. Format all cells that contain money amounts in the Annual Plan worksheet for Accounting Number Format ($) with no decimals.

25. Click cell B10 on the **Investments** worksheet. Enter a COUNT function that counts the number of investments that currently have a balance in column B. Make sure that the additional blank rows in rows 6 through 8 are included in the

range for this function. The function output will automatically change if any new investments are added to the worksheet. It is important to note, however, that the Total in cell B9 should not be included in the Count range.

26. Click cell D3 on the **Investments** worksheet.

27. Type an equal sign =. Click the **Annual Plan** worksheet. Click cell D17 and type a forward slash / for division. Click the **Investments** worksheet. Click cell B10 and press the ENTER key. This formula divides the profit calculated on the Annual Plan worksheet by the number of investments in the Investments worksheet. We will assume that the profits from this business will be invested evenly among the funds listed in Column A of the Investments worksheet.

28. Before copying and pasting the formula created in cell D3, absolute references must be added to the cell locations in the formula. Edit the formula in cell D3 on the **Investments** worksheet so that cells D17 and B10 are absolute. The formula in cell D3 should be: ='Annual Plan'!$D$17/ Investments!$B$10. When you copy the formula in cell D3 down, the cell references will not change, because they are absolute. The formula will continue to divide the Operating Income in cell D17 of the Annual Plan by the Number of Investments in cell B10 of the Investments sheet.

29. Copy cell D3 and paste it into cells D4 and D5 or use the Auto Fill handle to copy down.

30. Click cell B9 on the Investments worksheet. Enter a SUM function that adds the current balance for all investments in column B. Make sure that blank rows (rows 6 through 8) are added to the range for the function so additional investments will automatically be included in the Autosum function output.

31. Copy the SUM function in cell B9 and paste it into cell D9.

32. Format the Investments and Leases sheets appropriately for Accounting Format. This should include $ signs on the top row and total row for money amounts, and comma style in the middle rows. In the Investments sheet, apply Comma Style with 0 decimals to the ranges B4:B5 and D4:D5. In the Leases worksheet, apply Accounting Number Format ($) with two decimals to the range D3:F3 and F10. Apply comma format with two decimals to the range D4:F9. Double check that your formatting matches Figures 2.47a through 2.47c.

33. Save the **PR2 Lawn Care** workbook.

	A	B	C	D
1	**Lawn Care Annual Financial Plan**			
2	**Sales Plan:**			
3	Price per Acre	$ 50		
4	Average Acreage per Customer	0.5		
5	Average Price per Cut		$ 25	
6	Number of Customers	30		
7	Frequency of Lawn Cuts per Customer	22		
8	Total Lawn Cuts		660	
9	*Total Sales*			$ *16,500*
10	**Expenses:**			
11	Monthly Lease Payments	$ 122		
12	Annual Lease Payments		$ 1,461	
13	Lawn & Equipment Expenses Per Cut	$ 5		
14	Total Lawn & Equipment Expenses		$ 3,300	
15	Office and Other Expenses		$ 1,500	
16	*Total Expenses*			$ *6,261*
17	**Operating Income**			$ 10,239
18				
19				
20				

Annual Plan | Investments | Leases | (+)

Figure 9.4a Completed Lawn Care Annual Plan Worksheet

	A	B	C	D
1	**Investment Analysis**			
2	**Investment Fund**	**Current Balance**	**Target Growth Rate**	**Annual Investments**
3	Treasury Bond	$ 10,000	4.5%	$ 3,413
4	Domestic Stock Fund	20,000	8.0%	3,413
5	Emerging Markets	10,000	10.5%	3,413
6				
7				
8				
9	**Total**	$ 40,000		$ 10,239
10	**Number of Investments**	3		
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Annual Plan | **Investments** | Leases

Figure 9.4b Completed Lawn Care Investments Worksheet

	A	B	C	D	E	F
1	**Equipment Leasing Plan**					
2	**Item**	**Interest Rate**	**Terms of Lease in Years**	**Price**	**Residual Value**	**Monthly Payment**
3	Blower	6.0%	3	$ 700.00	$ 200.00	$ 16.13
4	Commercial Lawn Mower	5.5%	4	6,000.00	3,000.00	83.14
5	Edger	4.0%	2	400.00	150.00	11.32
6	Trimmer	4.0%	2	350.00	100.00	11.15
7						
8						
9						
10	**Total**					$ 121.74
11						
12						
13						
14						
15						
16						
17						

Annual Plan | Investments | **Leases**

Figure 9.4c Completed Lawn Care Leases Worksheet

ATTRIBUTION

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- Lawn Care Finished

9.5 CHAPTER ASSESSMENT

COMPLETE THE 9.4 CHAPTER PRACTICE, COMPARE YOUR OUTPUTS TO THE SCREENSHOTS POSTED THERE.

TEST YOUR KNOWLEDGE OF TERMS USING THE QUIZLET BELOW:

https://quizlet.com/413785651/flashcards/embed?i=24veoc&x=1jj1

CHAPTER 10:
INTEGRATING MICROSOFT OFFICE SUITE APPLICATIONS

Microsoft offers a range of productivity tools that seamlessly integrate across applications allowing you to process content in one app and continue to develop in another. This means you can take advantage of data storage and processing related features in Access or Excel and then create a report using your findings in Word, prepare a presentation in PowerPoint, add annotations in OneNote. You can also take data from Access or Excel and create mailing lists, labels, or personalized promotional materials for printing using Word or for e-mail in Outlook. You can find a full list of the Office Apps with great detailed documentation and tutorials on [the support.office.com website](#).

In this chapter, we look at some of the opportunities for integrating Office Suite applications, including the use of mail merge, embedding, and linking content.

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10.1 CLEANING AND RESTRUCTURING DATA IN EXCEL

Before we can work with our data, we need to make sure it's valid, accurate, and reliable. In the age of Big Data, companies may spend just as much or more on maintaining the health and cleaning their data as they spend on collecting or purchasing it in the first place. Consider the issues that can stem from missing or wrong values, duplicates, and typos. The validity, accuracy, and reliability of your calculations depend on your ability to keep your data up-to-date. Many estimates show that about 30% of your data may become inaccurate over time (JD Supra, 2019; Strategic DB, 2019) and even small data sets can be costly to clean, let alone files that are tens or hundreds of thousands of records deep – or much more if you are using large scale databases.

There are many data cleaning solutions out there for a wide range of file formats, data volumes, or budgets. However, there are many things we can accomplish using Excel functions and features so that you can process our data quickly and effectively. Instead of purchasing an application, assigning data cleaning to an employee, or hiring a service to scrub your data, for records under a million per sheet, Excel can save you a great deal of time

and funds using a variety of functions and features. Table 10.1 shows you some important functions that can help you clean up your data.

CLEAN	Removes all nonprintable characters from text.
TRIM	Removes all spaces from text except for single spaces between words.
CONCATENATE	Join two or more text strings into one string.
LEFT	Returns a string containing a specified number of characters from the left side of a string.
RIGHT	Returns a string containing a specified number of characters from the right side of a string.
MID	Returns a specific number of characters from a text string.
SEARCH	SEARCH returns the number of the character at which a specific character or text string is first found.
FIND and FINDB	Locate one text string within a second text string.
UPPER	Converts text to uppercase.
LOWER	Converts text to lowercase.
PROPER	Capitalizes the first letter in a text string and any other letters in text that follow any character other than a letter. Converts all other letters to lowercase letters.
TEXT	Change the way a number appears by applying formatting to it with format codes.
VALUE	Converts a text string that represents a number to a number.

Table 10.1 A sample of text and data cleaning functions in Excel.

The following sections show the functions above in action. The Ch10_Data_File contains four sheets. The *Documentation* sheet notes the sources of our data. *Text_FUNC* sheet features a variety of common errors you may see in a data set, including line breaks in the

wrong place, extra spaces or no spaces in between words, non-printing characters, improperly capitalized or all upper case, all lower case text, ill-formatted data values. The *DataGen_Companies* sheet contains a set of "dummy" (plausible, but not real) data about companies generated at https://www.generatedata.com/ that the author of this chapter intentionally injected with common errors seen in data in order to unfold and process it for the sake of practicing Excel functions for the Chapter Practice section. The *Mockaroo_Cars* sheet is a "dummy" dataset about consumers and their addresses generated at https://mockaroo.com/, this data set will be used for the Mail Merge section. Both of these "dummy" data sets are archived here for educational purposes.

Figure 10.1.1 below shows the *Text_FUNC* sheet with a variety of common errors seen in data you import from other sources. The CONCATENATE & TRIM range is an example of how a single line of text can be created from the contents of three rows by nesting two Excel functions. CONCATENATE on its own will merge the three cells into one, but alone, it does nothing about the extra spaces we see in the text. TRIM will remove all spaces, which means we need to add " " in order for Excel to add the needed blank cells in between words.

	A	B	C	D	E	F	G	H
1								
2		**CONCATENATE & TRIM**				**FIND & SEARCH**		
3			University of Houston			INtrOducTion	11	5
4		University	University of Houston			to	2	2
5		of	UniversityofHouston			COMputers	#VALUE!	2
6		Houston	University of Houston					
7								
8		**LEFT, RIGHT, MID**				**UPPER, LOWER, PROPER**		
9		DRT156XD	156			INtrOducTion	INTRODUCTION	
10		DRT378XC	378			to the	To The	
11						COMputers	computers	
12		DISC2373	2373					
13		ACCT3301	ACCT			**VALUE, TEXT**		
14						12345	12345	
15						12345 12345		0012345
16								

Figure 10.1.1 The Text_FUNC sheet with original and cleaned content side by side.

The LEFT, RIGHT, MID range in columns A:C illustrate another common set of functions used to process data. Oftentimes data comes in large chunks merged together. While we can use the Data > Text to Columns feature with delimiters to tell Excel where we want our data split, the LEFT, RIGHT, MID functions will process data from certain directions depending on where in the string is the text or number we wish to extract. B9 and B10 show a part number we can extract portions of using the MID function into C9, C10. B12 and B13 show course numbers we can extract portions of using the RIGHT and LEFT functions into C12, C13.

Figure 10.1.2 shows the formulas in columns A:C to illustrate the combination of CONCATENATE and TRIM nested in a variety of ways to find the best configuration to output the way we want our text to appear with the syntax for LEFT, RIGHT, and MID showing underneath.
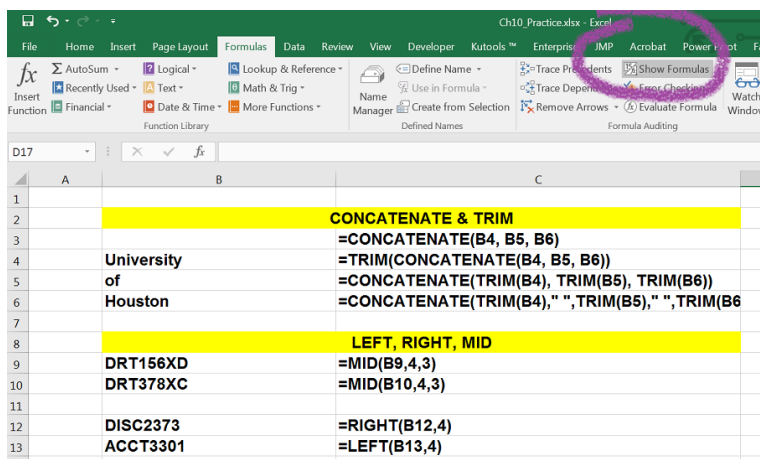
Figure 10.1.2 The Text_FUNC sheet with the "Show Formulas" option enabled for columns A:C.

Figure 10.1.3 below shows the formulas in columns F:H to illustrate the different between FIND and SEARCH, as well as show the UPPER, LOWER, PROPER, VALUE and TEXT functions used to produce the contents for data in those ranges.

Figure 10.1.3 The Text_FUNC with the "Show Formulas" option enabled for columns F:H.

More Examples

Visit [the Official Microsoft site](#) for a list of common text functions in Excel.

Observe the variety of tasks you can achieve by using relatively simple formulas and nested alternatives.

"**Note:** Although you can use the TEXT function to change formatting, it's not the only way. You can change the format without a formula by pressing **CTRL+1** (or ⌘ +1 on the Mac), then pick the format you want from the **Format Cells** > **Number** dialog ([Source](#))."

Consider possible uses of these functions in order to clean your data. We will revisit these functions and the use of delimiters in the Chapter Practice.

ATTRIBUTION

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Media Attributions

- Figure_10-1
- Figure_10-2
- Figure_10-3

10.2 MAIL MERGE

Everyday communications between colleagues, business partners, a business and a customer, a non-profit and its donors can take many shapes or forms. Thank you notes, reminders, product updates, invoices, and many other topics may require an individual to send identical documents with small changes to each document such as the recipient's name, address, donation amount, product number, purchase date, or more. Mail merge automates the tedious task of copy-pasting a large number of data from one application to another one field at a time a hundred or a thousand times over. We can use mail merge in Word or Outlook while depending on a data source from Excel or Access and allow employees to process hundreds or thousands (or more, depending on your processing speed or patience) of records to populate fields (name, address, donation amount, etc.) in a pre-written document or email.

> "With the combination of your letter or email and a mailing list, you can create a mail merge document that sends out bulk mail to specific people or to all people on your mailing list. You also can create and print mailing labels and envelopes by using mail merge (support.office.com)."

We will use the *Mockaroo_Cars* sheet in the Ch10_Data_File in combination with a Word document to create a letter to mail to our clients regarding an extended warranty offer for their vehicle. The *Mockaroo_Cars* sheet is a "dummy" dataset about fictional consumers, their addresses, and their vehicles generated at https://mockaroo.com/. The data set generated online is archived here for educational purposes.

1. Open the Ch10_Data_File and go to the *Mockaroo_Cars* sheet.

2. Observe the field names in the header row.

   ◦ How would these appear on a mailing label?

   ◦ How would you add them as an address block in a letter?

   ◦ How much time would it take for you to manually copy and paste the car_model (Column K) and the car_year (Column L) into a letter that wishes to personalize content for its recipients?

3. Open a blank Word document. Highlight, copy and then paste the following text into it. "Address|Dear [name],|We are pleased to inform you about our ongoing special regarding your [car_model, car_year].|Please contact us regarding this limited time offer and schedule a meeting with your service advisor.|Sincerely,|Mockaroo Cars." Replace the | symbols with hard line breaks using the ENTER key to format your document to match Figure 10.2.1 below.
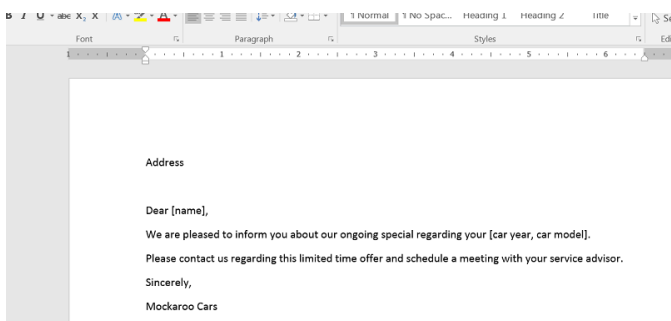
Figure 10.2.1 Word document with pre-written content.

4. Save your document as Mail_Merge_Sample.docx in the folder where you have been saving your course-related documents in a subfolder under Chapter 10.

5. Click into the Mailings Tab > Start Mail Merge > Step-by-Step Mail Merge Wizard as shown in Figure 10.2.2.
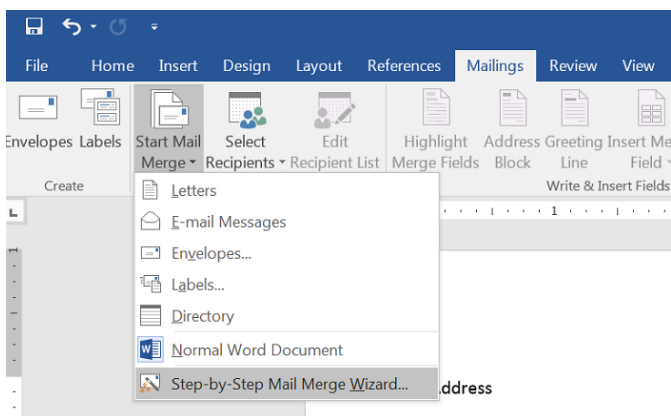

Figure 10.2.2 Starting a Mail Merge Wizard.

6. You will be asked to confirm the type of mail merge you wish to complete. In the navigation pane that appears on the right side of your

window, make sure the *Letters* option is selected as the document type. Click ->*Next: Starting document* as shown in Figure 10.2.3.
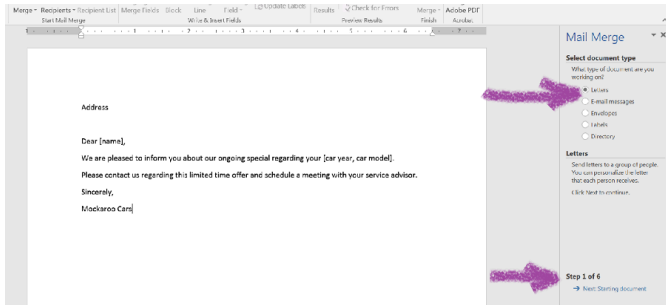
Figure 10.2.3 Selecting document type.

7. You will be asked to confirm whether you wish to use the document you have open or other sources. Select the *Use current document* option for this practice at the top of the navigation pane. At the bottom, click *Next: Select recipients* as shown in Figure 10.2.4.
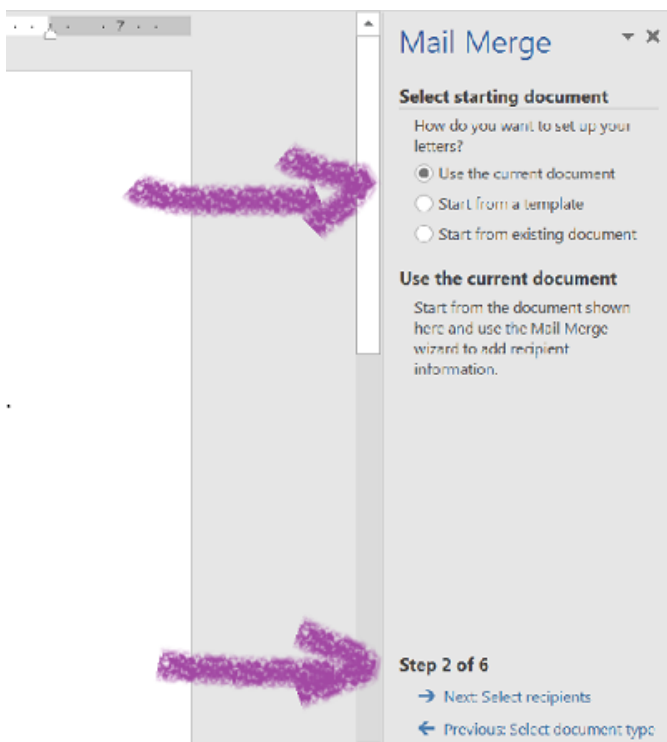
Figure 10.2.4 select your starting document.

8. Next, you will select the fields you want to use from your *Mockaroo_Cars* sheet Excel file. Under the Mail Marge pane on the right, under *Use an existing list*, (1) click *Browse* to select names and addresses from a file or database. Navigate to the folder where you downloaded the Ch10_Data_File and (2) select the *Mockaroo_Cars* sheet. Make sure that the checkbox is selected next to the *First row of data contains column headers* option as shown in Figure 10.2.5. (3) Click Next: Write your letter.
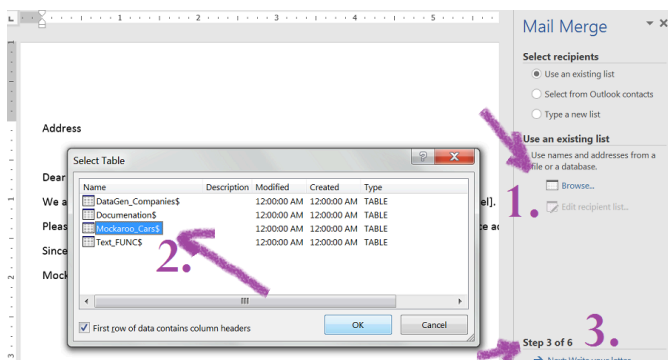
Figure 10.2.5 Selecting your data source.

9. A dialogue box will allow you to confirm the Data Source, correct sheet/fields and to make edits as needed. Click OK upon approval of the contents shown.

10. In the pane on the right, you will see the *Write your letter* options. This is the time for you to update your letter with the data from your Excel sheet to populate fields like *Address*, Dear *[name]*, *[car year, car model]* in your Word document. Click *Address block...* and preview how the default selection appears based on your data. You can use the *Match Fields...* button to call up more fields from your Excel file as shown in Figure 10.2.6.
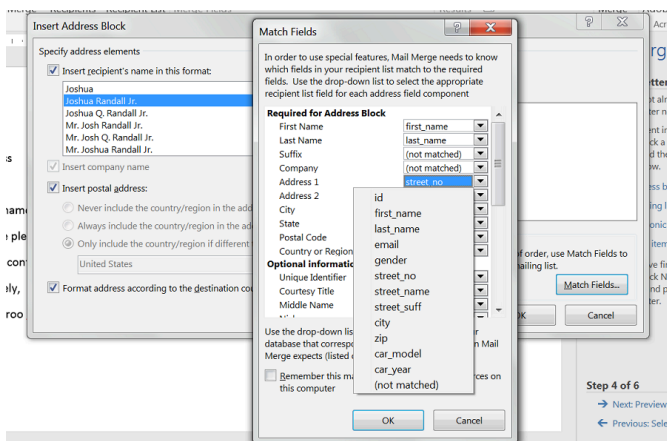
Figure 10.2.6 Matching fields from your Excel list to create the desired address block.

11. You have two options as your Excel field names don't necessarily map out onto an Address Block exactly as you would like. (1) You can insert all the fields through the Match Fields… button and dialogue box as is and then edit the line breaks manually on the next step. (2) You can also go back to your Excel sheet and use the CONCATENATE function to merge the customers' addresses into single lines (street_no, street_name, street_suff), save your Excel file, then *Browse* to select your source again. For option (2), your field name for the combined address line will show up as your *Address Block*. You can now delete the Addresses word from before *Address Block* in your Word document we used as a placeholder.

12. Click *Greeting Line…* and replace Dear [name] with an option of your choice from the available presets as shown in Figure 10.2.7.
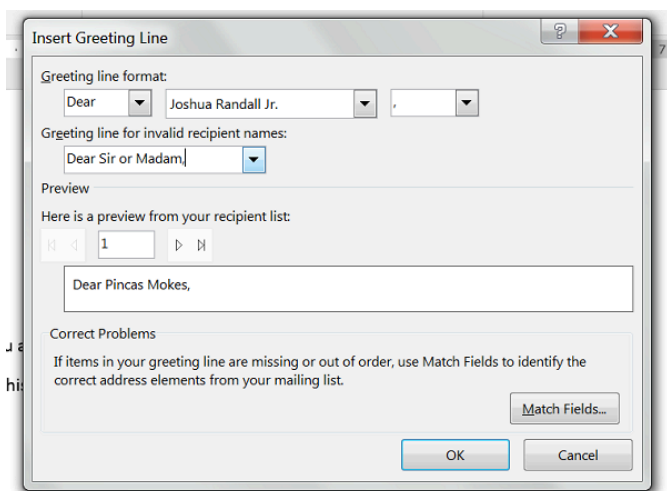
Figure 10.2.7 Greeting line options.

13. Go to More items… and insert the fields for car year and model. Your Word document should match what is shown in Figure 10.2.8 (without the yellow highlighting).

«AddressBlock»

«GreetingLine»

We are pleased to inform you about our ongoing special regarding your «car_year»«car_model».

Please contact us regarding this limited time offer and schedule a meeting with your service advisor.

Sincerely,

Mockaroo Cars

Pincas Mokes

245 Graedel Crossing

Pasirlimus

Dear Pincas Mokes,

We are pleased to inform you about our ongoing special regarding your 1990 Electra.

Please contact us regarding this limited time offer and schedule a meeting with your service advisor.

Sincerely,

Mockaroo Cars

Figure 10.2.8 Preview of your fields inserted into

your Word document.

14. You can now *Complete the merge*. It is best to save all letters you are creating as a separate file, that way you can have a record of all mailers in a New Document. You will as many pages in Word for your customers as the number of records in your Excel sheet. Depending on your processing speed and working memory, this process may take a few minutes.

Mail Merge e-Mail Exercise

Complete [this 10-minute training on support.office.com](#) to practice other forms of mail merge at the official Microsoft Office website.
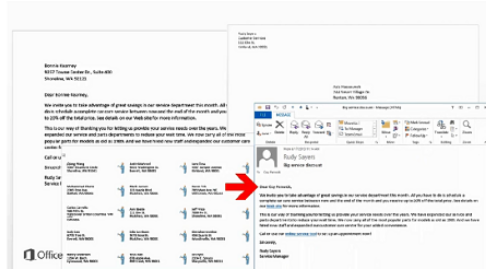

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- Figure_10-2-1
- Figure_10-2-2
- Figure_10-2-3
- Figure_10-2-4
- Figure_10-2-5
- Figure_10-2-6
- Figure_10-2-7
- Figure_10-2-8
- Figure_10-2-9
- Tutorial

10.3 INTEGRATING EXCEL® WITH WORD® AND POWERPOINT®

Learning Objectives

1. Learn how to paste an image of an Excel chart into a Word document.

2. Learn how to paste a link to an Excel chart into a PowerPoint slide.

Charts that are created in Excel are commonly used in Microsoft Word documents or for presentations that use Microsoft PowerPoint slides. Excel provides options for pasting an image of a chart into either a Word document or a PowerPoint slide. You can also establish a link to your Excel charts so that if you change the data in your Excel file, it is automatically reflected in your Word or PowerPoint files. We will demonstrate both methods in this section.

PASTING A CHART IMAGE INTO WORD

For this exercise you will need two files:

- *The Excel spreadsheet you have been working with during the Charts & Graphs chapter: **CH4 Charting**.*

- *A Word document data file — CH4 Diversity*

Excel charts can be valuable tools for explaining quantitative data in a written report. Reports that address business plans, public policies, budgets, and so on all involve quantitative data. For this example, we will assume that the Change in Enrollment Statistics Spend Source stacked column chart is being used in a student's written report (see **Figure 10.3.1**).
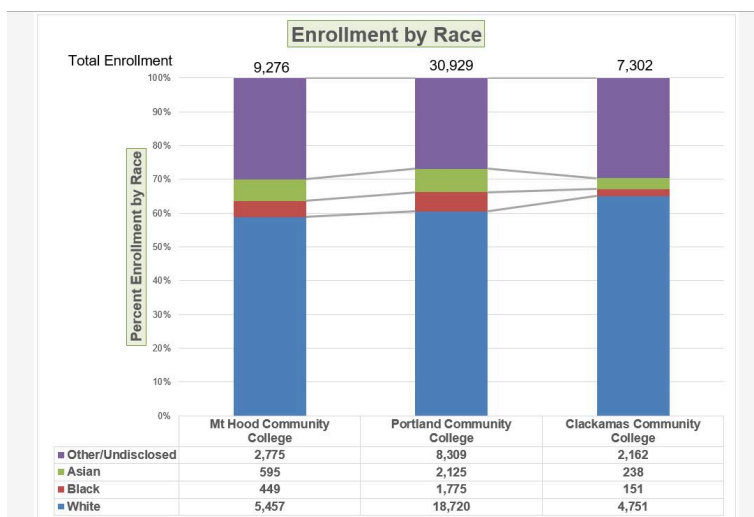

Figure 10.3.1 Completed Stacked Column Chart

The following steps demonstrate how to paste an image, or picture, of this chart into a Word document:

1. Open *CH4 Diversity*. Save it as *CH4 Diversity in Enrollment in Community Colleges*

2. Click below the figure heading in the Word document that reads: **Figure 1: Enrollment by**

Race. The image of the stacked column chart will be placed below this heading.

3. If needed, open the Excel file you have been working with (*CH4 Charting*). Activate the **Enrollment by Race** chart in the **Enrollment by Race Chart** sheet.

4. Click the down arrow on the **Copy** button in the **Home** tab of the ribbon. Select **Copy as Picture**

5. Select **OK —** Accepting the Copy Pictures defaults:

    ◦ As shown on Screen

    ◦ Picture

6. Go back to the *CH4 Diversity in Enrollment in Community Colleges* Word document by clicking the file in the taskbar.

7. Confirm that the insertion point is below the Figure 1: Enrollment by Race heading (see Figure 10.3.2) and click the **Paste** button in the Home tab of the ribbon (or press **Crtl-V**).

learning centers. In 2014, over 30,000 students attended Portland Community College. PCC offers certificate programs, Associates degree programs through 149 major areas.

Mt Hood Community College (MHCC) serves students who live north and east of Portland proper. In 2014, over 9,000 students attended MHCC. Mt Hood offers certificate programs, Associates degree programs with 99 different majors.

Clackamas Community College (CCC) serves students who live south of the Portland area. In 2014 over 7,000 attended CCC. They were offered certificate and Associates degree programs with a possibility of 88 majors.

Each college has plans to increase diversity in both students and employees to more closely reflect the population of the metropolitan area.

Figure 1: Enrollment by Race

Your insertion point is here

Figure 10.3.2 Paste Picture in Word

Oh no!! The picture is so big that it falls on to the next page. We will need to change its size.

1. Click anywhere on the picture of the chart to activate it.

2. Click the **Format** tab under the **Picture Tools** section of the ribbon (see **Figure 10.3.2**).

3. Click the down arrow on the **Shape Width** button in the **Size** group of commands. Continue to click the down arrow until the width of the picture is **5.4**.” As you reduce the width of the picture, the height is automatically reduced as well. (The height should be ~ **3.92″**)

4. To center the chart on the page, make sure the chart is activated. Then go to the **Home** tab, to the **Paragraph** group, and select **Center.**
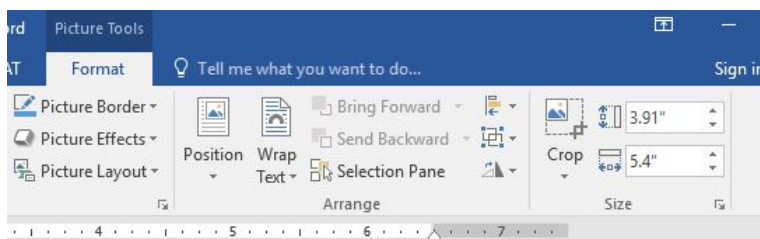
5. Save your work.

Figure 10.3.3 Changing the Size of a Picture in Word

Figure 10.3.4 shows the final appearance of the Enrollment by Race Source chart pasted into a Word document. It is best to use either the Shape Width or Shape Height buttons to reduce the size of the chart. Using either button automatically reduces the height and width of the chart in proper proportion. If you choose to use the sizing handles to resize the chart, holding the SHIFT key while clicking and dragging on a corner sizing handle will also keep the chart in proper proportion.

Diversity in Enrollment in Community Colleges in the Portland Metropolitan Area.

The Portland metropolitan area benefits from a wide array of public and private colleges. By far, most students are enrolled at one of the local community colleges.

Portland Community College (PCC) is the largest, with four full fledges campuses and several smaller learning centers. In 2014, over 30,000 students attended Portland Community College. PCC offers certificate programs, Associates degree programs through 149 major areas.

Mt Hood Community College (MHCC) serves students who live north and east of Portland proper. In 2014, over 9,000 students attended MHCC. Mt Hood offers certificate programs, Associates degree programs with 99 different majors.

Clackamas Community College (CCC) serves students who live south of the Portland area. In 2014 over 7,000 attended CCC. They were offered certificate and Associates degree programs with a possibility of 88 majors.

Each college has plans to increase diversity in both students and employees to more closely reflect the population of the metropolitan area.
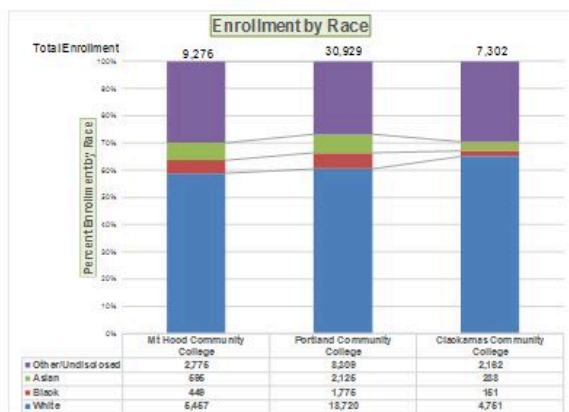
Figure 1: Enrollment by Race

Figure 10.3.4 Final Appearance of Pasting a Chart Image into Word

Skill Refresher

Pasting a Chart Image into Word

1. Activate an Excel chart and click the Copy

button in the Home tab of the ribbon.

2.   Click on the location in the Word document where the Excel chart will be pasted.

3.   Click the down arrow of the Paste button in the Home tab of the ribbon.

4.   Click the Picture option from the drop-down list.

5.   Click the Format tab in the Picture Tools section of the ribbon.

6.   Resize the picture by clicking the up or down arrow on the Shape Width or Shape Height buttons.

PASTING A LINKED CHART IMAGE INTO POWERPOINT

For this exercise you will need two files:

- *The Excel spreadsheet you have been working in your Charts & Graphs chapter: **CH4 Charting**.*

- *A PowerPoint data file – CH4 Diversity.*

Microsoft PowerPoint is perhaps the most commonly used tool for delivering live presentations. The charts used in a live presentation are critical for efficiently delivering your ideas to an audience. Similar to written documents, a wide range of presentations may require the explanation of quantitative data. This demonstration includes a PowerPoint slide that could be used in a presentation. We will paste the Enrollment by Race chart

into this PowerPoint slide. However, instead of pasting an image, as demonstrated in the Word document, we will establish a link to the Excel file. As a result, if we change the chart in the Excel file, the change will be reflected in the PowerPoint file. The following steps explain how to accomplish this:

1. Open *CH 4 Diversity.pptx*. Save it as *CH 4 Diversity in Enrollment in Community Colleges*.

2. Navigate to **Slide 6 – Diversity in Enrollment**. This is the slide where you will place the linked chart.

3. If needed, open the Excel file you have been working with (*CH 4 Charting*). Activate the **Enrollment by Race** chart in the **Enrollment by Race Chart** sheet.

4. Click the down arrow on the **Copy** button in the **Home** tab of the ribbon. Select **Copy** (not Copy as Picture.)

5. Go back to the *CH 4 Diversity in Enrollment in Community Colleges* presenation by clicking the file in the taskbar.

6. Make sure you are still on Slide 6 – Diversity in Enrollment. Click on the **outside edge** of the empty prompt box on the right.

7. Click the down arrow below the **Paste** button in the **Home** tab of the ribbon in the PowerPoint file.

8. Hover over each of the Paste Options until you find **Keep Source Formatting & Link Data** (see Figure **10.3.5**). Select this option. This pastes an image of the Excel chart into the PowerPoint slide.

In addition, a link is created so that any changes made to the chart (in Excel) appear on the PowerPoint slide.
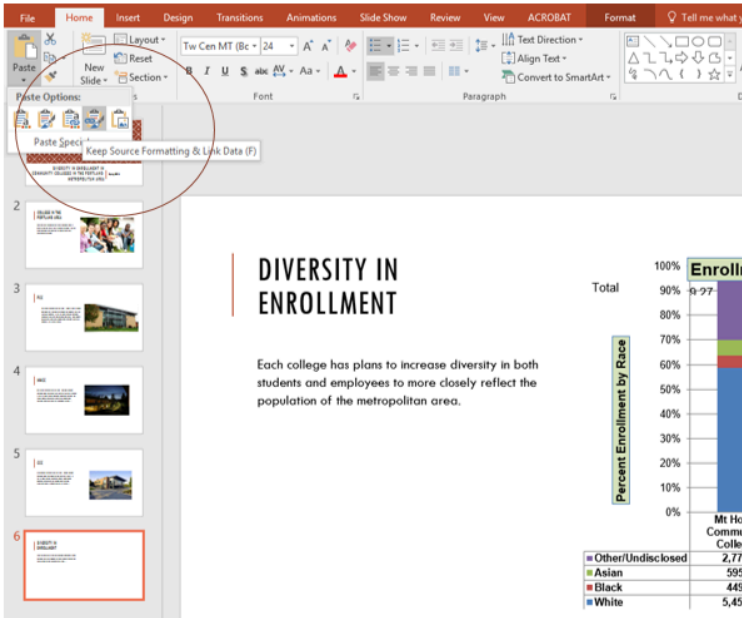

Figure 10.3.5 Creating a Link to an Excel Chart in PowerPoint

Next we need to make some changes to clean up the chart a bit. First, we are going to apply a different chart style.

1. Click anywhere in the plot area of the column chart pasted into the PowerPoint slide. You will see the same **Excel Chart Tools** tabs added to the ribbon (see **Figure 10.3.6**).

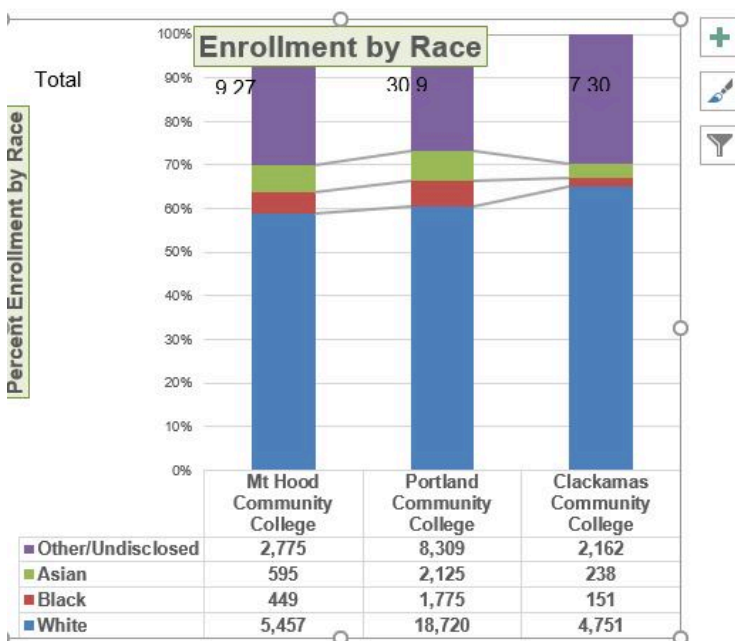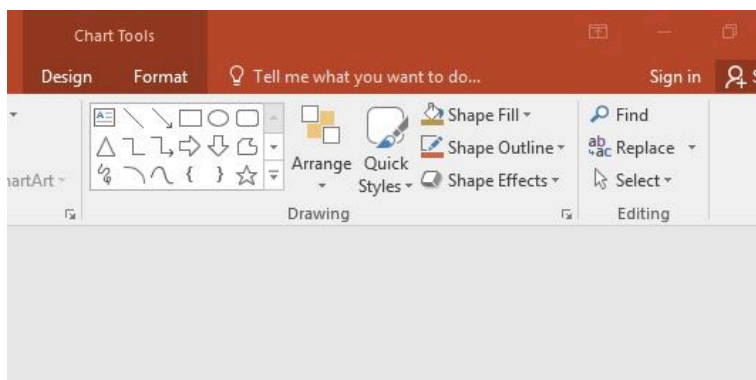2. On the **Design** tab, select **Style 8** in the **Chart Style** group.

Figure 10.3.6 Modifying and Excel Chart Pasted into a PowerPoint Slide

Paste linking this chart caused trouble with the text boxes we added, so next, we are going to delete them.

1. Select each text box by clicking on the outside

edge of the text box with the four-headed arrow. Press the delete key on your keyboard. Be sure that the insertion point is NOT blinking inside the text box. If it is, you will be editing the contents of the text box instead of deleting the actual text box.

The benefit of adding this chart to the presentation as a link is that it will automatically update when you change the data in the linked spreadsheet file.

1. Return to your *CH4 Charting* Excel file.

2. Select the **Enrollment Statistics** worksheet (the one with the Enrollment data.) Change the value in cell D3 to **1000**. You have just changed the number of white students at Clackamas Community College to **1000**. This isn't true, but you want to change the data enough to see the effect in the charts.

3. Select the **Enrollment by Race Chart** worksheet. Notice how the chart has changed.

4. Return to the Diversity in Enrollment in Community Colleges PowerPoint file by clicking the file in the taskbar.

5. On Slide 6, you should see the updated chart.

6. If the chart has not changed; be sure that your chart is selected, click the **Design** tab in the **Chart Tools** section of the ribbon. Click the **Refresh Data** button. The change made in the Excel workbook is now reflected on the PowerPoint slide.

7. If that still doesn't work, you may have created a "normal" link — instead of a **Paste Link**. Delete the chart and follow the steps again. Start from the beginning of this section.

8. Save your work. You will submit both the Word and PowerPoint files, along with the Excel file, at the end of the next section.

Figure 10.3.7 shows the appearance of the column chart after the change was made in the Enrollment Statistics worksheet in the Excel file. Note that the Data Chart at the bottom reflects the new number, too. The change that was made in the Excel file will appear in the PowerPoint file after clicking the Refresh Data button.
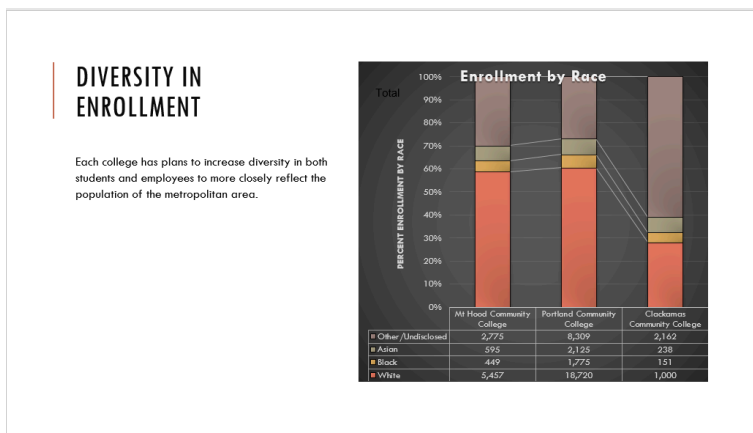

Figure 10.3.7 Styled and Updated Chart.

Integrity Check

Refreshing Linked Charts in PowerPoint and Word

When creating a link to a chart in Word or PowerPoint, you must refresh the data if you make any changes in the Excel workbook. This is especially true if you make changes in the Excel file prior to opening the Word or PowerPoint file that contains a link to a chart. To refresh the chart, make sure it is activated, then click the Refresh Data button in the Design tab of the ribbon. Forgetting this step can result in old or erroneous data being displayed on the chart.

Integrity Check

Severed Link?

When creating a link to an Excel chart in Word or PowerPoint, you must keep the Excel workbook in its original location on your computer or network. If you move or delete the Excel workbook, you will get an error message when you try to update the link in your Word or PowerPoint file. You will also get an error if the Excel workbook is saved on a network

drive that your computer cannot access. These errors occur because the link to the Excel workbook has been severed. Therefore, if you know in advance that you will be using a USB drive to pull up your documents or presentation, move the Excel workbook to your USB drive before you establish the link in your Word or PowerPoint file.

Skill Refresher:

Pasting a Linked Chart Image into PowerPoint

1. Activate an Excel chart and click the Copy button in the Home tab of the ribbon.

2. Click in the PowerPoint slide where the Excel chart will be pasted.

3. Click the down arrow of the Paste button in the Home tab of the ribbon.

4. Click the Keep Source Formatting & Link Data option from the drop-down list.

5. Click the Refresh Data button in the Design tab of the ribbon to ensure any changes in the Excel file are reflected in the chart.

> **Key Takeaways**
>
> - When pasting an image of an Excel chart into a Word document or PowerPoint file, use the **Picture** option from the Paste drop-down list of options – if you want the image to act as an image. You will not be able to make any changes to the content of the picture.
>
> - When creating a link to a chart in Word or PowerPoint, you may need to refresh the data if you make any changes in the originating spreadsheet. You should not use the **Picture** option.

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- Figure 4-41
- Figure 4-42
- Figure 4-43
- Figure 4-44
- fig45
- Figure 4-46
- fig47

10.4 CHAPTER PRACTICE

To expand your understanding of the material covered in the chapter, complete the following assignment. You will be working with the *DataGen_Companies* sheet in your [Ch10_Data_File](#) workbook. As noted before, the *DataGen_Companies* sheet contains a set of "dummy" (plausible, but not real) data about companies generated at https://www.generatedata.com/ that the author of this chapter intentionally injected with common errors seen in data in order to unfold and process it for the sake of practicing Excel functions for the Chapter Practice section. Our goal is to clean and restructure that data using functions and features discussed earlier in this chapter.

1. Open the [Ch10_Data_File](#) workbook and examine the data in the *DataGen_Companies* sheet.
    – What issues do you see with this data?
    – What is present, what is missing: what do we need to delete and what do we need to add?
    – Currently, all our data is in a single cell for each company. We want to have the company name in one column, their street address in another, their city, their ZIP code in others. Altogether we wish

to have the data chopped up into segments that correspond with how we may want to use them in the future and align with categories generally associated with mailing addresses.

2. Highlight column A, where all your data is, then go to the Text to Column feature under Data > Data Tools on the ribbon.

3. The Convert Text to Columns Wizard pops up and will guide you through the process of converting a single cell into multiple ones based on where commas or any other recurring characters or patterns may be in your data. Each category in your data (company name, street address, city, ZIP code) is separated from one another using a comma. Click the Delimited checkbox, then Click next.

4. On Step 2 of 3 of the wizard, you are asked to select the delimited present in your data Excel can use to process the conversion. Your text has a comma in between the categories you want to display in individual cells, so select the Comma option by checking the box next to that option. The data preview will show vertical lines where your columns will be inserted (Figure 10.4.1). Click next after confirming that the text would convert as you like.
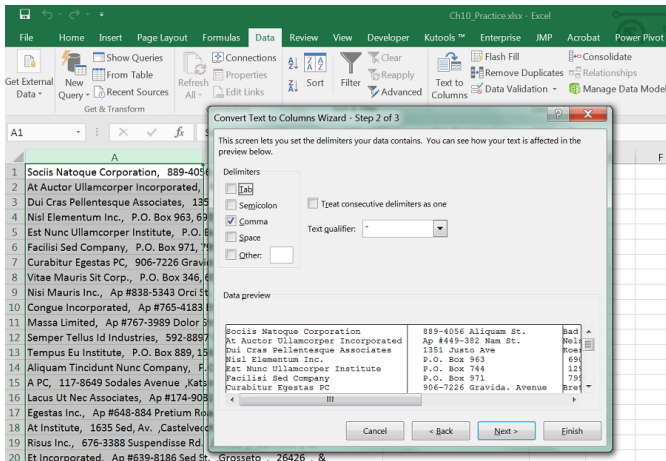
Figure 10.4.1 Setting Comma as a Delimiter for your Convert Text to Columns Wizard.

5. Your data will now display over 6 columns instead of one, with company names in column A and with & in column F. Even though we used the feature correctly, our conversion is not perfect because of the different types of addresses present. Some businesses have a street or apartment number, some have a P.O. Box number in a cell preceding their street address. Businesses with a P.O. Box number have one more cell's worth of data than others (Figure 10.4.2).

Figure 10.4.2 Our data is mismatched because of different types of business addresses.

6. Let us consolidate the addresses into a single cell for the sake of consistency. Sort column B in

Ascending Order to have all the street, apartment and P.O.Box addresses below one another by type.

7. Select the range that contains the P.O. Box numbers. Insert cells to Shift Cells Right.

8. In the blank range, use CONCATENATE to merge the P.O. Box numbers with the street address.

9. Move cell contents to ensure that the City and Zip codes are in the adjacent range without blanks in between.

10. Sort your data to resolve issues with street names with periods or other issues you may see with the data set.

11. Delete Column E with the superfluous & symbol.

12. Save your work for your records.

Mail Merge: Printing Mailing Labels Exercise

"One of the most popular Avery label sizes is 2.625in x 1in which is the white label 5160. It is available as 30 labels per page and is used for addressing and mailing purposes. It is one of the most important mailing labels and its layout has been copied by many other manufacturers (Streetdirectory.com). "

- Go to avery.com and examine the wide range of labels available for purchase at one of the most commonly used office products.
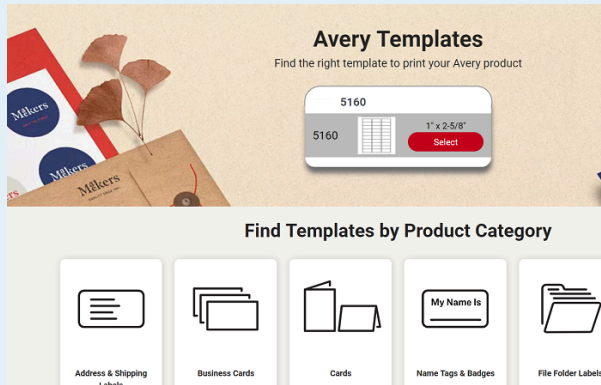
- Observe all the other types of labels or mailers available from Avery.

- Search for and download 5160.

- Use this template to create mailing labels from your address lists.

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- Figure_10-4-1
- Figure_10-4-2
- Avery

10.5 CHAPTER ASSESSMENT

THE FOLLOWING ARE **SAMPLE QUESTIONS** TO
TEST WHETHER YOU KNOW, UNDERSTAND,
AND ARE ABLE TO APPLY YOUR LEARNING
FROM THIS CHAPTER.

---

1. A common process to create mailing labels or
marketing materials combining Excel and Word is:
   a) Charts
   b) Macros
   c) Mail Merge
   d) PivotTables
   e) Templates

---

2. The fastest way to create mailing labels is
through using the built-in:
   a) PivotTable
   b) Script

c) Warlock

d) Wizard

3. This function removes all spaces from text except for single spaces between words.
   a) CONCATENATE
   b) CLEAN
   c) TRIM
   d) VALUE

4. This function capitalizes the first letter in a text string and any other letters in text that follow any character other than a letter. Converts all other letters to lowercase letters.
   a) CAPITAL
   b) LOWER
   c) PROPER
   d) UPPER

5. Which function produces C10 from B10?

	A	B	C
9			
10		**DISC2373**	**DISC**
11			**2373**
12			
13		**ACCT3301**	**ACCT**
14			**3301**

a) LEFT
b) RIGHT
c) MID
d) EXTRACT

6. Which function produces C11 from B10?

	A	B	C
9			
10		**DISC2373**	**DISC**
11			**2373**
12			
13		**ACCT3301**	**ACCT**
14			**3301**

a) LEFT
b) RIGHT
c) MID
d) EXTRACT

7. The second argument in the MID function specifies where the extraction should start.
    TRUE/FALSE

8. =CONCATENATE(TRIM(B3)," ",TRIM(B4)," ",TRIM(B5)) does what?
    a) Merges cells B3, B4, B5
    b) Clears spaces from B3, B4, B5
    c) Extracts characters from B3, B4, B5
    d) Chops up B3, B4, B5
    e) Both a and b
    f) Both c and d
    g) Both a and d

9. If an Excel chart is linked into a Word document, what file(s) must be transferred in order for another person to work with the information completely?
    a) Word document file only
    b) Excel spreadsheet file only
    c) Both the Word document and Excel spreadsheet files
    d) Neither the Word document or the Excel spreadsheet file

10. What happens when a standard copy/paste procedure is used to insert an Excel chart into a Word document?

   a) it creates a table in Word which can only be revised using Word capabilities

   b) it creates a separate object in Word which can only be revised by double-clicking and opening Excel capabilities

   c) it causes updates in one location to update the other location

   d) it creates a permanent link between the spreadsheet and the document

   e) all of the above

Solutions: ███████████████████████████

YOU CAN ALSO TEST YOUR KNOWLEDGE OF THE FUNCTIONS USING THE QUIZLET BELOW.

https://quizlet.com/414448350/flashcards/embed?i=24veoc&x=1jj1

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- Ch10_Sample

This is where you can add appendices or other back matter.