Updates for Excel 2010

This book was written for use with Microsoft Excel 2003. The newest version of Excel is 2010, which is not terribly different from 2003. Below are some points to note when considering the use of this book with Excel 2010:

1. The formulas entered into cells are identical.
2. Charts, scrollbars, tables, and Solver all operate in the same basic way. The main difference is the location of the commands.
3. *Every spreadsheet built in this book can be built in Excel 2010 with very little modification.*

This document replaces Appendix A and describes the most commonly used Excel tools in this book.

Basic Terminology

When you first open Excel 2010, you should get a window that looks similar to Figure 1. (Your window may not look exactly like that in the figure due to customization of the ribbons.)

Each rectangle, called a *cell*, is a place where data, text, or formulas can be entered. A collection of cells is called a *worksheet*. The name of the worksheet is given in the *worksheet tab* near the bottom of the worksheet. The worksheet name can be changed by right–clicking on the worksheet tab and selecting **Rename**. A collection of worksheets is called a *workbook*. Worksheets can be added or deleted from a workbook by right–clicking on the worksheet tab and selecting either **Insert...** or **delete**. A worksheet tab can be moved to the left or right by left–clicking, holding, and dragging.

The name of each *column* is listed along the top of the worksheet while the number of each **row** is listed along the left–hand side of the worksheet. The width or height of a column or row can be changed by left–clicking and holding on the right or bottom and then dragging to the desired width or height. A cell is named according to its column and row position. The *selected cell* has a thicker border around it and its name is shown in the *name box*. The selected cell can be changed using the arrow keys or by clicking on another cell.

A two–dimensional *range* of cells can be selected by left–clicking on the cell in the upper left–hand corner of the range, holding, and dragging to the cell lower right–hand corner of the range. This highlights these cells indicating they are all selected. Ranges are referred

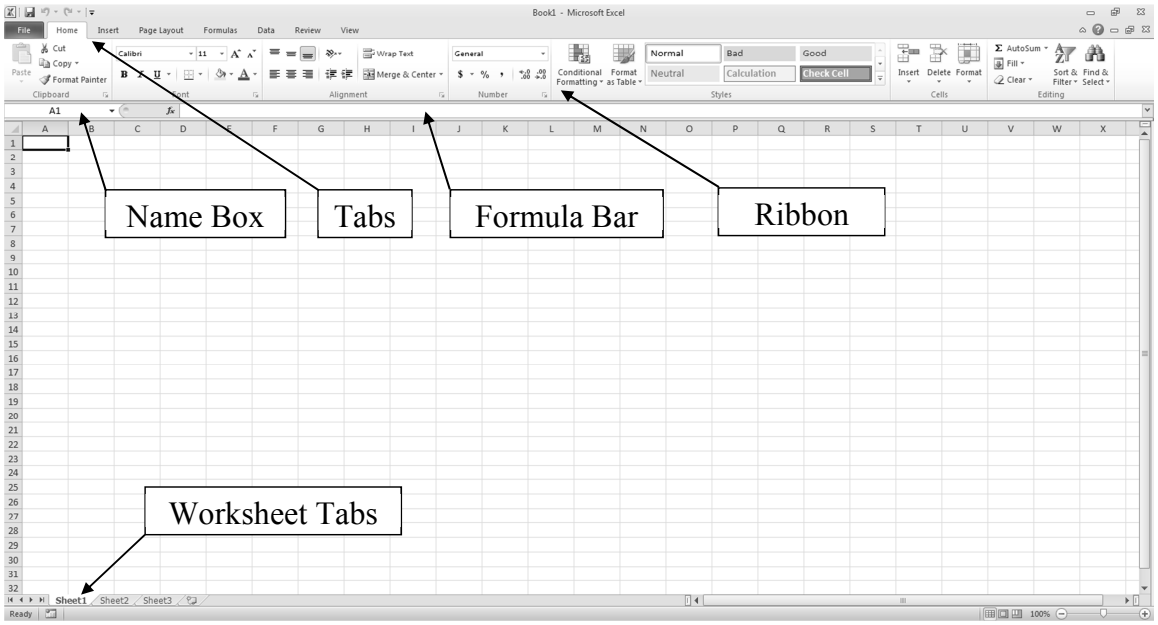

Figure 1

to by the cells in the upper left–hand and lower right–hand corners in the form *(Upper Left):(Lower Right)*.

Along the top of the screen are the *tabs* that label the *ribbons* which contain various *commands*. These ribbons can be customized by selecting **File** → **Options** → **Customize Ribbon**.

Entering Text, Data, and Formulas

Text, data, and formulas are easily entered by selecting the desired cell, typing the desired contents, and pressing **Enter**. To practice doing this, format a blank worksheet as in Figure 2. This worksheet contains two columns of data named "**x**" and "**y**" and a third column named "**z**" that we will define later.

	A	B	C
1	**x**	**y**	**z**
2	1	5	
3	2	8	

Figure 2

Notice that when you press enter, the selected cell moves to the cell directly under the previous one. By default text is left–justified. The text in row 1 can be changed to bold and centered by selecting the range **A1:A3**, and then clicking on the bold font icon in the **Font** section of the **Home** ribbon and then the center icon located in the **Alignment** section.

Now suppose we want to define the quantity **z** to be **x** + **y**. We can easily do this by entering the formula in Figure 3. Every formula begins with an equal sign. This formula can be entered by typing it as in the figure and then pressing **Enter**, or you can type =, click on cell **A2**, type +, click on cell **B2**, and then press **Enter**.

	C
2	=A2+B2

Figure 3

Once the formula is entered, select cell **C2** and click in the formula bar. Notice how different colored boxes are put around cells **A2** and **B2** and that the **A2** and **B2** in the formula are changed to the corresponding colors. This feature simplifies the process of debugging formulas.

To calculate the second value of **z**, we could type the formula **=A3+B3** in cell **C3**, but there is an easier way. Select cell **C2**, left–click and hold on the dark square in the lower right–hand corner of the cell. Then drag the box down one row and release. The results are shown in Figure 4. This is exactly what we want.

	C
1	**z**
2	=A2+B2
3	=A3+B3

Figure 4

Understanding Cell References

To understand why the formula in cell **C2** copied down to cell **C3** in this way, we need to understand what we mean when we reference cells in formulas. The formula in cell **C2** should not be interpreted as "add cell **A2** to cell **B2**." Rather, it should be interpreted as "add the cell two columns to the left and in the same row to the cell one column to the left and in the same row." In other words, these cell references are *relative*. When this formula is copied down one row, the cell "two columns to the left and in the same row" is now **A3** and the cell "one column to the left and in the same row" is now **B3**.

Now, change the formula in cell **C2** to that shown in Figure 5. The **$**'s can be entered manually or you can delete the contents of **C2**, then type =, click on cell **A2**, press the **F4** key, type +, click on cell **B2**, press the **F4** key, and then press **Enter**.

	C
2	=$A$2+$B$2

Figure 5

Copy the formula in cell **C2** down to **C3**. The results are shown in Figure 6. Notice that the formula did not change. This is because the **$**'s "fix" the row and column reference. So the formula in **C2** really does mean "add cell **A2** to cell **B2**." When we copy it down, the meaning does not change.

	C
1	**z**
2	=$A$2+$B$2
3	=$A$2+$B$2

Figure 6

Now, change the formula in cell **C2** to that shown in Figure 7. The **$**'s can be manually entered or they can entered by selecting the cells and pressing **F4** two or three times, similar to above.

	C
1	**z**
2	=A$2+$B2

Figure 7

Copy the formula in cell **C2** down one row and to the right one column. The results are shown in Figure 8.

	C	D
1	**z**	
2	=A$2+$B2	=B$2+$B2
3	=A$2+$B3	

Figure 8

We get these results because the **$** in **A$2** "fixes" the row at 2, but the column is still relative. When we copy down, this row does not change, but when we copy to the right, the column changes to **B**. Likewise, the **$** in **$B2** "fixes" the column at **B**, but the row is still relative. When we copy down, this row changes, but when we copy to the right, the column does not change.

Formatting Cells

The formats of a cell or range can be easily changed by first selecting the cell or range and then right–clicking within the cell or range. Selecting **Format Cells...** yields the window shown in Figure 9.

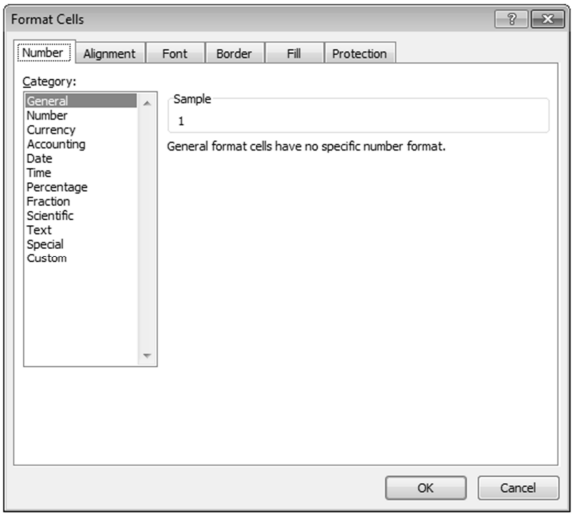

Figure 9

Several of these tabs are useful for building the models in this book:

- **Number** – The number tab allows you to change the way numbers are displayed. For instance, selecting **Number** under **Category:** allows you to, among other things, set the number of displayed decimal places.
- **Font** – The font tab allows you to change the font, font style, and size of text. It also allows you to add effects such as superscript or subscript.
- **Border** – The border tab allows you to change the border around and between cells.
- **Patterns** – The patterns tab allows you to change the background color and pattern of cells.

Creating Charts and Graphs

To illustrate the process of creating charts and graphs, rename a blank worksheet **Graph** and format it as in Figure 10.

To create a simple plot of **y** vs. **x**, follow these steps:

	A	B
1	**x**	**y**
2	1	2
3	2	5
4	3	9
5	4	12
6	5	13

Figure 10

1. Select the range **A1:B6** and click on the **Insert** tab. In the **Charts** section of the ribbon, select **Scatter** and choose the type in the upper-left hand corner of the drop-down box. This creates the chart shown in Figure 11.

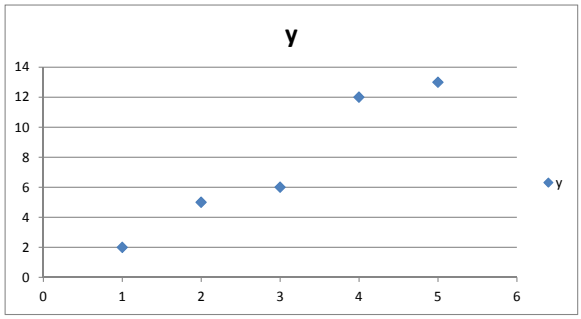

Figure 11

2. The color and style of the points can be changed by right–clicking on a point and selecting **Format Data Series...** The *plot area* (the region on which the points lie) can be change by right–clicking on it and selecting **Format Plot Area...** The gridlines and legend can be deleted (if desired) by left–clicking on them and pressing **Delete**.

3. The chart title may be changed by left–clicking on it. To add axis titles, left–click anywhere on the chart. This causes three **Chart Tools** tabs to appear. The **Layout** tab contains commands for adding the desired titles. Once created, the fonts of the titles may be changed by right–clicking on them.

4. The format of the x– and y–axes can be changed by right–clicking on a number next to an axis and selecting **Format Axis...** Under **Axis Options** we may set the minimum and maximum values on the axis and change the **Major units** (the distance between tick-marks).

5. After adding some titles and changing axis options, we get the chart in Figure 12.

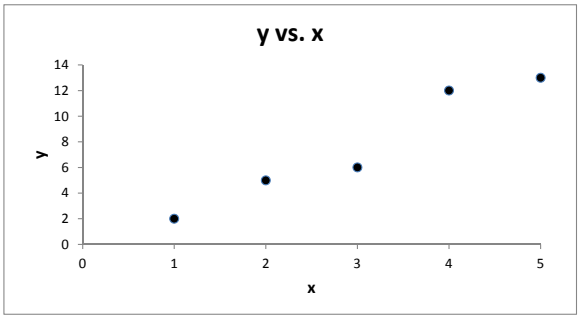

Figure 12

Adding Data Series

Oftentimes we want to add another series of data points to a chart after the chart has been created. To illustrate how to do this, add the data shown in Figure 13 to the worksheet **Graph**.

	C
1	**z**
2	3
3	4
4	8
5	10
6	11

Figure 13

To add this **z** data to the chart, right-click anywhere on the chart and select **Select Data...** In the resulting **Select Data Source Window**, press the **Add** button. Format the resulting **Edit Series** window as in Figure 14 by clicking the icon next to a formula box and then selecting the appropriate range on the worksheet. (Note that **Series X Values** and **Series Y Values** are generic names corresponding to the horizontal and vertical axes, respectively.)

Press **OK** twice. After changing the chart title and adding the legend by selecting **Layout** → **Legend** → **Show Legend at Right**, we get the chart in Figure 15.

Graphing Functions

Excel does not have a built–in tool for graphing functions, but we can easily create an x–y table and then plot the points. For example, to graph the function $f(x) = x^2$ over the

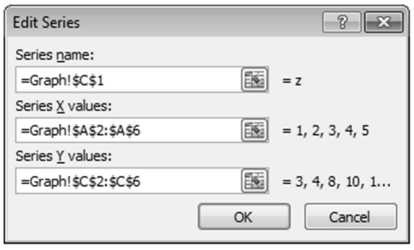

Figure 14

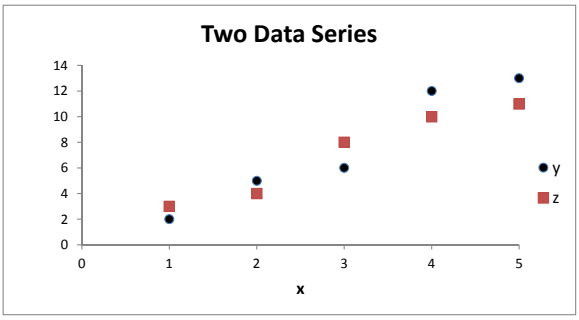

Figure 15

interval $[-2, 2]$, format a blank worksheet as in Figure 16. Copy row 3 down to row 42.

	A	B
1	**x**	**y**
2	-2	=A2^2
3	=A2+0.1	=A3^2

Figure 16

Select columns **A** and **B** by left–clicking and holding on the column **A** header and then dragging to column **B**. Choose **Insert** → **Scatter** and choose the type in the middle of the left called "Scatter with Smooth Lines." Once the chart is created, delete the gridlines and legend; set the x–axis **min** and **max** to -2 and +2, respectively with a major unit of 1; and the y–axis **min** and **max** to 0 and 4, respectively, also with a major unit of 1. Change the chart title to $y = x^2$, and the result should look like Figure 17.

Scroll Bars

Scroll bars allow us to change the value of a cell with a graphical interface. This allows us to dynamically change the values of parameters within a model and analysis the results. To

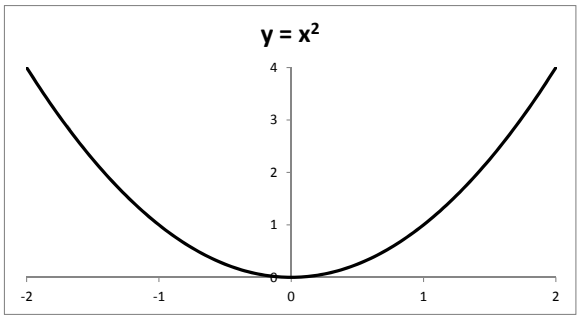

Figure 17

access the scroll bar commands, we must add the **Developer** tab. To do this, select **File** → **Options** → **Customize Ribbon**. Under **Main Tabs**, check the box next to **Developer** and press **OK**.

In a blank worksheet, select **Developer** → **Insert**. A drop-down box similar to that in Figure 18 should appear.

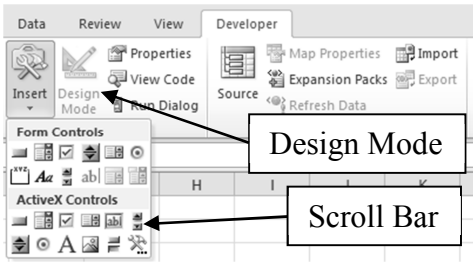

Figure 18

When you press the scroll bar button, the cursor changes to a small cross. Use this to draw a long, skinny rectangle. Right–click on the resulting scroll bar and select **Properties**. A window similar to that in Figure 19 should appear.

There are three important properties we need to change. The **LinkedCell** is the cell whose value we want to change. Set this to **A1** by typing **A1** in the box next to it. The **Min** and **Max** are the minimum and maximum values of the cell. Set these to 0 and 1,000, respectively. Close the properties window and click on the **Design Mode** button so it is not highlighted. The scroll bar is now ready to use. Move the slider on the scroll bar back and forth and note that the number in cell **A1** changes between 0 and 1,000 in increments of 1. The scroll bar properties can be changed by clicking on the **Design Mode** button and right–clicking on the scroll bar.

In most instances, we may want the value of a cell to change in increments other than 1.

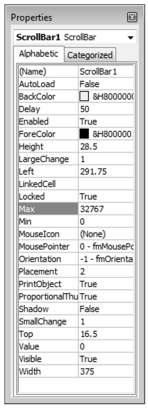

Figure 19

This can be accomplished using a formula that references the linked cell. For instance, enter the formula shown in Figure 20. Move the slider back and forth and note that the number in cell **A2** changes between 0 and 100 in increments of 0.1.

	A
2	=A1/10

Figure 20

(**Note**: There is a somewhat easier way to create scroll bars using the **Form Control** version of the scroll bar. However, these scroll bars do not work as well with graphs. With the method described above, if the scroll bar changes a value on a graph, the graph changes in a continuous manner as the slider is moved back and forth. If the **Forms** toolbar is used, the graph will not change until you release the mouse button.)

Array Formulas

Excel can perform simple matrix operations such as addition, multiplication, and finding inverses. For example, if $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$, to compute $C = A + B$, format a blank worksheet as in Figure 21. To center the text "A" between cells **A1** and **B1**, select the range **A1:B1** and then press the **Merge and Center** icon in the **Alignment** section of the **Home** tab.

Next, select the range **G2:H3**, type **=A2:B3+D2:E3**, and press the combination of keys **Ctrl-Shift-Enter** (this combination tells Excel to compute an array formula). The results

	A	B	C	D	E	F	G	H
1	**A**			**B**			**C**	
2	1	2		5	6			
3	3	4		7	8			

Figure 21

are shown in Figure 22. Notice that when you select any cell in the range **G2:H3**, the formula is in curly brackets, {...}. This indicates that an array formula has been entered.

	G	H
1	**C**	
2	6	8
3	10	12

Figure 22

Other Tools

Other tools used in this book work the same way in Excel 2010 as they do in 2003, but are accessed differently. Below we describe how to access them in 2010. For details on how to use them, see the corresponding sections of the text.

1. **Data Analysis**: The **Regression** command of the **Data Analysis** tool is used in Section 3.5 for doing multiple regression. To install the **Data Analysis** add-in, select **File** → **Options** → **Add-Ins**. Near the bottom of the window, select **Manage: Excel Add-ins** and press **Go...** Check the box beside **Analysis ToolPak** and press **OK**. In the **Data** tab there should now be an **Analysis** section with a **Data Analysis** command. Selecting this command opens a window identical to that in Excel 2003.
2. **Tables**: Tables are used extensively in Chapter 6 for doing simulations. To define a table, select the desired range and then press **Data** → **What-If Analysis** → **Data Table...** This opens a box identical to that in Excel 2003.
3. **Solver**: Solver is used extensively in Chapter 7 for doing linear programming. To install the **Solver** add-in, select **File** → **Options** → **Add-Ins**. Near the bottom of the window, select **Manage: Excel Add-ins** and press **Go...** Check the box beside **Solver** and press **OK**. In the **Data** tab there should now be an **Analysis** section with a **Solver** command. Selecting this command opens a window that looks different than that in Excel 2003, but operates the same way. One difference is that Excel 2010 allows you to **Select a Solving Method**. When solving linear programs

in Sections 7.2–7.7, select **Simplex LP**. When solving nonlinear program in Section 7.8, select **GRG Nonlinear**.