# Introduction to Excel

Excel is a computer spreadsheet program. Spreadsheets are convenient to use for entering and analyzing data. Although Excel has many capabilities for analyzing data and generating reports, this introduction aims to give you the basics of entering data, defining formulas, creating simple graphs, and performing simple analyses. The screen shots are taken from Microsoft Excel 2007, 2012, & 2013. Any earlier versions will have similar properties – but the menus have changed.

Getting Started

To access Excel on the computers, double-click on the Excel icon [image] to start the program. Select Blank Workbook. You should see an Excel window open similar to the one shown below.
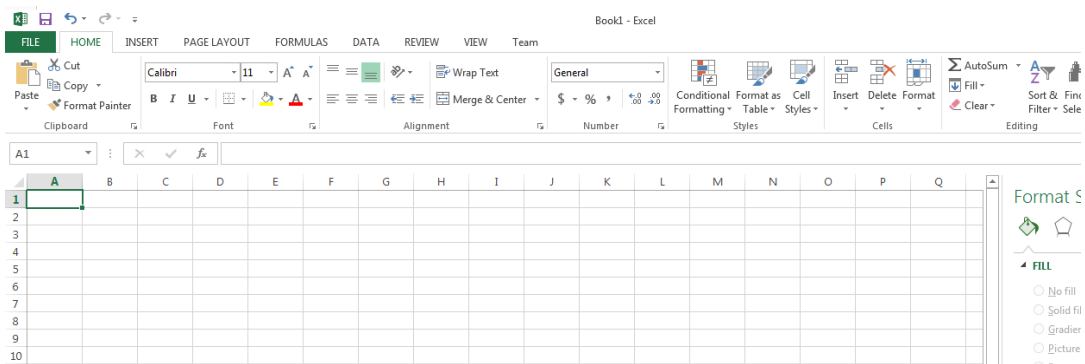
The spreadsheet consists of a large grid where <u>rows are indicated by numbers</u> increasing down the page and <u>columns are indicated by letters</u> shown across the top.

Each **cell** can be identified by the letter of the column and the number of the row where it is found.

- The A1 cell is highlighted in the picture above.
- Use the arrow keys or point-and-click to move to different cells.

The spreadsheet can hold large amounts of data.

- Use the arrow keys to move the highlighted cell off of the right edge or the bottom edge of the page. You should see the whole spreadsheet shift.
  In fact, you could have 1,048,576 rows and 16,384 columns!
- Return to the A1 cell.

Data Entry

To enter data in any cell, highlight the desired cell and begin typing.
- Type 1236 into cell A1.
  As you type, your input is displayed on the *Formula Bar* shown below.

- Press [Enter].
  The data is entered into the cell and the highlight automatically moves to the cell in the row below.
- Enter different data in a cells B1 B2 & B10.
- Enter the name Michael Jordan into cell A4.
  Since the name is too long it will appear to overlap with the adjacent cell.

- Increase the column width by placing your pointer on the <u>right edge</u> of the column heading A until the cursor changes to a vertical line with outward arrows. You can adjust the width in two ways:
  - o To manually adjust the width hold down the mouse button and drag the mouse to increase or decrease to the desired width.
  - o To adjust the width to automatically fit the widest contents, double-click the mouse at the right edge of the column heading.
- Type your full name in cell C3 and use the second method to automatically fit the column width to the cell contents.

Changing and Clearing Data
- Go to cell A1 and type Jon Bon Jovi [Enter].
  Notice that the old data is overwritten by the new data.
- Highlight cell A1. Hold your mouse button down and drag the pointer to cell H20.
  All of these cells should be highlighted.
- Press [Delete].
  This will clear all data entered in those cells.
- Type 1 in cell A1, 2 in cell A2, and 3 in cell A3.
- Highlight cell A1. Hold the [Ctrl]-key down and click on cell A3 (do not drag the mouse).
  This selects non-adjacent cells or sections of the spreadsheet.
- Press [Delete] to clear these two cells only. You should still have a 2 in cell A2.
- Clear all of your cells

DataTypes
1. **Numbers** are entered directly without commas. When you press enter the numbers are automatically moved to the right when displayed in the cell. You can easily change the display format of numbers by using Numbers grouping in the Home Tab.
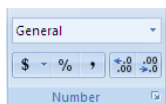
  - Enter 1 in A1; enter 0.89 in B1; enter 3000000 in C1; enter 4 in D1; enter 3.14159 in E1.
  - Highlight cell A1 and click on the [$]. Highlight cell B1 and click on [%]. Highlight cell C1 and click on [,]. Continue with the remaining 2 cells and the remaining 2 buttons to see what they do to the format of the number.
  - Clear all data from the cells

2. **Text** or **Labels** are usually combinations of letters, numbers, and characters from the keyboard. The default is to position such data flush to the left of the cell. You will often use text labels in row 1 of your spreadsheet to enter column headings and column A to enter row headings.

3. **Formulas** contain mathematical operations (e.g., +, - , *, /, ^) or predefined worksheet functions (e.g., SUM, AVERAGE, etc.). To enter a formula, begin by typing an = sign followed by the desired formula.

  - Type =12*3 [Enter] in cell C3 (don't forget the "="). Move your curser back to cell C3. Notice the result is displayed in the cell, not the formula. But the formula still appears on the Formula Bar.

- Type 12*3 [Enter] in cell D3 (without the "="). Excel treats this as just text and does not compute the formula.

As you can see, the beginning equal sign ("=") is important otherwise the spreadsheet will treat the data as text rather than a formula. When you press [Enter], the computed result will display in the cell rather than the formula. However, the formula is still displayed on the Formula Bar:

| C1 | ▾ | ⋮ | ✕ | ✓ | *fx* | =12*3 |

- Edit the formula in cell C3 to compute 12/5. To edit a formula, highlight the desired cell, then move your cursor up to the Formula Bar and click to place your cursor in the formula. Edit the formula to be 12/5 and press [Enter].
- Type the formula =12/5 into cells A1 through F1 (Do **NOT** use copy and paste). What happened and why? _____

- To change the number formats back to the default, select the desired cells (at least A1-F1). In the Number grouping above, the drop-down menu should say Accounting. Click on the arrow to see the other options. Select General No Specific Format. The cells should all say 2.4 now.
- Clear all data in the cells.

More about Formulas

Worksheet Functions Formulas may contain worksheet functions that are already defined in Excel. Some commonly used examples are SUM, AVERAGE, MAX, and MIN. Each of the functions require that you tell it which values to use (called its argument) either directly or by referencing cells (discussed in the next subsection). The argument is enclosed in parentheses directly after the argument name. Examples:

=SUM(2,3,5) will sum the numbers and display the number 10.

=MIN(A1:A10) will display the minimum data value found in cells A1 through A10.

=IF(H3>=0.60,"Pass", "Fail") will display the text Pass **if** the value in H3 is greater than or equal to 0.60 (e.g. 60%), otherwise it will display Fail.

- What is $\sin(\pi)$? _____
- Enter the formula =sin(pi) into cell C1. What happened? _____
  Pi is considered a function in Excel, so you must type pi( ) to get the number pi.
- Type the formula =pi() into cell C2. Does it give the correct value? _____
- Retype the formula in C1 as =sin(pi()) and write down the result. _____
  Did Excel return the result of zero that you expected? If not, how close to zero is it? _____
  [This is an example of round-off error that comes from Excel approximating those values.]

Referencing Cells *[This is really important and will help you to better use Excel – so pay attention.]* One of the advantages of spreadsheets is the option to refer to cell positions in formulas, so that when the data changes in a cell the formula automatically computes the new value.

- To reference a single cell just type the cell column-row position, e.g., D4 refers to the cell found in column D, row 4. [Note: You may type the cell references in lower case letters, but they will be displayed in the Formula Line in upper-case.]

- You may also refer to a range cells by entering the reference for the upper-left cell in the range, followed by a colon (:) and the cell reference for the bottom-right cell in the range.

Examples:
A2:D4 refers to all the cells in columns A through D and in rows 2 through 4.
A2:A13 refers to the cells in rows 2 through 13 of column A
B3:E3 refers to the cells in columns B through E of row 3.

Suppose you are tracking sales at four different electronic stores.

- Enter the following data into your spreadsheet as shown. Adjust the column widths any way you like to make it easy to read. Change the number format as needed.

	A	B	C	D	E	F	G	H
1	Store		Laptop	Tablet	TV	DVD		Total Store Sales
2	Oak Brook		203	185	215	81		
3	Schaumburg		226	264	333	112		
4	Skokie		314	201	199	84		
5	Northbrook		284	192	200	90		
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- Compute the total sales for Oak Brook by entering the formula =c2+d2+e2+f2 into cell H2.
- To get this formula into cells H3-H5, you have two options:
  1. *Fill*: **[Preferred Method – If you do not understand it, please ask the instructor.]** Select cell H2. The fill handle is the small black square located at the lower right corner of the cell. Click on this handle and drag it to select all the cells you want to fill with the original formula.
     or
  2. *Copy and Paste*: **[Delete the entries in H3-H7 first.]** Highlight cell H2 and copy (Ctrl-C or right click or from Home Tab).
     Select cells H3 through H5.
     Select paste to paste the formula.

- Move your cursor through the cells H2-H5. What is the formula in each cell now:
  H2: _____
  H3: _____
  H4: _____

  Notice that the cell references adjusted automatically for each row.

- Enter the label Total Unit Sales into cell A7.
  Enter the formula =sum(c2:c5) in cell C7. Fill or paste this formula into cells D7-F7 and H7. Note that the =sum() function is a much easier way to sum values in a column or row.

- Enter the label Percentage Sales into cell I1.
  To enter the formula into cell I2, type =, then move your cursor and click on cell H2 [Do ***not*** press enter]. You will see that Excel has entered H2 into your formula. Type / and then click on cell H7. You can use this method for a range of cells also. Fill or paste this formula into cells I3:I5 and I7 and observe what happens.

  What output does Excel give you in the cells I3:I5? _____

- Look at the formula in each of those cells:
    I2: _____
    I3: _____
    I4: _____
    I5: _____   [Delete anything in cell I6.]
    I7: _____

    What is wrong with the formulas? _____

Absolute Cell References **[This is also really important and will help you to better use Excel – so pay attention.]** If you do not want the cell reference to adjust when you fill/paste formulas, you must use an absolute cell reference. An absolute cell reference is indicated by placing a dollar sign before the part you do not want to change.
Examples:
D7 prevent both the column and row reference from changing when you fill/paste the formula.
$D7 would allow the row to change accordingly, but it would always remain in column D.
D$7 would allow the column to change, but not the row.
To compute the sales percentage, you *always* want to divide by the total sales in cell H7:

- To do this, enter the formula = H2/H7 into cell I2. Fill or paste this formula into the other cells in column I.   Write down the formulas from the cells now:
    I2: _____
    I3: _____
    I4: _____
    I5: _____   [Delete anything in cell I6.]
    I7: _____

    Can you see how the absolute reference worked.

- Delete all of the formulas in I2-I7. Type = H2/ and then click on the cell H7 (do not press enter). Now press the function button F4 on your keyboard. This will automatically put two "$" in to make it the absolute cell reference H7. Repeat pressing the F4 button will toggle through all the options, e.g. H7, H$7, $H7, H7.   Press F4 until you return to H7, then press enter.   Fill the formula again into the cells I3-I7 and delete anything in cell I6.

- Click on the column heading I to highlight the entire column. Click on the [%] button to change the format for these numbers to show percentages. Increase the decimal to show one decimal place.

If-Then Conditional Statements An *If-Then* conditional statement is one of the form

If <condition>, **then** <result>

This statement says that if the condition is satisfied or true, then the result is obtained. Two examples are:

1. **If** your average is 90% or higher, **then** your grade is an A.
2. **If,** $a \cdot b = 0$ **then** $a = 0$ or $b = 0$.

An *If-Then-Else* conditional statement is one of the form

$$\textbf{If} <\text{condition}>, \textbf{then} <\text{result}> \textbf{else} <\text{different result}>$$

This statement says that if the condition is satisfied or true, then the result is obtained. Otherwise, if the condition is not satisfied (or false), then the different result is obtained. Two examples are:

3. **If** your average is 60% or higher, **then** you pass, **else** you fail.
4. **If** $x \geq 0$, **then** $|x| = x$, **else** $|x| = -x$.

Excel has a built-in IF-statement with the following syntax:

$$=\textbf{IF}(\textbf{\textit{conditional statement, value to return if true}}, \textit{value to return if false})$$

The conditional statement can refer to values in other cells. Then the value to return will be displayed in the cell where the conditional statement is typed. You must have the first two argument (in bold), the *value to return if false* is optional. If you do not include the optional *value to return if false* argument, then by default the function will return the value/word FALSE.

Return to your example for electronic sales at local stores. In cell J1, type Total Sales Performance. Type the following if-then statement into cell J2:

$$=IF(H2>750, \text{"Satisfactory"})$$

Fill the formula to the remaining cells in column **J**. What happens if the total sales are below 750? Modify the if-then statement so that it will return "Poor" if the sales are less than 750 (e.g. make it an if-then-else statement of the following form:

$$=IF(\underline{\hspace{5cm}}, \underline{\hspace{3cm}}, \underline{\hspace{3cm}})$$
$$\text{\textit{conditional statement,}} \quad \text{\textit{result,}} \quad \text{\textit{other result}}$$

A nested IF-statement would another contain IF-statement in either of the result positions. For example, if we want to change the performance rankings to "Excellent", "Good", "Satisfactory", and "Poor" if the total sales are greater than or equal to 900, 800, 700, or 600, respectively, we would use the following nested IF-statement.

$$=IF(h2>=900, \text{"Excellent"},IF(h2>=800, \text{"Good"}, If(h2>=700,\text{"Satisfactory"}, \text{"Poor"})))$$

So if $h2> 900$ is false then Excel goes to the *other result*, which is the If-statement $h2 > 800$, which returns "Good" if true, but looks at the If-statement $h2 > 700$ if it is false, and so on. Type this statement into cell J2 and fill column J. Did it return the correct performance level?

Plotting

Excel has several options for plotting data, which can be found in the Chart Grouping on the Insert Tab:

From this Grouping, you can see the various types of charts you can create. If you click on the downward arrow next to each type, it shows you several options for that specific type of chart.

- Enter the following data into a new Excel worksheet. For an easier way to enter the years, type 1900 and 1910 into two cells. Highlight ***both*** cells and then drag the mouse to fill in the remaining cells. Excel recognized that you wanted to add 10 to the previous value and did it automatically.

Year	U.S. Population
1900	75,995,000
1910	91,972,000
1920	105,711,000
1930	122,755,000
1940	131,669,000
1950	150,697,000
1960	179,323,000
1970	203,212,000
1980	226,505,000
1990	248,710,000

- Select/highlight the *entire data set **and** their labels*.
- Since we want a plot of the Population as a function of Year, the Line plot seems like it might be a good choice. Click on the down arrow next to 〽 ▾ and select the 2D-Line plot 🗠 that will connect the data points with straight lines.
- First, notice that the top menu has automatically switched to Chart Tools and opened the Design Tab. We will explore those options later.
- Now look at the graph, is it what you expected or wanted? _____ What is the problem?_____

- Since this graph is not what we wanted, let's try another option. Delete the graph. Make sure the data and labels are still highlighted. From the Insert Tab, select the Scatter option ⠿ ▾ and select that connects the points with straight lines 🗠. Is this graph the type that we wanted? _____

So a Line Plot assumes that ***all*** columns represent *y*-values, whereas the Scatter Plot assumes the first column gives the *x*-values and the remaining columns are *y*-values.

Let's make our graph look nicer:

- Under the Chart Tools Design Tab, click on Add Chart Element from the Chart Layouts Grouping.
- To add titles to the axes, select Axis Titles. Select Primary Horizontal. You should now see a box on your graph for the Axis Title. Click in the box and change the title to "Year".
- Create the vertical axis title to be "Population" and the title should be rotated (so that it reads on its side).

Let's make a new graph with additional data

- In column C, add the following data for the Population of Brazil.   [Note: The 1910, 1930, & 1990 population values are approximations based on a model from the reported data.]

Year	U.S. Population	Brazil Population
1900	75,995,000	17,438,000
1910	91,972,000	21,948,000
1920	105,711,000	30,636,000
1930	122,755,000	34,767,000
1940	131,669,000	41,236,000
1950	150,697,000	51,944,000
1960	179,323,000	70,119,000
1970	203,212,000	93,139,000
1980	226,505,000	119,071,000
1990	248,710,000	138,197,000

- Select/highlight **only the data set** including the year and both populations -- **do not include the labels** (Year, U.S. Population, and Brazil Population).
- Create a scatter plot of this data. What do you notice that is different? _____
- This time we would like a legend that is meaningful. Right-click anywhere in the graph and choose Select Data. Highlight Series 1 and select Edit. In the window that opens type U.S. Population in the box labeled Series Name. Click OK.
- Now select Series 2 and select Edit. This time rather than typing in the series name, click on the

   Select Range button [icon] . This will open a new window. Click on cell C1 and see that it is entered into this window (including the sheet name). Click on the [X] to close this window and go back to the edit window. Click Ok.
- In your Excel Spreadsheet, change the data labels in cells B1 and C1 to be U.S. Pop. and Brazil Pop. (using abbreviations).   Why did it only change one of the legend items? _____
   _____

- Correct the legend so that both names are consistent.
- Move the legend to the top left corner of the graph and resize the plot area to fill the chart space.
- Click anywhere on the curve for the Brazil Population. Right Click and select Format Data Series. In the Format Data Series Window that opens on the right, select the Fill & Line Button (it looks like a paint bucket). Select the Marker button. Click on the arrow to show the Marker Options. Select Built-in. Change the Type to a triangle.
- Add a Chart Title and Axes Titles. Make any necessary resizing adjustments to get your graph to look like the one below.

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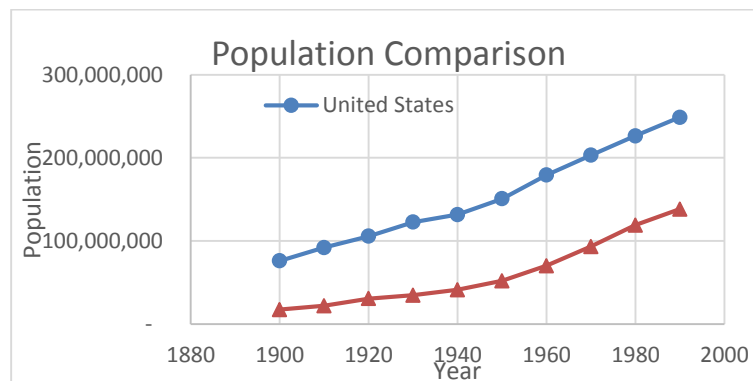
There are many other options for changing your graph.
- Select the US Brazil Graph and copy it. Paste a this copy somewhere else in your worksheet.
- Select this copied graph and select the Design Tab under Chart Tools. Click on the different Chart Styles and see how it changes the graph. Go back to the first (default) option.
- Select Quick Layout and click on the different options to see how it changes the graph.
- Click on the other buttons under the Design Tab.
- Delete this 2ⁿᵈ graph. Make another copy of the original. Select this copy and click on Add Chart Element. Select Axes-> More Axis Options. In the Format Axis Window, click on Axis Options and select Vertical (value) Axis. Select Horizontal axis crosses: Axis value: 150000000. [If you are having trouble finding these options, you can click on the vertical axes in the graph which will put a box around it. Right click and select Format Axis. Then you should be able to change the option Horizontal axis crosses: Axis value: 150000000.] What happens? _____
- Repeat the process to change the Horixontal Axis Crosses: Automatic.

Play around with the myriad of options to change many things in the graph.

Exercises   [Put all answers in the same Excel Workbook – use a different Worksheet (tab) for each Exercise]

1. Brief answer:

   a. Explain the main difference between a Line Plot and a Scatter Plot.

   b. What is wrong with entering the formula =tan(pi)?

2. Suppose you are keeping track of grades for 4 students.

   a. Enter the data from the table below into your spreadsheet.

   b. Use the SUM function to compute the **Total Points** (for each student and for the total points possible).

   c. Enter a formula to compute Alice's **Percentage Grade** based on the total points earned, using an absolute cell reference to the cell containing the total points possible. Fill this formula in the appropriate cells to compute the Percentage Grade for each student.

   d. Use nested if-then statements (i.e. nested IF functions) to assign letter grades A-F based on the percentage computed in part (c).

Name	Quiz 1	Quiz 2	Quiz 3	Midterm	Final
Alice	17	18	16	83	86
Bob	14	10	9	55	66
Chloe	20	20	19	98	99
David	18	15	17	94	90

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Elizabeth	11	15	15	76	77
Frank	17	17	18	88	91
Gertrude	19	17	17	93	89
Possible	20	20	20	100	100

3. Given the following table of data, create a plot that looks exactly like the one below. [Make Bob's line/markers green and Lucy's line/markers purple. Notice the tick marks, the *__location__* of the horizontal axis labels, and the shading in the legend.]

Week	Bob's Weight Loss	Lucy's Weight Loss
1	7.5	3.5
2	5.0	3.5
3	3.0	2.0
4	2.5	1.5
5	-1.0	0.0
6	4.5	2.5
7	3.0	2.0
8	4.0	2.0
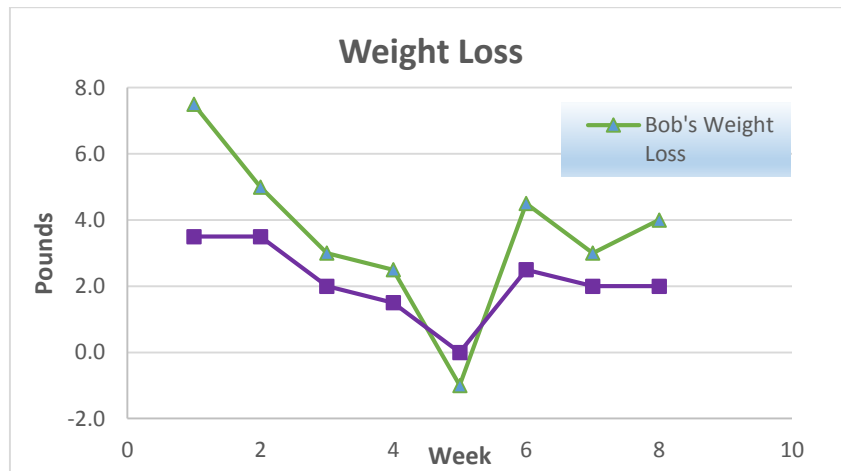
Save your file as *IntroExcel_YourNameHere.xlsx* ***and email it to the instructor.***

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