

# Contents

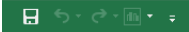
<b>1</b>	<b>Introduction to Using Excel Spreadsheets</b>	<b>2</b>
1.1	A Serious Note About Data Security . . . . .	2
1.2	The Components of an Excel File . . . . .	2
1.3	Changing Font (RIBBON:HOME:FONT) . . . . .	3
1.4	Changing Formatting Options for Row 1 (left click on 1, then RIBBON:HOME:FONT) . . . . .	3
1.5	Selecting Cells (left click, hold and drag to select multiple cells) . . . . .	3
1.6	Undo (from Quick Access Toolbar) . . . . .	3
1.7	Changing Width of Columns & Rows (left double click the line between column headings) . . . . .	3
1.8	Working with Sheets (use tabs at bottom on sheets) . . . . .	3
1.9	Relative Cell Reference: Sum, Copy, Paste (no dollar signs, B2) . . . . .	4
1.10	Absolute Cell Reference (dollar signs, \$K\$2) . . . . .	4
1.11	Formatting Cells to Represent Percentages or Currency (RIBBON:HOME:NUMBER) . . . . .	5
1.12	Delete, Insert (right click to select) . . . . .	5
1.13	Paste (select, then choose to paste values or formulas) . . . . .	5
1.14	Showing the Formulas (Ctrl `) . . . . .	5
1.15	Sort (RIBBON:DATA:SORT&FILTER) . . . . .	5
1.16	Freezing Panes (RIBBON:VIEW:WINDOW) . . . . .	6
1.17	Comment Boxes in Excel (RIBBON:INSERT:ILLUSTRATIONS) . . . . .	6
<b>2</b>	<b>Analyzing Data Using Excel</b>	<b>6</b>
2.1	Dates in Excel (use command =DATE()) . . . . .	6
2.2	Importing Data Into Excel (RIBBON:DATA:GET EXTERNAL DATA) . . . . .	7
2.3	Statistical Formulas (AVERAGE, STDEV, VAR, MEDIAN, QUARTILE, MAX, MIN) . . . . .	7
2.4	Formatting Charts . . . . .	7
2.5	XY Scatterplots . . . . .	7
2.5.1	Creating a Scatterplot (RIBBON:INSERT:CHARTS) . . . . .	8
2.5.2	Adding Regression Line and Correlation to Scatterplot . . . . .	8
2.6	Histograms (RIBBON:INSERT:CHARTS:HISTOGRAM) . . . . .	8
2.7	Boxplots (RIBBON:INSERT:CHARTS:BOXPLOT) . . . . .	9

# 1 Introduction to Using Excel Spreadsheets

This section of the guide is based on the file (a faux grade sheet created for messing with) **ExcelIntro.xlsx** which can be downloaded from the course moodle site. Download the file and open it in Excel to get started.

**Important:** Download the file to the desktop before you begin to work with it so you can find it easily later (right click on link in moodle, choose Save Link As). If you open the file while it is still “online”, some of the Excel functions I refer to later will be disabled. This is just meant to get us comfortable with Excel, we will get more practice in class and on assignments throughout the semester. You may have to click **ENABLE EDITING** once you open the file.

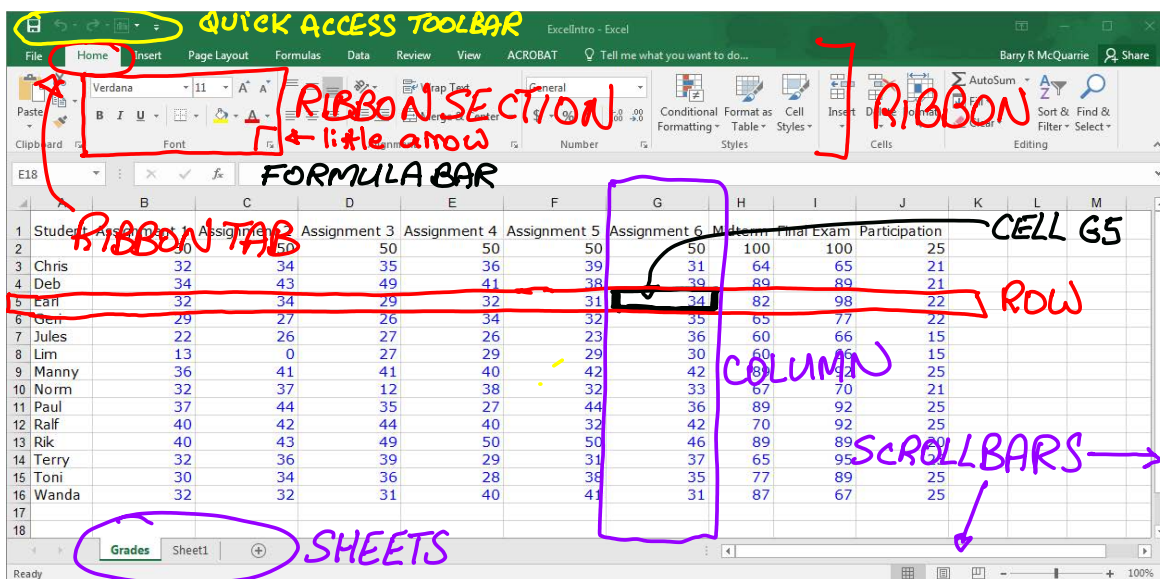
## 1.1 A Serious Note About Data Security

Save your work often, since things sometimes go wrong. It’s a good idea to have a backup copy of really important work, or work that would take a lot of time to recreate. In Excel, you can save your work by clicking the disk image on the Quick Access Toolbar  in the top left of the window. Before you leave a public computer, make sure you take your work with you on a portable disk, and/or email the work to yourself so you have a copy.

Equally important to is to delete any work that has been saved to the desktop when you leave. Delete, and empty the trash. It has happened that a student left work on a public computer, and another student came along and used this work for an assignment—the first student (whose only crime was not being diligent about securing his intellectual property) had to deal with the fallout from an academic integrity violation when the instructor graded the assignments.

## 1.2 The Components of an Excel File

- The Quick Access Toolbar on the top left.
- Sheets with columns labelled A,B,C, ... and rows labelled 1,2,3, ....
- You can have multiple sheets in one file using the tabs at the bottom.
- The RIBBON, which is the area at the top with tabs for FILE, HOME, INSERT, etc..
- Each tab in the RIBBON is divided into sections, for example RIBBON:HOME:FONT.
- Some sections have a little arrow in the bottom right corner to give even more options in a dialog box.
- The *formula bar*, which is just below the RIBBON and shows the formula for the cell you have selected.
- Scrollbars on the bottom right and left side to move the around in long sheets.



### 1.3 Changing Font (RIBBON:HOME:FONT)

You can change the font on an individual cell if you like. Let's change the font for the entire spreadsheet.

1. Select all the cells in the spreadsheet, which is accomplished by clicking on the corner rectangle, which is the rectangle to the left of A and above 1.
2. Change the font face and size by selecting from the RIBBON:HOME:FONT.
3. Clicking the arrow in bottom right corner of RIBBON:HOME:FONT will bring up a dialog with even more formatting options.

Alternately, you can right click on a region you selected and select **FORMAT CELLS** to get the dialog box.

You can change the format of the number, text alignment, font, border, fill (background colour), among other things.


### 1.4 Changing Formatting Options for Row 1 (left click on 1, then RIBBON:HOME:FONT)

The first row can be selected by left clicking on the 1. Once you have selected the first row, you can adjust the format of it from RIBBON:HOME:FONT. You select the first column by clicking on the A.

### 1.5 Selecting Cells (left click, hold and drag to select multiple cells)

To select multiple cells, left click, hold and drag to select. Select all the student names and then make the background orange using RIBBON:HOME:FONT and choosing the paintbucket to select orange. You can also use RIBBON:HOME:FONT to add borders around the cells you have selected.

### 1.6 Undo (from Quick Access Toolbar)

If you don't like a change you made, you can undo it by clicking the undo button  on the Quick Access Toolbar on the top left of the page. You can undo multiple times. The Keystroke Ctrl-Z will also undo.

### 1.7 Changing Width of Columns & Rows (left double click the line between column headings)

If you changed the text earlier, you may have a cell that is too small to contain the text. You can adjust the width of columns or rows by the following means.

- Select the line between column headings A and B at the top and drag to desired width (similar for rows).
- Left double click the line between column headings A and B at the top to set column width to automatically match width of text in cells.
- If you select all cells in the sheet first, the above methods will adjust width of all cells in sheet.
- Right clicking the column or row heading and then selecting either **COLUMN WIDTH** or **ROW HEIGHT**.

### 1.8 Working with Sheets (use tabs at bottom on sheets)

Excel files can have more than one sheet. This file has one sheet, titled **Grades** (at the bottom of the window). You can change the name of the sheet by right clicking on the *Worksheet Tab* Grades and selecting **RENAME**. You can also copy and paste sheets at this point by selecting **MOVE OR COPY**. Try it!

### 1.9 Relative Cell Reference: Sum, Copy, Paste (no dollar signs, B2)

OK, let's do something useful with the data. To sum the potential grades a student can earn, we should enter a formula in cell K2. To enter a formula or data into a cell you first left click on the cell. You can also type the cell reference you wish to work with in the *Name Box*, and the active cell will move to that cell.

The formula we want should tell Excel to sum the entries from cell B2 to J2. This is done by typing

```
=SUM(B2:J2)
```

This should be evaluated and give 525 in cell K2. Notice the formula appears in the *Formula Bar*, but it is the value of the evaluated formula that appears in the active cell in the spreadsheet. Also notice when you select a cell with a formula Excel highlights the cells being used in the formula, which is useful to find errors in formulas.

We want this sum for all the students, but we don't want to type this for each student. Instead, we can copy and paste the formula from cell K2, and Excel will adjust the formula to have the correct form for each row! How cool is that? The answer is very cool, of course. Once you start cutting and pasting formulas in Excel it becomes an extremely useful program. Here's how we do it:

1. Right click on cell K2, and select COPY.
2. Use the mouse to select cells K3 to K16 (left click, hold, and drag).
3. Right click anywhere in the group of cells you just selected, and select PASTE OPTIONS, and choose FORMULAS.

You should have the totals for all students now. What has happened here is Excel has used relative cell references, and adjusted each formula to be the correct formula depending on what row the formula is in. If you click on cell K9, you will see the formula in the *Formula Bar* is =SUM(B9:J9).

Another way to copy is to highlight the cell you want to copy, and hold left click the small black square at the lower right of the cell. You can now drag the cell and it will be copied. This is a useful technique if you want to copy multiple cells down a column, or across a row (in this case you highlight all the cells you wish to copy).

### 1.10 Absolute Cell Reference (dollar signs, \$K\$2)

If we want a percentage grade for each student, we divide each student's total grade by 525 (the total possible).

To get started, we should work on the total for Chris. We want 357/525, but we want to enter this in a way that if we change the grade Chris received on an assignment we wouldn't have to adjust the formula here as well. You might think entering in cell L3 something like K3/K2 would work, but you will find it won't. Anytime we enter a formula we need to tell Excel that is going to calculate something, and we do that with an equal sign. So we should enter

```
=K3/K2
```

This will work for Chris, but remember the power of Excel is when we can copy and paste formulas and have them work elsewhere. Copy and paste cell L3 into L4, and see what happens. Yikes! Deb scored 1.241 (124%!), which is clearly wrong.

The problem is that we need an absolute cell reference for the cell K2. When we copy and paste the formula we create in cell L3 to cell L4, we want the K3 value to change to L4 but the K2 to remain as K2. We can modify our formula in cell L3 so this will happen.

```
=K3/$K$2
```

If we copy and past this formula to a different row, Excel will adjust the K3 to the correct cell for that row, but will always divide by the value in cell K2. The dollar signs are what make this an absolute cell reference.

### 1.11 Formatting Cells to Represent Percentages or Currency (RIBBON:HOME:NUMBER)


Cells can automatically be formatted as a percentage, or include a dollar sign if the cell value represents money.

1. Select the cell or cells that you want to represent as a percentage (column L in this case).
2. From RIBBON:HOME:NUMBER change *General* to *Percentage*.
3. From RIBBON:HOME:NUMBER you can also change the number of decimals shown.

If the cells represent currency, from RIBBON:HOME:NUMBER select \$.

### 1.12 Delete, Insert (right click to select)

You can delete or insert rows or columns. Let's delete Geri from the class.

1. Right click on the 6 beside Geri to select the entire row associated with her.
2. You can choose to copy this row, delete this row, or insert a row here.
3. Select DELETE and the row will be removed, the rows below shifting up.
4. If you decide you deleted Geri by mistake, you can undo it by clicking the undo button  on the Quick Access Toolbar on the top left of the page.

### 1.13 Paste (select, then choose to paste values or formulas)

Paste can be tricky in Excel, since sometimes you want to paste a formula, and sometimes you want to paste the number that formula gives you (the value). By default, Excel will try to paste the formula. If you want to paste the value, you need to choose PASTE SPECIAL.

Select cell L8, which on the spreadsheet is a number but in the *Formula Bar* contains a formula. Try to copy and paste into cell C19 and see what happens. From the pop-up you can choose to paste values, formulas, transpose, formatting, and link. You should experiment a bit with what each does, but we will only use values or formulas.

### 1.14 Showing the Formulas (Ctrl `)

Sometimes it can be useful to have Excel show all the formulas in the spreadsheet, rather than what they evaluate to (this can be useful if you have an error somewhere and don't know where it is). To have Excel show you the formulas, hold down **Ctrl `** (control, backtick) all at once. The backtick is on the ~ key. To switch back to showing the evaluation of the formulas, hold down **Ctrl `** again. Try it! Notice that the widths of the columns will change, so you might have to scroll over to see the formulas using the scroll bars at the bottom right.

### 1.15 Sort (RIBBON:DATA:SORT&FILTER)

You can sort the data by the value in a particular column if you like.

1. Select rows 3 through 16 (all the students).
2. From RIBBON:DATA:SORT&FILTER choose SORT which brings up the SORT dialog box.
3. Make sure the box beside "my data has headers" is unchecked (your data does have headers, but we haven't selected them).
4. If you choose to sort by Column A, the data will be alphabetized by student. If you choose to sort by Column L, the data will be sorted by student grade.
5. You can sort by more than one attribute if you like.

If you select the headers as well, just make sure to check the box "my data has headers" when you sort.

### 1.16 Freezing Panes (RIBBON:VIEW:WINDOW)

This is very useful if you have large data sets to manipulate, and you want to always see the row and column labels.

- From RIBBON:VIEW:WINDOW choose FREEZE PANES
- FREEZE PANES will freeze above and to the left of the selected cell
- If you select cell B2, then FREEZE PANES will freeze column and row headings, so you can scroll both to the right and down and maintain headings.

### 1.17 Comment Boxes in Excel (RIBBON:INSERT:ILLUSTRATIONS)

The DRAWING TOOLS is used to add a box to a spreadsheet which you can write comments in.

1. From RIBBON:INSERT:ILLUSTRATIONS choose SHAPES to select a shape to insert.
2. Left click on the spreadsheet to place the shape, which can then be resized and to which you can add text.
3. Double left click on the shape and the DRAWING TOOL will appear in the RIBBON. You can use this to modify the shape. Try it! If you have added some text to the shape, you can right click on the text and choose *Font* to modify the size of the font.

## 2 Analyzing Data Using Excel

### 2.1 Dates in Excel (use command =DATE())

The date January 1, 2013 can be entered in Excel using the formula =DATE(2013,1,1).

This is a great benefit in personal finance problems, because you can then add 1 month to this date using the formula =DATE(2013,1+1,1) which will yield February 1, 2013.

You can add 4 months using =DATE(2013,1+4,1), which yields May 1, 2013.

To add 1 day to the date, and get an output of January 2, 2013, you can enter the formula =DATE(2013,1,1+1). In a similar fashion you can get any date you want from the initial date. If you add 12 months to a date, the year will increment by one, so =DATE(2013,1+12,1) will yield January 1, 2014.

Here is one way (there are others) that you can conveniently enter dates in Excel, when the dates are changing in the month. This would be useful in a problem where interest was being compounded monthly. This way is convenient because you can copy/paste to get more dates! In a new sheet, type

	A	B
1	Compounding Period	Date
2	0	=DATE(2013,1,1)
3	1	=DATE(2013,1+A3,1)

If you select cells A3 to B3, then copy down you create a list of dates very easily.

Once you have the formulas in Excel, you can format how the date is presented. After selecting the cells that represent dates, Right click anywhere in the selected region, choose FORMAT CELLS, and from the *Number* tab then select DATE.

## 2.2 Importing Data Into Excel (RIBBON:DATA:GET EXTERNAL DATA)

Getting data into Excel can be a bit tricky, but it is important if you hope to be able to analyse data effectively using Excel. Here is an outline of how you can do it when the obvious doesn't work.

I have some data on the course moodle site in the file **data1.txt**. Click on the link to see the data.

First try a simple copy/paste and see what goes wrong. The problem is that the data is not stored in separate columns.

Here is a technique to import data which, although a bit long, always works:

1. Store the Data in a text file such as data.txt as comma delimited text, or tab delimited text.  
You can use Notepad or some other editor to do this, and can copy and paste the data from a webpage. I usually store it on the desktop so it is easy to find.
2. In Excel, choose from the drop down menu RIBBON:DATA:GET EXTERNAL DATA and choose FROM TEXT, then choose the file you just created.
3. You will have some choices to make, so make the appropriate choices based on how you stored the data in the text file. You can view how the data will be imported into Excel at this stage.

## 2.3 Statistical Formulas (AVERAGE, STDEV, VAR, MEDIAN, QUARTILE, MAX, MIN)

I've assumed the data  $x_1, x_2, x_3, x_4$  is stored in cells A1, A2, A3, A4. **Vary the ranges in the Excel formula for the data you are working with.**

Statistical Quantity	Mathematical Formula	Excel Formula
mean	$\bar{x} = \frac{1}{4} \sum_{i=1}^4 x_i$	=AVERAGE(A1:A4)
standard deviation	$s = \sqrt{\frac{1}{3} \sum_{i=1}^4 (x_i - \bar{x})^2}$	=STDEV(A1:A4)
variance		=VAR(A1:A4)
median		=MEDIAN(A1:A4)
first quartile		=QUARTILE(A1:A4,1)
third quartile		=QUARTILE(A1:A4,3)
maximum		=MAX(A1:A4)
minimum		=MIN(A1:A4)

## 2.4 Formatting Charts

In Excel, rarely are the default options for a chart either pleasing to the eye or the best way to convey information. You should always include axes labels, include a title, remove unnecessary legends, and change grid lines and other parts of the chart to make it easy to understand and (frankly) enjoyable to look at.

## 2.5 XY Scatterplots

To do linear regression (and nonlinear regression as well) and determine the correlation  $r$  between two variables, we can first create a scatterplot of the data, and then get Excel to figure out the equation of the regression line and the correlation from the scatterplot. Let's treat the data you pasted into Excel as  $(x, y)$  pairs, and create a scatterplot for the data using the following process.

### 2.5.1 Creating a Scatterplot (RIBBON:INSERT:CHARTS)

Here is one way you can create a scatterplot in Excel.

1. First, highlight the data you want in your scatterplot. If your data is not in two columns that are beside each other, start a new sheet and put the data in two columns side-by-side—it's just a whole lot easier if it's like this!
2. From RIBBON:INSERT:CHARTS choose SCATTER to get the scatter plot. You can choose to have only points, points connected by lines, etc. Once the chart is created, you can modify it, so the choice you make here isn't very important. Choose only the points, since we will be putting a regression line on the plot later.
3. Once the chart is created, right click on it to access options to change the layout, data, and other things in your chart. The options change if you click different parts of the chart. If you choose a layout with titles (and you should!) you can double click on the titles to change them. Once the chart is selected, these options will also appear to the immediate right of the chart as CHART ELEMENTS, CHART STYLES, and CHART FILTERS.
  - You can move the scatterplot around in the sheet once it has been created.
  - If you click on the chart to make it active, you will get a dialog that allows you to change things (clicking different parts of the chart brings up different dialogs).
  - You can also double click on the chart itself to make changes (sometimes you need to change the format of the data points, which you can do by double clicking on the data points).
  - You can also drag a corner of the chart to change its size.

### 2.5.2 Adding Regression Line and Correlation to Scatterplot

1. Once you have a plot of the data, right click on the data points and you will get some options.
2. Choose ADD TRENDLINE. Choose LINEAR, then check the boxes next to DISPLAY EQUATION ON CHART and DISPLAY R-SQUARED VALUE ON CHART. Notice that this is how you can add other types of trendlines beyond linear.
3. You can move the equation to another part of the chart if you like.

You should find that  $y = 0.501x + 1.6686$  and  $R^2 = 0.4911$ . The  $R^2$  is the square of the correlation  $r$ , and with the equation of the linear regression line you are able to make predictions of future behaviour of the variables.

## 2.6 Histograms (RIBBON:INSERT:CHARTS:HISTOGRAM)

**Warning!** A histogram is a column chart, but a column chart is not a histogram! If you simply try to create a histogram by selecting the data and using RIBBON:INSERT:CHARTS (Column) you will not get a histogram!

Let's construct histograms of the following two datasets available in the moodle site in the file **data2.txt**. Download the data sets into Excel (see Section 2.2 Importing Data Into Excel). I put them in columns A and B on a new sheet. Note that our data has headings.

To generate the histogram:

1. Select the data set you want to be in the histogram, including the heading. Since I stored my data in columns A and B, I will select Column A first.
2. From RIBBON:INSERT:CHARTS select *Histogram*.



3. Once the histogram is created, right click on it to access options to change the layout, data, and other things in your chart. The options change if you click different parts of the chart. If you choose a layout with titles (and you should!) you can double click on the titles to change them. Once the chart is selected, these options will also appear to the immediate right of the chart as CHART ELEMENTS and CHART STYLES.

This creates the histogram, but it will be a lousy histogram, so we need to make some changes to make it convey the information better.

- The default chooses too large a bin width, or in other words, too few bins. To fix this, right click on the  $x$ -axis and select *format axis*. Change the number of bins to something that conveys the structure of the histogram well, so not too small and not too large. You can make other adjustments, but generally this is all that is needed. Notice this adds the counts in each bin, which is a nice feature.
- Choose CHART ELEMENTS and add a *Legend* to your histogram, which will add the heading if you selected it when first creating the histogram.
- Change “Chart Title” to something meaningful.
- If you drag the bottom of the histogram to make it large, you can make enough room for the labels on the  $x$ -axis to show the bin ranges.

## 2.7 Boxplots (RIBBON:INSERT:CHARTS:BOXPLOT)

Let’s construct boxplots of the following two datasets available in the moodle site in the file **data2.txt** which we have already downloaded in to Column A and Column B when we created a histogram. Notice the datasets have headings, Rats and Rabbits.

An important use of boxplots is to compare two data sets, so we will create the data sets for the two distributions together so they can be easily compared.

To generate the boxplots:

1. Select the data set you want to be in the histogram, including the heading. Since I stored my data in columns A and B, I will select Column A and B together.
2. From RIBBON:INSERT:CHARTS select *Box and Whisker*. This is available if you click the drop-down arrow beside the button for the Histogram.
3. Once the boxplots are created, right click on it to access options to change the layout, data, and other things in your chart. The options change if you click different parts of the chart. If you choose a layout with titles (and you should!) you can double click on the titles to change them. Once the chart is selected, these options will also appear to the immediate right of the chart as CHART ELEMENTS and CHART STYLES.
4. Choose a CHART STYLE that will add a legend to the boxplots, which will include the headings from the data sets.
5. Note Excel will automatically identify outliers as dots in your box-whisker plot.