

## TABLE OF CONTENTS

Introduction.....	page 2
Useful Functions.....	page 2
Getting Started with Formulas.....	page 2
Nested Formulas.....	page 3
Copying and Pasting Formulas.....	page 4
Getting the Most out of Formulas.....	page 4
Formatting and the F4 Key.....	page 5
Sorting and Filtering Data.....	page 6
Named Ranges.....	page 7
Dates and Times.....	page 7
Data Analysis Toolpak.....	page 7
Text to Columns.....	page 7
Other Tips and Shortcuts.....	page 7
Troubleshooting.....	page 8
Excel Charts and Graphics.....	page 9

## INTRODUCTION

This is a basic introduction to the Excel features frequently used by CUNY data staff. This guide assumes basic familiarity with Excel (there are good tutorials on the Microsoft website to help you get started).

## USEFUL FUNCTIONS

<b>Function</b>	<b>Excel Formula</b>
Addition	=SUM(number1, number2, ...) or =number1 + number2 + ...
Multiplication	=PRODUCT(number1, number2, ...) or =number1*number2*...
Average	=AVERAGE(number1, number2, ...)
Median	=MEDIAN(number1, number2, ...)
Maximum	=MAX(number1, number2, ...)
Logical Test	=IF(logical_test,[value_if_true],[value_if_false])
Join Mult. Strings into One	=CONCATENATE(text1, text2, ...)
Select Char(s) from String	=MID(text, start_num, num_chars)
Convert Char String to #	=VALUE(text)
Convert Char to UPPERCASE	=UPPER(text)
Count # Empty Cells	=COUNTBLANK(range)
Count # Cells Meeting Condition	=COUNTIF(range, criteria)
Current Date	=TODAY()

## GETTING STARTED WITH FORMULAS

You may either type numbers directly into a formula or link a formula to numbers in other cells. For example, to find the sum of the numbers 2, 3, and 4, you can simply type **=SUM(2,3,4)** in any cell and hit enter. Alternatively, you can use a link formula by entering the numbers 2, 3, and 4 into any three cells, typing **=SUM(** in a fourth cell, and then dragging the cursor over the cells containing the numbers and hitting enter.

When working with even basic data sets, budgets, or tables, use Excel formulas (and particularly linked formulas) as much as possible. Never do a calculation by hand and then type the solution into Excel. There are three main reasons for this recommendation:

- First, your calculations are subject to human error.
- Second, formulas serve as a road map of all of your assumptions and calculations, which comes in handy both as a reminder to yourself and for sharing files with other people.
- Third, working with Excel worksheets often requires revisions as estimates or decision rules change over time. Using linked formulas makes revisions easier.

## NESTED FORMULAS

It is possible to nest multiple **IF** functions within one Excel formula. You can nest up to seven **IF** functions to create a complex IF THEN ELSE statement. The syntax for the nesting the **IF** function is:

```
=IF( condition1, value_if_true1, IF( condition2, value_if_true2, value_if_false2 ))
```

*condition* is the value that you want to test

*value\_if\_true* is the value that is returned if *condition* evaluates to TRUE

*value\_if\_false* is the value that is return if *condition* evaluates to FALSE

**Example 1:** In Excel, you need to write a formula that works this way:

If (cell A1) is less than 20, then multiply it by 1,

If it is greater than or equal to 20 but less than 50, then multiply it by 2

If it is greater than or equal to 50 and less than 100, then multiply it by 3

And if it is great or equal to than 100, then multiply it by 4

You can write a nested IF statement to handle this. For example:

```
=IF(A1<20, A1*1, IF(A1<50, A1*2, IF(A1<100, A1*3, A1*4)))
```

**Example 2:** In Excel, you need a formula in cell C5 that does the following:

IF A1+B1 <= 4, return \$20

IF A1+B1 > 4 but <= 9, return \$35

IF A1+B1 > 9 but <= 14, return \$50

IF A1+B1 > 15, return \$75

In cell C5, you can write a nested IF statement that uses the **AND function** as follows:

```
=IF((A1+B1)<=4,20,IF(AND((A1+B1)>4,(A1+B1)<=9),35,IF(AND((A1+B1)>9,(A1+B1)<=14),50,75)))
```

## COPYING AND PASTING FORMULAS

Copying and pasting formulas can save a lot of time. For example, if you need to calculate the average exam score for students taking four exams (assume one column of score data for each exam type), you can first set up the sum formula for the first exam type column and simply copy and paste the formula into the columns for the second, third, and fourth exam types.

This works because Excel's default option is "relative cell references," which means that when you copy and paste a formula into a new cell, the cell references in the formula move a corresponding number of cells across and down. For example, suppose you create a formula in cell C3 that divides the value in cell A3 by the value in cell B3; the formula in cell C3 would be =A3/B3. If you copy and paste the formula into the next cell to the right (D3), the formula will automatically shift the references one cell to the right, to become =B3/C3. Similarly, if you copy and paste this formula in the next cell down (C4), the formula will automatically shift the references one cell down, to become =A4/B4.

But what if you want to keep the numerator or denominator constant? For example, suppose you want to divide each of the values in cells A3 through A10 by the value in cell B3. You could enter those formulas one at a time, but there is an easier way: you can tell Excel not to automatically adjust some or all of the cell references in the formula. All you have to do is place a dollar sign (\$) in front of the column letter or row number you want to remain fixed. In this case, the formula in C3 should be =A3/B\$3. This is known as an "absolute cell reference." When you copy and paste this formula into cells C4 through C10, the numerator will change but the denominator will remain B3. If you want to keep the column fixed as well – for example, so that the formula can be copied into a cell in column D without changing the denominator—then put a dollar sign in front of the column letter as well: =\$A3/\$B\$3. A shortcut is to highlight the formula and use the F4 key as a toggle.

## GETTING THE MOST OUT OF FORMULAS

### Adding Hidden Text to Formulas:

Imagine you have a formula like: =\$2018+\$1056-4\*\$120. When you initially wrote it you knew what each number represented, but you come back later and can't remember. Add a hidden note to your formula by using the **N()** formula i.e. =\$2018+\$1056-4\*\$120+N("My Wage+Bonus-4 weekly loan repayments"). The **N()** function will convert text to zero.

### Adding Text to Formulas:

To show a **formula result** and text or number(s) in the same cell type a & (Ampersand) after the formula then your text/number(s).

### **See Formula Cells:**

If you have a sheet full of **formulas** and you want to identify these cells at a glance go to **Edit>Go to>Special** and select "Formulas" then click "OK". Now go to **Format>Cells** or **Ctrl+1** and select the "Patterns" tab and choose a color.

### **Showing Formulas:**

Occasionally you will need to show the Excel formula you used as text. To display a formula, simply put an apostrophe in front of the formula. For example: '=SUM(3,24,100).

### **Formula Errors:**

Whenever typing one of Excel's functions (especially nested ones) into a cell always use lower case. This way when you push **Enter** Excel will capitalize only the names of the functions you have entered correctly.

## **FORMATTING AND THE F4 KEY**

### **Changing the format of a cell (dollar signs, decimal places, negative numbers, etc.):**

To change the format of a cell, select the cell, go to the Format menu, and click Cells. On the Number tab, choose the desired format type and then, if you are working with a number, select the desired number of decimal places. The **F4 key** (which repeats the previous operation) can be used to repeat the format changes for multiple cells.

### **Making Columns wider:**

If a column is too narrow to show the entire contents of the cell, ##### will appear in the cell. To increase the column width, go to the Format menu and click Column and then Autofit (or, for a custom width, choose Width and then select a larger number). Alternatively, you can just drag the right edge of the column header to the right. Similarly, make rows taller by going to Format menu and selecting Rows instead of Columns, or drag the bottom edge of the row header down.

### **Merging Cells (e.g., center a heading over a table or create a large text box):**

Select the cells you want to merge, go to the Format menu, and click Cells. On the Alignment tab, click the box called Merge Cells. If you are centering a heading, choose Horizontal Alignment: Center. (Or as a shortcut, you can use the "Merge and Center" button on the toolbar; it looks like the letter "a" with arrows on either side). If you are creating a text box and you want the text to "wrap around" to the next row of the cell, select Wrap Text (in this case you might also want to select Horizontal Alignment: Top). If you want a border around the merged cells, go to the Border tab and choose Outline.

### **Making a large table fit onto a single page:**

Go to the File menu, select Page Setup, and select "Fit to 1 page(s) wide by 1 tall." For wide tables, choose the Landscape setting; for tall tables, choose the Portrait setting. Before printing, always use Print Preview to make sure that your table does not span multiple pages or comes out so small that it is illegible.

### **Controlling your view of the data:**

Freeze Panes is a useful feature when you are working with a large document that has many rows. By freezing a certain row (usually the header), you make that row visible wherever you are in the document. For example, if you have a document with 100 rows, you can't see the header row when you're at cell A100. To solve that problem, click on the row below the one that you would like to freeze. To freeze the header row, click on the cell in the second row and first column. Then go to **Window > Freeze Panes**. [It's important to note you can freeze columns as well as rows. If you just click at an arbitrary point in the second row, not only will you freeze the top row, you'll also freeze all columns to the left of the cell you've selected.]

## **SORTING AND FILTERING DATA**

You can order your data from the Sort window in ascending or descending order as well as based on multiple header values. Sorting data is simply a way of automatically re-ordering rows on a spreadsheet to put them in a more useful order. For instance, you might sort an address book alphabetically by last name, or a list of items you'd like to buy from most expensive to least expensive.

Start by selecting the data you want to sort. It's important to select all the columns in the data, not just the column you want to sort by. For instance, if you have a list of items in one column, with the prices in the next column, you would select both columns before running the sort. If your sheet has a "header row" at the top with labels for your columns (like "name," or "price") it's a good idea to include that row in your selection as well, as you'll see in a moment.

Once you have your data selected, click Data > Sort. If your data has a header row, be sure the "header row" bubble is filled in at the bottom. Excel will then use your labels in the "Sort by" boxes instead of the usual (unhelpful) "Column A," "Column B," etc. Now you can use the "Sort by" box to select the column you'd like to sort the data by (if that column contains text, it will sort alphabetically; if the data is numeric it is sorted in number order). The two "Then by" boxes select what column to use next if there is a tie in the "Sort by" column.

Another way to organize data is to filter it. A filter only displays data that meet a certain criteria, such as all records for a certain day. To do this, go to **Data > Filter > AutoFilter**. A dropdown arrow will appear in the header cell of each column of your worksheet. Click on the arrow and select the criteria that you would like to use as a filter (e.g. April 10th). The worksheet will now display only the records from that day. You can also use the AutoFilter tool to display the top or bottom 10 numbers in a column, only records with blank spaces in that particular column, records that have a value greater than a certain number in the column that you are filtering, etc.

## NAMED RANGES

To name a selected range, click in the “**Name box**” (far left on the formula bar) and type a one word name.

To go to an existing named range select it from the “**Name box**” or hit **F5**.

To delete or edit a named range go to **Insert > Name > Define** or Push **CTRL + F3**.

To obtain a list of all Named Ranges and where they refer, select any blank cell (make sure you have not data underneath or 1 column over) and go to **Insert > Name > Paste** then **Paste List**.

## DATES AND TIMES

To insert today’s date: **CTRL + ; (semicolon)**

To insert the current time: **CTRL + SHIFT + : (colon)**

## DATA ANALYSIS TOOLPAK

Microsoft Excel provides a set of data analysis tools, called the Analysis ToolPak that you can use to save steps when you develop complex statistical analyses. Excel can even do regressions. **Data Analysis** will bring up a dialog box where you can choose the type of analysis (regression, histogram, ...) and then choose which cells contain your X or Y data.

Click **Tools** → **Data Analysis** → **Descriptive Statistics**

If **Data Analysis** doesn't show up as an option in your **Tools** menu, add it by going to **Tools** → **Add-Ins** and checking the **Analysis Toolpak**.

## TEXT TO COLUMNS

**Text to Columns** (located in the **Data** menu) is a useful tool for separating into multiple columns text that is currently contained in one column. For example, maybe you have social security numbers in column A and you just need the last four digits of the SSN. **Text to Columns** would let you separate the SSN into two columns.

## OTHER TIPS AND SHORTCUTS

- When working with multiple worksheets, move one worksheet to the right by pressing **CTRL + PAGE DOWN**  
To move one worksheet to the left, press **CTRL+ PAGE UP**

- To insert a line break in a cell, press **ALT + ENTER** to start a new line while you're typing or editing data.
- To move or copy a worksheet  
Right-click a tab, and then click **Move or Copy** on the shortcut menu.  
In the Move or Copy dialog box, you can:
  - Move the worksheet to a spot within its own workbook by selecting a sheet in the **Before sheet** box.
  - Move the worksheet to another open workbook by selecting the workbook in the **To book** list and then click **OK**.
  - Keep a copy of the worksheet you're moving in this workbook (rather than just moving it), select the **Create a copy** box.
- When you've imported data sometimes numbers will come in as text. That is, they look like numbers but don't act like numbers. A quick way to identify this problem is to use the Excel feature that when a block of cells is selected the SUM of the cells will appear in the Status Bar. Numbers that are text will have a value of zero in the SUM. To **convert text to numbers**:
  - Select the cells to convert
    - Right-click in the upper left-hand corner of a block of blank cells large enough to accommodate the cells you want to convert
    - Choose Paste Special
    - In the Paste Special dialog box choose the **Operation, Add**

Doing this arithmetic operation of adding the cells' text value with the zero value of the destination cells forces Excel to convert the text value to a number.

## TROUBLESHOOTING

Common sources of errors are parentheses that don't match or missing arguments for functions. If your formula is free from those errors, here are some error values you might get:

- |        |   |
|--------|---|
| #####  | There is nothing wrong with your formula; the cell simply isn't big enough to display the result. Widen the column.   |
| #DIV/0 | You are trying to divide by zero; correct the divisor. If the divisor is a cell reference, check to make sure the cell isn't empty.   |
| #NAME? | There is a name in the formula that Excel doesn't recognize. If you typed in a function, check the spelling or verify that the function exists. If you are performing operations on text, enclose the text in double quotation marks. |



- #REF! A cell reference is not valid. Reenter the formula.
- #VALUE! The formula uses the wrong type of operand or argument. Check to see that you're not performing math operations on labels or that arguments of functions that need to be numeric are not referring to cells containing labels.

## **EXCEL CHARTS AND GRAPHICS**

A chart often makes it easier to understand the data in a worksheet because users can easily pick out patterns and trends illustrated in the chart that are otherwise difficult to see.

A full discussion of Excel's many charting options is beyond the scope of this handout. However, it is fairly straightforward to create a simple chart (and some complicated ones) using the chart wizard. Just highlight the data you wish to base your chart on (including header rows, if you have any) and click the chart wizard button on the toolbar. The chart wizard will then take you through four steps:

1. Selecting the type of chart you want
2. Verifying the data range you selected
3. Setting options for labels, axes, legends, etc.
4. Choosing whether you'd like the chart to appear in the current working sheet, or in its own, new sheet.

A help button is available at each step in the wizard if you're confused by any option. A quick way to get a chart started is to select the data and headers you wish to chart, and press F11 on your keyboard.