Introduction to Google Sheets

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If you've only used spreadsheet programs[1] occasionally, you may have only used them to put numbers in some organized form.

If so, that's a shame. These programs are very powerful, and learning even the basics of how to use them greatly expands your ability to efficiently analyze quantitative data.

Here, instructions will refer to Google Sheets, because that is a program that everyone with an internet connection has access to. The general abilities discussed here, should apply to virtually any spreadsheet program, however.

1 Using Formulas

1.1 Basic Calculations

The first thing one should understand about Google Sheets is that it has a built-in calculator.

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[1] Excel, Google Sheets, OpenOffice Calc, LibreOffice Calc. . .

Whenever you start a cell with an equals sign, Sheets treats everything that follows as a calculation.[2] For instance, if you enter `=2+3` in a particular cell, that cell will appear as `5`. (Try it!)

If you double-click on the cell, it will return to displaying `=2+3`. Thus, you can enter a formula into a cell, then go back and edit it later. You can also look at the text bar at the top of the screen, where it will display the full formula; clicking there will also enable you to edit the formula.

1.2 Functions

In addition to the usual operations (`+`,`-`,`*`,`/`,`^`), Google sheets has a number of functions you can use. For instance, if you want to calculate the square root of 2, you can write `=sqrt(2)`.

Some that you may find useful:

- `sqrt(x)`: As mentioned.

- `pi()`: If you want to insert π, rather than typing 3.14, you can use this function. (Remember the parentheses - it won't work without them.)

- `sin(x)`, `cos(x)`, etc.: Note that these take arguments in *radians*, so if you have your numbers in degrees you'll need to convert them. Multiply your angles by `pi()/180` to do this conversion, of course.

- `asin(x)`, etc.: this is how you write the function also called arcsin or $\sin^{-1}$. Note that these return angles in radians, too.

- `exp(x)`: $\exp(x)$ means the same thing as e^x.

- `ln(x)`, `log10(x)`, `log(x,b)`: logarithms in various bases. In this class, we'll only use `ln`.

There's also a number of more mathematically advanced functions included built-in, in addition to some general analysis tools. A more complete list can be found at `https://support.google.com/docs/table/25273?hl=en`.

1.3 Calculations Using Cells

The real power of Google Sheets comes from the fact that you can do calculations not only with numbers, but with *cells*.

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[2]If you ever want it *not* to do this - say, you want a cell that actually starts with an equals sign - put a single quote, ', before the equals sign.[3] This forces everything after to be treated as ordinary text rather than a calculation.

[3]If you want a cell to actually start with a single quote for some reason, start with two single quotes instead. The first one will "mark it as text," and the second one will appear.

For instance, you can have an expression like `=A1+A2`. If you enter this into, say, cell `A3`, then cell `A3` will automatically be filled with the sum of whatever is in cell `A1` and cell `A2`. (Empty cells are treated as zero.)

This means that you don't have to re-enter numbers. You can just refer to the cells those numbers are in. This lets you do calculations directly in Excel very easily.

That's kinda convenient, but it actually gets better. Whenever you change a cell, Google Sheets *automatically* updates anything that's based on that cell.

For example: suppose you started with a 1 in cell `A1` and a 2 in cell `A2`. If cell `A3` was `=A1+A2`, then it would show 3, of course. If you then changed cell `A1` to a 5, then cell `A3` would automatically change to a 7.

1.4 Usefulness of Cell Calculations

Alright, it's neat that the spreadsheet works that way, but how would this help you in lab?

Well, let's suppose you have a sequence of calculations across multiple cells. If you do something wrong in the middle, you can fix that calculation, and it'll automatically fix the last one!

For instance, suppose cell `A3` is `=A1+A2`, and cell `A4` is `1/A3`. You then realize that, oops, you made a mistake, and `A3` should be `=A1-A2` instead.

If you had done this in the calculator, you would have to recalculate both. In Google Sheets, you can change the formula for `A3`, and `A4` will change automatically. Nice and convenient!

Actually, if you're ambitious, this can help even more. If you read the lab beforehand and understand what calculations you're going to be doing, you can do all your calculations ahead of time!

Before you get to class, enter all the formulas into the data sheet. Then, when you get to class, you can enter in the data, and your final results will come out as you take your data. This means you can check whether your results are reasonable before even leaving the lab, without having to do a bunch of work during lab to get that done.

2 Using Google Sheets Autofill

2.1 Pattern Recognition

The second trick that makes spreadsheet tools incredibly useful is their ability to pick up on patterns.

Let's suppose you want your first column to have the numbers 1-100. If you enter the first few numbers into the first few cells, you can have Google Sheets do the rest.

Enter 1 into A1, 2 into A2, and 3 into A3. Then, highlight those three cells, click the square in the bottom-right corner, and drag it down.

What you should observe (after releasing) is that Google Sheets has automatically filled the next handful of cells for you, detecting the pattern you were setting up and filling in the rest. Handy!

This works horizontally as well as vertically - you can auto-fill rows, too, if you just drag horizontally.

2.2 Using Cells

As before, though, this really comes into its own when you combine it with the ability to reference cells.

Suppose you have three columns. You want your third column to be the product of your first two - that is to say, C1 should be =A1+B1, C2 should be =A2+B2, etc.

If you enter the first entry in C1 and drag down as before (with even just once cell this time!), it'll automatically increment all cell references. So, in the second row, A1 will turn into A2 and B1 will turn into B2, and so on.

This means that if you're doing a bunch of identical calculations (say, on a bunch of different data points), you can do the calculation once, drag, and get all the results.

If you want a shortcut that's faster than click-and-drag, double-clicking on that same square will automatically fill the column down as far as the previous column goes. For instance, if you had every cell from A1 to A7 filled in and you double-clicked on an entry in B1, it would autofill everything down to B7, just as if you had clicked and dragged to that point.

2.3 Fixing a Cell Reference

What if you didn't want them all to change, though? Suppose you wanted your first one to be something like `=A1+E7`, your second one to be `=A2+E7`, etc. - you want one of the cells stay fixed when the other one changes.

The way to do this is to use a dollar sign, `$`. Enter it as `=A1+$E$7`, and the autofill will not change the `E7` anymore.

The first dollar sign fixes the letter, and the second one the number. If you wrote `E$7`, then the column (`E`) could change if you autofilled horizontally, but not the row (`7`) when you autofill vertically. Similarly, `$E7` could change `7` but not `E`.

2.4 A Reminder

The autofill is nice, but you have to be careful with it. You should always look over the formulas it makes to ensure that it extended the formulas correctly. Always check your work!