Lab 14: LaTeX

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1 Directions

Your lab assignment today is to write the code to produce this document.

1. First, write some code.
2. Then, compile it with `pdflatex`.
3. Check the pdf to see if it looks right.
4. When you're done, submit your tex file.
5. Good luck on finals!

2 Text Formatting

Sometimes, you *may* want to **emphasize** some text.

3 Math

Let $i^2 = -1$, or as you may recognize it, $i = \sqrt{-1}$.

Claim: $e^{\pi i} + 1 = 0$. Why on earth would this be true?

First, what does it mean for us to raise e to an imaginary power? Well, the Maclaurin series for e^x might help us:

$$e^x = \sum_{k=0}^{\infty} \frac{x^k}{k!} = 1 + x + \frac{x^2}{2} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots \tag{1}$$

(Hint: `\cdots` makes a centered ellipsis.)

So, plug in ix:

$$e^{ix} = \sum_{k=0}^{\infty} \frac{i^k x^k}{k!} = 1 + ix + \frac{i^2 x^2}{2} + \frac{i^3 x^3}{3!} + \frac{i^4 x^4}{4!} + \cdots \tag{2}$$

Now we get to use our nice rule that says $i^2 = -1$:

$$e^{ix} = 1 + ix - \frac{x^2}{2} - \frac{ix^3}{3!} + \frac{x^4}{4!} + \frac{ix^5}{5!} - \cdots \tag{3}$$

Let's rearrange a little bit:

$$e^{ix} = \Big(1 - \frac{x^2}{2} + \frac{x^4}{4} - \cdots\Big) + i\Big(x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots\Big) \tag{4}$$

If you put on your Maclaurin series glasses and squint a bit, it turns out that all this hootenanny reduces to

$$e^{ix} = \cos(x) + i\sin(x) \tag{5}$$

And since $\cos(\pi) = -1$ and $\sin(\pi) = 0$, $e^{\pi i} = -1$.

4 Figures

If you like drawing pretty figures, you should look at TikZ.

If you want to read more about complex numbers and fractals, read `http://acko.net/blog/how-to-fold-a-julia-fractal/`.

Figure 1: The complex plane!