Assignment 3

Natalie Faraj

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1 Introduction

This assignment served as a thorough introduction to dealing with complex numbers on python, plotting and graphing various equations, aswell as experimenting with LaTex. Although tough, now that I have finished all my code, I feel as though I have learned many things. I now know more commands, techniques, and mathematical equations. This gives me an overall better understanding in computational astrophysics.

2 Question 1

The toughest part of this question was just understanding what it was asking; I went to my notebook and drew sketches before I actually coded anything. This question involves a complex plane which holds real and imaginary numbers; although I have a strong background in mathematics, this concept is always pretty tough to grasp. Since this question heavily involves mandelbrot sets, I had to do some research and makes sense of the equation first.

Once I figured out what I needed to do, I got to work. I imported all the modules I needed, I set boundaries (max/min values), set up the iteration, and plotted 2 images. Figure a shows a scatter plot where points that diverge are shown in gray dots (mostly scattered around the center). Figure b shows a similar depiction, except a colour scale indicates the iteration number at which the points diverge. These two figures are shown on the next page; notice the similarity in shape.

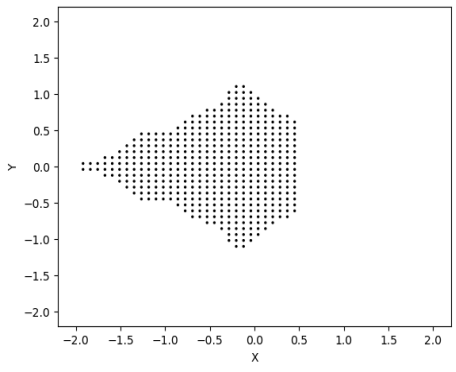

Figure a

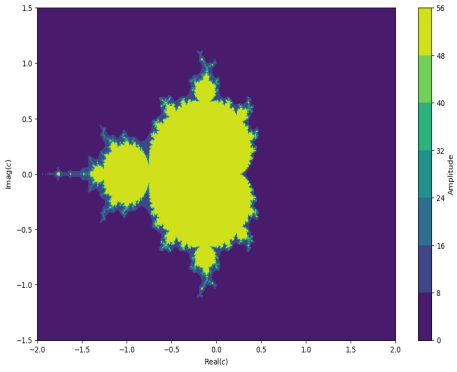

Figure b

3 Question 2

Question 2 introduced a set of equations known as Lorenz' equations. These were derivatives that needed integrating. Firstly, I coded and defined the equations. Next, I used solveivp to actually integrate these set of equations. Then, we were told to recreate some plots of the Lorenz equations. Figure 1 was composed of waves (keep in mind it's rotated here).

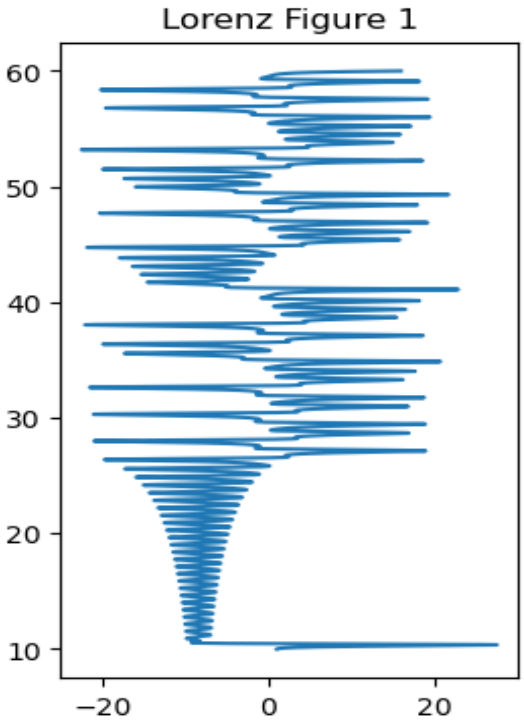

Figure 1

Figure 2 was composed of two 2D graphs; these were X vs Y (in yellow below) and Y vs Z (in green below).

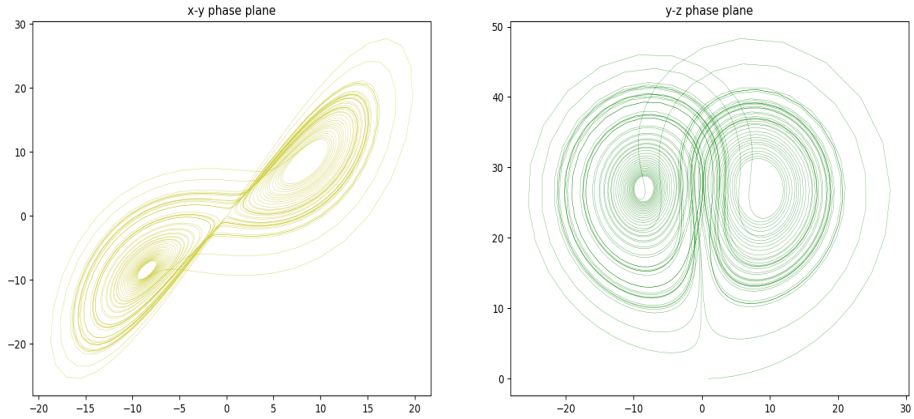

Figure 2

Then, I wanted to experiment with some 3D graphing, thus I plotted the 3D Lorenz plot (figure 3, shown below):

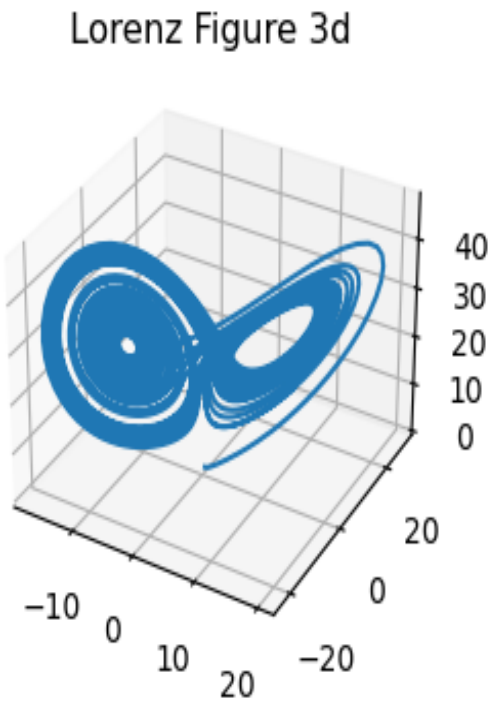

Figure 3

Lastly, I conjured up a series of commands that allowed me to find the distance between W and W'. Then I was able to graph this on a semilog. It can be seen on the next page (Figure 4)

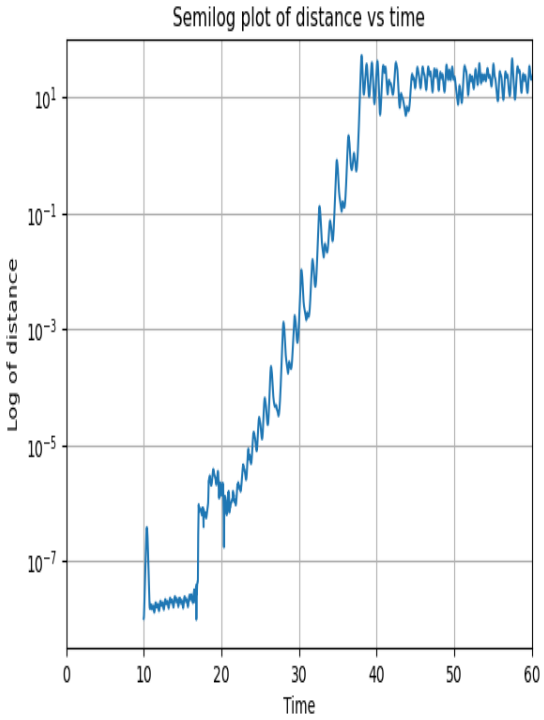

Figure 4

4 Conclusion

In conclusion, I learned a lot from this assignment. I plotted new equations, learned new commands, and picked cool colours for Lorenz' equations! I also can't forget to mention that I also learned to use LaTex (case in point).