Hw 2

Stefany Fabian Dubón*
Bryn Mawr College
(Dated: February 10,2020)

[Solve exercises 2.13 a), 3.1, and 3.3]

1. INTRODUCTION

For this homework assignment, I was able to practice recursion to calculate the Catalan numbers C_{n}. Then, ways to plot experimental data using an online file was introduced. Finally, I was able to learn how to use a grid of values to create a density plot.

2. EXERCISE 3.6

To create a program that uses recursion, which is the ability of a function to call itself to calculate the C_{n}. I used the definition of Catalan numbers C_{n} given in the form:

$$C_{\mathrm{n}} = \begin{cases} 1 if n = 0, \begin{cases} \frac{4n-2}{n+1} C_{\mathrm{n}-1} if n > 0 \end{cases} \end{cases}$$

(1)

I first define the function that calculates Catalan (n) using and if statement. I started the if statement saying that id n == O, then i would get 1 as the return, else I would used the formula $\frac{4n-2}{n+1}C_{\mathrm{n}-1}$ to get the return number. Next, to use the function to calculate and print C_{100} I just call the function and input the number 100.

3. EXERCISE 3.1

For this exercise, I started by getting the sunspots.txt from the on-line resources, which contains the observed number of sunspots on the Sun for each month since January 1749. I then proceeded to write the starting code that reads in the data and makes a graph of sunspots as a function of time. I did this by defining x and ya values that would read in the specific columns in the file. I then also input the value 1000, so that the code would only display up until the 1000th data point on the graph. I then created a for loops to calculate the running average of the data defined by:

$$Y_{\mathrm{k}} = \frac{1}{2r+1} \sum Y_{\mathrm{k+m}} \tag{2}$$

Finally, i plotted both the original data, and the running average on the same graph over the range covered by the first 1000 points

4. EXERCISE 3.2

For this exercise, I also used a on-line resourced called stm.txt , which contained a grid of values from scanning tunneling microscope measurement of the (111) surface of silicon. For a little background, a scanning tunneling microscope, is used ti measure the shape of a surface at the atomic level. This results in a grid of values that represent the height of the surface. To compute the density plot of the values found in the file, I created a a program that read the file, and using the imshow argument to create the image.

*Electronic address: sfabiandub@brynmawr.edu; URL: Optionalhomepage

5. RESULTS

For exercise 3.1, I used an online file, which obtained the observed number if spots on the sun for each month since January 1749. After modifying the data so that it only displays the first 1000 data points on the graph, as well as to calculate and plot the running average of the data, I obtained the following graph:

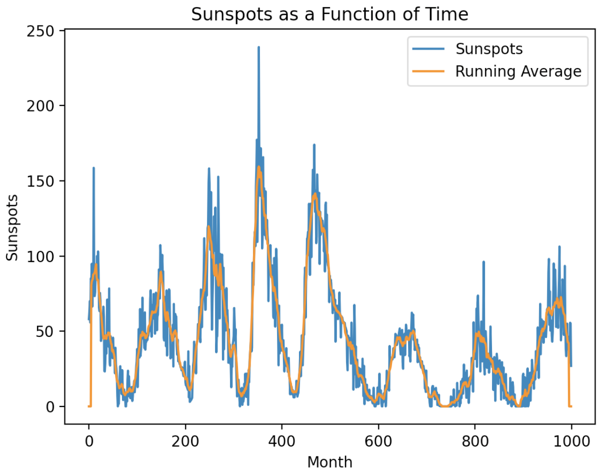

FIG. 1: Sunspots plotted as a function of time

For exercise 3.2, I used a grid of values from scanning tunneling microscope measurements to create a density plot. As a result, I obtained the following image to show the structure of the sillicon surface

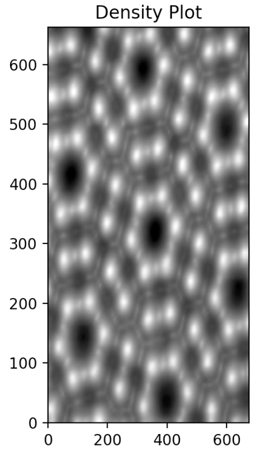

FIG. 2: Image of the Density plot using the values that represent the height of the surface.

6. CONCLUSION

Overall, this homework set did take me some time, since I had some issues with getting my vscode to work with pylab. The problem was that it kept saying that I didn't have the module, and when trying to install it from the terminal, it said that Anaconda didn't have it, in the end I was able to do the graphs using matplotlib. I did learned how to make a legend and how to make a density plot, which even thought I've seen before, I've never really thought deeply on how they are produced.