Homework 5

Ch En 263 – Numerical Tools

Due: 12 Feb. 2024

Instructions

- Complete the problems below and submit the following files to Learning Suite:
 - Handwritten portion: scan each page (or take a picture) and combine them into a single pdf named: LastName_FirstName_HW5.pdf
 - Excel portion: submit a workbook named LastName_FirstName_HW5.xlsx where each worksheet tab is named "Problem_1", "Problem_2", etc.
 - Python portion: submit a separate file for each problem named LastName_FirstName_ HW5_ProblemXX.py where XX is the problem number.

Problems

- 1. Visit finance.yahoo.com and select a stock by searching for a company name and selecting the "Historical Data" tab. Download the data for the past three months and import it into to a your Excel worksheet. Generate a single plot that shows the "High" and "Low" data. Format the plot for readability by:
 - Adjusting the plot size to be 4 in. high and 6 in. wide,
 - Plotting the data as lines (of different color) instead of markers,
 - Adjusting the y-axis to zoom in enough to see a difference between the two curves,
 - Naming the y-axes (e.g. Price, \$),
 - Deleting the Chart Title,
 - Eliminating the grid-lines,
 - Putting a legend in the top-right corner that labels "High" and "Low",
 - Adjusting the font size to be 16, and
 - Rotating the text-direction of the dates on the x-axis to be vertical.
- 2. Do the following in a Python file.
 - (a) Define arrays for the following equations

$$y_1 = 2x^{-3} + 2x^{-1}$$

 $y_2 = 2x^{-3}$
 $y_3 = 2x^{-1}$

where $x \in [10^{-2}, 10^2]$ with at least 100 points in each array. *Hint: Use the numpy function logspace.*

- (b) Write x, y_1, y_2 , and y_3 to a text file called power_law.dat with a header that says # columns:x, y1, y2, y3.
- (c) Read x, y_1, y_2 , and y_3 back in from the text file power_law.dat from disk, and store them as the variables t, s_1, s_2, s_3

- (d) Plot t versus s_1 , s_2 , and s_3 with the following formatting specifications, and save the plot as power_law.pdf.
 - Make the plot a log-log plot.
 - Make the default font size 16.
 - Plot s_1 as a black solid line of width 2, s_2 as a blue dashed line of default width and s_3 as a red dotted line of default width.
 - Label the x-axis with a symbol, σ .
 - Label the y-axis with the word "Energy"
 - Title the figure "Power-Law Crossover"
 - Change the x-axis limits to span from 10^{-2} to 10^2 and the y-axis from 10^{-5} to 10^5
 - Add a legend where s_1 is labeled as "exact", s_2 is labeled as "large σ " and s_3 is labeled as "small σ ".

Hint. You are going to have to read the online documentation to learn how to do some of this formatting. I did this on purpose, so you can get comfortable doing this because it is an important skill.

Problems 3 and 4 are similar to the debugging problems in Lab 9. Your assignment for these problems is to debug a code that is given. As was the case in the lab, for each problem, you will need to document your debugging process in an Excel sheet. For each bug (a problem can have multiple bugs), record your (1) observation, (2) hypothesis and (3) experiment loop in a text box in your worksheet. Record each step in the loop. After you find and fix the bug, identify whether it was a syntax error, an execution error or a logical error. For each of these problems you should have a python file containing the fully debugged code named "LastName_FirstName_HW5_ProblemXX.py" and a tab named "Problem_X" in the Excel workbook "LastName_FirstName_HW5.xlsx" with your written answers.

- 3. In a Python file, write a function called dot that takes two 1D numpy arrays as arguments and returns dot product. Your function should use a loop and should work for arrays of any length. Demonstrate that your function works, by printing the dot product of [4, -2, -8, 1] and [-3, 8, -1, -4].
- 4. Write a Python code that reads the file XOM.csv (which contains the stock price of Exxon Mobile for the last several months) and plots the "High" price and the "Close" price versus "Day". Format your plot with the high price as a blue curve, the closing price as a red curve, axes labels and a legend.