Coding Practice #4

OBJECTIVES

After completing this week's exercises, you will:

- Read and write data files
- Practice using functions
- Practice creating and labelling plots

- Use dataframes to wrangle and manipulate data
- Practice using for loops and lists

Tasks

1. Open Eclipse and find the **sample-code-solutions** repository under the Project Package Explorer window and **pull** from this repository. This should make the files "background_reading_4_2022.py", and "Flux_data_PS_CHE5834_D2O_R0.xlsx" appear. Use this as you go through the Background Reading pdf, found on D2L under the Coding Exercise 4 folder, to review the basics that are relevant to this Coding Exercise.

2. Locate your **last name-first name** repository in Eclipse and **pull**.

3. Create a new .py file **in your last name-first name repository**. Name your file **coding_exercise_4.**

4. Review the Background Reading in **Coding Exercises > Code Exercise 3** on D2L.

5. Write a code that has the following functions (you may make additional functions as you please, but you **must** have the ones listed below to be eligible for full marks):

- A function that calculates the neutron flux for a point source, S, as a function of r:

$$\phi(r) = \frac{S}{4\pi D} \frac{e^{-\frac{r}{L}}}{r}$$

Carry out the calculation for neutrons diffusion through a beryllium (Be) moderator. The diffusion coefficient and diffusion length for neutrons in Be are 0.5 cm and 21 cm, respectively. Use a source term of 10^7 neutrons/cm^{2}s.

- A function that:

  o Reads the provided **Flux_data_PS_CHE5834_D2O_R0.xlsx** file and creates a dataframe for the point source neutron flux in heavy water (D_2O).

- o Cleans up the data such that all zero, missing, and outlier points are removed.

- o Returns the cleaned up dataframe.

- A function that:

  - o Calls on the function above, where a dataframe was created from the **Flux_data_PS_CHE5834_D2O_R0.xlsx** file.

  - o Creates a dataframe from the data output from the point source flux for neutrons in beryllium function over a radius range of 1 to 400 cm.

  - o Combines these two dataframes into one dataframe.

  - o Calls on a plotting function (see next function bullet point) that plots all of the columns in the dataframe against the distance index column.

  - o Shows and saves a png image of the plot. Name your plot image **Combined_PS_Flux_D2O_Be_YourName.png** and set the resolution to 300 dpi.

- A function that:

  - o Plots all columns in the dataframe against the distance index column over a range of **1 to 80 cm**. This will ensure that the two flux profiles are distinguishable.

  - o Labels the maximum flux as "Max Point Source" with a directional arrow (see Background Reading).

6. Use function docstrings to explain the basic purpose of your function and to provide some details on the input arguments, what is being returned, and if there are any side effects (see the Background Reading #2 pdf document for details on this).