

DSC 430: Python Programming  
Assignment 1002: Closest Planet

Continuing our investigation in the which planet is closest to Earth, create a simulation that runs for 1000 Earth years. On each day, compute the distance between every pair of planets, keeping the average.

Create a final report addressing the two Parts below:

**Part A:**

- 1) A well-documented top-down structure chart showing how both the planets and the simulation work and interact. Include any assumptions you made about your design.
- 2) Create a **8x8** chart showing the average distance between all the planets. **Show the chart in the documentation.**
- 3) Which planet is on average closest to Earth? Did that result match your expectations? Explain.
- 4) Run another simulation, this time for only 1000 days, each day **writing to a file** the distance from Earth to Mercury, Venus, and Mars (i.e., **one file for Earth to Mercury, another for Earth to Venus, and another for Earth to Mars**). In the end, you should have a dataset with 1000 rows and 3 columns. Using Pandas and Matplotlib, create three timeseries. **Show the timeseries in a plot in the documentation.** Also describe the time-series and discuss them considering your findings in #3.
- 5) Describe three ways you could extend the simulation.
- 6) ~~Include all your code of the simulation and analysis in an appendix to your report.~~

**Part B:**

- a) How efficient is your simulation? Can you do better?
- b) When computing the average distance between planets, would it be better to sample random days rather than iterating over every day for 1000 years?
- c) What was your original assumption regarding the closest planet to Earth? Did the results match your expectation? Does the definition of “closest” matter?

**Submission:** Submit a single **.pdf** file (**the documentation file**), **the source file (.ipynb)** and **the three output files, separately**. The documentation file must start with your name, assignment number, and the honor statement, “I have not given or received any unauthorized assistance on this assignment.”