Lab 5: Forming Geospatial queries with Shapely, plotting and counting with GeoPandas

Overall Deliverables & Rubric:

● Complete set of code and figures (one notebook per exercise) concatenated as 1 PDF file, uploaded to CANVAS.
● Total Points 50

0. Computer Programming Environment

All the exercises involve Python and can be done from your web browser using Google's Colab.

1. Exercise 1: Plotting spatial objects

You will create a plot of some shapes and compute area and distances.

Code Block 1:
Create a geometry scene consisting of one square with sides of length 2 centered at the origin (0,0) that intersects a circle of radius 1 such that the center of the circle is at a midpoint of one of the square's sides.

Figure 1: Using GeoSeries interface for Matplotlib, make sure both the original shapes and intersection are shaded by their transparency.

Answer 1. Calculate the area of the intersection and print it to the terminal using `print`.

Code Block 2:
Write a function that takes an arbitrary input point and calculates the distance to the intersection. You may want to create the intersection as its own shape and pass it to the function or define it inside the function.

Code Block 3:
Test this function for a set of points both inside of the original shapes, but not in the intersection, and outside the original.

Figure 2. Plot the intersection and plot these points colorcoded and changing the marker shape based on whether they are in the intersection.

Deliverable & Rubric:
Make this Exercise 1 in one standalone Jupyter Notebook and print it.
5 points for each figure. 5 points for each code blocks. (25 points in total).

2. Exercise 2: Geospatial queries

Upload the GDS_lab5_exercise_2.ipynb to Google Colab or use your own machine.
The location of households, parks, and grocery stores are given as Shapely objects.

Given the lists of spatial objects:
Purple = household
Green = park
Red x = grocery store
Find and plot the subset of households that within a radius of 7 units from any grocery store and 2 miles from any part of a park?

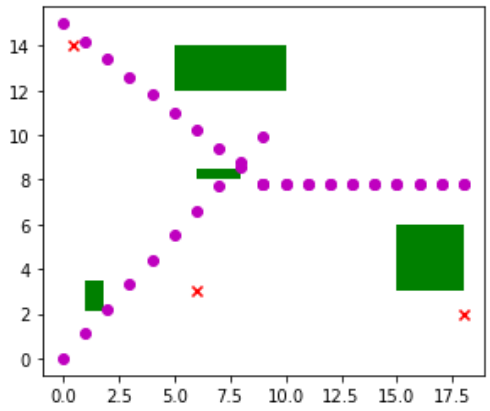

Figure 1:
Using the data, try to replicate the plot except switch the color and marker scheme.
Blue x = household
Red = park
Black square = grocery store

Add a legend. (Not covered in lab lecture.)

Code Block 1:
Find the subset of households that within a radius of 7 units from any grocery store and 2 miles from any part of a park.

Figure 2:
Plot the data again with the same scheme. Except for the subset of matching households.
Plot them with magenta stars with a larger markersize.

Deliverable & Rubric:
Make this Exercise 2 in one standalone Jupyter Notebook and print it.
10 points for the Figure 1. 5 points for Figure 2. 10 points for the code blocks. (25 points in total).