HONR 490 – Homework 4

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Homework Instructions
To receive credit for the assignment, do the following:

1. Create an `.ipynb` file, and name it: `purduealias_honr490_homework_number.ipynb` (e.g., `gould29_honr490_homework_1.ipynb`)

2. Show all your work and follow the instructions below very carefully.

3. Submit a printout (e.g., as PDF) of your `.ipynb` file–and the file itself–to Brightspace by the due date.

4. You must show **all** your work and provide comments in your code explaining what you are doing. **You must display your SQL query (queries) AND ALL GeoDataFrame(s) to receive any credit!**
(e.g., `#Adding title to map` or `#Load data`; displaying `GeoDataFrame` to prove SQL query works and returns correct data)

5. Each homework problem will have a qualitative question. You must answer it to receive the specified points. For example:
(e.g., **Question:** What city has the largest area (based on your `ST_AREA` calculation)? **Answer:** `NYC`. You can print this in a cell in your `.ipynb`.)

For grading this assignment, I will not leverage unit tests. I will look at the printout of your `.ipynb` file. When in doubt, please show and comment all your work.

All files and data you need to complete this assignment are located on GitHub, under the Homework 4 folder. It contains the following:

- `./airbnb`: A folder containing a shapefile (and supporting files) of Airbnb rentals, socioeconomics, and crime in Chicago.

The primary motivation of this homework assignment is to ensure PostgreSQL and PostGIS are installed correctly on your machine. Both of which are required in order to complete the homework assignment's questions.

Problem 1

Calculating Community Area–2 Points
Calculate the area of each Chicago community, reflected as hectares.

Input: The data and files described on page 1.

Desired Outputs:

1. (1 point) `GeoDataFrame` showing correct execution of SQL against your PostgreSQL database.

2. (1 point) The correct answer to the following question: *Which community is smallest, w.r.t. area?.*

Problem 2

Calculating Population Density–6 Points
Calculate the population density of each Chicago community (people per $unit^2$; please use mi^2)

Input: The data and files described on page 1.

Desired Outputs:

1. (5 points) `GeoDataFrame` showing correct execution of SQL against your PostgreSQL database.

2. (1 point) The correct answer to the following question: *Which community has the highest population density?.*

Problem 3

Executing Coordinate Transformation–2 Points
Convert the coordinate system in the `geometry` column to: NAD83 / Illinois East.

Input: The data and files described on page 1.

Desired Outputs:

1. (1 point) `GeoDataFrame` showing correct execution of SQL against your PostgreSQL database.

2. (1 point) Plot the resulting `GeoDataFrame` from above on a map.

Problem 4

Determining Alternate Airbnb Locations: Community Proximity *w.r.t.* **Distance, Crime, and Spot Availability–15 Points**
Justin wants to go to Chicago with his family, and they need an Airbnb. They would like to stay in the Grand Boulevard community; however, there is no more availability. Help Justin and his family find the next closest community. Please return a `GeoDataFrame` of the distances between Grand Boulevard and the other communities in Chiago, based on the community's polygon's centroid location, in descending order.

Input: The data and files described on page 1.

Desired Outputs:

1. (10 points) `GeoDataFrame` showing correct execution of SQL against your PostgreSQL database.

2. (5 points) The correct answer to the following question: *Which community is closest to "GRAND BOULEVARD", fulfilling the following constraints:* (1) *has a below-average (city-wide) number of crimes and* (2) *has more than* 20 *available spots?.*

HINTS:

- The distance function you need to use will return a number in meters, assuming you use the default CRS.
- Discount "EAST GARFIELD PARK" from your table. That will not be the closest community to GRAND BOULEVARD.