Lab 07: Building spatial weights matrices

Read the instructions COMPLETELY before starting the lab

This lab will help you become more comfortable with developing spatial weights matrices and working with spatially-lagged variables. It will also require you link multiple "hands on" portions of in-class work such that you demonstrate your understanding of underlying concepts and theory.

Tasks:

1. Select one of the datasets from the libpysal library (see https://pysal.org/libpysal/notebooks/examples.html for details). The dataset should include a polygon feature class, as you will make a choropleth map in a later task. It should also contain an "interesting" variable that you will use in a Moran plot.
2. If it is not projected, reproject it to an appropriate CRS. Show the CRS in the notebook.
3. Develop a contiguity-based spatial weights matrix of your choosing (i.e., rook or queen)
    1. Plot a histogram of the number of neighbors
    2. "Print" to the notebook the average number of neighbors
    3. Choose one areal unit of interest (e.g., a county), make a plot of the unit and its neighbors, similar to what we completed in class. NOTE, you MUST use a different (but appropriate) color scheme than what we used in class
    4. Row-standardized the W
    5. Using a variable of interest in your dataset, calculate the spatially-lagged value of variable in that neighborhood
    6. Make a Moran Plot
4. Repeat #3 above with a W developed using the distance-band method
5. Using the dataset from #4 (the distance-band-based W), write a script that:
    1. Finds those observations in the H-H category
    2. Plots a choropleth map of your dataset with a categorical color scheme, where the shading corresponds to the Moran plot (really, "LISA") quadrants. Thus, your map will have four shades of color.

Note, you have been provided all the information/knowledge/skills required to accomplish this task. THINK about how the lagged variables, the Moran plot, and quadrants work from a conceptual perspective FIRST. Then write your code

HINT: `numpy.where()` is a useful function for generating a new attribute based on a conditional test

Questions:

1. Describe in your own words: *what is a spatially-lagged variable?*
2. How does your analysis in this lab (as simple as it is) differ by how you have formalized W (e.g., space, neighbors) in two different methods? How might it affect analysis?
3. What does it mean if an observation falls in the "H-L" quadrant? Why might it be useful to detect such occurrences (e.g., think of a real-world example)?
4. Walk me through your process in completing task 5 above. What challenges did you encounter and how did you overcome them?

What to turn in

- Your Jupyter notebook (or Python script). I must be able to run your code - do not turn in a screenshot or code pasted into a Microsoft Word document
- The answers to the above questions