**Introduction to Urban Science**

**Assignment 1: Causal Diagrams and Feedback; or Economic Growth and Urbanization**

**Either:**

**Qualitative Exercise**: Write a short essay [500 words maximum + diagram]

After reading Jane Jacobs’ “Life and Death of Great American Cities” last chapter (link jacobs.the-kind-of-problem-a-city-is.lib-iss.pdf), write a short essay in three parts:

1. Summarize when issues of cities are *problems in “organized complexity”*.  [~150 words]
2. Provide an example of a “problem” that you consider important but challenging, and discuss its interconnections, much like Jacobs discusses city neighborhood parks (page 433 or 565).  Create a causal diagram like **this one** (link Jane\_Jacobs\_Park\_Causal\_Diagram.pdf**)** we discussed in class. You should find an example that is interesting to you! But, if you need a lead, examples may be a neighborhood with crime, or a struggling local school, or a neighborhood without basic retail, like a grocery store, or a challenge of social injustice.  [~200 words]
3. Describe (and draw the diagram, attach it with your text) of the most important processes and variables you think are involved. This diagram is your theory for how the problem arises and could be addressed (this is just a hypothesis and could be wrong, you need to find out).

Recall that what creates 'organized complexity' are **feedback loops**, so discuss those carefully in terms of vicious and virtuous cycles. The main guiding question is: How would you build an approach that could "solve your problem” in a way that embraces its complexity? How do you find out if your theory is wrong? [~150 words].

**Or - Quantitative Exercise:**

Consider the relationship between GDP per capita and urbanization  we discussed in class. You can see the classical plot at [Our World in Data.](https://ourworldindata.org/grapher/urbanization-vs-gdp?time=2005) (OWID).  If you enjoy an economics' perspective, you may also want to read this [short piece.](https://marroninstitute.nyu.edu/blog/urbanization-passes-the-pritchett-test) by 2018 Economics Memorial Nobel Prize Paul Romer about this relationship.

1. **Run this python code** (link *plot\_OWID\_single\_nations.py*), or write your own, **using this data** (link *urbanization-vs-gdp.csv*) from the OWID plot to produce the fits (including parameter values) and figures for **at least 2 nations of your choice**(change  country = 'United States' to another nation).  It should look something like this:

A graph with blue dots

Description automatically generated

1. **Clue:** Choose nations with enough urbanization range over the given data, like US, France, United Kingdom, South Korea, China, but do try others. Discuss if the parameters across your nations are similar or different. What do they imply about the growth of GDP per capita with urbanization (percent change in GDP/capita with percent change in urbanization)?
2. Look in detail at the plots for your two nations and point out any jumps in the data. Can you try to guess what happened there (do a little research e.g. Japan in the 1990s economy) etc (maximum 200 words).
3. For PR China, what is the expected GDP per capita (extrapolating the fit) when it becomes (one day in the future) 80% urbanized, like the US is today?  Which number is larger? (maximum 150 words)
4. For an extra bonus point, what happens when you try to answer the same question in 3) for India? Or Nigeria?  Do you want to venture a GDP per capita number for India at 80% urbanization? Explain your reasoning and try to quantify the uncertainty in such a prediction (maximum 150 words).

Submit the replies in text and the two figures, including a basic caption with parameter values for fits (as a pdf, 1-2 pages).