

EC1410-Fall 2026 Problem Set 2.AI solutions

(Updated 12 October 2026)

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Note: all plots are for reference. Exact answers may vary.

1. (25)

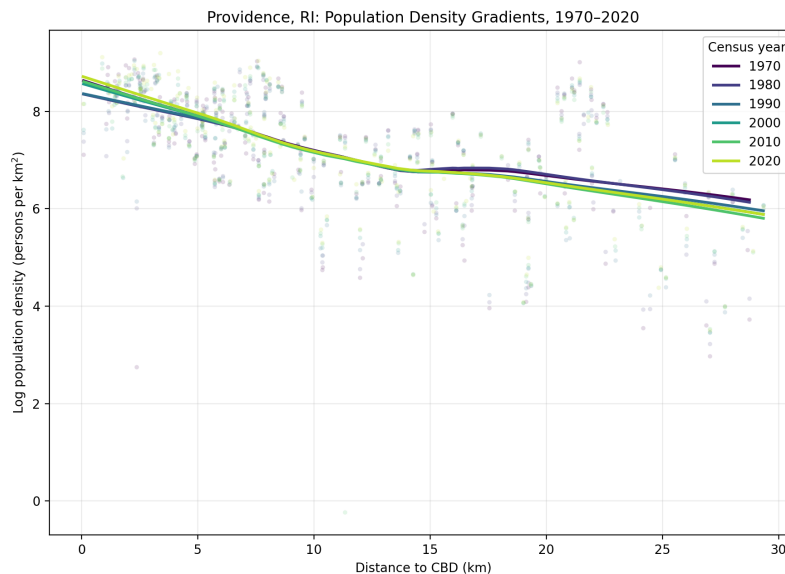


Figure 1: Population Density Gradient of Providence, 1970-2020. Source: National Geographic Information System (NHGIS)

There are more people living in the city center and less living 15 to 30 km away from the CBD in 2020 than 50 years ago.

This implies that population growth was concentrated around 0-5 km of the CBD over the 50-year period.

The monocentric city model does not have a conclusion on the population density gradient. Since it assumes each individual takes up the same units of land ($\bar{l}$), and there is the same amount of land everywhere (no differential building heights), the model assumes there is the same amount of people everywhere.

2. (25)

Figure 2 does what it is supposed to do. It traces out the fake gradient as we instructed. The black dots show the raw data, and the dotted line shows the LOWESS smoothing.

Answers to this may vary depending on how the synthetic plot looks.

3. (25) **LLM answer:** Copying the python program into ChatGPT gives: At a high level, this script constructs urban population density gradients for

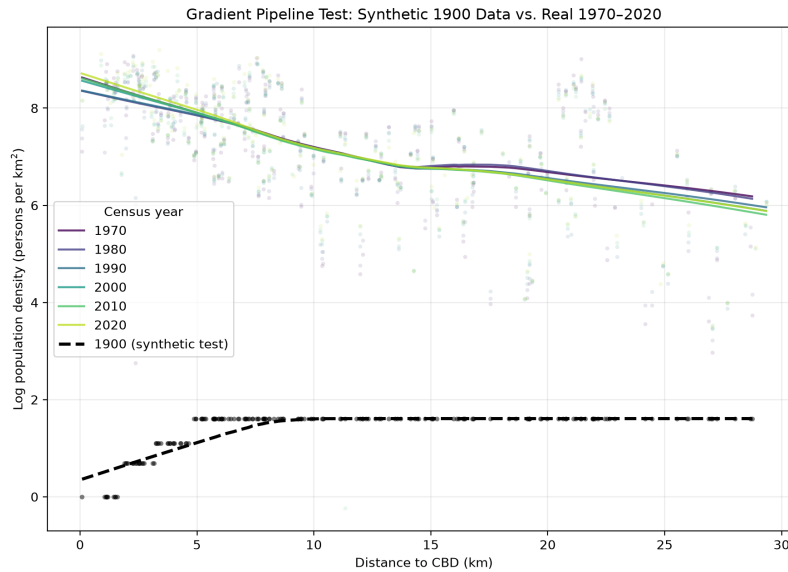


Figure 2: Synthetic Population Density Gradient. Source: National Geographic Information System (NHGIS)

Providence, RI from 1970–2020, using census tract data. It's a fairly standard applied urban economics pipeline: compute tract-level densities, measure distance to the CBD, and estimate the density-distance relationship via nonparametric smoothing.

And then it describes the pipeline of the computation and graphing. This confirms that the code is doing what it is supposed to do.

4. (25 pts)

(Any reasonable description of the data is valid)

There are no missing records, and one tract in 2020 has recorded 0 population. For implausible density, it classifies density < 50 persons/km² as implausibly low and > 15000 persons/km² as implausibly high. There are no implausibly high tracts, but 1-5 implausibly low tracts over the census years. Claude note that these could be park/water/industrial/airport tracts.

Out of 182 - 202 tracts:

- (a) 154 tracts present in all six years.
- (b) 78 tracts present in fewer than six years.
- (c) (list of tracts that are only present in certain years not others.)

Yes, this heatmap confirms that the data is what it's supposed to be. The center of Rhode Island is Providence and its surrounding counties/tracts. The west region of Rhode Island is very sparsely inhabited. Furthermore, the northwest region of RI also shows high pop density. This is Woonsocket, a town bordering Massachusetts with 43k population (2020 census).

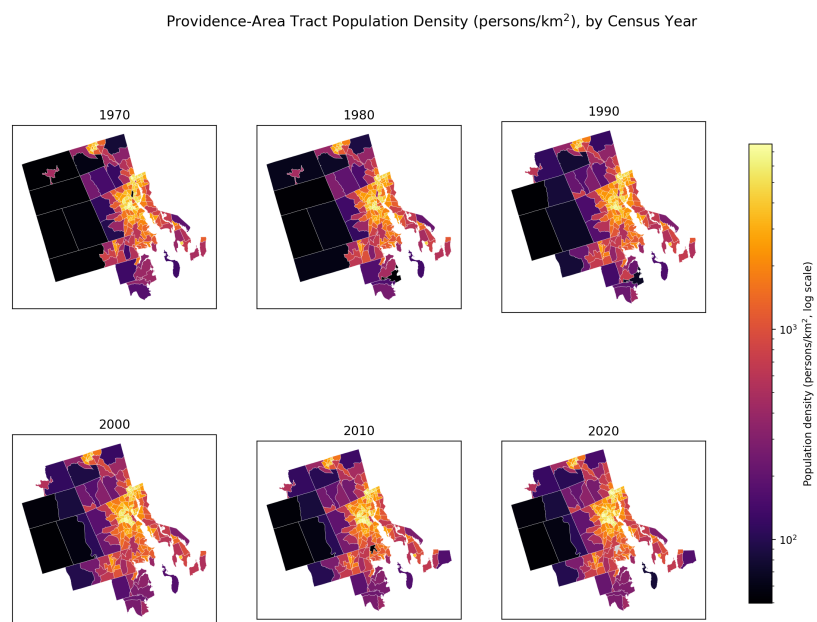


Figure 3: Population Density Heatmap of Rhode Island, 1970-2020. Source: National Geographic Information System (NHGIS)