Andrew Dickinson
EC330, **Practice 2021**
Midterm

Name (Print): _____

Student ID _____

Time Limit: 80 Minutes

Uoregon email: _____

Please do not open the exam until you are told to do so. Do, however, make sure to write your name, student ID, and email address above. You may *not* use your books or notes during this exam. You are required to show your work on each short answer problem on this exam. d

Short Answer

1. (5 points) **Axioms.** List 3 of the 5 axioms of urban economics. No particular order is needed and no further explanation is required.

2. (10 points) In a short paragraph, articulate Glaeser's argument for why urban poverty of the world's mega cities reflects urban strength rather than weakness.

3. (10 points) **Zipf's Law.** Recall the equation for Zipf's Law:

$$\text{Pop} = \frac{c}{\text{pop rank}}$$

(a) (2 points) Draw a graph with population rank on the x-axis and population on the y axis that depicts roughly the relationship Zipf's law describes.

(b) (3 points) In words, what does Zipf's law say? (Do not just put: population is equal to a constant over population rank). Why might Zipf's law hold?

(c) (5 points) Suppose that a region's 5th largest city has a population of 300,000 people. Use Zipf's law to calculate the predicted size of the region's largest city.

4. (15 points) **Factory Towns.** The city of Chicago lies at the west end of a railroad. To the east, there are one hundred miles of plains along which there are several towns—all connected to Chicago by the rail line. To the west of Chicago are 80 miles of mountains, whose small villages are connected by a few winding dirt roads. The only factory in the region is in Chicago. It produces widgets at a cost of $10 per unit at the factory door. Thanks to the rail line, the transport cost to anywhere east of Chicago is $0.20 per mile. Given the poor state of the roads through the mountains, the transport costs to anywhere west of Chicago is $0.40 per mile.

   (a) (8 points) Graph the costs of widgets produced throughout the entire 180-mile region. Carefully label the costs at the factory, at the far western end of the region, and at the far eastern end of the region.

   (b) (7 points) Assume that the cost of making a widget at home is $20. What is the market area for the factory? (That is, how many miles west of Chicago will it stretch, and how many miles east of Chicago will it stretch?)

5. (15 points) **Neighborhood Sorting.** Suppose we have 2 neighborhoods, A and B, each with 200 lots. Additionally, there are two types of households (HHs), those that like the band Nickleback (we will call them LN) and those that hate Nickleback (HN). The rent premia for living in neighborhood A is depicted by:
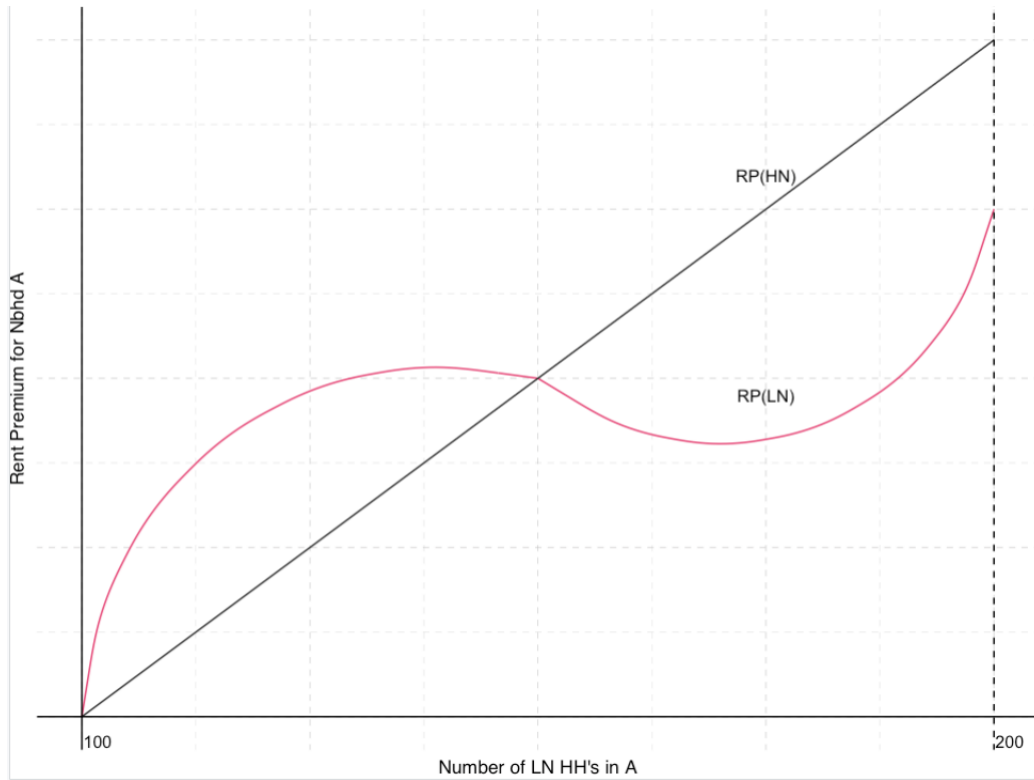
(a) (5 points) On the graph, label each equilibrium point. Furthermore, label each equilibrium as either full integration, full segregation, or mixed.

(b) (5 points) If you labeled full segregation as an equilibrium, explain why it is an equilibrium. If you did not label full segregation as an equilibrium, explain why it is not an equilibrium.

(c) (5 points) Of the equilibrium you labeled, which are stable and which are unstable? Explain.

6. (20 points) **City Structure. Please note: this question is considerably more difficult than other questions on the exam.** Consider a city that consists of 3 groups that compete for land: Offices, farms, and commuters. Both office and farms compete in perfectly competitive markets. Office and farms face a total cost of:

$$TC(x_{\text{office}}) = R(x_{\text{office}}) + (a + b * x_{\text{office}})$$

$$TC(x_{\text{farm}}) = R(x_{\text{farm}}) + (a + \frac{b}{2} * x_{\text{farm}})$$

where x_{office} and x_{farm} are the distances that office and farms locate away from the city center, respectively. **Note**: In each type of firm's cost function, a and b represent the same numbers. Denote the revenues for each type of firm as TR_{office} and TR_{farm}, respectively. Commuters allocate money between housing and commuting such that their bid rent curve is given by:

$$R(x_{\text{commuter}}) = c - \frac{b}{4} * x_{\text{commuter}}$$

(a) (5 points) Write out the profit function for office firms and farms as a function of distance to the city center.

(b) (5 points) Derive the bid-rent curves for both Offices and Farms. To get full credit, you need to show all relevant work and provide two equations.

(c) (5 points) What restriction(s) must you place on the model to ensure that the bid rent curve for offices has a greater valued bid-rent intercept than the bid rent curve for farms, and the bid rent curve for farms has a greater valued intercept than the bid rent curve for commuters?

(d) (5 points) Assume that the restictions you placed on the model in part c hold. Graph all three bid-rent curves. Find the range of distance from center that offices, farms, and commuters will be located. Label these ranges on your graph.