Please write all answers in legible handwriting in the space provided. **3** points will be added to your score for signing your name, though those points will be deducted if the grader cannot read what you wrote on your pdf scan. For math questions, show all relevant work. **For questions with numeric answers, clearly circle or box your final answer.**

Total points possible: 25

1. (12 points) **Land-Use Regulations.** Suppose the rental market in Eugene is perfectly competitive and characterized by the following equations:

$$\text{Demand}: R_d = 20 - H_d$$
$$\text{Supply}: R_s = (1 + k) * H_s$$

where R is rental price, and k is the level of land-use restrictions in Eugene. For now, we will not assign a value to k.

   (a) (2 points) Solve for the equilibrium price and quantity in terms of k. What happens to equilibrium price and equilibrium quantity as you increase the land use regulations (increase k)?

(b) (2 points) Graphically illustrate your answer to part (a). That is, draw the initial equilibrium, and illustrate what happens to the equilibrium when k increases.

(c) (2 points) Now suppose $k = 2$. Compute the equilibrium using the equations derived in part (a).

(d) (2 points) The Eugene public is upset over high rental prices so they demand that the local government fixes the issue. They deem that the maximum price anybody should pay for rent is one less than the equilibrium price you computed in part (c). The local government implements a rent control of of the price in (c) minus 1. Quantify the shortage of housing arising from the rent control when $k = 2$ using the supply and demand equations.

(e) (2 points) An alternative to rent control would be to lower land-use restrictions. Find the level of land use restrictions k such that equilibrium rents are the equilibrium price with rent control in part (d). Show your work.

(f) (2 points) In the housing market, which policy is more efficient? (Think back to the 201 definition of efficiency). Does the solution proposed in part (e) involve any costs? What might be some consequences to lowering land use regulations? No math is needed. (1 points)

For questions 2 and 3 pick one to submit. Study both.

2. (10 points) **Difference In Differences.** Suppose we want to estimate the effect of streetlight intensity on crime (e.g: does installing streetlights in a particular area change the crime rate). We have two neighborhoods, A and B. We build streetlights in neighborhood A.

 (a) (4 points) Two ideas for estimating this effect

 (i). Compare average crime in neighborhood A to average crime in neighborhood B after the streetlights were installed.

 (ii). compare average crime in A after the streetlights were installed to average crime in neighborhood A to before the streetlights were installed.

 Why are these comparisons problematic? You need to provide one reason for each comparison. (5 points)

 Now suppose we decide to estimate the treatment effect using Difference in Differences. The following table reports observed measurements of crime rates in each neighborhood per 100,000 residents before and after treatment (installation of streetlights):

Group	Before treatment	After treatment
Treatment group	21.5	19
Control group	22.5	23
Difference		

 (b) (2 points) Calculate the pre-treatment difference between treatment and control units between the treatment and control units. Calculate the post treatment difference between treatment and control units. Clearly write out the each simple difference below and fill in the correct answers in the table above (2 point)

(c) (2 points) Using part b, calculate the difference in differences of the policy in the following form:

$$\tau = (y_{\text{treat, post}} - y_{\text{control, post}}) - (y_{\text{treat, pre}} - y_{\text{control, pre}})$$

Where y denotes the neighborhood crime rate per 100,000 residents (2 points).

(d) (2 points) In order to interpret this difference in differences estimate causally, we would need to assume parallel trends between the neighborhoods A and B (ie had the streetlights never been installed, the crime rate in neighborhood A would have trended in the same way as neighborhood B). Assuming we have parallel trends here, what would be the casual interpretation of installing streetlights on crime τ. *Keep your interpretation short (1-2 sentences)*

3. (10 points) Recall this figure. In a short paragraph, interpret this figure in your own words and discuss the main insights of its result. Specifically, what evidence does this result provide regarding the geography of social mobility and the casual effects of neighborhoods? *Note: You may replace Savin Hill with "high opportunity areas" and Roxbury with "low opportunity areas"*

Income Gain from Moving to a Better Neighborhood

By Child's Age at Move