Intermediate Microeconomic Theory
ECN 100B, Fall 2019
Professor Brendan Price

Homework #6

Due: Saturday, November 23rd at 5:00pm

1 Water pollution (12 pt.)

The process of tanning leather creates toxic byproducts that pollute the local water supply. Suppose that a city's tanneries (i.e., producers) compete in a perfectly competitive market, facing demand given by $p(Q) = 60 - \frac{1}{2}Q$ and a constant (private) marginal cost of 10. Leather production imposes external costs equal to $EC(Q) = \frac{1}{4}Q^2$.

a. (3 pt.) Draw a clearly labeled graph representing this market. Include:

   - The private marginal benefit curve (i.e., the demand curve)
   - The private marginal cost curve (i.e., the supply curve)
   - The external marginal cost curve
   - The social marginal cost curve

   Include axis labels for all points where these curves intersect each other or the axes.

b. (3 pt.) On your graph from part a, mark the competitive quantity (Q_c) and price (p_c). Shade in the deadweight loss and compute its area. Then calculate the consumer surplus, producer surplus, external cost, and (finally) total surplus.

c. (3 pt.) Find the socially optimal quantity (Q_s). What is the private marginal cost at Q_s? What is the external marginal cost at Q_s? What is the social marginal cost at Q_s?

d. (3 pt.) Suppose that the city imposes a corrective tax t on the tanneries for each unit of output they produce. Find the value t^* that results in the socially optimal amount Q_s being produced. Compute consumer surplus, producer surplus, tax revenue, and external cost under this tax. How does the total surplus compare with the total surplus in part b?

2 Classifying goods (6 pt.)

a. (2 pt.) Give an example of a public good that we haven't discussed in class. Explain why you consider it a public good.

b. (2 pt.) Give an example of a common good that we haven't discussed in class. Explain why you consider it a common good.

c. (2 pt.) Give an example of a club good that we haven't discussed in class. Explain why you consider it a club good.

3 Neighborinos (12 pt.)

Homer Simpson and Ned Flanders can both contribute to mowing the grass between their properties. Let Q denote the total number of minutes spent on mowing in a given week, where $Q = q_H + q_F$ is the sum of minutes spent mowing by Homer and by Flanders, respectively.

Homer's demand curve is

$$p_H(Q) = \begin{cases} 50 - Q & \text{for } Q \leq 50 \\ 0 & \text{for } Q > 50 \end{cases}$$

Flanders' demand curve is

$$p_F(Q) = \begin{cases} 10 - \frac{1}{2}Q & \text{for } Q \leq 20 \\ 0 & \text{for } Q > 20 \end{cases}$$

The marginal cost of mowing is the opportunity cost of time, which will change throughout the problem depending on how busy each neighbor is in a given week.

a. (3 pt.) Calculate the social marginal benefit curve as a function of Q. (Hint: it's a "kinked" or piecewise-linear curve, so you'll need two equations to describe it: one for smaller values of Q and one for larger values of Q. You may want to draw a graph.)

b. (3 pt.) Suppose that the marginal cost of mowing is 70 for each neighbor. What is the socially optimal total amount of mowing, Q_s? If Homer and Flanders play a static game, what are the Nash equilibrium quantities q_H^* and q_F^*?

c. (3 pt.) Now suppose the marginal cost is 45 for each neighbor. What is the socially optimal total amount of mowing, Q_s? From the standpoint of Pareto efficiency, does it matter who does the mowing (and if so, which neighbor should do the mowing)? If Homer and Flanders play a static game, what are the Nash equilibrium quantities q_H^* and q_F^*?

d. (3 pt.) Finally, suppose that Homer's marginal cost is 20, while Flanders's marginal cost is only 5. What is the socially optimal amount Q_s? From the standpoint of Pareto efficiency, does it matter who does the mowing (and if so, which neighbor should do the mowing)? What are the Nash equilibrium quantities q_H^* and q_F^*?