Problem Set #1: due on Thursday, February 14 at lecture.
Late assignments will not be accepted.

Numerical Questions

(1) Suppose that an industry has an inverse demand curve given by \( P = 90 - 3Q \), where \( P \) is the price in dollars, and \( Q \) is the quantity. The marginal private cost (MPC) of production is \( MPC = 10 + Q \), and the marginal external cost of production (MEC) is given by \( MEC = 2Q \). For all parts of this question, solve the problems both algebraically and using the appropriate graph.

a) Determine the socially optimal level of output (\( Q^* \)). Calculate the total external cost (TEC\(^*\)), consumer surplus (CS\(^*\)), producer surplus (PS\(^*\)), and total social welfare (SW\(^*\)) at this level of output.

b) Calculate the quantity produced if the market is in perfect competition and only private costs are accounted for (the externality associated with production is NOT taken into account). What is the quantity produced (\( Q_c \))? Calculate the total external cost (TEC\(_c\)), consumer surplus (CS\(_c\)), producer surplus (PS\(_c\)), total social welfare (SW\(_c\)) and dead-weight loss (DWL\(_c\)) at this level of output.

c) Now assume that there is only a single producer in the industry (monopoly). What is the quantity produced (\( Q_m \))? Calculate the total external cost (TEC\(_m\)), consumer surplus (CS\(_m\)), producer surplus (PS\(_m\)), total social welfare (SW\(_m\)) and dead-weight loss (DWL\(_m\)) under a monopoly.

d) Now suppose that the government wants to fix the externality problem using a price mechanism (tax or subsidy). Calculate the optimal tax or subsidy under a competitive market (part b) and under a monopoly (part c). Graphically, show how this tax or subsidy (choose one) is chosen under both cases.

e) Assume that the market is perfectly competitive, and the government imposes the appropriate tax or subsidy (calculated in part d). Be sure that you clearly indicate which one you are using! Compared to (part b), how do the government’s finances change? What is the change in consumer surplus, producer surplus, total external costs, and social welfare? What is the level of dead-weight loss?

(2) Suppose that oil refineries in Contra Costa County earn a marginal benefit (net of private costs) of \( MB = 50 - 0.1Q \), where \( Q \) is measured in barrels of oil. However, the oil refineries don’t have to pay for all of the externalities associated with their production. These externalities include health problems of local residents, and decreased property values in the area (compared to the values of similar property in areas without refineries present). These costs are measured to be \( MEC = 0.2Q \). Costs and benefits are measured in dollars.

a) What is the optimal amount of oil produced from the refineries point of view? From the view of the local residents? What is the optimal amount from society as a whole? Explain your answers.

b) What is the dead-weight loss in each case?

c) If property rights were defined in such a way to give the refineries the right to do as they please, what would be the maximum possible gains from trade of moving to the optimal production level (\( Q^* \))? What if the residents were given the property rights?

d) What would prevent the two groups from moving to the optimal production level (\( Q^* \)) in real life?
Essay Question

Write a brief essay (less than one page) on the topic described below. Be sure to write your answer in the form of an essay; don’t just answer the questions listed below.

(1) In November 2000, the National Park Service (NPS) at Yellowstone and Grand Teton National Parks signed a record of decision formally declaring their intent to phase out recreational snowmobiles from the parks and the adjacent Rockefeller Parkway by the winter of 2003-04. In the winter, the other recreational users of the park are mostly backcountry skiers and snowshoe users. There has been an effort on the part of this group and other conservation organizations to keep snowmobiles out of the park. This implies that the skiers and snowshoe users incur some cost when snowmobiles are allowed in the park. These costs could include enjoyment that is foregone by having to share trails with snowmobiles, or because of the loud noise made by snowmobiles. It also could include health problems incurred by park employees and damage to the environment associated with pollutants that are emitted by snowmobiles. Analyze the situation from an economic framework using the tools we have discussed. Your essay should address the following (anything else you feel is relevant could also be included):

- Who gains and loses under the current situation? Under the proposed ban?
- Could there be a market resolution to this issue?
- Which group’s rights are more important under the current system?
- What are some policies that could be used to solve this problem efficiently?