**Economics 101**
**Fall 2011**
**Homework #6**
**Due: 12/13/2010 in lecture**

**Directions:** The homework will be collected in a box **before** the lecture. Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade. Please remember the section number for the section **you are registered,** because you will need that number when you submit exams and homework. Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

**1. Monopoly**

Suppose Exxon Mobile purchased every gas company in the world and set their prices. Then, it would have a control of the gas market with no other competition. Thus Exxon Mobile becomes a monopolist in providing gas. The market demand curve faced by Exxon Mobile is $P = -Q + 40$, and Exxon Mobile's cost is given by $TC=Q^2 + 140$, and the marginal cost is given by $MC=2Q$.

a) What is the equation for Exxon Mobile's Marginal Revenue curve?

b) Draw the Demand Curve, Marginal Revenue Curve, Average Cost Curve and Marginal Cost Curve for this monopolist in a graph. Label your graph carefully and completely.

c) What is the monopolist's profit-maximizing production quantity $Q_M$? What price will the monopolist charge $P_M$?

d) Compute the consumer surplus, producer surplus and profits for the monopolist.

Now, suppose there is a technological change for the monopolist, and its total cost is now given by $TC = 20Q$ (no fixed cost), and its marginal cost is given by $MC = 20$.

e) What is the monopolist's profit-maximizing production quantity $Q_M$? What price will the monopolist charge $P_M$? Show these values in a graph.

f) Suppose this market was a perfectly competitive market (i.e., the monopolist's demand curve is still the market demand curve, but now there are many firms providing gas for the market). Given the market is perfectly competitive, what would be the equilibrium price ($P_{pc}$) and quantity ($Q_{pc}$) in this competitive market?

g) Assume the technological change in the market is still true. What is the difference between the consumer surplus in the monopoly case and the consumer surplus in the perfect competition case?

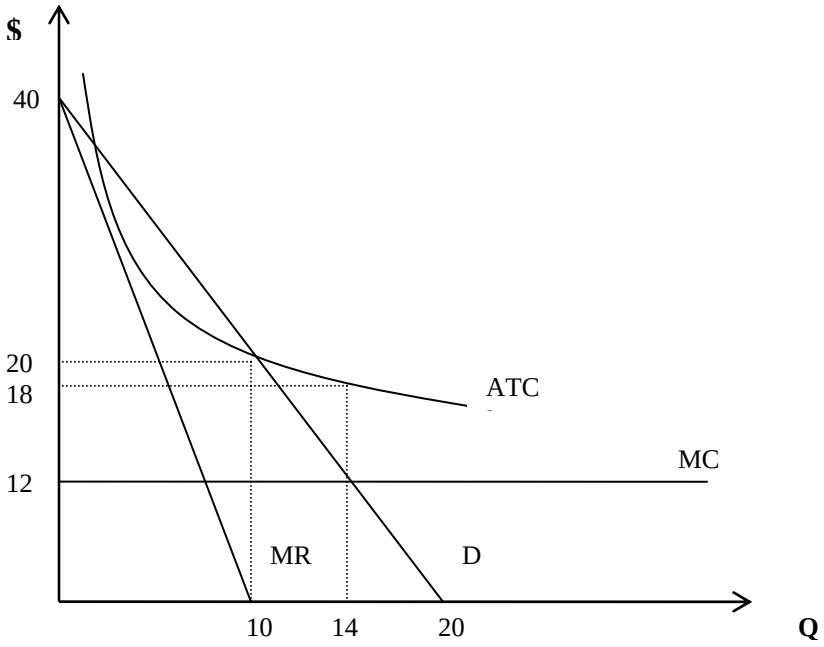
h) What is the difference between the producer surplus in the monopoly case and the producer surplus in the perfect competition case?

i) What is the dead weight loss caused by the monopolist?

**2. Natural monopoly**

a) Suppose Madison Gas and Electric (MGE) is a natural monopoly in Madison for electricity. That is the case where one firm can produce the total quantity in a market more cheaply than multiple firms because there is a large fixed cost or economies of scale in this industry.

The Demand curve, Average Total Cost curve, Marginal Cost Curve, and Marginal Revenue Curve for this firm are shown in the picture below.




The government decides to regulate this market using marginal cost pricing. That is, the firm is told to produce that level of output where MC is equal to P for the last unit produced.

a) Identify in the graph the quantity ($Q_{MC}$) and price ($P_{MC}$) outcomes under this scheme; label it with the letter "A". Is this regulatory scheme allocatively efficient? Why or why not?

b) Compute the profit of the firm. What is the minimum amount of subsidy that will be necessary in order to keep this monopolist in business?

Suppose the government decides to use average cost pricing regulation. That is, the government tells the monopoly to produce that level of output where the firm earns zero economic profit.

c) Identify in the graph the equilibrium price and quantity that corresponds to this type of regulation label it with the letter "B".

d) Is this price and output combination allocatively efficient? Why or why not?

**3. Third Degree Price discrimination**

The University Book Store is the only store (hence, it is a monopoly) that sells the Krugman's book (Microeconomics) for the Econ 101 class. The staff (maybe some TAs) can only identify customers as morning class or afternoon class, but other than that they all look the same.

This monopolist faces demand from two groups of consumers.

Demand from morning class is given by: $Q_1 = 8 - P$

Demand from afternoon class is given by: $Q_2 = 12 - 2P$

The bookstore faces the following cost curves with respect to the market for selling the Krugman text (remember that the bookstore is a monopolist in this scenario):

$TC = (1/2)Q^2 + 4$
$MC = Q$

Notice that $Q = Q_1 + Q_2$

Finally, for this problem assume that the book store is able to price discriminate between the two markets.

a) Which group of customers has the more elastic demand curve?

b) What is the equation for Marginal Revenue for each class of consumers?

c) Assume the bookstore price discriminates between the two classes. What quantities will the monopolist sell in the two markets (the morning class market and the afternoon class market)?

d) What price will the price discriminating monopolist charge in each market?

e) Review your answers from parts (a) and (d). Compare the prices that the two classes pay for the textbook: which class pays the higher price and is this the class with the more elastic or more inelastic demand curve?

f) Which class gives the monopolist the greater revenue?

g) What is the profit of the firm?

**4. Game Theory**

Amy and Bill live next door and work in the same office building downtown. In the morning each of them can get to the job either by car or by bike. The only road they can use is of very poor quality, and parking is scarce. Amy and Bill are the only potential users of this road. If both go by car it would take each 15 minutes to get to their workplace. Yet, if there is just one car traveling the time goes down to 5 minutes. Traveling by bike is generally quite fast: it only takes 10 minutes if there are no cars. However the local law gives priority to the cars on the road. As a result, it takes 17 minutes to reach the destination by bike if another person decides to drive at the same time. Amy and Bill love to sleep long hours (each minute matters in the morning!), so fast commuting time is their topmost priority. Even if they agree about the mode of transportation at night, there is no way they can guarantee that the neighbor sticks to their promise in the morning.

a) Use the information above to fill in the following payoff matrix:

| | | **Bill** | |
|---|---|---|---|
| | | Bike | Car |
| **Amy** | Bike | | |
| | Car | | |

b) Is there any strictly dominant strategy for Amy? Explain your answer.

c) Is there any strictly dominant strategy for Bill? Explain your answer.

d) What is the equilibrium outcome in this game? Do you think this is a socially optimal outcome?

**5. Externality**

Demand in the market for refrigerators is given by P=100-Q. The marginal private cost of producing refrigerators is 10+Q. However, the use of chloroflourocarbon (CFC) in the production process creates a per unit external harm (i.e. negative externality) equal to 0.5Q (i.e. the level of the externality increases with the quantity produced).

a) Assume that the negative externality is currently not being corrected for in this market. What will be the unregulated market output and market price given the above information?

b) The marginal social cost (MSC) accounts for the marginal private cost of production as well as for the additional costs borne by the society. What is the MSC equation for production of refrigerators?

c) To achieve the socially optimal level of production the producers should make their production decisions based on the marginal social cost rather than the marginal private cost. How many refrigerators should be produced to achieve social optimum? What would be the market price?

d) Suppose that the government wants to achieve the socially optimal outcome. One way to do that is for the government to impose a tax on the producers so that the firm's marginal cost increases by the amount of the negative externality. What would be the size of the tax per one unit of output? What would be the marginal cost of production after the tax?

**5. Public Good**

There are two groups of consumers in the economy that have a demand for national defense which is a public good. Because the two groups have different perceptions of the actual threat to the national security, their individual demands for national defense are different. Group 1 has demand $P = 10 - Q$, and group 2 has demand $P = 8 - 2Q$. The marginal cost of providing national defense is constant and can be expressed as $MC = 9$.

a) Which two properties must be satisfied for national defense to qualify as a public good?

b) Is there a potential for a free-rider problem in the provision of national defense?

c) Derive the market demand curve for national defense (HINT: The market demand for public good is a VERTICAL summation (not horizontal as is the case with private goods) of the individual demand curves. At each quantity level, we see the willingness to pay of each individual and then estimate society's total willingness to pay by adding the willingness to pay of the various individuals.).

d) How much public good will be provided in the market if the socially optimal amount of the public good is provided? What price will each group pay: that is, what price will the first group pay per unit of national defense and what price will the second group pay per unit of national defense? (HINT: to find the socially optimal quantity, you need to identify the point where MC intersects the market demand curve. The market price is a sum of the individual prices paid by the two groups).

e) Is the result you found in part (d) a realistic outcome? In your answer, discuss how government funds public goods.