Homework 8

1. There are three firms in the printing business. Firm 1 has a total cost curve given by $C_1(Q_1) = .1Q_1^2 + 250$ where Q is measured in books printed per day. Firms 2 and 3 have identical costs to each other but their costs are higher than firm 1. In particular, the total cost curve is $C_j(Q_j) = .1Q_j^2 + 5Q_j + 250$ (j=2 or 3). The daily demand for books is given by Q^D=550-15P.

    a) What are the marginal costs of firm 1? What are the average costs? What is the optimal scale of firm 1? What is the supply curve? Illustrate firm 1's marginal and average cost curves. What are the marginal and average costs of firm 2? What is the optimal scale of firm 2? What is the supply curve? Illustrate firm 2's marginal and average cost curves in a separate diagram.

    b) What is the market supply of the 3 firms? What is the market clearing price and quantity in the short run? Are firms earning positive profits in the short run?

Suppose that firms can freely copy the technology of firms 2 and 3 but not firm 1. So if a firm enters the market the firm will have the same cost curve as firms 2 and 3.

    c) In the long run, if firms can enter and exit the printing business then what will be the long run market clearing price and quantity traded? What will be the profits of the 3 firms in the long run? Illustrate the long run profits in your diagrams for parts (a) and (b).

2. Consider a market composed of 8 buyers and 8 sellers. Each of the 8 sellers has one unit of the good to sell and each of the buyers wants to buy exactly one unit of the good. The reservation prices of the buyers and the costs of production of each of the suppliers are given in the following table;

Buyer	Reservation Price	Seller	Cost of 1 Unit
Alice	10	Alex	2
Blanche	9	Bob	3
Cary	8	Charles	4
Donna	7	David	5
Edwina	6	Edgar	6
Fanny	5	Fred	7
Georgia	4	Glenn	8
Harriet	3	Howard	9

    a) Assume that both buyers and sellers are perfectly competitive. What is the market clearing price? What is the total surplus associated with the market clearing price and quantity?

    b) Match each buyer with a seller such that each can gain by trading with the other (for example a buyer with a reservation value of 4 can be matched with a seller with a cost of 3 and each could gain by trading with the other). What would be the total surplus generated by this matching of every buyer and seller? Compare your answer with (a).

    c) Although the surplus is higher in (a) than in (b) are there some traders that would prefer the outcome in (b)?

    d) *Bonus:* show that there is no matching mechanism that generates more surplus than the

surplus generated by the competitive equilibrium.

3. The variable cost curve of a typical tempered glass manufacturer is given by $VC(Q) = .1Q^2 + 10Q$ where Q is measured in sheets of glass per day. The fixed costs of the manufacturer are $16,000 per day.

a) What are the total costs of the manufacturer? What are the marginal costs of the manufacturer? What are the average costs? What is the optimal scale of the firm?
b) Illustrate the marginal and average cost curves. Be sure to indicate the optimal scale of the firm and the minimum average cost of the firm.
c) Suppose that the glass industry is perfectly competitive and that all firms have the typical cost structure given above. If the market is in long run equilibrium then what is the price in the market?

Richland Glass Co. has the opportunity to invest in a new technology. The new technology would lower the per-unit costs of production by $10 per sheet.

d) If *Richland* invests in the new technology then what will be the new marginal and average cost curves of *Richland*? What is the new optimal scale of the firm? Illustrate the new marginal and average costs in your diagram from part (b).

Suppose that *Richland* is a small manufacturer and the impact of *Richland*'s production on price is negligible. Thus after *Richland* install the new cost saving technology the price in the market remains at the price that you calculate in part (c).
e) Assuming that *Richland* has the new technology how many sheets per day would *Richland* like to supply at the price that you calculated in part (c)?
f) What are the profits associated with the level of supply that you calculated in part (f)? Illustrate these profits in your diagram from part (b).

4. Suppose that the daily market demand curve for pencils in Independence is $Q^D(P) = 1150 - 50P$. Price (P) is measured in dollars per 1,000 and quantity (Q) is measured in units of 1,000 per day. The total cost curve of a typical pencil manufacturer is $C(Q) = 0.25Q^2 + Q + 100$.

a) What is the average cost curve for a typical manufacturer? What is the marginal cost curve? What is the optimal scale of the manufacturer? Illustrate the AC and the MC in the diagram below and indicate the optimal scale.
b) What is the supply curve of the typical manufacturer?
c) If the market is in long run equilibrium then what will be the price of pencils? What will be the quantity demanded? How many firms will there be in the industry?
d) Given the number of firms that you found in part (c) illustrate the market supply curve of those firms in a diagram. In your diagram also illustrate the demand curve and the long run market clearing price that you found in part (c)

Suppose the government of Independence decides to place a per unit tax on pencils of **$1**.

e) Illustrate in your diagram from part (c) the impact of the tax on the price received by the manufacturers and the price paid by the consumers in the short run. Illustrate the loss of market surplus that results from the tax. You do not need to calculate any numbers.
f) In the long run what will the price received by the manufacturers be? What will be the price paid by the consumer?

5. Suppose that the tobacco market is initially in equilibrium with the price and quantity equal to p0 and q0 respectively. A cartel of tobacco farmers manages to secure government approval for a supply reduction program with the following provisions:

    i.no farmer can sell a pound of tobacco without a quota right.
    ii.the total number of pounds of quota rights issued by the government will equal .8q0.
    iii.quota rights will be issued to tobacco farmers in proportion to last years sales of tobacco: if you sold 10,000 pounds of tobacco last year you get 8,000 pounds of quota this year.
    iv.quota rights can be freely bought or sold.

Assume in the following that the demand elasticity is -.6 and the supply elasticity is .5

    a)   What is your prediction for the price of tobacco next year as a fraction of p0?
    b)   What is your prediction for the market clearing price of a pound of tobacco quota as a fraction of p0?

6. The market clearing price of a bushel of wheat is $2. At this price 100 units are sold per year where a unit is one billion bushels. The estimated slope of the demand curve is -20 and the estimated slope of the supply curve is 2.
    a)   Illustrate the market clearing price and quantity in a diagram.

A farm aid package is passed in Congress. The new legislation promises wheat farmers that they will receive a price of $2.5 per bushel. Specifically the farmers are promised that the government will <u>purchase</u> any excess supply (supply minus demand) in the market at the price of $2.5.

    b)   In your diagram for part (a) illustrate the supply at $2.5 and the demand at $2.5. Label the excess supply in the market. Given the slopes of supply and demand calculate the quantity supplied and the quantity demanded at a price of $2.5.
    c)   How much wheat will the government have to buy at a price of $2.5? What will be the total cost to the government? Illustrate this total cost in your diagram for part (a).
    d)   What will be the change in the consumer surplus due to the price rise to $2.5? Illustrate this change in your diagram for part (a). What will be the change in the producer surplus due to the price increase to $2.5? Illustrate this change in your diagram for part (a).
    e)   How much of the increase in producer's surplus comes from consumers? How much of the increase in producer's surplus comes from the government?
    f)   If the government <u>values</u> the wheat that it purchased at the original market clearing price of $2 (for example if the government can sell the wheat on the world market at $2) then what is the dead weight loss generated by this price support program? Please note that although the government values the wheat at $2 it paid $2.5 for it. Illustrate the dead weight loss in your diagram for part (a).
    g)   If the government had imposed a production quota on farmers limiting their supply that would have raised the price to $2.5 instead of the price support program then would the quota necessarily raise the producer surplus of the farmers? You do not have to calculate this simply answer "yes" or "no" and provide a brief reason.

7. The current price of gas is $2.5 per gallon and 100 million gallons are traded daily. The estimated slope of the supply curve for gas is 80 and the estimated slope of demand is -20.

a) At the current price and quantity traded what is the elasticity of supply? What is the elasticity of demand?

Because of the high price of gasoline the government is considering imposing a price ceiling in the gasoline market. The ceiling price would be set at $2 per gallon.

b) Illustrate supply and demand curves for the gasoline market. In your diagram indicate the current market clearing price for gas.

c) In your diagram for part (b) illustrate the proposed price ceiling. Indicate the quantity traded at the ceiling price of $2 per gallon. At $2 per gallon will there be excess supply or excess demand (or neither) for gasoline?

d) In your diagram for part (b) indicate the change in producer surplus and consumer surplus that would result from the imposition of the price ceiling.

e) In general will consumers necessarily gain from a price ceiling? Briefly explain your answer. What effect does the elasticity of supply have on the change in consumer surplus?

f) Given the estimated slopes of supply and demand what would be the quantity traded at the ceiling price of $2?

g) What would be the dollar value of the transfer from firms to consumers at the ceiling price? What would be the loss of the consumers at the ceiling price?

h) Given your answer to (g) did the price ceiling make consumers better off?

i) If instead of imposing a price ceiling the government announced that it would sell gasoline in the market until the price of gas dropped to $2 per gallon then how many gallons of gas would it have to sell? Illustrate this amount in your diagram from part (b). Would consumers necessarily be better off? Briefly explain your answer.

j) Assume that the government is selling gas until the price falls to $2 as in part (i). If the government valued the gasoline at $2.50 per gallon but sold the gas in the market at $2 then would there be dead weight loss associated with the sale? Briefly explain your answer.

8. Suppose that the demand for broccoli is given by: Q^D - 1000 - 5P where Q is the quantity per year measured in hundreds of bushel and P is price in dollars per hundred bushels. The long run supply curve for broccoli is given by: Q^S = 4P - 80.

a) Show that the equilibrium quantity here is Q = 400. At this output what is the equilibrium price? How much in total is spent on broccoli? What is the consumer surplus at this equilibrium? What is the producer surplus at this equilibrium?

b) How much in total consumer and producer surplus would be lost if Q = 300 instead of 400?

c) Show the allocation of the loss of total consumer and producer surplus between suppliers and demanders described in part b depends on the price at which broccoli is sold. How would the loss be shared if P = 140? What if P = 95?

d) What would the total loss of consumer and producer surplus be if Q = 450 rather than Q = 400? Show that the size of this total loss also is independent at of the price at which the broccoli is sold. Graph your results.