The homework is due on Wednesday, November 30. Each question is worth 0.8 points.

Question 1 There are 200 firms in an industry. Half of the firms use newer technology resulting in a cost function $c(Q) = 200 + Q^2$, while the the remaining firms' cost functions are $c(Q) = 200 + 2Q^2$. Market demand is $Q_D(P) = 3,450 - 40P$. The industry is competitive (i..e., P = MC.)

(a) Determine the equilibrium price and quantity and the profits of both types of firms.

(b) Now suppose that the firms with the inferior technology exit the market (their profit in (a) should be negative). Determine the new equilibrium price, quantity and firm profits.

(c) Determine the loss to the consumers when the high-cost firms exit the market (recall that the area underneath the inverse demand curve $P(Q)$ between two values Q_1 and Q_2 measures the benefit to all consumers from increasing consumption from Q_1 to Q_2).

(d) Taking the effect of firm profits into account determine by how much welfare increases or decreases when the high-cost firms exit the market.

(e) Should the government subsidize the industry such that all producers will remain in the market? Your answer should be based on the argument in (d). Does your answer change if the high-cost firms are domestic firms and the low-cost firms are foreign, and all the demand for the product is from domestic consumers only?

Question 2 Consider a Cournot Oligopoly. One firm has costs $C_1(Q_1) = 10Q_1$ while the other firm's cost function is $C_2(Q_2) = 12Q_2$. The demand for both firms products $Q = Q_1 + Q_2$ is $Q_D(P) = 200 - 2P$.

(a) Determine the equilibrium price P, the market shares s_1, s_2, and the quantities Q_1, Q_2 produced by both firms.

(b) Suppose more firms with the newer technology enter the market. How many firms with the new technology must be in the market such that the firm with the old technology makes negative profits. In other words, suppose there is one firm with the high costs, and n firms with the low costs. At what level n will profits of the high-cost firm be negative?

Question 3 Suppose a market demand function is given by $Q_D(P) = 1,000 - 10P$. The product can be produced with a cost function $C(Q) = 10,000 + 20Q$.

(a) Determine Q and P and the firm's profit if there is a single firm.

(b) Determine total output Q, the equilibrium price, and the profit of each firm if there are two firms (i.e., a Cournot oligopoly).

(c) Determine Q, the equilibrium price, and the profit of each firm if there are 10 firms.

(d) Determine the welfare gain or loss between situations (a) and (b).

Question 4 A monopolist sells a product in two different markets. Demand in the first market is $Q = 120 - 2P$. Demand in the second market is $Q = 120 - 8P$. The firm's cost function is given by $C(Q) = 10Q$.

(a) Suppose the firm can charge different prices in the two markets. Determine the prices and the firm's profit.

(b) Now suppose that the firm must charge the same price in both markets. What is the firm's profit now.

(c) Determine the the total change in surplus (consumer + firm) between (a) and (b).

Question 5 Suppose there are 100 households whose demand for electricity is given by $Q = 40 - P$. The local power company has a constant marginal cost of 2, and a fixed cost of 10,000.

(a) Suppose the power company charges a price per unit of electricity that maximizes profits. Determine the price, the demand of each household, and the company's profit (Recall that you must use aggregate demand of all 100 households. $Q = 40 - P$ is the demand of a single household).

(b) Now suppose that the power company uses two part pricing. It selects a price P per unit and a fixed fee F that maximizes profit. Determine P, F, and the firm's profit (Now you must use individual demand $Q = 40 - P$ to determine P and F. Of course, in order to determine profits you must use the fact that there are a total of 100 such households.)

(c) Determine the efficiency gain from using two-part pricing instead of a price per unit. This efficiency gain is measured by the sum of the following: (a) the change of firm profits; (b) the change of consumer utility.

(d) Now suppose that the government wants to regulate the power company. In particular, the government wants (i) production to be efficient and (ii) firm profits to be zero. This objective can be achieved by charging a fixed fee F in addition to a price per unit P. Determine F and P.