

HOMEWORK SET #1

(Due in Class #7)

DIRECTIONS: Answer all questions and show your work. Your completed homework set may be handed in at the beginning of class #7 or may be given to the Professor *prior* to the due date. Remember that late homework sets will receive no credit. Please read the statement in the 14.23 syllabus on homework set policy.

1. NStar produces and distributes electricity to residential customers in the Boston metropolitan area. This monopoly firm is regulated, as are other investor owned electric companies. Suppose that the company faces the following demand for electricity: $P = 6 - Q$ and has a marginal cost of $MC = 1.25 + 0.75Q$, where Q is in millions of kilowatt hours and P is cents per kilowatt hour.

- a) Under regulation, the firm must set $P=MC$. Find the regulation equilibrium price and quantity in this market. Calculate consumer and producer surplus.
- b) Suppose that NStar is allowed to operate as a profit-maximizing firm. What is equilibrium price and quantity for electricity now? Calculate consumer and producer surplus.
- c) What is the deadweight loss that would result if NStar is allowed to behave like a monopolist?

2. Acme and Becme are the only two widget manufacturers in the world. Each firm has a cost function given by: $C(q) = 10q + q^2$, where q is number of widgets produced. The market demand for widgets is represented by the inverse demand equation: $P = 100 - 3Q$ where $Q = q_1 + q_2$ is total output. Suppose that each firm maximizes its profits taking its rival's output as given (i.e. the firms behave as Cournot oligopolists).

- a) What will be the equilibrium quantities selected by each firm? What is total output, and what is the market price? What are profit levels for each firm?
- b) It occurs to the managers of Acme and Becme that they could do a lot better by colluding. If the two firms were to collude, what would be the profit-maximizing choice of output? What is the industry price? What are the output and profits for each firm in this case?
- c) What discount rate is required for firms to find it worthwhile to collude? (You can assume that widgets are perishable, i.e. one period's output must be sold in the same period).
- d) Suppose Acme can set its output level before Becme does. How much will the companies produce in this case? What is the market price, and the profits of each firm? Is Acme better off by choosing its output first (why or why not)?

3. You and your competitor are both about to introduce similar products, and you will both have to announce your prices. The demand for your product is: $Q_1 = 24 - 6P_1 + 3P_2$ and your competitor's demand is $Q_2 = 24 - 6P_2 + 2P_1$ where P_1 is your price and P_2 is your competitor's price. You both have costs equal to $3+2Q_i$.

a) Suppose you must both announce your prices at the same time. What price will you announce, and what price could you expect your competitor to announce? How much profit will each of you make?

b) Suppose you must announce your price first. What price will you choose? What price would you expect your competitor to choose? How much profit will each of you make? Is there an advantage to going first? Why or why not?

c) Suppose you and your competitor can collude in setting price. What price will each of you set, and how much profit will each of you make?

4. Suppose there is an industry with an incumbent monopolist facing the possible entry of a new competitor. The incumbent must choose whether to invest in lots of capacity (in an attempt to scare off the competitor). After seeing the incumbent's investment level, the competitor decides to enter the market or not, incurring a cost of K if it does. The pay-offs are 20 to the incumbent if the competitor does not enter when investment was high and 25 when investment was low. If the competitor does not enter she gets nothing. If she enters then payoffs for the incumbent and the competitor respectively are $\{9, 5-K\}$ if investment was high, and $\{10, 10-K\}$ if investment was low.

- a) If the cost of entry is low ($K=1$), what will the competitor do if the monopolist chooses high investment? What if investment is low? Knowing this, what should the monopolist do?
- b) If the cost of entry is moderate ($K=6$), what happens?
- c) If the cost of entry is high ($K=11$), what happens?
- d) Can you think of real industries where firms may over-invest to deter entry? Justify your answer briefly.