Problem set 2

"due" 2/18/2010

Problem 1 The cost function for John's shoe repair is $c(q) = 100 + 10q - q^2 + \frac{1}{3}q^3$, so that marginal cost is $c'(q) = 10 - 2q + q^2$. Shoe repair is a perfectly competitive industry.

a. Suppose the price of shoes is \$80. Solve for John's profit-maximizing quantity of shoes repaired. What is John's profit in this case?

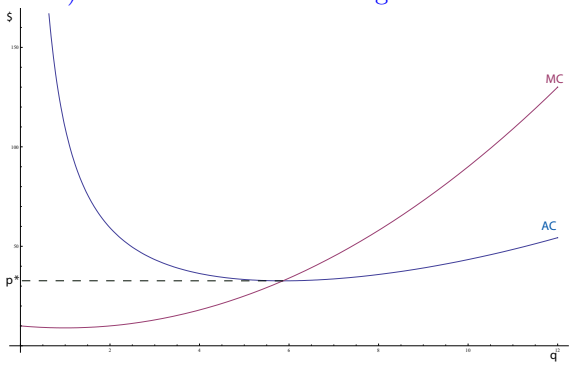
The profit-maximizing quantity q solves $80 = 10 - 2q + q^2$, or $q = 9.43$.

b. What is John's supply curve, relating the price of a shoe repair p to the quantity of shoes he repairs, q?

$p = 10 - 2q + q^2$

c. Draw a picture of John's average cost curve (hint: average cost is $\frac{c(q)}{q} = \frac{100}{q} + 10 - q + \frac{1}{3}q^2$) and his marginal cost curve. Indicate where in your picture John's supply curve is. Also indicate the price below which John would shut down his business in the long run.

The supply curve is his MC curve above his average cost curve. In the long run, he would shut down at any price below p^*. Note that this ignores the fact that he might continue to operate in the short run (if $p > AVC$) but shut down in the long run.



Problem 2 Each firm in a competitive market has a cost function of $c(q) = 16 + q^2$. The market demand function is $Q = 24 - p$. Determine the long-run equilibrium price, quantity per firm, market quantity, and number of firms.

Marginal cost is $MC = 2q$. Each firm's average cost is $AC = \frac{16}{q} + q$. Each firm's long run quantity will be where $MC = AC$, or where $2q = \frac{16}{q} + q$, i.e. $q = 4$. The long run price is equal to the marginal cost of producing 4 units, or 8. At this price, quantity demanded by the market is 16. Therefore, there must be 4 firms operating in the market. If this sounds like an implausibly low number for a competitive market, note that this could denote, say, four thousand firms.

Problem 3 The Albuquerque Isotopes, a minor league baseball team, have a stadium which seats 30,000 people. All seats are identical. The optimal ticket price is \$5, yet this results in an average attendance of only 20,000 people.

a. Explain how it can be profitable to have 10,000 empty seats.

Were the Isotopes to fill the stadium, they would have to lower the ticket price from \$5. While this would generate additional revenue from the new spectators, it would lose revenue from those who came even when the price was \$5.

b. Next week the Isotopes play the Capital City Goofballs, who have offered to buy an unlimited number of tickets at \$4 each, to be resold only in Capital City. How many tickets should be sold to Capital City to maximize the Isotopes' profit? 10,000? More than 10,000? Explain.

Capital City's offer raises the marginal cost of selling a ticket to an Albuquerque fan by \$4; this is the opportunity cost of the seat given Capital City's offer. Increasing this marginal cost lowers the quantity which should be sold in Albuquerque (draw a picture to convince yourself of this).

c. Given your answer to b, what price should the Isotopes charge their own fans? \$4? \$5? More?

Given the answer to b., they should charge a price of more than \$5 to Albuquerque fans.

Problem 4 True/false: a monopolist will increase its output if the government institutes a binding price ceiling. Explain why. If the government wants to set a price ceiling which achieves allocative efficiency, what price should it choose? (Hint: use a graph to help answer this question).

True. A monopolist has an incentive to restrict output in order to inflate price. If the government mandates a price ceiling, this motive dissipates, and thus the monopolist will produce more.

Problem 5 There are 10 households in Lake Wobegon, Minnesota, each with a demand for electricity of $Q = 50 - P$. Lake Wobegon Electric's (LWE) cost of producing electricity is $c(Q) = 500 + Q$.

a. If the regulators of LWE want to reach allocative efficiency, what price will they force LWE to charge? What will output be in this case? Calculate LWE's profit with that price.

They will impose a price ceiling where marginal cost crosses the demand curve, at $P = \$1$. If LWE produces the demanded quantity of 49 per customer, their profit would be $10 * 1 * 49 - 500 - 49 * 10 = -500$. They would thus need a subsidy of at least \$500 were they to continue to operate at this price.

b. If regulators want to ensure that LWE doesn't lose money, what is the lowest price they can impose? Calculate output, price, and profit. Is this outcome allocatively efficient?

They will impose a price ceiling where average cost crosses the demand curve. The total demand curve, summed across the 10 customers, is $Q = 500 - 10P$, or $P = 50 - .1Q$, so we need $50 - .1Q = \frac{500}{Q} + 1$, which holds at $Q = 479.57$, $P = \$2.04$. Profit would be 0. The outcome is not allocatively efficient, as price is above marginal cost.

c. It is suggested that each household be required to pay a fixed amount just to receive any electricity at all, and then a per-unit charge for electricity. Then LWE can break even while charging the price calculated in a. What fixed amount would each household have to pay for the plan to work? Per the answer in a, if each household paid LWE a \$50 fee, LWE could break even charging a price of \$1; this outcome would be allocatively efficient.

Problem 6 A monopolist faces the demand curve $p = 24 - Q$, and has constant marginal cost of \$4. If the firm runs an advertising campaign, its demand shifts out to $p = 32 - Q$. What is the largest amount the firm would be willing to pay for this campaign?

Profit is \$100 with no campaign and \$196 with the campaign, so the firm would be willing to pay any amount less than \$96.

Problem 7 An airline has two types of customers who fly a given route, tourists and business travelers. Say that tourists have demand function $p = 20 - q$, where q is the quality level for the seat in which a tourist sits, and business travelers have demand given by $p = 40 - q$. Suppose that there is a fixed number of customers

who fly this route, $\frac{1}{8}$ of them business travelers, and $\frac{7}{8}$ of them tourists. For simplicity, assume that the cost of providing a given quality level on a flight is 0 for the airline, and that the cost of taking on an additional passenger is also 0.

a. Suppose the airline can only set one quality level on this route. What quality level should the airline set, and what price should it charge for a ticket?

The only two quality levels which make any sense are $q = 20$ and $q = 40$. At $q = 20$, they can charge a price of \$200, and sell to everyone, making a per customer profit of \$200. At a quality level of 40, they can charge a price of \$800, sell only to the business travelers, and earn a per customer profit of $\frac{1}{8} * \$800 = \$100$. Clearly, the former is better.

b. Now suppose it is possible for the airline to offer both a first class section and a coach section, with different quality levels. Suppose the quality and price of a coach seat is the same as the quality and price you solved for in b. What should the price of a first class ticket be to maximize profit?

If the price of a coach ticket is \$200, the price of a first class ticket needs to be \$400 to induce the business travelers to buy a first class ticket.

c. Now suppose the airline reduces the quality in coach by 2 units. What is the new price in coach? In first class? Show that this quality reduction increases the airline's profits.

Reducing coach quality to 18 lowers the price the airline can charge for a coach ticket to \$198, while raising the price they can charge for a first class ticket to \$440. This increases per customer profit to $\frac{7}{8}\$198 + \frac{1}{8}\$440 = \$228.25$. In part b, per customer profit was only $\$200 + \frac{1}{8}\$200 = \$225$.

Problem 8 John runs a car washing service with five potential customers. John has a marginal cost of \$8 per wash. The price that each customer will pay John to wash her car is listed below:

Customer	willingness to pay
Abby	\$30
Bianca	\$5
Chloe	\$20
Diana	\$15
Erin	\$25

a. Suppose that John must charge the same price to all of his customers (he is a single-price monopolist). What price does he charge and how many washes does he sell?

If John sells 1 car wash, he charges \$30 and makes a profit of \$22. If he sells 2, he charges \$25 and earns \$34. 3, price is \$20, profit is \$36. 4, price is \$15, profit is \$28. 5, price is \$5, profit is negative. He maximizes his profit by sells 3 washes at a price of \$20.

b. Suppose now that it is possible for John to price discriminate. Now how many washes will John sell?

Now he'll sell 4 washes, at prices ranging from \$15 to \$30.