

Problem Set #4

1) Suppose fast food firms have production functions of the form:

$$Q = G(\text{FM}, \text{Teens})$$

Where:  $Q$  is the quantity of fast food produced per week,

FM is the number of frying machines leased per week.

Teens is the number of teenagers, ages 16-19, employed per week.

Let  $V$  be the cost of leasing a frying machine for a week and  $W$  be the wage required to hire a teenager for a week. Assume the production function,  $G(\quad)$  allows for normal substitution between frying machines and teenagers and produces standard “curved” isoquants rather than the “right angle” isoquants of the one-person-one-computer example we briefly discussed in class.

- a, Draw a set of diagrams that shows how we begin with isoquants and isocost lines and cost minimization and show how this leads to the total cost curve for a fast food firm. Then show how the total cost curve leads to the average and marginal cost curves. Draw the isocost lines to show equal increments of cost - \$10,000, \$20,000, \$30,000 etc. Then label the isoquant lines so that the resulting total cost curve first shows increasing returns as output expands and then decreasing returns.
- b. Suppose a technical innovation in frying machines reduces  $V$ , the lease cost, by one-half. Use a series of drawings to show (roughly) how this fall in  $V$  changes your isoquant/isocost map, the total cost curve, average cost curve and the marginal cost curve.
- c. The lower lease rate of frying machines means that fewer teenagers will be hired *per unit of fast food*. Does it follow that fewer teenagers will be hired in *the fast food industry*? How does the price elasticity of demand for fast food affect your answer?

2) Assume that chickens are produced by many farmers in a perfectly competitive industry. All farmers have identical technologies and minimum average cost is reached at \$3.00 per chicken.

- On Friday, October 7, 2010, the industry is in long run equilibrium.

- On Monday, October 10, 2010, the government imposes a tax of 25 cents per chicken.

a) Using appropriate diagrams, draw the equilibrium for the industry and the representative

chicken farmer as of October 5.

b) Again, using appropriate diagrams, show in both the short run and the long run how the industry and the representative farm adjusts to the 25 cent per chicken tax.

3. In class, we used various graphs to illustrate how a perfectly competitive industry expands and contracts. Go to [http://www.pbs.org/newshour/newshour\\_index.html](http://www.pbs.org/newshour/newshour_index.html), the web site for the Jim Lehrer News Hour, search for dairy farmers and view this segment - "Global Recession Impacts Dairy Prices, Farmers" –(Begin by using search to go to the show for Monday July 13, 2009). Then apply the graphs used in class to illustrate, as well as you can, the story told in the segment. For our purposes, the beginning of the story comes toward the end of the segment.

4. Suppose that cloves, the well known spice, are grown only in Zanzibar, a small island off the coast of East Africa. The entire clove industry consists of 1,000 farms who act as perfect competitors. Each of these 1,000 farms can grow other crops if the clove market is weak. But no other farms, inside or outside of Zanzibar are suitable for growing cloves.

Each of the 1,000 farms has the same technology with these characteristics:

- Each farm has a maximum capacity of 1,000 pounds of cloves.
- Each farm achieves its minimum average cost at an output of 500 pounds of cloves, at which point the average cost is \$7.00 per pound.

a. On October 7, 2010, the market price for cloves is \$7.30 per pound. Using appropriate diagrams carefully draw this equilibrium for both the clove industry and for the typical clove farm, incorporating as much detail as the problem description allows.

b. It seems reasonable to assume that a farmer will make the most profit if he/she produces at the output at which average cost is minimized. Does that apply to those farms that are growing cloves in (a) above? If not, briefly explain why.

c. When a competitive industry is in equilibrium, it often occurs that only some of the firms in the industry are actually producing while other potential firms are sitting on the sidelines perhaps producing other goods. Explain why there is not enough information in the problem to determine whether all potential farms are producing cloves or not.

d. Suppose you were told that the price of cloves had been stable at \$7.30 per pound since July 2008. Would this cause you to change your answer in (c)?

5. Ten ounce bags of Wah-Hoo Potato Chips have the following demand curve:

$$Q = 100,000P^{-2.0}$$

where Q is the number of bags sold per week and P is the retail price per bag in dollars.

As you know from Problem Set 2, a straight line demand curve does not have the same elasticity at every point. But the demand curve shown above does have the same elasticity at all price/quantity points – in this particular case, an elasticity of -2.0.<sup>1</sup> Given this constant elasticity at all prices/quantities, carefully explain which parts of the following statement you agree and disagree with.

"We know from economic theory that when you reduce the price of a good along an elastic portion of the demand curve, total revenue will rise. This demand curve always has an elasticity of -2.0 and so it follows that the profit maximizing strategy is to sell Wah-Hoo Potato Chips at as low a price as possible."

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<sup>1</sup> To see this, begin with the fact that we can rewrite elasticity in terms of derivatives as follows:  
 $(\Delta Q/Q)/(\Delta P/P) = (\Delta Q/\Delta P) \times (P/Q) = (dQ/dP) \times (P/Q)$ . If you take the derivative of this demand curve,  $(dQ/dP)$  and then multiply by  $(P/Q)$ , you will see that the answer is always -2.0.

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