Microeconomics, Module 11: "Monopoly" (Chapter 10)

Practice Problem for Homework Assignment

(The attached PDF file has better formatting.)

(Review this practice problem to answer the homework assignment.)

Monopoly Pricing and Surplus

A perfectly competitive industry has many firms. The market demand curve is $Q = 150 - \frac{1}{2} P$. The product uses a sparse mineral that is difficult to obtain, and the marginal cost curve *for the industry* is $MC = \frac{1}{2} Q$.

A. If the firms price competitively, what is the industry supply curve? (This is the same as the marginal cost curve above the point of minimum variable costs. The marginal cost curve is upward sloping, so the minimum variable costs are at $Q = 0$.)
B. What is the equilibrium quantity? (Equate supply and demand for the industry.)
C. What is the equilibrium price? (Derive from the demand curve or the supply curve.)
D. What is consumers' surplus? (Derive from the linear demand curve and the price. The consumers' surplus is the area of a right triangle, whose base is the equilibrium quantity and whose height is the price from the demand curve at $Q = 0$ minus the equilibrium price. The top of the triangle is the demand curve and the left side is the vertical axis.)
E. What is producers' surplus? (Derive from the linear supply curve and the price. The producers' surplus is the area of a right triangle, whose base is the equilibrium quantity and whose height is the equilibrium price minus the price from the supply curve at $Q = 0$. The bottom of the triangle is the supply curve and the left side is the vertical axis.)
F. Suppose the firms merge and price monopolistically. What is the total revenue curve? (Derive from its demand curve, which is the same as the industry demand curve, since it is now the only firm. Total revenue is $P \times Q$; express this as a function of Q, not P.)
G. What is the firm's marginal revenue curve? (Marginal revenue is the partial derivative of total revenue with respect to quantity. We expressed total revenue as a function of Q so that we could differentiate with respect to Q.)
H. What is the equilibrium quantity? (Equate marginal cost and marginal revenue.)
I. What is the equilibrium price? (Derive from the demand curve, *not* the marginal cost curve. The most common mistake of new students is to use the marginal cost curve to derive the equilibrium price. In a competitive market, we can use either the supply or demand curve to get the equilibrium price; in a monopolistic or oligopolistic market, we use the demand curve.)
J. What is consumers' surplus? (Derive from the demand curve and the monopoly price. This is still a right triangle, but the quantity is lower and the equilibrium price is higher.)
K. What is producers' surplus? (Derive from the supply curve and the monopoly price. This is no longer a triangle. It is a trapezoid lying on its side. The right and left side are vertical; the bottom and top lines are sloped.)
L. What is the dead weight loss? (Add the consumers' surplus and producers' surplus in the competitive case and subtract the consumers' surplus and the producers' surplus in the monopolistic case.)

Solution:

Part A: The industry supply curve is $MC = P = \frac{1}{2} Q$ or $Q = 2P$.

Part B: We write the demand curve as P in terms of Q: $\frac{1}{2} P = 300 - Q \Rightarrow P = 300 - 2Q$.

We equate supply and demand: $300 - 2Q = \frac{1}{2} Q \Rightarrow 2.5Q = 300 \Rightarrow Q = 120$

Part C: From the demand curve, $P = 300 - 2Q = 60$; from the supply curve, $P = \frac{1}{2} Q = 60$.

Part D: Consumers' surplus is the area of a triangle with vertices (0,60), (0,150), (120, 60): this is ½ × 240 × 120 = $14,400.

Part E: Producers' surplus is the area of a triangle with vertices (0,0), (0,60), (120, 60): this is ½ × 60 × 120 = $3,600.

Part F: If the firm behaves as a monopolist, its total revenue curve is $P \times Q = Q \times (300 - 2Q) = 300Q - 2Q^2$.

Part G: The marginal revenue curve is $\partial(300Q - 2Q^2)/\partial Q = 300 - 4Q$.

Part H: We find the monopoly quantity by equating marginal revenue and marginal cost:

$$300 - 4Q = \frac{1}{2}\,Q \Rrightarrow 4.5Q = 300 \Rrightarrow Q = 66.667$$

Part I: The monopoly price is 300 − 2Q = 300 − 133.333 = $166.667.

Part J: Consumers' surplus is the area of a triangle with vertices (0,166.67), (0,300), (66.67, 166.67): this is ½ × 133.33 × 66.67 = $4,444.44.

Part K: Producers' surplus is the area of a trapezoid with vertices (0,0), (0,166.67), (66.67, 33.33), (66.67, 166.67). This is the area of a triangle plus a rectangle:

$$\frac{1}{2} \times 66.67 \times 33.33 + 66.67 \times (166.67 - 33.33) = \$10,000$$

Part L: The dead weight loss is ($14,400 + $3,600) − ($4,444.44 + $10,000) = $3,555.56

Question: What happens when the firms price as a monopoly?

Answer: Consumers' surplus decreases and producers' surplus increases. Total social welfare decreases (the dead weight loss).

Question: Why wouldn't one firm buy out the other firms if it can increase profits?

Answer: Unless the firm can restrict entry, it has no market power. If it buys out the other firms and increases prices, another firm enters and charges a lower price.

Question: In the competitive market, the producers' surplus is positive. How can this be? Don't firms make zero economic profits in a competitive market?

Answer: The producers' surplus does not include fixed costs. If fixed costs are $600 per firm, there will be six firms in the competitive market, and total economic profits are zero?

Question: Why are there six firms?

Answer: If there are more than six firms, the total economic profits are negative, and one or more firms exit the market. If there are less than six firms, total economic profits are positive, and new firms enter.