

Assignment 3

Due date: Dec 23

Name:

Student ID:

Problem 1: True or False. Please explain why. (15 points)

1. Long-run average costs can't be higher than the short-run average cost. (5 points)

Solution: True.

The long-run average costs can't be higher than the short-run average costs because in the long-run all costs are variable while in the short-run only some costs are variable.

2. In a perfectly competitive market with identical firms, a permanent positive demand shock leads to a permanent increase in the price in the long run. (5 points)

Solution: False.

In a perfectly competitive market with identical firms, the long-run equilibrium price is equal to the minimum ATC. Even through there is a permanent positive demand shock, firm entry will bring the price back to the same level as in the initial state, where $P = \min ATC$.

3. Adding up the individual supply curves $P = 5 + Q_1$ and $P = 3 + Q_2$ will lead to the market supply curve $P = 8 + 2Q$. (5 points)

Solution: False.

We have to add the curves horizontally, not vertically, it doesn't make sense to add prices. The market supply curve would be

$$Q(P) = Q_1(P) + Q_2(P) = \begin{cases} 2P - 8 & \text{if } P \geq 5 \\ P - 3 & \text{if } 3 \leq P < 5 \\ 0 & \text{if } P < 3 \end{cases}$$

Problem 2: Production cost. (15 points)

You obtained the following short-run cost information of a firm.

When the firm produces 2 units of output, its total cost is

\$500,040. When the firm produces 10 units of output, its average fixed cost is \$50,000.

(a) What is the average variable cost when the firm produces 2 units of output? (10 points)

When $Q=2$, $TC(2)=500,040=FC+VC(2)$.

When $Q=10$, $AFC(10)=50,000$, which implies that $FC = 50,000 \times 10 = 500,000$.

Thus, we have $VC(2)=40$, which implies that $AVC(2)=40/2=20$.

(b) What is the average fixed cost when the firm produces 5 units of output? (5 points)

Since $FC=500,000$, the average fixed cost when $Q=5$ is $AVC(5)=500,000/5=100,000$

Problem 3: Perfect competition. (20 points)

Consider a perfectly competitive market for skateboards that is in a long-run equilibrium. Each firm's short-run cost is

$$SRTC(q) = q^3 - 3q^2 + 3q + 4.$$

Each firm's long-run total cost is

$$LRTC(q) = 3q.$$

The market demand for skateboards is $Q^D(P) = 27 - P$.

(a) What's the equilibrium price in the long-run equilibrium?(5 points)

Since the market is competitive, the long-run equilibrium price

$$P^* = \min LRATC = 3.$$

(b) What's the number of skateboards each firm produces in the long-run equilibrium.(5 points) [Hint: If the market is in a long-run equilibrium, it is also in a short-run equilibrium.]

In the short-run equilibrium, market price $P^*=MC(q^*)$, in which q^* is the quantity a firm produces.

Since

$$SRMC(q^*) = 3q^{*2} - 6q^* + 3,$$

by $P^*=MC(q^*)$, we would have $3=3q^{*2} - 6q^* + 3$. So $q^*=2$.

(c) What is the equilibrium market quantity in the initial long-run equilibrium? How many firms are in the market? (10 points)

At price $P^*=3$, by the market demand function we have equilibrium market quantity is $Q^* = 24$.

Since every firm produces 2 units, there have to be $24/2=12$ firms.

Problem 4: Monopoly. (50 points)

A monopoly faces market demand $Q = 30 - P$ and has a cost function $C(Q) = \frac{1}{2}Q^2$.

(a) Find the profit maximizing price and quantity and the resulting profit to the monopoly. (15 points)

The monopoly produces at the point where $MR = MC$. In this question $MR = 30 - 2Q$ and $MC = Q$. Equating MR and MC gives us $Q = 10$, which is the profit-maximizing quantity.

From demand function, we can find the profit-maximizing price $P = 30 - 10 = 20$.

The resulting profit is $10 \times 20 - C(10) = 150$.

(b) What is the socially optimal price? Calculate the deadweight loss (DWL) due to the monopolist behavior of this firm. Calculate consumer surplus (CS) and producer surplus (PS). (15 points)

At the socially optimal price,

$$D(Q) = MC(Q).$$

That is, $30 - Q = Q$, which implies socially optimal quantity is $Q = 15$ and social optimal price is $P = 30 - Q = 15$.

Instead, monopoly sells $Q = 10$ at $P = 20$, which generates $DWL = (20-10)(15-10)/2 = 25$.

$CS = (30-20) \cdot 10/2 = 50$ and $PS = 150$.

(Note that the producer surplus is equal to the profit, in the absence of the fixed cost.)

(c) Assume that the government puts a price ceiling on the monopolist at $P = 18$. How much output will the monopolist produce? What will be the profit of the monopolist? Calculate CS, PS, and DWL. Is the deadweight loss higher than that in part (b)? (20 points)

Now monopoly can't charge its optimal price of \$20. Instead, it chooses the maximum price it is allowed to charge: $P = 18$.

Monopoly sells $Q = 30 - 18 = 12$ at this price. The resulting profit is $18 \cdot 12 - 12 \cdot 12/2 = 144$. $CS = 12 \cdot 12/2 = 72$, $PS = \text{profit} = (18+6) \cdot 12/2 = 144$, and $DWL = 6 \cdot 3/2 = 9$. The DWL is smaller now because price is lower than under monopoly and output is higher.

