Problem Set 2

Due on Canvas at 12:00pm on September 26, 2025

Solutions

Instructions: **No partial credit will be awarded.** All answers must be entered in the Problem Set 2 Quiz on Canvas. Note that it is not possible to edit your responses on Canvas after submitting. Best practice is to **complete the problem set on paper** and then transfer solutions to Canvas. You may collaborate on this problem set with other students in your learning team, but each student must submit his or her own solutions.

Grading: Grading is done on a 10-point scale across all problems in the problem set. Note that after submitting on canvas, you may see a score, but that does not include any points for any qualitative questions and is only a **preliminary** score. **Grades will be finalized a few days after the due date.**

Material covered: This problem set covers lectures 5- 8 of the course.

Problem 1. GreenLeaf Bags

A Yale SOM alum launches GreenLeaf Bags, a New Haven venture that screen-prints custom eco-friendly tote bags for local retailers. Output is measured in bags per month and denoted by q. Output is produced with labor L (labor-hours/month) and printing capacity K (machine-hours/month) via

$$q = 2\text{sqrt}(LK).$$

Suppose wages are equal to w=$25 per labor-hour, materials cost (blank bag + ink) is m=$4per bag, and this month the firm has already leased K= 250 machine-hours at a rental rate r=$25 per machine-hour, a sunk commitment for the month. Unless noted otherwise, treat the market as perfectly competitive.

a) (1 point) Derive the short-run variable cost function VC(q) from the production function.

b) (1 point) Compute the short-run marginal cost MC(q) and average variable cost AVC(q).

c) (1 point) Suppose the prevailing price is P=$28 per bag. How many bags will the firm produce this month? What are monthly profits?

d) (1 point) At what price will the firm shut down in the short run?

e) (2 point) Long run with free entry and identical firms. Now suppose firms can adjust K freely each period and all face w=$25, r=$25, and m=$4. What is the long-run competitive equilibrium price?

f) (1 point) Briefly state the returns to scale of this technology and justify your answer.

Problem 2. Cranberries

a. Consider the market for cranberries in the US. The domestic demand is given by

$$Q_D = 40 - 2P$$

where Q_D is quantity measured in millions of pounds and P is the price per pound. Cranberries are also produced domestically in the US and the domestic supply curve is given by

$$Q_S = \frac{1}{2}P$$

where Q_S is US output in millions of pounds and P is the domestic price per pound.

(0.5 point) Solve for the domestic (autarky) equilibrium price and quantity of vegetable fiber.

Price: _____

Quantity: _____

b. (1 point) Cranberries trade in a highly competitive world market at a price of $10 per pound. Suppose the US opens up to free trade and there is enough availability that the US can import as much as it needs at this price. Do you think US would import cranberries? If so, write the quantity that will be imported. If not, enter "0".

   Quantity imported: _____

c. (1 point) Subsequently, the US government imposed a $7 import tariff. Under this tariff, what do you predict is the domestic price of vegetable fiber?

   US domestic price in regime with import tariffs: _____

d. (0.5 point) What would be the total tariff revenue collected by the Government?

   Tariff revenue: _____

e. (0.5 point) Without any further computations, can you predict who would be the gainers and losers from such a tariff?

   Relative to free trade, US domestic producer surplus under the import would …

   □ Increase

   □ Decrease

   □ Unclear without more information

   US domestic consumer surplus (under the tariff vs free trade) would …

   □ Increase

   □ Decrease

□ Unclear without more information

Total US domestic surplus (under the tariff vs free trade) would …

□ Increase

□ Decrease

□ Unclear without more information

Why did you conclude this about total surplus? _____

_____

_____

Problem 3. Comcast

Comcast is a monopolist in the market for cable in New Haven. Its inverse demand for cable service is given by

$$p(y) = 200 - 4y$$

Assume its marginal costs are zero for simplicity.

a) *(0.5 points)* Suppose that Comcast can perfectly price discriminate among the consumers. What is Comcast profit if in that case? What is consumer surplus? Is the allocation efficient?

Let's get more realistic and assume that Comcast can charge different prices on two segments of the market: private customers and firms. The demands on the two segments are:

$$Y_i(p_i) = 120 - (3/2)p_i$$
$$y_f(p_f) = 80 - (1/2)p_f$$

b) *(0.5 points)* If Comcast does not price discriminate, what is the aggregate inverse demand?

c) *(1 point)* Find the level of sales, price, and profit in this scenario (no price discrimination).

d) *(1.5 points)* Compare producer's and consumer's surplus in the three cases: uniform price (calculated with demand in point 1), perfect discrimination, and 3rd-degree price discrimination.