

EconS 301- Intermediate Microeconomic Theory  
Homework #4 - Due date: Tuesday October 25th, 2022.

1. Consider a firm with the Cobb-Douglas production function  $f(K, L) = 4K^{1/2}L^{1/3}$ , where  $K$  denotes units of capital and  $L$  represents units of labor. Assume that the firm faces input prices of  $r = \$10$  per unit of capital, and  $w = \$7$  per unit of labor.
  - (a) Solve the firm's cost-minimization problem, to obtain the combination of inputs (labor and capital) that minimizes the firm's cost of producing a given amount of output,  $q$ .
  - (b) Use your results from part (a) to find the firm's cost function. This is its long-run total cost, as all inputs can be altered.
  - (c) Find the firm's marginal cost function, and its average cost function. Interpret.
  - (d) Assume now that the amount of capital is held fixed at  $\bar{K} = 3$  units. Solve the firm's cost-minimization problem again to find the amount of labor that minimizes the firm's cost.
  - (e) Use your results from part (c) to find the firm's short-run cost function (since in the short run the firm can only alter the amount of labor, but without changing the units of capital).
2. Repeat the analysis in Question 1, but assume that the firm faces a production function  $f(K, L) = 4K + L$ , thus treating capital and labor as substitutes in the production process.
3. A publisher for textbooks has a total cost of  $TC(q) = 25,000 - 50q + 15q^2$ .
  - (a) Find the publisher's marginal cost, average cost, average variable cost, and average fixed cost.
  - (b) Find the value of  $q$  for where the marginal cost curve crosses the average cost curve and average variable cost curve.
  - (c) Find the output elasticity  $\varepsilon_{TC,q}$ .
4. Consider a monopolist facing an inverse demand  $p(q) = 10 - 4q$ . Use the Lerner index to find the monopolist's profit-maximizing price.
5. Consider a drug company holding the patent of a new drug for a rare disease (monopoly rights). The firm faces inverse demand function  $p(q) = 100 - 0.1q$ , and a cost function  $C(q) = 4q$ .
  - (a) Find the monopolist profit-maximizing output, its price, and its profits.
  - (b) Find the competitive equilibrium output in this context.
  - (c) Find the subsidy per unit of output that the government needs to offer the monopolist to induce the latter to produce the competitive equilibrium output you identified in part (b).
  - (d) What is the total cost that the government incurs with the subsidy? How are profits affected by the subsidy (i.e., the change in profits from parts a to c)?