

ECON 310  
Nazarov  
Problem set (Chapter 8)

1. Laura's internet services has the following short-run cost curve:

$$C(q, K) = \frac{25q^3}{K^{2/3}} + rK$$

where  $q$  is Laura's output level,  $K$  is the number of servers she leases and  $r$  is the lease rate of servers. Laura's short-run marginal cost function is:

$$MC(q, K) = \frac{50q}{K^{2/3}}$$

Currently, Laura leases 8 servers, the lease rate of servers is \$15, and Laura can sell all the output she produces for \$500.

- Find Laura's short-run profit maximizing level of output.
- Calculate Laura's profits.
- If the lease rate of internet servers rise to \$20, how does Laura's optimal output and profits change?

2. The squishy industry is competitive and the market price is \$0.80. Apu's long-run cost function is:

$$C(q, r) = \frac{0.436}{3}r^{3/2}q^{3/2}$$

where  $r$  is the price Apu pays to lease a squishy machine and  $q$  is squishy output. The long-run marginal cost curve is:

$$MC(r, q) = 0.218r^{3/2}q^{1/2}$$

- What is Apu's optimal output if the price Apu pays to lease a squishy machine is \$1.10?

Suppose the lease price of squishy machines falls by \$0.55.

- What happens to Apu's optimal output if the market price for a squishy remains at \$0.80?
- Did profits increase for Apu when the lease rate of squishy machines fell?

3. The long-run cost function for LeAnn's telecommunication firm is:

$$C(q) = 0.03q^2$$

A local telecommunication tax of \$0.01 has been implemented for each unit LeAnn sells. This implies the marginal cost function becomes:

$$MC(q, t) = 0.06q + t$$

If LeAnn can sell all the units she produces at the market price of \$0.70,

- a. Calculate LeAnn's optimal output before and after the tax.
- b. What effect did the tax have on LeAnn's output level?
- c. How did LeAnn's profits change?

4. Consider a competitive market in which the market demand for the product is expressed as  $P = 75 - 1.5Q$ , and the supply of the product is expressed as  $P = 25 + 0.50Q$ . Price,  $P$ , is in dollars per unit sold, and  $Q$  represents rate of production and sales in hundreds of units per day. The typical firm in this market has a marginal cost of  $MC = 2.5 + 10q$ .

- a. Determine the equilibrium market price and rate of sales.
- b. Determine the rate of sales of the typical firm, given your answer to part (a) above.
- c. If the market demand were to increase to  $P = 100 - 1.5Q$ . What would the new price and rate of sales in the market be? What would the new rate of sales for the typical firm be?
- d. If the original supply and demand represented a long-run equilibrium condition in the market, would the new equilibrium (c) represent a new longrun equilibrium for the typical firm? Explain.

5. The demand curve and long-run supply curve for carpet cleaning in the local market are:

$$Q_D = 1000 - 10P$$

$$Q_S = 640 + 2P$$

The long-run cost function for a carpet cleaning business is:  $C(q) = 3q^2$ . The long-run marginal cost function is:  $MC(q) = 6q$ .

- a. If the carpet cleaning business is competitive, calculate the optimal output for each firm.
- b. How many firms are in the local market?
- c. Is the carpet cleaning industry an increasing, constant, or decreasing cost industry?