73230 Intermediate Microeconomics
Problem Set 3

Anh Nguyen

Due: In-class at 10:30am on April 3, 2019

Problem 1 (45 pts)

Let $\bar{K} = 1$ be the level of capital in the short run. The prices of capital and labor are $r = 10$ and $w = 5$, respectively. For each of the following production functions, (1) derive the short-run cost function (5 pts), (2) derive the long-run cost function (5 pts), and (3) illustrate how you derive the long-run cost function with isoquants and isocosts (5 pts).
Hint: for the long-run cost function, first set up the cost minimization problem.

(a) (15 pts) $f(K, L) = K^{1/2}L^{1/4}$

(b) (15 pts) $f(K, L) = \min\{K, 3L\}$

(c) (15 pts) $f(K, L) = K + 3L$

Problem 2 (15 pts)

A firm has the following (long-run) cost function:

$$TC(Q) = Q^3 - 10Q^2 + 100Q \tag{1}$$

(a) (5 pts) What is the range of Q for which the firm has increasing returns to scale? decreasing returns to scale? Constant returns to scale?

(b) (5 pts) What is the long-run shut-down price?

(c) (5 pts) Suppose that the market demand is given by $Q = 200 - P$, and all firms have identical cost functions as in Equation (1). How many firms are present in the market?

Problem 3 (15 pts)

Consider a perfectly competitive market in the short run. The market demand is given by $Q = 44 - 2P$. There are currently 8 firms in the market with the following identical (short-run) cost function:

$$TC(Q) = Q^2 + 4Q + 10$$

(a) (5 pts) Derive the short-run market supply.

(b) (5 pts) What is the short-run equilibrium price and quantity?

(c) (5 pts) The government decides to impose a \$1.5 tax on every unit sold. Calculate the after-tax consumer surplus, producer surplus, and government revenue. What is the deadweight loss due to tax? Illustrate your answer on a graph.

Problem 4 (25 pts)

Jane is a farmer, and the amount that she can grow depends on the weather. If the weather is good, then she can grow \$160,000 worth of crops; if the weather is bad, then she can grow \$40,000 worth of crops. Jane's utility function is:

$$u(m) = \frac{1}{100}\sqrt{m},$$

where m is the amount of money she has after selling her crops. Assume that the probability of good weather is $\frac{1}{2}$.

(a) (5 pts) What is $\mathbb{E}[m]$, the expected value of the amount of money Jane makes from selling her crops?

(b) (5 pts) What is $\mathbb{E}[u(m)]$, Jane's expected utility?

(c) (5 pts) What is Jane's certainty equivalent?

(d) (5 pts) What is Jane's risk premium?

(e) (5 pts) Suppose that Jane has the option of buying crop insurance for price p. If Jane buys this insurance, then she gets \$120,000 in cash from the insurance company when the weather is bad, so she ends up with \$160,000, regardless of whether the weather is good or bad. What is the maximum amount she's willing to pay for this insurance policy?