HS 402: Assignment 3

1. Suppose that a competitive firm has a total cost function $C(q) = 450 + 15q + 2q^2$ and a marginal cost function $MC(q) = 15 + 4q$. If the market price is $P = \$115$ per unit, find the level of output produced by the firm. Find the level of profit and the level of producer surplus.

2. Suppose that a firm's production function is $q = 9x^{\frac{1}{2}}$ in the short run, where there are fixed costs of $1000, and x is the variable input whose cost is $4000 per unit.

   (a) What is the total cost of producing a level of output q? In other words, identify the total cost function $C(q)$.

   (b) Write down the equation for the supply curve.

   (c) If price is $1000, how many units will the firm produce? What is the level of profit? Illustrate on a cost curve graph.

3. A firm produces a product in a competitive industry and has a total cost function $C = 50 + 4q + 2q^2$ and a marginal cost function $MC = 4 + 4q$. At the given market price of $20, the firm is producing 5 units of output. Is the firm maximizing its profit? What quantity of output should the firm produce in the long run?

4. Japanese rice producers have extremely high production costs, due in part to the high opportunity cost of land and to their inability to take advantage of economies of large-scale production. Analyze two policies intended to maintain Japanese rice production: (1) a perpound subsidy to farmers for each pound of rice produced, or (2) a per-pound tariff on imported rice. Illustrate with supply-and-demand diagrams the equilibrium price and quantity, domestic rice production, government revenue or deficit, and deadweight loss from each policy. Which policy is the Japanese government likely to prefer? Which policy are Japanese farmers likely to prefer?

5. A monopolist faces the following demand curve: $Q = 144/P^2$ where Q is the quantity demanded and P is price. Its average variable cost is $AVC = Q^{\frac{1}{2}}$ and its fixed cost is 5.

   (a) What are its profit-maximizing price and quantity? What is the resulting profit?

   (b) Suppose the government regulates the price to be no greater than $4 per unit. How much will the monopolist produce? What will its profit be?

   (c) Suppose the government wants to set a ceiling price that induces the monopolist to produce the largest possible output. What price will accomplish this goal?

6. A monopolist can produce at a constant average (and marginal) cost of $AC = MC = \$5$. It faces a market demand curve given by $Q = 53 - P$.

   (a) Calculate the profit-maximizing price and quantity for this monopolist. Also calculate its profits.

(b) Suppose a second firm enters the market. Let Q1 be the output of the first firm and Q2 be the output of the second. Market demand is now given by $Q1 + Q2 = 53$–P. Assuming that this second firm has the same costs as the first, write the profits of each firm as functions of Q1 and Q2.

(c) Suppose (as in the Cournot model) that each firm chooses its profit-maximizing level of output on the assumption that its competitor's output is fixed. Find each firm's "reaction curve" (i.e., the rule that gives its desired output in terms of its competitor's output).

(d) Calculate the Cournot equilibrium (i.e., the values of Q1 and Q2 for which each firm is doing as well as it can given its competitor's output). What are the resulting market price and profits of each firm?

(e) Suppose there are N firms in the industry, all with the same constant marginal cost, MC $= \$5$. Find the Cournot equilibrium. How much will each firm produce, what will be the market price, and how much profit will each firm earn? Also, show that as N becomes large, the market price approaches the price that would prevail under perfect competition.