Practice Set 5

Monopolistic Competition and Oligopoly

This problem set contains material for the relevant lab. Lab teachers are expected to provide sufficient guidance for the entire problem set. It is in the teacher's discretion to select the most representative tasks to solve instructionally in every lab. For the rest of the tasks, methodology, hints and final answers will be provided. Students are expected to work on practice problems, however, they are not required to submit written solutions. It is a non-negotiable policy in this course to not provide handouts with the solutions of practice problem sets.

1. A firm operating in a monopolistically competitive market faces a demand $p = 10 - 0.1q$. The firm's total cost is $C = -10q + 0.0333q^3 + 130$, where p is in dollars per unit, output, q is in units per time period, and total cost, C is in dollars.
   (a) Determine the price and output that will allow the firm to maximize profit (or minimize losses).
   (b) Compute a Lerner index.
   (c) If you know that there are another 9 firms in this market, can you find the long-run equilibrium? If yes, what is it? If no, why not?

2. Consider a duopoly producing a homogeneous product. Firm 1 produces one unit of output with one unit of labor and one unit of capital, while firm 2 produces one unit of output with two units of labor and one unit of capital. The unit costs of labor and capital are w and r respectively. The inverse demand function is $p = A - q_1 - q_2$ and the firms compete in quantities.
   (a) Compute the reaction functions of the two firms. How are these affected by changes in the demand shift parameter A and in the input prices w and r?
   (b) Compute the Cournot-Nash equilibrium.
   (c) Show that firm 1's equilibrium profit is not affected by the price of labor.

3. Firms A and B are Cournot duopolists producing a homogeneous good. Inverse market demand is $P = 100 - Q$, where P is market price and Q is the market quantity demanded. Each firm has marginal and average cost $C = 40$.
   (a) The two firms propose to merge. Derive total output, market price, profit and consumer surplus before the merger and after the merger. Explain intuitively any changes you see to these variables when the merger occurs.
   (b) A regulator for this market has objective function $W = \lambda\Pi + (1 - \lambda)CS$, where Π is industry profit, CS denotes consumer surplus and λ is a constant, $0 \leq \lambda \leq 1$. Will a regulator with $\lambda = 0$ permit the merger? Will a regulator with $\lambda = 1$ permit the merger? Interpret these two regulatory stances and explain the implications of your answer for competition policy. At what level of λ would the regulator be indifferent to the merger?
   (c) The firms now claim that there will be efficiency gains to the merger, so that the marginal cost of production will fall to $C = 30$. How does this affect your answer in part b)? Explain the implications of your answer for competition policy.

4. Consider an industry with 5 identical firms competing a la Cournot. Assume a linear market demand function and constant marginal costs.
   (a) Imagine two of the firms are deciding to merge. Would such a merger occur?
   (b) What if three firms decided to merge and the resulting industry structure were therefore to consist of three identical firms?
   (c) Does this model suggest that mergers generally occur for strategic reasons?
   (d) Which assumption is crucial for your results above?
   (e) What if all five firms merge?

5. Consider a market where there are two differentiated goods. The demand for good 1 is given by $q_1 = a - bp_1 + dp_2$, and the demand for good 2 is given by $q_2 = a - bp_2 + dp_1$, where $a > 0$ and $0 < d < b$. The production cost of each good is zero.
   (a) Suppose that both goods are produced by the same firm (a monopolist). Compute the prices set by the monopolist.
   (b) Suppose now that each good is produced by a different firm and the firms choose prices simultaneously. Compute the equilibrium prices and confirm that they are lower than the monopoly prices. Explain the intuition for this result.
   (c) Now assume that each good is produced by a different firm but the firms set prices sequentially; in particular, firm 2 can observe the price set by firm 1 before setting its own price. Compute the equilibrium price of firm 1 in this two-stage game. How do these compare to your answer in (b)? Explain the intuition for your result.

6. Two firms are competing with respect to quantity in an industry where the market demand is $q = 100 - p$. The average cost for Firm A is 20 and for Firm B is 30. The latter firm proposes that the two firms merge into one single firm and share the profits equally.
   (a) Will Firm A accept this offer?
   (b) If your answer to (a) is "yes", is equal split of profits the best deal that Firm B can get? If your answer to (a) is "no", how does Firm B need to adjust the offer to incentivize Firm A to accept it?

7. Consider an industry which produces a homogeneous product with inverse demand function $p = 17 - 2Q$, where p is the market price and Q total industry output. Suppose that the cost function for each firm is $C = q + F$, where C is total cost, q is the firm's output, and $F = 2$. Firms are profit-maximizers and compete by setting quantities.
   (a) Assuming free entry and exit, derive the equilibrium number of firms in the industry?
   (b) Would collusion among existing firms raise the equilibrium number of firms in the industry?

8. Two firms compete by sequentially setting quantities in an industry where the market demand is $Q = 1 - P$. Firm X moves first and has constant average costs of c; Firm B moves second and has zero costs.
   (a) What is the output of each firm?
   (b) What is the value of c that makes the two firms' output equal?