

METU, Department of Economics

ECON 201 – Problem Set 9

Q 1. Suppose there are 100 identical firms in a perfectly competitive industry. Each firm has a short-run total cost function of the form

$$C(q) = \frac{1}{300}q^3 + 0.2q^2 + 4q + 10$$

Calculate the firm's short-run supply curve with q as a function of market price (P).

- On the assumption that there are no interaction effects among costs of the firms in the industry, calculate the short-run industry supply curve.
- Suppose market demand is given by $Q = -200P + 8000$. What will be the short-run equilibrium price–quantity combination?

Q 2. In a market, duopoly firms produce differentiated products. The inverse demand function for Firm 1 is $p_1 = 104 - 10q_1 - 2q_2$. The inverse demand function for Firm 2 is $p_2 = 42 - 2q_2 - q_1$. Each firm has a constant marginal cost of $MC = 6$. What are the Nash-Cournot equilibrium quantities and prices?

Q 3. Duopoly quantity-setting firms face the market demand $p = 200 - 5Q$. Each firm has a marginal cost of \$20 per unit.

- What is the Nash-Cournot equilibrium?
- What is the Stackelberg equilibrium when Firm 1 moves first?

Q 4. Suppose that two oligopoly firms set prices to maximize their profits. Each faces the same constant marginal cost, $m = 15$. The demand function for Firm 1 is $q_1 = 120 - 6p_1 - 2p_2$ and for Firm 2 is $q_2 = 120 - 6p_2 - 2p_1$, where p_1 is Firm 1's price and p_2 is Firm 2's price. What are the Nash-Bertrand equilibrium prices and quantities?

Q 5. A monopolist can produce at constant average and marginal costs of $AC=MC=5$. The firm faces a market demand curve given by $Q = 53 - P$.

- Calculate the profit-maximizing price–quantity combination for the monopolist. Also calculate the monopolist's profits.
- What output level would be produced by this industry under perfect competition?
- Calculate the consumer surplus obtained by consumers in case (b). Show that this exceeds the sum of the monopolist's profits and the consumer surplus received in case (a). What is the value of the “deadweight loss” from monopolization?

Q 6. Suppose that the government imposes a specific tax (t) on a monopoly with the following characteristics. Use appropriate calculus tools to show your work. Show the effect of that

specific tax on the price of monopoly under following cases and interpret the incidence of tax that falls on consumers.

- a) A monopoly that has constant marginal cost at m and faces a demand curve with constant elasticity of e .
 - i) Show the effect of that specific tax on the price of monopoly in terms of e and interpret the incidence of tax that falls on consumers.
 - ii) Now suppose $t=2$ and $e=-2$. Calculate the change in price.
- b) A monopoly that has linear MC curve that has the form of $MC=aQ+b$ and linear MR curve that has the form of $MR=c-dQ$.
 - i) Show the effect of that specific tax on the price of monopoly in terms of a and d and interpret the incidence of tax that falls on consumers.
 - ii) Now, suppose $a=4$, $b=2$, $c=18$, $d=4$, $t=4$. Calculate the change in price.

Q 7. Show that the elasticity of demand is unitary at the midpoint of a linear inverse demand function and hence that a monopoly will not operate to the right of this midpoint.

Q 8. Suppose that firms' marginal and average costs are constant and equal to 5 and that inverse market demand is given by $Q = 53 - P$.

- a. Calculate the profit-maximizing price–quantity combination for a monopolist. Also calculate the monopolist's profit.
- b. Calculate the Nash equilibrium quantities for Cournot duopolists, which choose quantities for their identical products simultaneously. Also compute market output, market price, and firm and industry profits.
- c. Calculate the Nash equilibrium prices for Bertrand duopolists, which choose prices for their identical products simultaneously. Also compute firm and market output as well as firm and industry profits.
- d. Suppose now that there are n identical firms in a Cournot model. Compute the Nash equilibrium quantities as functions of n . Also compute market output, market price, and firm and industry profits.
- e. Show that the monopoly outcome from part (a) can be reproduced in part (d) by setting $n=1$, that the Cournot duopoly outcome from part (b) can be reproduced in part (d) by setting $n=2$ in part (d), and that letting n approach infinity yields the same market price, output, and industry profit as in part (c).