Problem Set 3: Oligopoly

Markets, Incentives and Ethical Management

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1. Asymmetric Bertrand competition. Consider the Bertrand model of the lecture, but assume that the firms face different marginal costs: let $c_1 > c_2$. To exclude uninteresting cases, assume that c_1 is smaller than the monopoly price of the industry. To simplify the analysis, assume that prices can only be changed in small discrete increments of ε (e.g. $\varepsilon = 1$ Euro cent).

   (a) What is the equilibrium outcome?

   (b) What would happen if we increased the number of firms by introducing firms that have the same or higher marginal production cost as firm 1?

   (c) How would you interpret the effect that firm 1 has on the market outcome?

2. Welfare in Cournot duopoly. Consider the symmetric Cournot duopoly discussed in the lecture. Calculate the welfare loss, i.e., the dead weight loss that arises from the firms' market power (their ability to set prices above marginal cost).
   Hint: To determine the consumer and producer surplus and the social welfare, it is helpful to draw the inverse demand function.

3. How are prices determined in the Cournot model? Can equilibrium prices paid for products differ among firms?

4. Consider a Cournot model in which n identical firms are active, with a cost function

$$C_i(q_i) = \frac{1}{2}q_i^2, \quad \forall i.$$

   Assume that the market demand is given by $D(p) = 1 - p$. Calculate the price and the quantity of the symmetric Cournot equilibrium.

5. Consider a market with two firms $i = 1, 2$. The firms face the following demand functions:

$$q_1 = \tfrac{1}{2} - p_1 + \tfrac{1}{4}p_2;$$
$$q_2 = \tfrac{1}{2} - p_2 + \tfrac{1}{4}p_1.$$

To simplify the description, suppose that costs of each firm are 0.

(a) The demand functions are interdependent, that is, the demand for product 1 depends not only on the own price but also on the p_2, and vice versa.
Do the firms produce substitutes or complements?
Are the products differentiated or not?

(b) Assume that the two firms compete in prices. Calculate the Nash equilibrium for this game. (At the right point of your calculations, use the symmetry between the two firms.)