Queen Mary
University of London

Main examination period 2025

ECN 385 Industrial Economics Duration: 2 hours

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Answer ALL questions.
Explain clearly your answers.

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Examiner: Sam Altmann

Question 1 [23 marks]

The demand for ice cream is given by $Q = 112 - 2p$, where Q is the quantity demanded and p is the price. The market for ice cream is perfectly competitive, and the total cost of production of each of the firms in the market is given by $TC_i(q_i) = 8 + 2q_i + \frac{1}{2}q_i^2$, where q_i is the quantity produced by firm i.

(a) Find the (short-run) supply function of each firm. **[6 marks]**

(b) Find the long-run competitive equilibrium. That is, find the equilibrium output by each firm, the equilibrium price and the equilibrium number of firms in the market **[8 marks]**

(c) In the summer of 2020, there was a wave of high temperatures, and the demand for icecreams increased to $Q = 193 - 2p$. Since it was totally unexpected, there was no change in the number of firms prior to the demand shift. Therefore, you can assume the number of firms found in part (b) (if you did not solve part (b), assume that the number of firms is 19). Find the (short-run) equilibrium output for each firm, the market output, the equilibrium price and firms profits. Do these firms have market power? **[9 marks]**

Question 2 [30 marks]

Firms 1 and 2 compete in quantities, in the manner of Cournot competition. The market demand curve is given by $P = 100 - q_1 - q_2$, and both firms have cost functions given by $TC_i(q_i) = 28q_i$.

a) Find the Nash-Cournot equilibrium. Does this level of output maximise social welfare? **[8 marks]**

b) Suppose the firms decide to collude by setting their quantities jointly (and equal). Show that both firms will set output $q_i = 18$, and find their collusive profits. Is this a Nash equilibrium? **[5 marks]**

Suppose that the stage game is repeated infinitely, and that firms discount future payoffs with discount factor $\delta = \frac{1}{2}$. Consider the following strategy: Play $q_i = 18$ in each period *unless* either player deviated in the previous period, in which case play $q_i = 36$. This strategy involves punishing players who deviate in any way for a single period (the punishment phase), before returning to the collusive level of output one period later (the agreement phase).

c) How would a player optimally deviate in each of the two phases? **[5 marks]**

d) Write down the two incentive inequalities that must be satisfied for this strategy to constitute a subgame perfect Nash equilibrium, and hence show that collusion can be sustained in equilibrium. **[7 marks]**

e) Comment on the factors that make collusion easier or harder to sustain in models of repeated interactions. **[5 marks]**

Question 3 [25 marks]

Consider a Hotelling model in which a unit mass of consumers is uniformly distributed along interval [0, 1]. Firm 1 is located at point $y_1 = 0.25$ and Firm 2 at point $y_2 = 0.75$. The firms sell a product that is homogeneous (except for its location of sale) and of which each consumer purchases exactly one unit (*no more and no less*). A consumer at location x who buys from firm i incurs a total expenditure of $p_i + |x - y_i|$. Firms 1 and 2 face constant marginal costs $c_1 = c_2 = 3$.

Consumers are not necessarily aware of the products and their prices, but firms can use reach advertising. Firms simultaneously set prices p_1 and p_2 and choose the level of advertising ϕ_1 and ϕ_2. ϕ_i gives the probability that a random consumer will receive the advert from firm i. The cost of advertising ϕ_i is given by $\alpha\phi_i^2$. Consumers seek to minimise expenditure (among the firms that the consumer is aware of) and firms to maximise profits.

(a) Write down the demand functions for each firm as function of p_1, p_2, ϕ_1, and ϕ_2. **[5 marks]**

(b) Find the firms' best response functions for prices. How does firm 1's optimal pricing decision depend on p_2, ϕ_1, and ϕ_2? **[6 marks]**

(c) By finding the firms' best response functions for advertising (or otherwise), find the Nash Equilibrium of this pricing and advertising game. Explain how the equilibrium depends on the advertising cost parameter α? **[7 marks]**

[*Hint*: You may use the fact that firms are symmetric to help solve for the equilibrium.]

(d) How can advertising impact a firm's market power? **[7 marks]**

[*You should attempt this question even if you did not finish parts a), b, or c)*]

Question 4 [22 marks]

Answer the following questions. If your answers are focused and precise, they need not be very long.

(a) Explain how the incentives of monopolies to conduct research & development compare to the ones of competitive firms. **[11 marks]**

(b) The latest data from mobile phone networks suggests that different users pay very different prices for their data, with some consumers paying far more per megabyte than others. Explain the potential reasons for non-uniform pricing in this market.

[11 marks]

End of Paper