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Problem Set 3

Due April 18 in class or by 4:30 pm in E52-262 in the 14.20 Hand-in boxes

1. Consider a market characterized by competition around a unit circle, where consumers are uniformly distributed on the circle (their density is equal to 1). Consumers wish to buy one unit of the good and have a transport cost t of \$4 per unit distance. Each consumer will purchase exactly one unit from the lowest-effective-price firm provided that their effective price, $p + t * (\text{distance to firm})$, is less than their reservation price s of \$6, and zero otherwise. Also, assume marginal cost of production c is \$2 and that there is a fixed cost f of \$1 for a firm to locate on the circle. In the first stage, potential entrants simultaneously choose whether or not to enter. Let n denote the number of entering firms. Firms are automatically located equidistant from one another on the circle.
 - a. Given n firms, so that the first stage of the game has already occurred, what is the equilibrium price p ?
 - b. What is the equilibrium number of firms in the market? What is the equilibrium price now?
2. A monopolist faces an inverse demand function $P = 10 - Q$ in each of two periods A and B . Her marginal costs are 5 for period A and $5 - q^A$ for period B . Thus, the monopolist “learns” about production in period A , so that her marginal costs fall in period B . Assume that there is no discounting of second-period income.
 - a. Derive the monopoly output for period A , disregarding production in period B .
 - b. Now consider the dynamic (two-period) monopoly problem. Derive the monopolist’s profit maximizing quantities in both periods. Does the monopolist’s output in period A stay the same as in the first part of the question? Explain.
 - c. Suppose that in period B the monopolist (incumbent) faces an entrant with unit cost $c^e = 5$. Write down the first order condition for this two-stage duopoly game. Just by inspection of the first order conditions, can you compare q_1^A in the dynamic monopoly case with the strategic duopoly case? What explains the difference?
3. Consider the following entry game. In the first stage, an entrant decides whether or not to enter the market. In the second stage, the incumbent sets the monopoly price if there is no entry, and in the case of entry, the incumbent chooses between accommodating entry and engaging in a predatory price war. Both the incumbent and the entrant act to maximize expected profits, and this is common knowledge. The payoffs are as follows: if both firms are in the market, and the incumbent accommodates, each firm gets 3, and if the incumbent fights, then each gets -1 . If the entrant stays out, it gets 0 and the incumbent gets 10.
 - a. Sketch the extensive form of the game. What is the subgame perfect equilibrium?
 - b. Suppose there is a probability p that the incumbent firm will meet any entry with a price war. Sketch the new extensive form of the game. Explain how this might modify the equilibrium strategy you found above.
 - c. Find the perfect Bayesian equilibrium given $p = 0.5$.
 - d. Suppose the incumbent operates in N different markets. There are N potential entrants, one per market, and they make their entry decisions sequentially. The potential entrant in each market can observe the past behavior of the incumbent toward all previous entrants. What is the subgame perfect equilibrium of this game?

4. Tobacco advertising discussion: The cigarette industry, like many others, creates and sustains product differentiation through substantial advertising and promotion expenditures. In the 1960's, tobacco firms were banned from advertising on television. In late 1998, tobacco companies expected the multi-state tobacco litigation settlement to impose additional limits on cigarette advertising and promotion. Read the article "Cigarette Makers in Discount War to Lock in Share," its shape Wall Street Journal, September 23, 1998, B1. Answer the following questions.
- a. How do you think tobacco sellers usually try to differentiate themselves?
 - b. The article points out the claim that with advertising restrictions, market shares tend to remain unchanged. Why do you think this might be case? Does it make sense to speak of "captive" customers in the tobacco industry?
 - c. How can demand for the industry as a whole be modified through advertising by one firm? How about modifying the firm's own demand through advertising? What kinds of considerations should the firm take into account when choosing in what type of advertising to invest?
 - d. Given more stringent advertising restrictions, how do you think entry into the cigarette market would be affected?