

**Economics 431
Winter 2002
Second Midterm Exam
March 18, 2002**

Print your name here _____

Your UM ID number¹ _____

Instructions:

- Do not open the exam until you are told to do so.
- *Once the exam begins*, check that you have all the pages. There should be 10 pages including this one.
- *Once the exam begins*, print your name in capital letters on top of each page to receive credit for it.
- This is a closed book, closed notes exam.
- You have 75 minutes to take the exam.
- Answer the questions in the space provided. To get credit on word questions, you should provide a brief explanation of your answer. Please write concisely and to the point. Feel free to use diagrams, but label them properly. If your answer involves doing math, show all work (this way you will get partial credit in case your ideas are correct but your math is not).
- If you run out of space on a particular question, you may use the back side of the same page. Clearly indicate on the front of the page that your answer is on the back; and on the back, give the number of question you are answering.

Good Luck!

¹The underlined 8 digits on the face of your M-Card

1) (15 points) A local market for bottled water is served by 5 firms, whose marginal costs per bottle of water are constant and are given in the following table

Firm	1	2	3	4	5
c , \$	0.80	0.70	0.85	0.65	0.85

The market price for a bottle of water is \$ 1.21. Assume that you can use Cournot model with linear demand to describe how this market operates.

a) (7 points) Which firm (or firms) has the largest market share? Explain.

b) (8 points) Estimate the elasticity of demand for bottled water at market price.

2) (15 points) The first digital phone book (national phone directory) was made by a firm called Pro CD and sold for \$ 10,000 per copy in 1986. Since then, *one other* firm, American Business Information, started making the same product. Prices dropped lower and lower, and now a national phone directory is available for free.

a) **(8 points)** How can a presence of just one other competitor result in a low equilibrium price for a product? Explain. What features of the market can account for this outcome?

b) **(7 points)** Now consider the market for digital encyclopedias. This market, again, is served by two firms: Microsoft (which makes Encarta encyclopedia) and Britannica. Both Britannica and Encarta are offered for \$ 89.99 on a CD and for \$ 85 as an on-line subscription. Why aren't digital encyclopedias free? What feature of the market makes a non-zero price sustainable?

3) (20 points) GigaTech is *the only* manufacturer of the cutting-edge new generation phone handsets that sell for \$ 200. SneakyCom is one among *many* providers of prepaid calling cards that sell for \$ 20. The customers who buy GigaTech phones and/or prepaid calling cards have the following reservation prices:

Customer's name	Reservation price for a phone, R_1	Reservation price for a card, R_2
A	205	10
B	210	15
C	180	25
D	190	40

Consumer utility from a product equals their reservation price minus the price of the product. Consumers do not buy unless they get positive utility.

a) **(5 points)** Suppose that the calling card and the phone are offered separately at prices $p_1 = 200$ for the phone and $p_2 = 20$ for the card. Which consumers buys which products?

b) **(8 points)** SneakyCom CEO approaches GigaTech CEO with the following plan. Instead of selling phones and cards separately, they can offer the phone and the card *only* as a package for the price of \$220 per package. Then consumers who like calling cards a lot may also buy phones, and GigaTech will be able to sell more phones. Which consumers buy which products if the phone and the card are bundled? (Hint: calling cards are still available separately from other providers) What happens to the sales of phones?

c) **(7 points)** Reconcile your result in b) with the fact that most new cars are offered only together with tires as one package. Will the dealers sell more cars if they offer them without tires and let the customers buy their most preferred tires elsewhere? Explain.

4) (30 points) Consider a senate race game. Player 1 (the incumbent senator) decides whether to launch an ad campaign or not (A, N). Player 2 (the challenger) *simultaneously and independently* decides whether to enter the race or stay out (I, O). The payoffs from each action combination are given by (Player 1's payoff is the first entry in each cell).

		Player 2	
		I	O
Player 1	A	1, 1	3, 3
	N	2, 4	4, 2

a) **(8 points)** Find all the Nash equilibria of this game. Which players, if any, have a dominant strategy?

b) **(10 points)** Now suppose that Player 1 moves first by choosing either A or N . Player 2 *observes* player 1's action and then chooses I or O . For every action combination, the players' payoffs are the same as in the above payoff matrix. Draw a tree of this new game. How many strategies does player 1 have and what are they? How many strategies does player 2 have and what are they? Find all the subgame perfect equilibria of this game.

c) **(12 points)** Now find *all* the Nash equilibria of the game in part b). Are there any Nash equilibria that are not subgame perfect? Which Nash equilibrium is more believable? Explain. Does Player 1 receive a higher payoff in a static game of part a) or in a dynamic game of part b)? Why do you think this difference arises?

5) (30 points) Market demand is given by $p = 12 - Q$. There are two firms: the incumbent firm (I) and the entrant firm (E). Incumbent moves first by choosing quantity q_I from the interval $[0, 4]$. The entrant observes q_I and decides whether or not to enter and how much to produce if he enters (q_E). There is *no fixed cost of entry*. If the entrant decides to stay out, his profit is zero and the incumbent enjoys a monopoly position. Suppose that both incumbent and entrant have identical marginal costs equal to $c = 8$.

a) **(10 points)** What is the subgame perfect equilibrium of this game? What are the quantities produced by the incumbent and entrant? What are their profits?

b) **(6 points)** What is the minimum quantity that must be produced by the incumbent to deter entry (to make entry unprofitable)? In this game, will the incumbent ever try to deter entry by increasing quantity?

Now suppose that before production begins, the incumbent can purchase new equipment: he can either produce with the old equipment at marginal cost $c = 8$ or spend an additional amount $K = 5$ on new equipment which and produce at a lower marginal cost $c_L = 6$. After the incumbent's marginal cost is determined, the game proceeds as in part *a*).

c) **(14 points)** If the incumbent had purchased new equipment and anticipates entry, what quantity does he produce? Will he deter entry? What is the incumbent's payoff? At the beginning of the game, will the incumbent choose to purchase new equipment? (Hint: does the entrant's dominant strategy change in any way when the incumbent's marginal cost changes?)

Reference Guide

Linear Demand

$$p = A - BQ$$

Elasticity

$$\eta = \left| \frac{dQ}{dp} \frac{p}{Q} \right| = \frac{1}{B} \frac{p}{Q}$$

Cournot Oligopoly

Firm i chooses q_i to maximize its profit given the outputs of all other firms:

$$\max_{q_i} (A - c_i - BQ_{-i} - Bq_i) q_i$$

In equilibrium, each firm's output must satisfy the condition for profit maximization:

$$A - c_i - BQ_{-i} - 2Bq_i = 0$$

or

$$p - c_i = Bq_i.$$

Stackelberg Game

Demand is linear, $p = A - BQ$, firm 1 is the leader, firm 2 is the follower, their marginal costs are constant and both equal c .

Follower's dominant strategy	$q_2^*(q_1) = \frac{A-c}{2B} - \frac{q_1}{2}$
Equilibrium quantity, leader	$q_1^* = \frac{A-c}{2B}$
Equilibrium quantity, follower	$q_2^* = \frac{A-c}{4B}$
Equilibrium profit, leader	$\pi_1^* = \frac{(A-c)^2}{8B}$
Equilibrium profit, follower	$\pi_2^* = \frac{(A-c)^2}{16B}$

Maximization problem

$$\max_q (a - bq)q$$

has the solution

$$q^* = \frac{a}{2b}$$