

ECO 300 – MICROECONOMIC THEORY

Fall Term 2005

PROBLEM SET 7

Due 1.00 p.m. on Thursday December 8 in the Economics Department office

Question 1: (Multiple choice, total 30 points, 5 each)

1. Monopolistically competitive firms set prices above marginal costs because they
 - a. face downward sloping demand curves.
 - b. are great in number.
 - c. have freedom of entry.
 - d. are free to advertise.
2. In comparing the Cournot equilibrium with the competitive equilibrium,
 - a. both profit and output level are higher in Cournot.
 - b. both profit and output level are higher in the competitive equilibrium.
 - c. profit is higher, and output level is lower in the competitive equilibrium.
 - d. profit is higher, and output level is lower in Cournot.
3. (You will have to consult P-R p. 482 to do this question.) In a soccer penalty kick, the kicker has the choice of kicking to the goalie's left or right, and the goalie has the choice of whether to go to his own left or right. The following payoff matrix shows the results of the game; in each cell the first entry is the kicker's payoff:

		Goalie moves to	
		Own left	Own right
Kicker kicks to	Goalie's left	30, 70	80, 20
	Goalie's right	90, 10	20, 80

- a. This is a constant sum game and the Nash equilibrium is the top left cell.
- b. This is a variable sum game and has no Nash equilibrium.
- c. This is a variable sum game and has a mixed strategy Nash equilibrium in which each player chooses each strategy with probability $1/2$.
- d. This is a constant sum game and has a mixed strategy Nash equilibrium in which the kicker chooses the goalie's left with probability $7/12$.
- e. This is a constant sum game and has a mixed strategy Nash equilibrium in which the kicker chooses the goalie's left with probability $3/5$.

In questions 4 and 5, you are asked to consider the following game:

		Bull Meat	
		Expand in the West	Expand in the South
Deer	Expand in the West	10, 30	40, 70
	Expand in the South	20, 80	30, 50

4. Which of the following is true regarding the above game?
 - a. Only Bull Meat has a dominant strategy.
 - b. Only Deer Meat has a dominant strategy.
 - c. Both companies have a dominant strategy: expand West.
 - d. Both companies have a dominant strategy: expand South.
 - e. Neither company has a dominant strategy.
5. Which of the following is true regarding the above game?
 - a. In the Nash equilibrium, Deer Meat expands in the South and Bull Meat in the West.
 - b. A Nash equilibrium results if both firms expand in the South.
 - c. In the Nash equilibrium, Deer Meat expands in the West and Bull Meat in the South.
 - d. The strategy combinations in a and c are both Nash equilibria.
 - e. The game has no Nash equilibrium.
6. Tacit collusion is possible in a repeated oligopoly
 - a. only if the game is played an infinite number of times.
 - b. if the game is played an infinite number of times, or if it is played a finite number of times but this number is uncertain.
 - c. only if the game is played a finite number of times, and this number is known by all players.
 - d. for the first $(n - 1)$ of the n times it is played, if n is known in advance.
 - e. at no time, because at least one firm always has an incentive to cheat.

Question 2: (total 40 points)

A small town has only two rival pizza sellers, Tower of Pizza (firm 1) and The Moon Hits Your Eye (firm 2). The inverse demand functions are

$$P_1 = 18 - 2 Q_1 - Q_2, \quad P_2 = 18 - Q_1 - 2 Q_2$$

The marginal costs are constant at 3 each.

(a) (8 points) Suppose each firm chooses its quantity (Cournot). Write down the expressions for each firm's profit as a function of both firms' quantities. Find the pair of conditions for each firm's quantity to maximize its own profit, given the quantity of the other firm. Use these to express the quantity reaction (best response) functions of the two firms.

(b) (7 points) Solve the best response functions as a pair of simultaneous equations in the two quantities to find the quantities in the Nash-Cournot equilibrium of this game. Hence find the prices and the profits in this equilibrium.

(c) (5 points) Solve the inverse demand functions to get the (direct) demand functions, expressing each of Q_1 and Q_2 in terms of both prices P_1 and P_2 .

(d) (8 points) Now suppose each firm chooses its price (Bertrand). Write down the expressions for each firm's profit as a function of both firms' prices. Find the pair of conditions for each firm's price to maximize its own profit, given the price of the other firm. Use these to express the price reaction (best response) functions of the two firms.

(e) (7 points) Solve the best response functions as a pair of simultaneous equations in the two prices to find the prices in the Nash-Bertrand equilibrium of this game. Hence find the quantities and the profits in this equilibrium.

(f) (5 points) Which of the two situations – Cournot and Bertrand – has the higher prices? Suggest an intuition for this finding. (Hint: Think about the own price elasticity of demand for firm 1, once when the price of firm 2 is held constant, and next when the quantity of the other firm is held constant.)

Question 3: (total 30 points)

In the precepts of Week 9 we considered the duopoly between a pizza seller and a beer seller. The demand functions were

$$Q_1 = 36 - 2 P_1 - P_2, \quad Q_2 = 36 - P_1 - 2 P_2$$

The marginal costs were constant and equal to 2 for each firm. In the price-setting (Bertrand) game, the Nash equilibrium resulted in prices $P_1 = P_2 = 8$, quantities $Q_1 = Q_2 = 12$, and profits $P_1 = P_2 = 72$.

Now suppose the two firms play a quantity-setting (Cournot) game instead.

(a) (5 points) Solve the above demand functions expressing each of P_1 and P_2 as a function of both Q_1 and Q_2 , i.e. find the inverse demand functions.

(b) (8 points) Suppose each firm chooses its quantity (Cournot). Write down the expressions for each firm's profit as a function of both firms' quantities. Find the pair of conditions for each firm's quantity to maximize its own profit, given the quantity of the other firm. Use these to express the quantity reaction (best response) functions of the two firms.

(c) (7 points) Solve the best response functions as a pair of simultaneous equations in the two quantities to find the quantities in the Nash-Cournot equilibrium of this game. Hence find the prices and the profits in this equilibrium.

(d) (5 points) Which of the two situations – Bertrand and Cournot – results in higher prices? What is the intuition for this finding? (Hint: Think about the own price elasticity of demand for firm 1, once when the price of firm 2 is held constant, and next when the quantity of the other firm is held constant.)

(e) (5 points) Compare the finding of (d) above with that of (f) in Question 2. What is the general economic principle you can infer by making this “comparison of comparisons”?