

**ANSWERS: Quiz #5**  
**APEC 3001**  
**Applied Microeconomics:**  
**Consumers, Producers, and Markets**  
**(Summer 2007)**  
**Instructor: Hurley**

**Name:**

*Please show all the work you do to solve a problem.*

1. How do the Cournot and Stackelberg duopoly models differ? Which model results in a higher equilibrium price? Which results in a higher equilibrium quantity? **(1.5 Points)**

**Answer:** In the Cournot duopoly model, firms simultaneously choose their level of output, while in the Stackelberg duopoly model, one firm gets to choose output first and the second firm gets to see this output before making its choice of output. The Stackelberg duopoly model results in a lower price and higher output than the Cournot duopoly model.

2. What is the contract curve in an Edgeworth Exchange Box? **(1.5 Points)**

**Answer:** The set of all Pareto optimal allocations where individuals' marginal rates of substitution are equalized.

3. Which of the following statements is **false**? (2.5 Points)
- Monopolistic competition is characterized by lots of firms that produce products that are different, but close substitutes.
  - In the short run, a monopolistic competitor's supply curve is equal to its marginal cost curve above average variable cost.
  - Monopolistic competitors earn no economic profit in the long run.
  - A monopolistic competitor produces only where demand is elastic.

Answer: b.

- True. Add perfect factor mobility and you have the definition of monopolistic competition.
  - False. Like a monopoly, monopolistic competitors choose price and quantity, so they have no supply curve.
  - True. Monopolistic competition assumes perfect factor mobility or free entry and exit. Therefore, as long as some firms are making an economic profit new firms will enter the industry driving economic profit to 0 in the long run.
  - True. When demand is inelastic, increasing quantity decreases revenue and increases costs, so profit must fall. Therefore, a monopolistic competitor will never produce where demand is inelastic and will produce where demand is elastic.
4. In the Table below, Firm 1 gets to choose the row by choosing either a **Low** or **High** output, while Firm 2 gets to choose the column by choosing either *Low* or *High* output. Firm 1's profits are denoted in **bold**, while Firm 2's profits are denoted in *italics*. What is the Nash equilibrium strategy for each firm?
- Firm 1 choosing **Low** and Firm 2 choosing *High*.
  - Firm 1 choosing **Low** and Firm 2 choosing *Low*.
  - Firm 1 choosing **High** and Firm 2 choosing *High*.
  - Firm 1 choosing **High** and Firm 2 choosing *Low*.

		<i>Firm 2</i>	
		<i>Low</i>	<i>High</i>
<b>Firm 1</b>	<b>Low</b>	<b>1,200</b> <i>1,000</i>	<b>1,500</b> <i>1,200</i>
	<b>High</b>	<b>1,400</b> <i>900</i>	<b>1,250</b> <i>1,000</i>

**Answer:** a. If **Firm 1** chooses **Low**, *Firm 2* maximizes profit by choosing *High* because  $1,200 > 1,000$ . If **Firm 1** chooses **High**, *Firm 2* maximizes profit by choosing *High* because  $1,000 > 900$ . Therefore, *Firm 2*'s best response is *High* regardless of what **Firm 1** does. If *Firm 2* chooses *Low*, **Firm 1** maximizes profit by choosing **High** because  $1,400 > 1,200$ . If *Firm 2* chooses *High*, **Firm 1** maximizes profit by choosing **Low** because  $1,500 > 1,250$ . Since *Firm 2* should always choose *High*, **Firm 1** should choose **Low**.

5. Suppose market demand is  $P = 1,000 - 20Q$  and that there are only two firms that produce for this market such that  $Q = Q_1 + Q_2$  where  $Q_1$  is Firm 1's output and  $Q_2$  is Firm 2's output. Firm 1's marginal cost is  $MC_1 = 100$ , while Firm 2's marginal cost is  $MC_2 = 40$ . Both firms choose output simultaneously. **(8 Points)**
- What is each firm's total and marginal revenue function?
  - Find each firm's reaction function.
  - Find each firm's equilibrium output, industry output, and the market price.

**Answer:**

a) Firm 1's total revenue is  $TR_1 = PQ_1 = (1,000 - 20(Q_1 + Q_2)) Q_1 = 1,000 Q_1 - 20Q_1^2 - 20Q_1Q_2$ . Firm 1's marginal revenue is  $MR_1 = TR_1' = 1,000 - 40Q_1 - 20Q_2$ . Firm 2's total revenue is  $TR_2 = PQ_2 = (1,000 - 20(Q_1 + Q_2))Q_2 = 1,000Q_2 - 20Q_1Q_2 - 20Q_2^2$ . Firm 2's marginal revenue is  $MR_2 = TR_2' = 1,000 - 20Q_1 - 40Q_2$ .

b) To maximize profit each firm will set marginal revenue equal to marginal cost:  $MR_1 = MC_1$  and  $MR_2 = MC_2$ . Solving for each firm's profit maximizing level of output given the other firm's choice of output yields each firm's reaction function.

$$\text{For firm 1, } 1,000 - 40Q_1^* - 20Q_2 = 100 \Rightarrow Q_1^* = (900 - 20Q_2)/40 = 45/2 - Q_2/2.$$

$$\text{For firm 2, } 1,000 - 20Q_1 - 40Q_2^* = 40 \Rightarrow Q_2^* = (960 - 20Q_1)/40 = 24 - Q_1/2.$$

c) To find the equilibrium output, we need to find the  $Q_1^*$  and  $Q_2^*$  that solve both firm's reaction functions:

$$Q_1^* = 45/2 - (24 - Q_1^*/2)/2 \Rightarrow 2Q_1^* = 45 - 24 + Q_1^*/2 \Rightarrow 4Q_1^* = 90 - 48 + Q_1^* \\ \Rightarrow 3Q_1^* = 42 \Rightarrow Q_1^* = 14.$$

$$\text{Substituting back into } Q_2^* = 24 - Q_1^*/2 = 24 - 14/2 = 17, \text{ so } Q^* = Q_1^* + Q_2^* = 31 \text{ and } P^* \\ = 1,000 - 20Q^* = 1,000 - 20 \times 31 = 380.$$