

KEY

ECO 610-401

Final Exam

Fall 1998

Five questions, 20 points each. Answer each question in the space provided. Use the back of each sheet of paper if needed.

1. The year is 1976. You serve as an economic advisor to the Organization of Petroleum Exporting Countries. You are trying to determine the total amount of oil that OPEC should sell on the world market. You have estimated that world demand for oil is given by  $Q_w = 80 - 2P$ , where  $Q_w$  denotes the quantity of oil (in millions of barrels per day) and  $P$  is the price per barrel in dollars. The cartel's marginal cost is approximately \$10 per barrel.

- a) If OPEC is a monopolist, determine the profit-maximizing output and price.  
b) In actuality, OPEC is not a monopolist. Other non-OPEC oil suppliers act as price takers in the world oil market. You have estimated that these follower "firms" have a joint supply curve that can be represented by  $Q_s = 4P - 28$ . Write an equation for OPEC's residual demand curve. Find its optimal output and price. What portion of total oil supplied is accounted for by OPEC?

20

$$a) Q_w = 80 - 2P \quad P = \frac{80 - Q_w}{2} = 40 - \frac{1}{2}Q_w$$

$$TR = P \cdot Q = 40Q - \frac{1}{2}Q^2$$

$$MR = \frac{dTR}{dQ} = 40 - Q$$

$$MR = MC$$

$$40 - Q = 10$$

$$Q = 30$$

$$P = \$25$$

$$P = 40 - 15 = 25$$

b) OPEC's demand = world demand - quantity supplied by followers

$$= 80 - 2P - 4P + 28$$

$$Q_o = 108 - 6P$$

$$P = \frac{108 - Q_o}{6} \quad P = 18 - \frac{1}{6}Q_o$$

$$TR = P \cdot Q = 18Q_o - \frac{1}{6}Q_o^2$$

$$MR = 18 - \frac{1}{3}Q_o$$

$$MR = MC$$

$$18 - \frac{1}{3}Q_o = 10$$

$$8 = \frac{1}{3}Q_o$$

$$Q_o = 24 \text{ million barrels/day}$$

$$P = \$14$$

- Follower's output

$$Q_s = 4P - 28$$

$$= 4(14) - 28$$

$$Q_s = 28 \text{ million barrels}$$

OPEC accounts for

$$\frac{24}{24 + 28}$$

$$= \boxed{46.15\%} \text{ of the total oil supply}$$

2. Delta Airlines and USAir are battling for market share on the Lexington, KY-Washington, DC route. The airlines compete in price, and the estimated profit (on a per-seat basis) for the various combinations of one-way fares are as follows:

	Fares:	USAir		
		\$139	\$119	\$99
Delta	<del>\$139</del>	<del>\$34, \$38</del>	<del>\$15, \$42</del>	<del>\$6, \$32</del>
	\$119	<del>\$42, \$20</del>	\$22, \$22	<del>\$10, \$25</del>
	\$99	<del>\$35, \$7</del>	<del>\$27, \$9</del>	<del>\$18, \$16</del>

where the first number in each cell is the payoff to Delta and the second number is the payoff to USAir.

- a) Suppose that the firms select fares independently and that they do it once and for all (i.e., the fares cannot be changed once they are set.) What fares should each airline select? Explain.
- b) Now suppose that the airlines share a computerized reservation system. Each one knows instantly if its rival changes the fare, and can react with almost no delay and change its own fare in response. Explain how you think that the two airlines will end up choosing their fares.

20

a) The \$139 fare is a dominated strategy for both airlines because no matter what strategy the other airline follows they can gain higher prices by following a different pricing strategy.

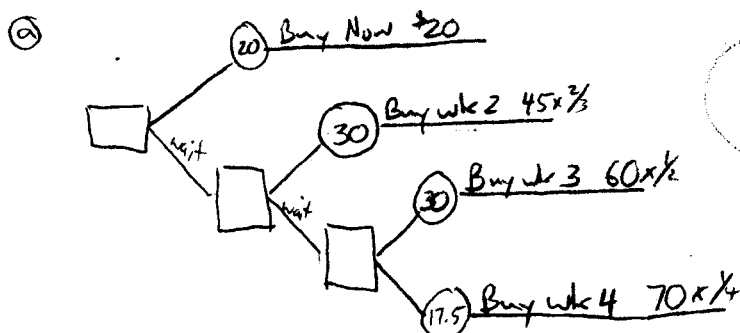
✓ After eliminating the \$139 fare both firms have a dominant strategy to charge \$99 and thus profits will be (\$18, \$16).

b) ✓ If the airlines use an automated reservation system and are able to change prices immediately the firms will have more incentive to collude and raise prices. If both firms charge \$139 they can have profits of (\$34, \$38) which is larger for both firms.

The access to information about the other firms' prices and the fact that retaliation can be quick provide a greater incentive for the firms to cooperate and raise total profits.

3. McAlpin's Department Store has a policy of marking down the price of sale items each week that they go unsold. You see an expensive brand of winter coat that is priced at \$100. In fact, you would be willing to pay as much as \$120 for the coat. You can buy it now and have a net gain of \$20 ( $=\$120-\$100$ ), or you can wait until next week when the price will be reduced to \$75. The chances that it will be available next week are  $2/3$ . If it is available in week two, you can buy it or wait until week 3, when its price will be reduced to \$60. There is a  $1/2$  chance that it will be sold between weeks 2 and 3. Finally, if it is available in week 3 you can buy it then at \$60, or take your chances and wait until the Moonlight Madness sale in week 4 when its price will be reduced to \$50. There is a  $1/4$  chance that it will be available in week 4 at the \$50 price. Week 4 is your last chance to buy the coat, because nothing goes unsold after Moonlight Madness.

- a) How long should you wait before buying the coat? Illustrate via a decision tree.  
 b) McAlpin's has 120 winter coats for sale. What is the expected total revenue from the pricing scheme in part a? (One-third of the coats sell in the first week, one-half of the remaining coats sell in week 2, three-fourths of the remaining coats sell in week 3, and all of the rest sell in week 4.)  
 c) Dillard's Department Stores buys out McAlpin's and puts an end to Moonlight Madness sales. Approximately one-half of the population of Lexington goes into mourning. Dillard's management conducts a demand study and estimates that the demand for winter coats is given by  $P = 180 - Q$ . Since we are ignoring costs in this problem, what price should Dillard's choose if its announced policy is to set one single price for all coats and not to offer price reductions. Compare the revenue from Dillard's one-price policy with the old McAlpin's approach.



You should wait and buy the coat in week 2 when the expected net gain is \$30.00. ✓

b)

	Sales	Price	Revenue
wk1 ( $120 \times 1/3$ )	40	$\times 100 =$	4000
wk2 ( $80 \times 1/2$ )	40	$\times 75 =$	3000
wk3 ( $40 \times 3/4$ )	30	$\times 60 =$	1800
wk4	10	$\times 50 =$	500
Total Revenue =			\$9300

Expected Total Revenue = \$9300

c)

$$P = 180 - Q$$

$$TR = 180Q - Q^2$$

$$MR = 180 - 2Q$$

$$0 = 180 - 2Q$$

$$-2Q = -180$$

$$Q = 90$$

$$P = 180 - 90$$

$$P = 90$$

$$TR = 180(90) - 90^2$$

$$= 16200 - 8100 = 8100$$

Dillard's should choose a price of \$90 per coat which would generate \$8100 in total revenue which is less than the \$9300 total revenue generated by McAlpin's. The Dillard's method yields more revenue per coat of \$90 when compared with McAlpin's average of \$77.5 per coat. However, we can't decide which is the better strategy because we don't know anything about costs, specifically variable costs and any pricing discounts McAlpin's may have received for purchasing more coats. ✓

- 20
4. Suppose that you work for a pharmaceutical company that has a monopoly on a certain performance-enhancing drug, by virtue of a patent that will expire in the next few years. Your company is considering whether it should alter its cost structure in anticipation of the market conditions that will be faced when the legally protected monopoly ends. Specifically, some members of management have proposed that a more capital-intensive production process be adopted. Variable costs would be reduced, however, fixed costs would be greater. Everyone agrees that the current production techniques are the cheapest way to produce this drug, at any output level the firm chooses to produce. That is, the proposed capital-intensive process would increase fixed costs by an amount greater than the reduction in variable costs when compared to the current approach. Now, thinking strategically, can you think of any reasons why your company should undertake an investment now that will increase the overall cost of producing this drug, even though your variable costs will be lower once the new capital-intensive technique is in place?

By undertaking the proposed capital-intensive process a threat is being sent to other pharmaceutical companies that we intend to compete vigorously against generic drugs entering the market. The capital-intensive process makes the threat more creditable. If we are able to lower our variable cost and therefore our marginal cost we will be able to produce more and charge less. Although this will reduce our overall profit, the reduced profitability of the industry may keep competitors out. If the new process will be sufficient to deter entry by competitors it should be adopted so long as our profits after adoption of the new process is greater than what our revenues would be from sharing the market.

5. The starting point for any industry study should be a definition of the market being studied. The definition of a market has two dimensions, namely, the definition of the product and the delineation of the geographic boundaries of the market. Write a brief essay in which you define the market for the industry which you chose for your term project. Your essay should explain the economic principles used to define a market. You should discuss the nature of the product in the context of demand-side substitutes and supply-side substitutes. You should then discuss the geographic boundaries of the industry that you studied.

20

Our market was the Lexington Area Video rental industry. To define our product we considered each rental firm separately. From a "bottom-line" standpoint we defined our product as the actual movies that were being rented (we did not consider services rendered from this standpoint although several firms included these in their product definition). Substitutes are determined using elasticities in Economics. Our substitutes on the demand side were movie theatres, satellite TV, cable TV and pay-per-view. On the supply-side substitutes are minimal. The product

is homogeneous and the market consists of 3 types of players (large-scale, mid-size, "mom & pop"). All firms share the same customer base & compete w/ the same substitutes -- hence, the market is defined.

The geographic area considered is the Lexington City Limits. Due to the small amount of an avg. person's budget that a movie rental accounts for - it is safe to say that one would most likely not drive to Nicholasville/Georgetown for a \$.50 difference in price. Large scale firms have the advantage of scouring prime locations while smaller firms settled for the "left overs." The small market area is defined by the "benefit" of the convenience to the customer as opposed to the "cost" of driving the extra distance.

Firms do have option of buying from vendors. Nat'l firms have contracts w/ studios & substitutes are not relevant.

1. (10 pts.) In 1978 there were 12 major airlines operating in the U.S. The names of the airlines and their respective percent of revenue passenger miles were: United (21.1), American (13.5), Delta (12.0), Eastern (11.1), TWA (9.4), Western (5.0), Continental (4.5), Braniff (3.8), National (3.6), Northwest (2.6), USAir (2.2), and Frontier (2.2). For purposes of this problem you can assume that there were nine minor airlines, each having 1.0 percent of revenue passenger miles. Compute the HHI for this industry and then compare it to the HHI's that one gets in a monopoly and in a perfectly competitive market.

$$HHI = \sum s_i^2 = 1081.12$$

$$HHI \text{ for monopoly} = 10,000$$

HHI for perfect competition approaches zero.

2. (15 pts.) The EPA imposes new restrictions on hog farms, resulting in a significant increase (upward shift) in the average total cost of producing pork. The industry is currently in long-run equilibrium. Describe in a step-by-step fashion what will happen in the short run and in the long run. Be concise, and don't use diagrams.

ATC shifts upward, so firms start suffering economic losses.

Losses cause some firms to exit from the industry.

Exit causes market supply curve to shift to the left, resulting in an increase in price.

New long run equilibrium is characterized by higher market price, lower market output, and fewer firms.

3. (20 pts.) Because your sister-in-law happens to be mayor, you were fortunate enough to be awarded the monopoly franchise to provide cable TV services to your hometown. As such, you are the only provider and as long as you have no competition, the discounted present value of your economic profit stream is \$24,000,000. Trouble looms on the horizon, however, because a satellite TV company is considering entering your market. Your monopoly franchise rights only apply to hard-wired cable TV, and do not apply to satellite signals and rooftop 18-inch satellite dishes. If entry occurs and you share the market with a competitor, your discounted present value of economic profits will fall to \$10,000,000. If you contest entry and fight a price "war," the discounted present value of economic profits is -\$1,000,000.

- a) You announce publicly that if entry occurs, you will fight. Is your threat credible?
- b) In preparation to fight a price war, you could add capacity to your system, so that you could offer additional channels that your competitor did not. The cost of adding such capacity in preparation to battle for customers is \$12,000,000. Only if entry occurs would you find it necessary to utilize this capacity. Should you make such a commitment to deter entry? Explain why or why not.

a) Threat is credible if profits are greater from fighting a price war than sharing the market, i.e. if  $\pi_w > \pi_d$ .  
Without any commitment  $\pi_d = 10$  and  $\pi_w = -1$ ,  
so the threat is not credible.

b) Commitment should be made if it makes the threat to fight a price war credible and if post-commitment monopoly profits exceed pre-commitment duopoly profits:

$$\textcircled{1} \quad \overset{?}{\pi_w} > \pi_d - C$$

$$-1 \overset{?}{>} 10 - 12 \quad \underline{\text{yes}}$$

$$\textcircled{2} \quad \pi_m - C \overset{?}{>} \pi_d$$

$$24 - 12 \overset{?}{>} 10 \quad \underline{\text{yes}}$$

so commit and deter entry.

4. (15 pts.) If you recall from your last exam, Bubba did follow his brother-in-law's advice and keep his restaurant/bar. Bubba has now turned his attention to ways that he could increase the economic profits of his business. He has all of the necessary components in place to start a pizza delivery business, operating it out of the back door of his restaurant. All of the costs of this add-on business are clear to Bubba except for one. He is a bit puzzled about the economic cost of delivering the pizzas once they are made. He would have to hire a delivery driver, but the labor costs are not the issue for Bubba. He is struggling with the costs of owning and operating a vehicle for delivering pizzas. He has estimated that at the end of a year he would have incurred the following costs:

purchase price of a slightly used pickup truck	\$15,000
gas, oil, and other maintenance	1,000
insurance	1,000
license tags and taxes	500
	<u>\$17,500</u>

Bubba figures that if he sells and delivers 17,500 pizzas per year, he will have to charge a dollar per pizza extra just to cover the vehicular cost of delivering pizzas. He once again turns to you for advice, and warns you that you better get it right this time or else!

Bubba does not lose \$15,000 when he buys a truck, because he has a truck that is worth \$15,000. He does lose the interest income that his \$15,000 could be earning if it were in the bank, however. Also, the truck depreciates or wears out a little bit over the course of the year. The depreciation cost is measured by the change in the market value of the truck. So the per pizza vehicular cost would be less than a dollar on 17,500 pizzas.



5. (10 pts.) Assume that Saudi Arabia and Kuwait are the only two producers of oil. Saudi Arabia produces much more oil than Kuwait. If Saudi Arabia and Kuwait cooperate, then they will want to restrict the output of oil. In a cooperative condition, Saudi Arabia would produce 4 million barrels per day and Kuwait would produce 1 million barrels per day. Not cooperating means that each one would increase its own output of oil by 1 million extra barrels per day, i.e., Saudi Arabia would produce 5 million barrels and Kuwait would produce 2 million barrels. Depending on their respective decisions, market output would thus be 5, 6, or 7 million barrels per day. The profits for each country under each possible scenario are listed in the table below, with Saudi Arabia's profits listed first in each cell:

Saudi Arabia Production	Kuwait Production		
	1		2
	4	(64), 16	(48), 24
5	60, 12	40, 16	

What strategy will each country pursue, and why?

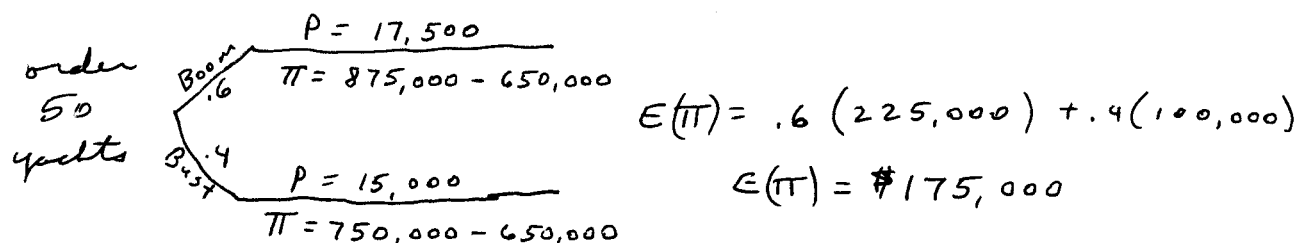
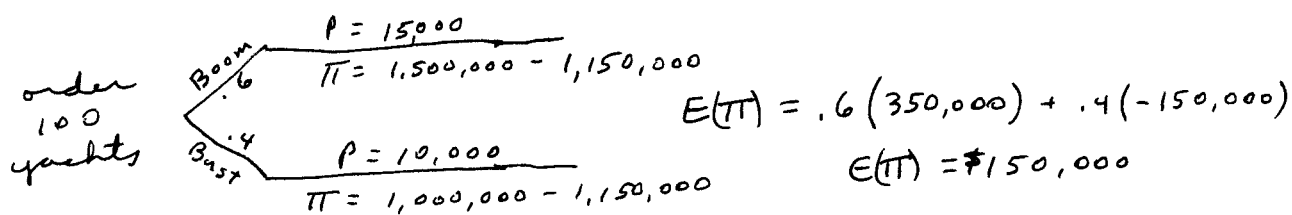
Saudi Arabia's dominant strategy is to produce 4 million barrels per day.

Kuwait's dominant strategy is to produce 2 million barrels per day.

6. (15 pts.) Selling yachts is a very cyclical business. You own a yacht (or, as we call them in Kentucky, houseboat) dealership on Lake Cumberland and have to decide right now how many yachts to order from your manufacturer for next summer. If the economy continues to boom, demand for your product will warrant ordering 100 yachts. If the economy turns sour, then demand for your product will warrant only ordering 50 yachts. The macroeconomic forecasts that you have seen put the probability of a continued boom at 60 percent, while the probability of an economic downturn is 40 percent. If you order 100 yachts and the economy booms, your profit-maximizing price is \$15,000, whereas if the economy busts, your profit-maximizing price is \$10,000. If you order 50 yachts and the economy booms, your profit-maximizing price is \$17,500, whereas if the economy busts, your profit-maximizing price is \$15,000. Your dealership's fixed costs are \$150,000 per year and the manufacturer's wholesale price that he charges you for the yachts is \$10,000. Figure out the profits from each possible scenario and then explain whether you should order 50 or 100 yachts.

$$TC(50) = 150,000 + 50(10,000) = 650,000$$

$$TC(100) = 150,000 + 100(10,000) = 1,150,000$$



Expected profit is greater if you order 50 yachts.

7. (10 pts.) Two firms compete as duopolists in a market. Each firm can choose to produce and sell one of three different possible outputs: 6, 8, or 10. The profit that each firm earns depends on its own output choice, but also on the output choice of its rival. The payoff possibilities are listed in the matrix below, where Firm 1's profits are listed first and Firm 2's profits are listed second in each cell:

Firm 1's Quantity	Firm 2's Quantity			
		6	8	10
	6	72, 72	60, <del>80</del>	<del>48</del> , <del>80</del>
	8	<del>80</del> , 60	<del>64</del> , <del>64</del>	<del>48</del> , 60
	10	<del>80</del> , <del>48</del>	60, <del>48</del>	40, 40

What output strategy will each firm pursue? Briefly explain how you arrive at your answer.

Each firm will pursue an output strategy of  $Q=8$ , since that output generates profits at least as great as any other output no matter what output the other firm chooses.

8. (20 pts.) Murray State University has decided to reduce tuition for Illinois residents from \$6900 to \$4110 per year. They estimate that the number of Illinois students will double, from the current 650 to 1300. Compute the arc elasticity of demand if their enrollment estimate turns out to be correct.

$$\epsilon_D = \frac{\frac{\Delta Q}{Q_0 + Q_1}}{\frac{\Delta P}{P_0 + P_1}} = \frac{\frac{650}{1950}}{\frac{2790}{11010}} = -1.32$$

To accommodate 650 more students, the dean of the faculty estimates that 20 additional faculty members will need to be hired at a cost of approximately \$100,000 per faculty. Should Murray State go ahead with this new tuition discount for Illinois residents?

$$\begin{aligned} TR_0 &= 650 \times 6900 = 4,485,000 \\ TR_1 &= 1300 \times 4110 = 5,343,000 \\ MR &= \$858,000 \end{aligned}$$

$$MC = 20 \times 100,000 = \$2,000,000$$

$MR < MC$  so profits go down.

Bad move!

9. (15 pts.) Suppose you work for a firm that has a dominant position in the market for a particular product. There are also a number of small fringe producers in the industry who behave as price takers. In the diagram below the market demand for the product is given by the demand curve labeled  $D$ . The supply curve for the small price-taking firms is labeled  $S$ . Your own marginal cost curve is labeled  $MC$ . Now, as the price leader in this market, what price should you set and what output should you produce in order to maximize your own profits? Be very precise in showing in the diagram how you arrive at your answer.

