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Economic Analysis for Managerial Decisions
Full Time MBA

PROBLEM SET

Assignment 1 - Supply and Demand Analysis

1. A recent breakthrough in the production of laser disk technology has decreased the cost of laser disks. These disks supposedly will increase the quality of music recordings tenfold over that available from CDs. What will happen to the price and quantity of CDs sold? Of laser disks sold?
2. You are an economic adviser to the Treasurer of the United States. Congress is considering increasing the sales tax on gasoline by \$.03 per gallon. Last year motorists purchased 10 million gallons of gas per month. The demand curve is such that every \$.01 increase in price decreases sales by 100,000 gallons per month. You also know that for every \$.01 increase in price, producers are willing to provide 50,000 more gallons of gasoline to the market. The legislature has stated that the \$.03 tax will increase government revenues by \$300,000 per month and raise the price of gasoline by \$.03 per gallon. Is it correct?
3. Consider the following demand and supply curves:

$$Q^d = 5800 - 6P \quad \text{and} \quad Q^s = 4P - 120$$

- a. Graph the supply and demand curves.
- b. What are the equilibrium quantity and equilibrium price?
- c. What happens in this market if a price floor of \$600 is placed on this good?
- d. If a price ceiling of \$500 instead of a price floor were placed on this good, how would the market be affected?

Assignment 2

Relationship between Sales Revenue and Demand Characteristics

4. The January 23, 1992 issue of the Economist states that due to a wet spring, truffle production in France is expected to reach 16 tons compared to last year's 8 ton production. The price of truffles, which hit \$690/pound last year, is expected to fall to approximately \$290/pound this year.
 - a. Assuming that the demand function for truffles has not changed, what is the arc elasticity of the demand for truffles?
 - b. Do you think that truffle producers are happy about the good truffle growing weather?

5. The residents of British Columbia survive largely on beer and cheese fries. You are the sole seller of cheese fries in Rossland, and have determined that the demand function for cheese fries is

$$q = 60 - 20p + 20p_b ,$$

where p_b is the price of beer. Currently, beer sells for \$1/bottle.

- a. Given the current price of beer, draw the demand curve for cheese fries. Indicate the portions of the demand that are elastic and inelastic.
 - b. What is the cross elasticity of demand for cheese fries with respect to the price of beer at the optimal price and quantity? Is beer a substitute or complement to cheese fries?
 - c. Without knowing the cost of cheese fries, do you think \$1.50 could be a profit maximizing price for cheese fries? How about \$3.00?
6. The following table presents hypothetical data for the market demand for a good. Complete the table.

Price	Quantity Demanded	Average Revenue	Total Revenue	Marginal Revenue	Arc Price Elasticity
\$50	1	_____	_____	_____	_____
\$40	2	_____	_____	_____	_____
\$30	3	_____	_____	_____	_____
\$20	4	_____	_____	_____	_____
\$13	5	_____	_____	_____	_____
\$8	6	_____	_____	_____	_____

7. Given: The demand equation is $P=81-9Q$.
- a. What is the equation for MR ?
 - b. At what output is $MR=0$?
 - c. At what output is TR maximum?
 - d. Determine the price elasticity of demand at the output where TR is maximum.
8. Suppose that the demand equation for a good is $Q=20-3P$. What is the price elasticity of demand at a price of \$1? At a price of \$4?
9. Given the price levels now prevailing for steel products, would you expect that the price elasticity of demand for the output of USX Corporation is higher or lower than the price elasticity of demand for the output of the steel industry as a whole? Why?
10. "The demand for automobiles must be less elastic than the demand for stereos because a \$50 reduction in price of cars does not affect the number sold nearly as much as a \$50 reduction in the price of stereos." Is this statement correct? Explain.

Assignment 3 - Cost of Production

11. Complete the following table. Assume that units of fixed input cost \$10 each and that units of variable input cost \$20 each.

Units of Fixed Input	Units of Variable Input	Units of Output	TFC	TVC	TC	AFC	ATC	MC
100	0	0						
100	20	600						
100	40	1500						
100	60	2000						
100	80	2200						
100	100	2300						

12. Consider the following cost information:
- AFC for 5 units of output is \$2000.
 - AVC for 4 units of output is \$850.
 - TC rises by \$1240 when the sixth unit of output is produced.
 - ATC for 5 units of output is \$2880.
 - It costs \$1000 more to produce 1 unit of output than to produce nothing.
 - TC for 8 units by output is \$19,040.
 - TVC increases by \$1535 when the seventh unit of output is produced.
 - AFC plus AVC for 3 units of output is \$4185.
 - ATC falls by \$5100 when output rises from 1 to 2 units.

Using this information, complete the following table:

Output	TFC	TVC	TC	AFC	AVC	ATC	MC
0	_____	_____	_____	_____	_____	_____	_____
1	_____	_____	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____	_____	_____
8	_____	_____	_____	_____	_____	_____	_____

13. A computer firm assembles high-speed large-capacity hard-disks from off-the-shelf parts for a variable cost of \$1000 per disk. The company operates with fixed costs (overhead, buildings, machinery) of \$100,000 per year and has a maximum capacity of 10,000 disks per year. Calculate and represent graphically the MC, AVC and ATC curves.
14. Your firm produces two products, Q_1 and Q_2 . An economic consulting firm has estimated your cost function to be

$$C(Q_1, Q_2) = 100 + Q_1Q_2 + Q_1 + Q_2$$

- Are there economies of scope?
- Are there cost complementarities?
- Your market for Q_1 is not very good, and an overseas firm has offered to buy the division of your company that produces Q_1 . What will happen to your marginal cost of producing Q_2 if you sell the division?
- You currently produce 2 units of Q_1 and 100 units of Q_2 . If you sell the division that produces Q_1 , what will happen to your average cost of producing Q_2 if you continue to produce 100 units of Q_2 ?

Assignment 4 -The Perfectly Competitive Industry

15. The Green Company produces chemical in a perfectly competitive market. The current market price is \$40; the firm's total cost is $C = 100 + 4Q + Q^2$ ($MC = 4 + 2Q$)
- Determine the firm's profit-maximizing output. More generally, write down the equation for the firm's supply curve in terms of price P.
 - Complying with more stringent environmental regulations increases the firm's fixed cost from 100 to 144. Would this affect the firm's output? Its supply curve?

- c. How would the increase in fixed costs affect the market's long-run equilibrium price? The number of firms? (Assume that green's costs are typical in the market.)
16. Suppose that a competitive firm's marginal cost of producing output q is given by $MC(q) = 3 + 2q$. Assume that the market price for the product is \$9.
- What level of output will the firm produce?
 - What is the firm's producer surplus?
 - Suppose average variable cost of the firm is $AVC(q) = 3 + q$ and its fixed costs are \$3. Will the firm earn positive, negative or zero profits in the short run?

Assignment 5 - Monopoly

17. A television station is considering selling promotional videos. It can have the videos produced by one of two suppliers. Supplier A will charge the station a set-up charge of \$1,200 plus \$2 for each cassette; supplier B has no set-up charge and will charge \$4 per cassette. The station estimates its demand for the cassettes to be given by $Q = 1,600 - 200P$, where P is the price in dollars and Q is the number of cassettes. (The associated price equation is $P = 8 - Q/200$.)
- Suppose the station plans to give away the video. How many cassettes should it order? From which supplier?
 - Suppose the station seeks to maximize its profit from sales of the cassettes. What price should it charge? How many cassettes should it order from which supplier? (Hint: Solve two separate problems, one with supplier A and one with supplier B, and then compare profits. In each case, apply the $MR = MC$ rule.)
- 18.
- Determine the maximum profit and the corresponding price and quantity for a monopolist whose demand functions are $P=20-.5q$ and total costs are $C=30+5q$.
 - Assume an increase in oil prices increases the cost per unit by 3 dollars. What are the implications for the price, output and profit of the firm. Is raising the price by 3 optimal?
 - Assume an increase in property taxes of \$20. Determine the price, output and profits of the firm.

19. The American Cracker Corporation has three plants for producing soda crackers. The marginal cost functions of the three plants and the firm's estimated demand-AR schedule are as follows:

Daily Output In Cartons	Marginal Cost of Plant 1	Marginal Cost of Plant 2	Marginal Cost of Plant 3	Price of Cartons of Soda Crackers
0				\$0.50
1	\$0.14	\$0.13	\$0.10	\$0.48
2	\$0.16	\$0.14	\$0.13	\$0.46
3	\$0.18	\$0.15	\$0.16	\$0.44
4	\$0.20	\$0.16	\$0.18	\$0.42
5	Capacity	Capacity	Capacity	\$0.40
6				\$0.38
7				\$0.36
8				\$0.34
9				\$0.32
10				\$0.30
11				\$0.28
12				\$0.26

Determine the most profitable price and output for the American Cracker Corporation. Then determine the optimal allocation of output among the firm's three plants.

20. A firm faces a demand curve of $p = 11 - Q$ and has a marginal cost of \$6 per unit. A regulatory agency imposes a price ceiling of \$7. Find the optimal price and compare it to the price the firm would have charged if there was no price ceiling. What is the highest level of output that can be achieved if a regulator were free in choosing a price ceiling.

Assignment 6 - Oligopoly and Game Theory

21. Within Europe, the market for air travel is highly regulated. Entry of new airlines is severely restricted, and air fares are set by regulation. Partly as a result, European air fares are higher than US fares for routes of comparable distance. Suppose that for a given European air route (say, London to Rome), annual air travel demand is estimated to be $Q = 1,500 - 3P$ (or, equivalently, $P = 500 - Q/3$), where Q is the number of trips in thousands and P is the one-way fare in dollars. (For example, 600 thousands annual trips are taken when the fare is \$300.) In addition, the long-run average (one-way) cost per passenger along this route is estimated to be \$200.
- Some economists have suggested there is an implicit cartel among European air carriers whereby the airlines charge monopoly fares under the shield of regulation. Given the preceding facts, find the profit maximizing fare and the annual number of passenger trips.
 - Suppose the European market were deregulated so that these routes became perfectly competitive. Find the competitive price and quantity of trips.

22. Firm A and B are battling for market share in two separate markets. Market I is worth \$30 million in revenue; market II is worth \$18 million. Firm A must decide how to allocate its three salespersons between the markets; firm B has only two salespersons to allocate. Each firm's revenue share in each market is *proportional* to the number of salespeople the firm assigns there. For example, if firm A puts two salespersons and firm B puts one salesperson in market I, A's revenue from this market is $[2/(2+1)]\$30 = \20 million and B's revenue is the remaining \$10 million. (The firms split a market equally if neither assigns a salesperson to it.) Each firm is solely interested in maximizing the *total* revenue it obtains from the two markets.
- Compute the complete payoff table. (Firm A has four possible allocations: 3-0, 2-1, 1-2, and 0-3. Firm B has three allocations: 2-0, 1-1, 0-2.) Is this a constant-sum game?
 - Does either firm have a dominant strategy (or dominated strategies)? What is the predicted outcome?
23. From 1989 to 1991 the Trump Shuttle and the Pan Am Shuttle battled for market share on the Boston/New York and Washington DC/New York routes. In addition to service quality and dependability (claimed or real), the airlines competed over price via periodic fare changes. The hypothetical payoff table below lists each airline's estimated profit (expressed on a per-seat basis) for various combinations of one-way fares.

Trump Shuttle Fares	Pan Am Shuttle Fares		
	\$139	\$119	\$99
\$139	\$34, \$38	\$15, \$42	\$6, \$32
\$119	\$42, \$20	\$22, \$22	\$10, \$25
\$99	\$35, \$7	\$27, \$9	\$18, \$16

- Suppose that the two airlines will select their fares independently and "once and for all." (The airline's fare cannot be changed.) What fares should the airlines set?
 - Suppose instead that the airlines will set fares over the next 18 months. In any month, each airline is free to change its fare if it wishes. What pattern of fares would you predict for the airlines over the 18 months?
24. Suppose that two identical firms produce widgets and that they are the only firms in the market. Their costs are given by $C_1=30Q_1$ and $C_2=30Q_2$, where Q_1 is the output of Firm 1, and Q_2 is the output of Firm 2. Price is determined by the following demand curve:
- $$P=150-Q$$
- where $Q=Q_1+Q_2$.
- Find the Cournot-Nash equilibrium. Calculate the profit of each firm at this equilibrium.
 - Suppose the two firms form a cartel to maximize joint profits. How many widgets will be produced? Calculate each firm's profit.
 - Suppose Firm 1 were the only firm in the industry. How would the market output and Firm 1's profit differ from that found in part (b) above?
 - Returning to the duopoly of part (b), suppose Firm 1 abides by the agreement, but Firm 2 cheats by increasing production. How many widgets will Firm 2 produce? What will be each firm's profits?

Assignment 7 – Special Issues in Pricing

25. A private garage operator has identified two distinct market segments: short-term parkers and all-day parkers with respective demand curves of $P_s=3-(Q_s/200)$ and $P_c=2-(Q_c/200)$. Here P is the average hourly rate and Q is the number of cars parked at this price. The garage owner is considering charging different prices (on a per-hour basis) for short term-parking and all-day parking. The capacity of the garage is 600 cars, and the costs associated with adding extra cars in the garage (up to this limit) is negligible.
- Given these facts, what is the owner's appropriate objective? How can he ensure that members of each market segment effectively pay a different hourly price?
 - What price should he charge for each type of parker? How many of each type (i.e., cars) will use the garage at these prices? Will the garage be full?
 - Answer the questions in part a assuming the garage has a capacity of only 400 cars.
26. A monopolist is deciding how to allocate output between two markets. The two markets are separated geographically (East Coast and Midwest). Demand and marginal revenue for the two markets are:
- $$P_1=15-Q_1 \quad MR_1=15-2Q_1$$
- $$P_2=25-2Q_2 \quad MR_2=25-4Q_2$$
- The monopolist's total cost is $C=5+3(Q_1+Q_2)$
What are prices, output levels and profits if the monopolist can price discriminate?
27. You are an executive for Super Computer, Inc. (SC), which rents out super computers. SC receives a fixed rental payment per time period in exchange for the right to unlimited computing at a rate of P cents per second. The demand of each potential customer of SC is $Q=10-P$, where Q is in million of seconds per month. The marginal cost to SC of additional computing is 2 cents per second. What rental fee and usage fee should SC charge in order to maximize its profits (two part tariff pricing rule).

Game Theory Cases - Problems for Discussion

Judo Economics

28. a. Suppose that:
- each buyer has a willingness-to-pay of \$200 for one unit of either the incumbent's or the entrant's product: and
 - both incumbent and entrant have a \$100 unit cost of serving buyers. Formulate a strategy for the entrant. How much money can the entrant make?
- b. Now suppose that:
- each buyer has a willingness-to-pay of \$200 for one unit of the incumbent's product and \$160 for one unit of the entrant's product; and
 - the incumbent has a \$100 unit cost and the entrant a \$120 unit cost. Formulate a new strategy for the entrant. How much money can the entrant now make?

Entry Barriers: Deep Pocket

29. As a potential entrant into the industry how do you assess the possible reaction of the incumbent firm to your entry? Do you expect to be accommodated?

Signaling Costs

30.

- a. Might player A want to signal its cost to player B?
- b. Is there a way for it to do so? In answering, pay particular attention to the question of the credibility of any signal that A might send B.

Hint: Note that if both firms are established in the market it is the firm with the lower unit cost that will dominate the market. It sets a price slightly lower than the unit cost of the higher cost producer.

The Free-rider Problem: Airline Frequent-flyer Programs

31.

- a. The newspaper article reproduced as **Exhibit 2** in the case states that "the customer loyalty built by frequent-flyer programs is artificial – it is not based on enhanced satisfaction of consumer wants..."Do you agree or disagree with this statement?
- b. Did it help or hurt American Airlines that other carriers quickly imitated its *AAdvantage* program?
- c. Assess the view expressed in the article that frequent-flyer programs function as kickbacks to business travelers.