

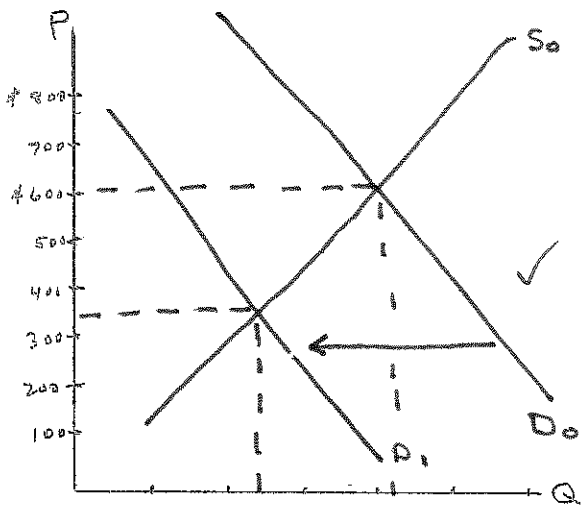
100!

Answer KEY

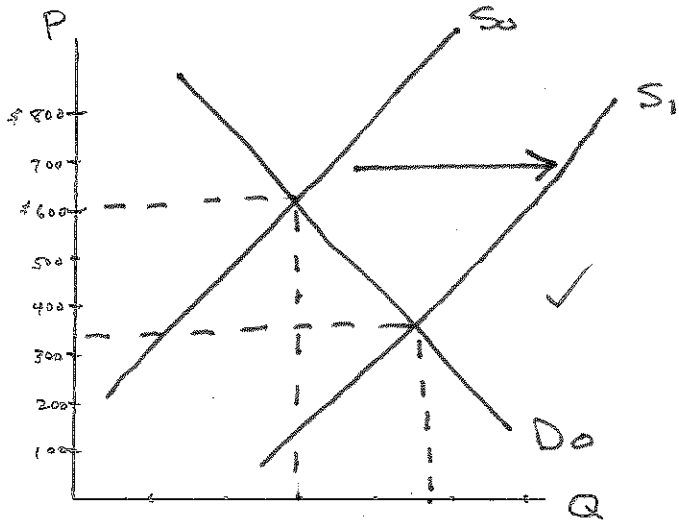
100 points total. Point values for each question are as indicated. Answer each question in the space provided. General advice: show your work, including any formulas or diagrams that you use in reasoning through your answers.

1. (15 pts.) During the calendar year 2018 lumber prices fell from over \$600 per thousand board feet early in the year to \$330 per thousand board feet by the end of the year. One of your friends suggests that the fall in price was due to a decline in new housing starts—fewer new homes were being constructed. Another of your friends disagrees and says that there was a historic glut of pine trees coming to maturity in the southeastern U.S.
 - a) Illustrate and explain each friend's reasoning in the two diagrams below.
 - b) What additional piece of information would help you decide which friend has the more credible explanation?
 - c) Suppose that you are told that the quantity of lumber exchanged was pretty much unchanged during the period that price was declining sharply. How would that affect your assessment of your friends' explanations then?

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Friend A



Friend B

a) FRIEND A - demand for lumber is derived from the demand for housing; a decrease in demand for housing shifts the demand curve to the left leading to a lower qty of lumber exchanged at a lower price

Friend B - a glut of pine trees maturing would shift the supply curve to the right leading to an increase in lumber exchanged at the lower price

b) Need to know if the quantity of lumber exchanged at the lower price was higher or lower than at the \$600 per thousand board feet level.

c) If the quantity demanded stayed relatively the same at both \$600 & \$330, this would suggest both friends' explanations together were at work.

2. (15 pts.) As brand manager of Pepsico's Quaker Instant Oatmeal, you have access to Kroger's vast database of information. You have experimented with changing the price of your product, and you have also observed how sales vary across stores located in neighborhoods with different socioeconomic characteristics.

a) When you increase the price of a six-pack box of instant oatmeal from \$2.50 to \$3.00, you observe that sales in a typical neighborhood Kroger's grocery store fall from 50 to 45 cases per week. Calculate own-price elasticity of demand, showing your calculations and the formula you use. In a few words, interpret the number that you have calculated.

$P_0 = 2.50$
 $P_1 = 3.00$
 $Q_0 = 50$
 $Q_1 = 45$

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$$E_{x, P_x} = \frac{\frac{Q_1 - Q_0}{\frac{1}{2}(Q_1 + Q_0)}}{\frac{P_1 - P_0}{\frac{1}{2}(P_1 + P_0)}} = \frac{\frac{45 - 50}{\frac{1}{2}(45 + 50)}}{\frac{3.00 - 2.50}{\frac{1}{2}(3.00 + 2.50)}} = \frac{\frac{-5}{47.5}}{\frac{0.50}{2.75}} = \frac{-0.105}{0.1818} = -0.579$$

Since the own-price elasticity of demand < 1 , the demand is considered inelastic meaning consumers are relatively unresponsive to changes in price.

b) In neighborhoods where the average household income for a family of four is \$40,000, neighborhood Kroger's grocery stores typically sell 45 cases per week. In neighborhoods where the average household income for a family of four is \$60,000, neighborhood Kroger's typically sell 55 cases per week. Calculate income elasticity of demand for Quaker Instant Oatmeal, showing your calculations and the formula that you use. In a few words, interpret the number that you have calculated.

$$E_{x, income} = \frac{\frac{Q_1 - Q_0}{\frac{1}{2}(Q_1 + Q_0)}}{\frac{I_1 - I_0}{\frac{1}{2}(I_1 + I_0)}} = \frac{\frac{55 - 45}{\frac{1}{2}(55 + 45)}}{\frac{60,000 - 40,000}{\frac{1}{2}(60,000 + 40,000)}} = \frac{\frac{10}{50}}{\frac{20,000}{50,000}} = \frac{\frac{10}{50}}{\frac{20}{50}} = \frac{10}{20} = 0.5$$

$= \frac{0.2}{0.4} = 0.5$

Since the income elasticity of demand > 0 it is a normal good. Since $0 < E_{x, inc} < 1$ it is considered a necessity. The quantity demanded increases when income increases and vice versa. Since $0 < E_{x, inc} < 1$ the consumption of the good increases when income increases but less than proportionate to the increase in income.

3. (10 pts.) Consider Gillette's pricing problem. It produces lower quality two-blade razors (Sensor), medium-quality three-blade razors (Mach 3), and higher quality five-blade razors (Fusion). It produces Mach 3 and Fusion razors in a one-piece disposable format and a two-piece format with a permanent handle and replaceable blade cartridges. It only makes Sensors in the one-piece disposable format.

a) Suppose that own-price elasticity of demand for Mach 3 handles is 1.5. Cross-price elasticity between Mach 3 handles and Mach 3 cartridges is -5.0. Cross-price elasticity between Mach 3 handles and disposable Mach 3 razors is 2.0. Explain how revenues from the sales of Mach 3 handles, Mach 3 cartridges, and disposable Mach 3 razors will be affected if Gillette lowers the price of Mach 3 handles by a given amount?

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If Gillette reduces the price of Mach 3 handles by a value of X , demand for the handles will increase by a factor of $1.5X$, increasing revenue. ✓

Mach 3 cartridges, will see a Demand increase of $5X$, again seeing a rise in revenue for Cartridges. ✓

Mach 3 disposables are substitutes to handles due to the positive cross-price elasticity, meaning a decreased handle price, will decrease the Demand for disposables by $2X$, reducing revenue from disposables. ✓

b) Consumers generally don't consider Sensors to be very good substitutes for Mach 3 handles and cartridges, but do consider Fusions to be pretty good substitutes, although not as good a substitute as the disposable version of the Mach 3. What sort of cross-price elasticity numbers between the price of Mach 3 handles and quantities sold of Sensors and Fusions would be consistent with these facts?

$\epsilon_{SPM} \approx 0$ Meaning Sensors Demand is not impacted By Mach 3 Price changes

$0 < \epsilon_{FPM} < 2$ ✓ Meaning Fusion Demand changes Due to price of Mach 3 handles, at a slower rate than Mach 3 Disposable Demand changes.

4. A good friend from high school decides to combine her passion for food with her passion for travel, and opens a food truck. She caters to the downtown lunch crowd, after-work beer drinkers at local craft brew-pubs, baseball and soccer families at parks on weekends, and wherever else she is able to find hungry people.

a) (5 pts.) After operating for several years, she asks you to help her evaluate how her business is doing. She opens her publicly audited books to you, and you see \$275,000 in revenues each year from food sales. You also see \$35,000 in labor costs for hourly workers who help her run the business, \$125,000 in wholesale food costs, \$15,000 for gas and maintenance on the truck, \$20,000 for insurance, taxes, and business license fees, and \$10,000 for advertising and web site expenses. What are her accounting profits?

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+ Revenues + \$275,000
 - explicit expenses (205,000)

explicit expenses
 '000s

+ labor 35
 + food 125
 + truck 15
 + fees 20
 + advert. 10

accounting profit = \$70,000

\$205K

b) (10 pts.) Sometimes you help her out on weekends when you have nothing better to do, and in that way you learn the following things. She works full time in her food truck but takes her compensation in the form of profits instead of paying herself a salary. She owns her truck outright, having purchased it a few months ago. Fully outfitted food trucks like hers cost \$75,000 when new, and have an expected life of five years, at which point they are worth nothing. She started working in the restaurant business right after high school, and her last job as a cook paid her \$35,000 per year. To buy her truck she took some money that was invested in indexed mutual funds where it earned 6%. How is she doing? Answer by calculating her economic profits (or losses) from owning and operating this food truck. Carefully explain how you arrive at your answer.

+ Revenues
 - explicit costs
 - implicit costs
 economic profit

\$275,000 Revenue
 (205,000) explicit
 (35,000) implicit
 \$35,000 = economic profit

Accounting & economic profits are both positive.

That alone tells us she would be better off as is than her next best alternative. Considering she has personally invested \$75K in the food truck, the rate of return comes to ~20.7%, which is far better than where it was sitting in her mutual fund.

Rate of Return = $\frac{\text{economic profit}}{\text{contributed capital}}$
 $20.67\% = \frac{15,500}{75,000}$

implicit costs '000s
 + truck depreciation = 15
 \$75K / 5 yrs

+ foregone salary = 35

+ foregone interest = 4.5
 .06 (75K)

\$54.9K

35,000 her salary
 + 15,500 profit
 \$50,500

c) (5 pts.) Suppose she decides to pursue other passions and wants to explore selling her business. She knows that you have an extensive network of fellow MBA students, and asks whether she could accompany you to an MBASA social event to make a sales pitch. Explain briefly whether you think she will find a buyer among this group.

If anyone at the event currently earns less than \$50,500 in salary, she may be able to find a buyer, that would find it economically profitable to take on her food truck.

5. (15 pts.) MacDonald's is considering installing automated kiosks in their restaurants. Such kiosks allow customers to stand in front of a big touch screen, choose their menu items, submit their order, and then pay, all without involving a human being standing at a cash register. Of course some customers want a live person taking their order, and some humans are still necessary at the ordering stage to make sure everything works correctly. After trying out this system at a number of restaurants, they find the following tradeoff between automated kiosks and workers. In a typical MacDonald's restaurant, the mix of humans (L) and automated kiosks (K) can process the following number of customer orders per hour (Q):

		Humans (L) $\sqrt{10}$			
		L = 1	L = 2	L = 3	L = 4
Kiosks (K) $\sqrt{12}$	K = 0	Q = 15	Q = 30	Q = 40	Q = 45
	K = 1	Q = 35	Q = 70	Q = 100	Q = 120
	K = 2	Q = 50	Q = 100	Q = 140	Q = 170

Now for the questions:

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- Does this production process exhibit diminishing marginal returns in the short run? Since the obvious answer is yes, select some data points from the above table and use the concept of marginal product to explain how you see diminishing returns in your production process.
 - Suppose company cost accountants have determined that the implicit "rental" rate on kiosks when a restaurant installs them is \$12 per hour. Also suppose that your restaurant is located in a labor market where the prevailing wage rate for fast-food workers is \$10 per hour. If you were using L=2 and K=1 to serve 70 customers per hour, how would you accomplish an increase in output from 70 to 100 customers per hour?
 - How would your answer change if the local government passed a city-wide increase in the minimum wage to \$15 per hour?

✓ a) Keeping L constant at 1, increasing K from 0 to 1 causes Q to increase by 20. Increasing K to 2 causes Q to only increase by 15. Therefore Diminishing Marginal Returns. Alternatively, keep K constant at 0 and increasing L from 1 to 2 causes Q to increase by 15. Alternatively, increasing L from 2 to 3 causes Q to only increase by 10.

L = 1	L = 1	K = 0	K = 0
K = 0 → 1	K = 1 → 2	L = 1 → 2	L = 2 → 3
MP _K = 20	MP _K = 15	MP _L = 15	MP _L = 10

- ✓ b) Increase the amount of Human Labor by 1. This is because Human Labor (L) is cheaper than the alternative of increasing the number of Kiosks

✓ c) If the Local Government passed a city-wide increase in the minimum wage ~~then it would~~ at \$15.00 per (L) then it would be cheaper to utilize more Kiosk (K) since their rate is now lower in order to increase output (Q) to 100.

6. (10 pts.) Farmer Jones raises chickens (X). Farmer Smith raises alligators (Y). Farmer Jones' current daily rate of output is 50 chickens, and farmer Smith's daily rate of gators is 5. Each has contemplated expanding their scale of production. They have also discussed the possibility of a merger. A local agricultural extension agent shares the following information about the production technology and costs of producing chickens (X) and alligators (Y), where $C(i, j)$ represents the cost of producing i units of X and j units of Y:

$$C(50, 0) = 100$$

$$C(5, 5) = 125$$

$$C(100, 0) = 180$$

$$C(0, 10) = 240$$

$$C(50, 5) = 200$$

$$C(100, 10) = 380$$

Does the production technology display economies of scale in the production of chickens? Does it display economies of scale in the production of alligators? Does it display economies of scope? In explaining your answers, state whether you expect to see small or big farms producing chickens. Do you expect to see small or big farms producing alligators? Do you expect to see farms specializing in either chickens or alligators, or farms producing both goods simultaneously?

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Production of Chickens - Yes there is an economy of scale. When production doubles from 50 \rightarrow 100 there is only an increase in cost of 80% instead of 100%

Production of Alligators - Yes there is an economy of scale. As production doubles from 5 \rightarrow 10 we see an increase in cost of 92% instead of 100% ✓

Economy of Scope \rightarrow Yes producing both together is cheaper than individually and also has an economy of scale ✓

I would expect to see large farms producing both goods simultaneously as there are both economies of scale, LRAC sloping down as farm size increases, and economies of scope, producing both together is less costly than apart. $C(100, 10) = 380$ while $C(100, 0) + C(0, 10) = 420$ ✓

7. (4 pts.) If $Q = 5$, $TVC = 150$. If $Q = 2$, $AFC = 50$. What is ATC if $Q = 5$? Briefly show/explain how you arrive at your answer.

4
If $Q = 5$, $TVC = 150 = \frac{TVC}{Q} = AVC = 30$

If $Q = 2$, $AFC = 50$, so $TFC = AFC * Q = 50 * 2 = 100$ TFC

If $Q = 5$, $TC = TVC + TFC \Rightarrow TC = 150 + 100 = 250$

$$ATC = \frac{TC}{Q} = \frac{250}{5} = 50 \checkmark$$

8. (6 pts.) Airlines find that the per passenger cost of transporting people from one destination to another is lower when they use bigger airplanes (6-8 seats across) than when they use smaller planes (3-4 seats across). Can you think of two reasons why they experience such economies of scale?

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1. Cube-Square Rule - The production capacity (transporting passengers) is proportional to the airplane size, which is not proportional to the total cost of production that is proportional to the surface area of the airplane.

2. The airline would be spreading the fixed cost over a greater number of passengers. Still need 1 captain, 1 copilot + flight attendants, regardless of passenger numbers. Also cost to fuel airplane would be spread out across a larger number of passengers.

9. (5 pts.) Boeing and Airbus have both recently decided to do something different about nacelles. What have they changed and why?

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They decided to start manufacturing nacelles in house. Because there has been hold-ups in the supply of parts for the planes. Secondly they wanted to capture the revenues that could be earned servicing the nacelles. Therefore, Boeing and Airbus are moving more towards vertical integration by manufacturing nacelles, in house. By doing this they are improving production efficiencies (no hold-up by UTC or other nacelle makers). They are preventing information asymmetries, i.e. exploitation from UTC + the other nacelle makers.
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