

1. Feram and Ocel are the only two steel manufacturers in the region. Feram is deciding whether to transport its steel with Truck or Rail. Ocel is deciding whether to produce its steel as Sheets or Beams. The payoff matrix shows the payoffs for each combination of strategies. The first entry in each cell shows Feram’s profit, and the second entry shows Ocel’s profit. Each firm independently and simultaneously chooses its strategy. Assume that Feram and Ocel know all the information in the matrix and do not cooperate.

		Ocel	
		Sheets	Beams
Feram	Truck	\$40 million, \$95 million	\$20 million, \$125 million
	Rail	\$50 million, \$75 million	\$30 million, \$25 million

Part A

What is Feram’s most profitable strategy if Ocel chooses to produce Sheets?

Part B

Does Ocel have a dominant strategy? Explain using numbers from the payoff matrix.

Part C

Identify the Nash equilibrium (or equilibria) for this game, or state that none exists.

Part D

Suppose Feram incurs a \$20 million increase in the cost of Rail transport, with no change in the cost of Truck transport. Redraw the payoff matrix, including the firms, strategies, and payoffs, showing how the \$20 million increase in the cost of Rail transport affects the payoff matrix.

Part E

Suppose instead that Feram and Ocel now cooperate and merge into one new firm, Acier, which is now the only producer of steel in the region. Acier produces the profit-maximizing quantity of steel and is earning positive economic profit. Draw a correctly labeled graph for Acier, and show each of the following.

- i. Acier’s profit-maximizing quantity, labeled Q_1
- ii. Acier’s profit-maximizing price, labeled P_1
- iii. The average total cost curve, labeled ATC, consistent with Acier earning positive economic profit
- iv. The area of deadweight loss, shaded completely

Part F

Government regulators impose a lump-sum tax on Acier. In the short run, will Acier’s profit-maximizing price of steel increase, decrease, or remain the same as a result of the lump-sum tax? Explain.

3. Tony’s Trinkets and Bitaly’s Bracelets are the only two firms in a town that produce and sell jewelry. Tony’s Trinkets is deciding whether to produce Unique jewelry or Typical jewelry. Bitaly’s Bracelets is deciding whether to produce Gold jewelry or Silver jewelry. The payoff matrix shows the payoffs for each combination of strategies. The first entry in each cell shows Tony’s Trinkets’ profit, and the second entry shows Bitaly’s Bracelets’ profit. Each firm independently and simultaneously chooses its strategy. Assume that the two firms know all the information in the matrix and do not cooperate.

		Bitaly’s Bracelets	
		Gold	Silver
Tony’s Trinkets	Unique	\$15, \$21	\$20, \$19
	Typical	\$10, \$7	\$21, \$16

- A. Suppose Bitaly’s Bracelets chooses to produce Silver jewelry. Is choosing to produce Unique jewelry the best choice for Tony’s Trinkets? Explain using numbers from the payoff matrix.
- B. Is Bitaly’s Bracelets’ dominant strategy to produce Gold jewelry, to produce Silver jewelry, or does it not have a dominant strategy? Explain using numbers from the payoff matrix.
- C. Identify all Nash equilibria for this game.
- D. Suppose Tony’s Trinkets’ profit from producing Typical jewelry increases regardless of what Bitaly’s Bracelets does. What is the minimum amount by which Tony’s Trinkets’ profit must increase in order for Typical jewelry to become a dominant strategy: \$2, \$4, \$6, \$11, or \$15?
- E. Suppose instead that these two firms now cooperate and merge into one firm to maximize their combined profits. The new firm will have two locations and continue to face the same actions and payoffs. Calculate the new firm’s maximum combined profit. Show your work.

STOP
END OF EXAM

		Field Cruiser	
		Reliability	Power
Nice Ride	Safety	\$10 million, \$28 million	\$32 million, \$35 million
	Comfort	\$30 million, \$40 million	\$25 million, \$20 million

3. Nice Ride and Field Cruiser are the only two producers of vehicles. Nice Ride is deciding whether to improve Safety or Comfort. Field Cruiser is deciding whether to improve Reliability or Power. The payoff matrix shows the payoffs for each combination of strategies. The first entry in each cell shows Nice Ride's profit, and the second entry shows Field Cruiser's profit. Each firm independently and simultaneously chooses its strategy. Assume the two firms know all the information in the matrix and do not cooperate.

- (a) What is Field Cruiser's most profitable strategy if Nice Ride chooses to improve Safety?
- (b) Does Nice Ride have a dominant strategy? Explain using numbers from the payoff matrix.
- (c) Is Nice Ride choosing to improve Safety and Field Cruiser choosing to improve Power a Nash equilibrium? Explain using numbers from the payoff matrix.
- (d) Suppose Nice Ride and Field Cruiser decide to merge to maximize combined profits and choose to keep producing both Nice Ride and Field Cruiser vehicles. Assuming the values in the payoff matrix do not change, what would be the new firm's total profit?
- (e) Suppose instead that a change in fuel prices reduces the profitability of choosing to improve Power by \$10 million for Field Cruiser. Identify each firm's profit at the Nash equilibrium.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

1. NCHart is a corporation that has developed and patented a new drug to treat heart disease. There are no substitutes for this drug, giving NCHart a monopoly.

(a) Draw a correctly labeled graph of NCHart making a positive economic profit, and show each of the following.

- (i) The profit-maximizing quantity, labeled Q_m
- (ii) The profit-maximizing price, labeled P_m

(b) At Q_m from part (a)(i), is demand elastic, unit elastic, or inelastic? Explain using information from the graph.

(c) Instead of maximizing profit, suppose NCHart considers providing the new drug to as many patients as possible as long as it can generate enough revenue to cover its total costs.

- (i) On your graph from part (a), show the quantity that is consistent with this goal, labeled Q_z .
- (ii) At Q_z from part (c)(i), is there a deadweight loss? Explain.

(d) NCHart's patent expires next year, and a new firm, TXDrug, is considering whether to Enter this market or Stay Out. NCHart can either produce Q_m or Q_z . The firms independently and simultaneously choose their actions. The first entry in the payoff matrix represents NCHart's payoff and the second entry represents TXDrug's payoff. Both firms have complete information. Use the payoff matrix below to answer the following questions.

		TXDrug	
		Stay Out	Enter
NCHart	Q_m	\$10, \$0	\$4, \$1
	Q_z	\$0, \$0	-\$2, -\$1

- (i) Does TXDrug have a dominant strategy? Explain using strategies and payoffs from the payoff matrix.
- (ii) What is the best response for NCHart if TXDrug chooses to Stay Out?
- (iii) Identify the Nash equilibrium.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

Dee's Pizzeria

		Enter	Stay Out
Patrick's Pie	Advertise	\$50, -\$2	\$175, \$0
	Do Not Advertise	\$150, \$15	\$100, \$0

3. Patrick's Pie is currently the only pizzeria in College Town. It can either advertise or not advertise. Dee's Pizzeria is contemplating whether to enter or stay out of the College Town market. Each pizza establishment independently and simultaneously makes its decision. The payoff matrix above shows the profits for each combination of decisions, and both players have complete information. The first entries in the payoff matrix are Patrick's profit, and the second entries are Dee's profit.

- What actions maximize the combined total profits for Patrick's Pie and Dee's Pizzeria?
- Conditional on your response in part (a), does either Patrick's Pie or Dee's Pizzeria have an incentive to cheat on this combination of actions that maximize the combined total profits? Explain using numbers from the matrix for each pizzeria.
- Does Patrick's Pie have a dominant strategy?
- Identify the Nash equilibrium or equilibria actions for this game.
- Ignoring antitrust considerations, suppose that Patrick pays Dee's Pizzeria \$20 if Dee chooses to "Stay Out."
 - Redraw this matrix including players, actions, and payoffs, showing how Patrick's Pie payment to Dee affected the payoffs.
 - Identify the Nash equilibrium for the redrawn matrix.

STOP**END OF EXAM**

Boulevard

		Delivery	No Delivery
Jackpot	6:00 P.M.	\$35, \$30	\$55, \$20
	9:00 P.M.	\$25, \$50	\$45, \$40

3. Jackpot Florist and Boulevard Gardens share the market for floral bouquets in Tuliptown. Jackpot is deciding whether to close at 6:00 P.M. or to close at 9:00 P.M., and Boulevard is deciding whether to offer Delivery or No Delivery. The payoff matrix above shows the annual profits for each combination of actions that the firms can choose. The first entry shows Jackpot's profit, and the second entry shows Boulevard's profit.

Assume that both firms know all the information in the matrix and act simultaneously and independently.

- Is Jackpot's dominant strategy to close at 6:00 P.M., to close at 9:00 P.M., or does it not have a dominant strategy?
- Suppose Jackpot chooses to close at 6:00 P.M. and Boulevard chooses No Delivery. Is this the profit-maximizing action by Boulevard? Explain using values from the payoff matrix.
- How much profit will Boulevard earn in the Nash equilibrium?
- Suppose these two firms merge to form one company with two locations and still face the same actions and payoffs. Which strategies would the new company choose to maximize its combined profit?
- Now assume that instead of merging, Jackpot proposes a plan to cooperate with Boulevard. Jackpot would agree to close at 9:00 P.M., and Boulevard would agree to No Delivery. If either firm breaks the agreement, it **MUST** subtract \$12 from its profit that is then added to the other firm's profit.
 - Assuming the agreement was in effect and enforced, redraw the matrix, including the players, actions, and payoffs.
 - Assuming Boulevard is a profit-maximizing firm and there are no antitrust concerns, would Boulevard agree to Jackpot's proposal? Explain using specific values from the redrawn payoff matrix.

STOP**END OF EXAM**

2. Breadbasket and Quicklunch are the only two sandwich shops serving a small town. Each shop can choose to set a high price or a low price for sandwiches. The payoff matrix below shows the daily profits for each combination of prices that the two shops could choose. The first entry shows Breadbasket's profits, and the second entry shows Quicklunch's profits. Assuming that both shops know the information shown in the matrix, answer the following.

		Quicklunch	
		High Price	Low Price
Breadbasket	High Price	\$105, \$110	\$40, \$130
	Low Price	\$120, \$80	\$75, \$70

- (a) Does each shop have a dominant strategy to set a high price, a dominant strategy to set a low price, or does it have no dominant strategy?
- (i) Breadbasket
- (ii) Quicklunch
- (b) If the two shops do not cooperate on setting prices, what will be the profit for each shop?
- (i) Breadbasket
- (ii) Quicklunch
- (c) The town government is concerned that food prices are too high. It decides to give a daily subsidy of \$20 to any shop that chooses to set a low price for its food items. Redraw the payoff matrix under the government subsidy system.

Using your redrawn payoff matrix, answer each of the following.

- (i) Would Quicklunch choose to set a high price or a low price? Explain using specific values from your redrawn matrix.
- (ii) Would the profits for Breadbasket increase, decrease, or stay the same? Explain with a comparison to your answer in part (b)(i). Use the specific values.