

## Chapter 10: Answers to Questions and Problems

1.
  - a. Player 1's dominant strategy is B. Player 2 does not have a dominant strategy.
  - b. Player 1's secure strategy is B. Player 2's secure strategy is E.
  - c. (B, E).

2.
  - a.

		<b>Player 2</b>	
		<i>Strategy</i>	<i>A</i>
<b>Player 1</b>	<i>A</i>	\$500, \$500	\$0, \$650
	<i>B</i>	\$650, \$0	\$100, \$100

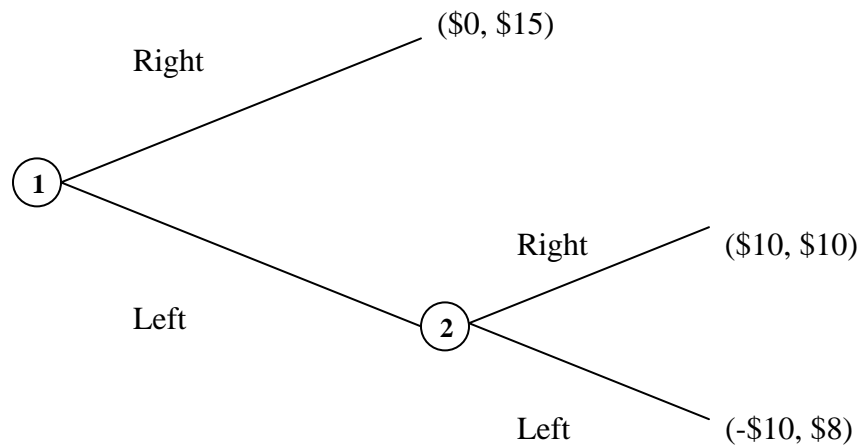
- b. B is dominant for each player.
  - c. (B, B).
  - d. Joint payoffs from (A, A) > joint payoffs from (A, B) = joint payoffs from (B, A) > joint payoffs from (B, B).
  - e. No; each firm's dominant strategy is B. Therefore, since this is a one-shot game, each player would have an incentive to cheat on any collusive arrangement.
3.
  - a. Player 1's optimal strategy is B. Player 1 does not have a dominant strategy. However, by putting herself in her rival's shoes, Player 1 should anticipate that Player 2 will choose D (since D is Player 2's dominant strategy). Player 1's best response to D is B.
  - b. Player 1's equilibrium payoff is 5.
4.
  - a. (A, C).
  - b. No.
  - c. If firms adopt the trigger strategies outlined in the text, higher payoffs can be achieved if  $\frac{\pi^{Cheat} - \pi^{Coop}}{\pi^{Coop} - \pi^N} \leq \frac{1}{i}$ . Here,  $\pi^{Cheat} = 60$ ,  $\pi^{Coop} = 50$ ,  $\pi^N = 10$ , and the interest rate is  $i = .05$ . Since  $\frac{\pi^{Cheat} - \pi^{Coop}}{\pi^{Coop} - \pi^N} = \frac{60 - 50}{50 - 10} = \frac{1}{4} = 0.25 < \frac{1}{i} = \frac{1}{.05} = 20$  each firm can indeed earn a payoff of 50 via the trigger strategies.
  - d. Yes.

5.

- a.  $x > 2$ .
- b.  $x < 2$ .
- c.  $x < 2$ .

6.

- a. See the accompanying figure.



- b. (\$0, \$15) and (\$10, \$10).
- c. (\$10, \$10) is the only subgame perfect equilibrium; the only reason (\$0, \$15) is a Nash equilibrium is because Player 2 threatens to play left if 1 plays left. This threat isn't credible.

7.

- a. Player 1 has two feasible strategies: A or B. Player 2 has four feasible strategies: (1) W if A and Y if B; (2) X if A and Y if B; (3) W if A and Z if B; (4) X if A and Z if B.
- b. (60, 120) and (100, 150).
- c. (100, 150).

8.

- a. There are two Nash equilibria: (5, 5) and (20, 20). The (5, 5) equilibrium would seem most likely since the other equilibrium entails considerable risk if the players don't coordinate on the same equilibrium.
- b. "B". This would signal to player 2 that player 1 is going to use strategy B, and therefore permit the players to coordinate on the (20, 20) equilibrium.
- c. Player 2 would choose Y and player 1 would follow by choosing B. This is the subgame perfect equilibrium.

9. The normal form game looks like this:

		Kmart	
		<i>Strategy</i>	<i>Sale Price</i>
Target	<i>Sale Price</i>	\$1, 1	\$5, \$3
	<i>Regular Price</i>	\$3, \$5	\$3, \$3

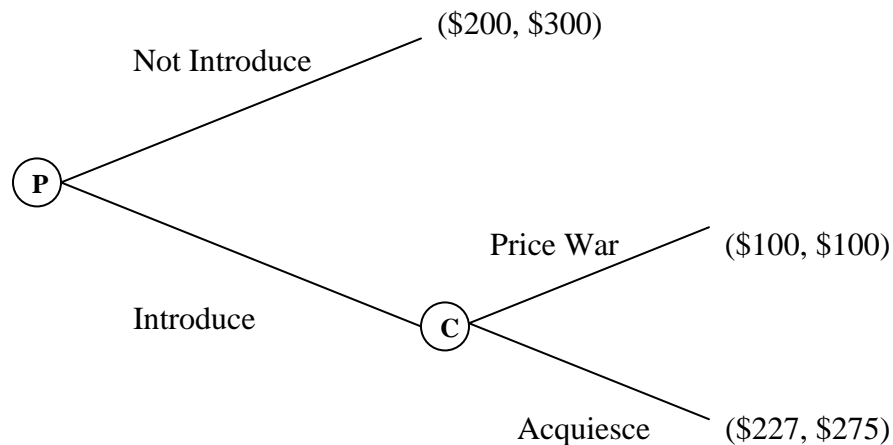
Notice that there are two Nash equilibria: (Sale, Regular) and (Regular, Sale) with profits of (\$5, 3) and (\$3, \$5), respectively. Thus, there is not a clear-cut pricing strategy for either firm. One mechanism that might solve this problem is to advertise your sales on alternate weeks. Another mechanism might be to guarantee “everyday low prices” (so that you effectively commit to always charge the sale price). In this case, your rival’s best response would be to charge the regular price and your firm would earn profits of \$5 million.

10. The normal form game looks like this:

		Ford	
		<i>Strategy</i>	<i>Airbags</i>
GM	<i>Airbags</i>	\$1.5, 1.5	\$2, -\$1
	<i>No Airbags</i>	-\$1, \$2	\$0.5, \$0.5

The dominant strategy, in this case, would be to offer airbags.

11. The extensive form game looks like this:



Notice that Coca-Cola’s best response if Pepsi introduces is to acquiesce to earn \$275 million rather than to start a price war and earn \$100. Thus, while Coca-Cola might threaten to start a price war in an attempt to keep you out of the market, this threat isn’t credible; your best option is to introduce.

12. The savings from letting the union use its own pen and ink to craft the document are most likely small compared to the advantage you would gain by making a take-it-or-leave-it offer.
13. Since you know for certain that the game will end in 1 month, your optimal strategy in the finitely repeated pricing game with a known endpoint is to reduce price (defect) from the implicit collusive agreement between you and your rival.
14. The normal form of this game looks as follows:

		<b>Rival</b>	
		<b>Strategy: Price</b>	
<b>You</b>	<b>Low</b>	\$0, \$0	\$9, -\$1
	<b>High</b>	-\$1, \$9	\$7, \$7

The one-shot Nash equilibrium is for both firms to charge a low price to earn zero profits. Now suppose you and your rival compete year after year but there is a 50 percent chance the Jeep is discontinued. The profits of a firm that conforms to the collusive strategy (high price) under the usual trigger strategies (firms agree to charge the high price so long as no player deviated in the past, otherwise charge a low price) are  $\pi^{Coop} = \$7 + \$7(1 - 0.5) + \$7(1 - 0.5)^2 + \dots = \frac{\$7}{.5} = \$14$  million. A firm that cheats earns \$9 million today and zero forever after. Since  $\pi^{Coop} > \pi^{Cheat}$ , the collusive outcome can be sustained as a Nash equilibrium.

15. The normal form game looks like this:

		<b>Rival</b>		
		<b>Advertise</b>	<b>No</b>	<b>Yes</b>
<b>Kellogg's</b>	<b>No</b>	\$8, \$8	-\$1, \$48	
	<b>Yes</b>	\$48, -\$1		\$0, \$0

Collusion is profitable under the usual trigger strategies if  $\frac{\pi^{Cheat} - \pi^{Coop}}{\pi^{Coop} - \pi^N} \leq \frac{1}{i}$ , or

$$\frac{\$48 - \$8}{\$8 - 0} = \$5 \leq \frac{1}{i}$$

Thus, one requirement is for the interest rate to be less than 20 percent. Another requirement includes the ability of firms to monitor (observe) potential deviations by rivals.

16. The normal form looks like this:

<i>Argyle</i>	<i>Baker</i>		
	<i>Price</i>	<i>\$10</i>	<i>\$20</i>
	<i>\$5</i>	<i>15, 16</i>	<i>15,18</i>
	<i>\$10</i>	<i>10, 16</i>	<i>10,18</i>

Your optimal price is \$5, since that strategy is a dominant strategy. You should not invest the \$2 million because the ability to move first does not result in a payoff advantage.

17. Direct labor and direct materials are the only relevant costs, since they are variable costs. Depreciation is a fixed (or sunk) cost, and is therefore irrelevant to the decision (the firms' fixed costs are \$20,000 (since  $\$20,000/250 = \$80$  and  $\$20,000/500 = \$40$ . These later numbers are the reported unit depreciation costs). Since depreciation is a fixed cost and must be paid regardless of the firm's output, it is irrelevant to the decision. The firm's marginal cost (which equals its average variable cost in this case) is thus the sum of unit labor and materials costs, or  $\$40 + \$30 = \$70$ . The payoff matrix (normal form) below shows the relevant payoffs (contributions) towards paying the \$20,000 in fixed costs for alternative levels of output by the two firms. The key is to note that if each firm produces 250 units, total market output is 500 units and the price is \$120. Each firm's contributions in this case are  $(\$120 - \$70) \times 250 = \$12,500$ . If one firm produces 250 units and the other firm produces 500 units, the market price is \$100. In this case, the firm's contributions are  $(\$100 - \$70) \times 250 = \$7,500$  and  $(\$100 - \$70) \times 500 = \$15,000$ . If each firm produces 500 units, the market price is \$90, and the contributions of each firm are  $(\$90 - \$70) \times 500 = \$10,000$ . The payoff matrix (normal form) below shows the relevant contributions toward paying the fixed costs of \$20,000.

		<b>NetWorks</b>	
<b>GearNet</b>	<i>Strategy</i>	<i>250 Units</i>	<i>500 Units</i>
	<i>250 Units</i>	\$12500, \$12500	\$7500, \$15000
	<i>500 Units</i>	\$15000, \$7500	\$10000, \$10000

Each firm's dominant strategy in a one-shot game is to produce 500 units. In equilibrium each firm contributes \$10,000 toward its \$20,000 in fixed costs.

18. The normal-form representation of this game is depicted in the following payoff matrix.

		<b>T-Mobile</b>	
		<i>Strategies</i>	
<b>Qualcomm</b>		<i>CDMA</i>	<i>GSM</i>
	<i>CDMA</i>	\$16 b, \$12 b	\$12 b, \$8 b
	<i>GSM</i>	\$14 b, \$7 b	\$13 b, \$18 b

There are two Nash equilibria to this coordination game: (1) Qualcomm and T-Mobile adopt the CDMA technology and (2) Qualcomm and T-Mobile adopt the GSM technology. There are many ways to solve multiplicity of equilibria in this coordination problem. As the book points out, the firms could “talk” to each and agree on one technology. Alternatively, Iraq’s government could announce which technology is to be used in the country.

19. The normal form of this game is contained in the following payoff matrix (in billions of U.S. dollars).

		<b>Japan</b>	
		<i>Strategies</i>	
<b>U.S.</b>		<i>Tariff</i>	<i>No Tariff</i>
	<i>Tariff</i>	\$43.78, \$4.76	\$44.2, \$4.66
	<i>No tariff</i>	\$43.66, \$4.85	\$44, \$4.8

The Nash equilibrium is for the U.S. and Japan to each impose tariffs. However, both countries achieve greater welfare by “agreeing” to impose no tariffs. The sustainability of such an agreement to impose no tariffs is dependent upon the game being repeated infinitely, the countries using trigger strategies and the interest rate being sufficiently low.