Answers to Text Questions and Problems Chapter 9

Answers to Review Questions

1. Each contestant in a military arms race faces a choice between maintaining the current level of weaponry and spending more to increase it. In this situation, each side views military superiority as the best possible outcome, and military inferiority as the worst possible outcome. Of the other two combinations—both maintaining current spending or both spending more—each nation would prefer the former, since both result in military parity. Assuming the contestants are the USA and the former USSR, these rankings give rise to the following payoff matrix. Each side’s dominant strategy is to spend more on weapons, yet the result when each side spends more is less attractive than if each side had held spending at current levels.

<table>
<thead>
<tr>
<th></th>
<th>Spend the same on weapons</th>
<th>USSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>Spend the same on weapons</td>
<td>Second best for each</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Best for USSR</td>
</tr>
<tr>
<td></td>
<td>Spend more on weapons</td>
<td>Worst for USA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Best for USA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worst for USSR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Third best for each</td>
</tr>
</tbody>
</table>

2. By waiting, Warner Brothers put itself in the position of having to reshoot many scenes if they used any other singer than Bennett. Warner Brothers would have done better to negotiate with Bennett before filming, when the reservation price for his services was much lower (because at that point, the film could more easily have been adapted).

3. Once the firm buys the specialized capital equipment, it becomes a sunk cost, since it cannot be used to serve any buyer other than GM. With no prior agreement about the price of the door handles, GM would then be in a position to offer a price greater than the marginal cost of making the door handles, but too low to enable the firm to recover its capital costs. At that point, after all, GM knows that the firm would be better off accepting the offer than refusing it. To guard against this possibility, the firm will want to sign a long-term contract specifying the price of the door handles before it invests in specialized capital equipment.

4. If you were going to play the ultimatum bargaining game many times with the same partner, your refusal of a one-sided offer in an early game could be rational, because it might discourage your partner from making similar offers in later games.

5. Because the waiter in this situation knows that a selfish diner would have no incentive to tip at the end of the meal, he would not bother providing good service, even though his cost of providing good service is less than the diner would be willing to pay for it. That most diners do in fact leave tips in restaurants located on interstate highways suggests that people are not always selfish in the narrowest sense of the term.
### Answers to Problems

1a.  

<table>
<thead>
<tr>
<th></th>
<th>Study a lot</th>
<th>Study a little</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study a lot</td>
<td>-5 for Sam</td>
<td>10 for Sam</td>
</tr>
<tr>
<td></td>
<td>-5 for others</td>
<td>-6 for others</td>
</tr>
<tr>
<td>Sam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study a little</td>
<td>-6 for Sam</td>
<td>-1 for Sam</td>
</tr>
<tr>
<td></td>
<td>10 for others</td>
<td>-1 for others</td>
</tr>
</tbody>
</table>

b. All study a lot and receive an average grade. From the students’ perspective, for everyone to study a little would have been better.

2a. No, the best choice for each player depends on what the other player does.  
b. The top-left and bottom-right cells are both potential equilibria, for in each of those cells, neither player has an incentive to change strategies.  
c. No, the payoffs do not follow the pattern associated with a prisoner’s dilemma, because neither player has a dominant strategy.  
d. If A knows that if he or she has the first move and buys a movie ticket, so will B, in which case A will get a payoff of 2. If A buys a baseball ticket, so will B, in which case A will get a payoff of 3. So A will buy a baseball ticket, and so will B.  
e. This time they will both see a movie.

3. The information is worth nothing to Blackadder, who knows that Baldrick’s dominant strategy is to confess, and who in any event has a dominant strategy of his own.

4a. The owner knows that if he opens the remote office (top branch at A), the potential manager’s best strategy is to be dishonest (bottom branch at B), in which case the owner will get –$600. Since the owner gets nothing by choosing the bottom branch at A, he will not open the new office.

```
A  
/ \  
|   |  B  
| \ |   
|  v|    
|  Owner opens satellite office  
| \    |  
|  v   |    
|  Owner does open satellite office  

Manager manages honestly.  
Owner gets $800,  
manager gets $2000

Manager manages dishonestly.  
Owner gets -$600,  
manager gets $3100

Owner gets $0,  
Manager gets $1000 working elsewhere
```

b. Yes. This time the potential manager’s payoff on the bottom branch at B is $3100 – $15,000 = – $11,900, so the owner knows the manager will choose the top branch at B.
5a.

b. The top branch at A is unattractive to the other driver. Since you get a higher payoff on the bottom branch at B, and the other driver knows it, the equilibrium outcome is that he gets the space and you keep waiting.

c. Suppose the other driver believed that you would experience a psychological cost of $30 not only if you got into a dispute, but also if you failed to protest his unjust behaviour. In that case, he would think that the net cost of your becoming involved in an argument would be $0. This belief would change your payoff in the ‘protest’ scenario to $10, so that you would protest, giving him a payoff of –$30. Thus he would no longer have anything to gain from attempting to take your parking space.

6a. If Company A breaks its quota while Company B keeps its quota, then A will get the largest possible profit and B will get the smallest. Both will get a higher profit if both keep the quota than if both break it. These incentives lead to a payoff matrix like the following:

<table>
<thead>
<tr>
<th>Company B</th>
<th>Keep Quota</th>
<th>Break Quota</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep Quota</td>
<td>Second best for both</td>
<td>Best for B Worst for A</td>
</tr>
<tr>
<td>Break Quota</td>
<td>Best for A Worst for B</td>
<td>Third best for both</td>
</tr>
</tbody>
</table>

If the quota is not enforced, each company will choose to break it, leading to overfishing.

b. The cutting of timber by two competing firms would also give rise to a prisoner’s dilemma situation.

c. Unlike many other types of production, environmental goods can be exhausted. If one firm cheats, then the other may face a permanently lower level of possible production.
7a. The players are you and your friend. Your strategy choices are heads or tails. The following matrix describes the payoffs, measured as the change in the number of pennies each player owns.

<table>
<thead>
<tr>
<th></th>
<th>Tails</th>
<th>Heads</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>You</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heads</td>
<td>-1 for you</td>
<td>1 for you</td>
</tr>
<tr>
<td>Tails</td>
<td>1 for your friend</td>
<td>-1 for your friend</td>
</tr>
</tbody>
</table>

bc. There are no dominant strategies and there is no equilibrium, because if your friend plays one side, you want to match that side. But if you match, your friend will want to change strategies.

8a. Harry and Sally are the players. Harry’s strategies involve his choice of $K$, the number of quarters he offers Sally ($K = 1, 2, 3, 4$); Sally’s strategies are to accept or to refuse Harry’s offer. The decision tree for this game is as follows:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harry proposes $K$ quarters for Sally, $4-K$ for himself ($K=1, 2, 3, 4$)</td>
<td>Sally accepts</td>
</tr>
<tr>
<td>Sally refuses</td>
<td>$0$ for Sally</td>
</tr>
</tbody>
</table>

b. At $B$ on the decision tree, Sally’s payoff will be higher if she accepts, no matter what $K$ is. So her best choice is to accept. Knowing that Sally will accept no matter what, Harry gets the highest payoff by choosing $K = 1$. Sally accepts his offer; Harry’s payoff is $0.75$ and Sally’s is $0.25$.

9a. The two possible equilibria are: (1) Boeing produces and Airbus does not and (2) Airbus produces and Boeing does not. If the manufacturers found themselves in one of these two cells, neither would want change its strategy, because given that one company is producing, the other will do better by not producing.

b. Because of the subsidy, producing is a dominant strategy for Airbus. Because Boeing knows Airbus will produce, it will choose not to.
c. Without the subsidy, either Boeing or Airbus may produce, but we cannot determine which one (given that Boeing and Airbus are quite similar). The subsidy is a tool used by the EU to ensure that Airbus is the one that will end up producing.

10a. In this part of the question, each player’s payoffs are independent of the action taken by the other. Each pail of water sells for $5. Since the cost of carrying each bucket is less than $5, Jill and Jack will each carry 2 buckets.

b. When the two children are forced to share revenues, their payoff matrix is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Carry 1 pail</th>
<th>Carry 2 pails</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carry 1 pail</td>
<td>$3 for each</td>
<td>$2.50 for Jill</td>
</tr>
<tr>
<td></td>
<td>$2.50 for Jill</td>
<td>$5.50 for Jack</td>
</tr>
<tr>
<td>Jack</td>
<td>$5.50 for Jill</td>
<td>$2.50 for Jack</td>
</tr>
<tr>
<td>Carry 2 pails</td>
<td>$5 for each</td>
<td></td>
</tr>
</tbody>
</table>

The equilibrium outcome is for each to carry one pail and earn $3.

Sample Homework Assignment

1. Suppose your economics class is graded on a curve, such that your grade on a quiz depends not only on your performance, but also on the performance of others in the class. You and your classmates have two choices, to study for a quiz or not. If you and your classmates study for a quiz, you will receive Bs. If you study and they do not, you will receive an A and they will fail the quiz. If you choose not to study and neither do your classmates, you will receive Cs. But if your classmates study and you do not, they receive As and you will fail. Assume that all of your classmates make the same choice.

a. Who are the players? What are each player’s strategies?

b. Construct the payoff matrix.

c. What choice will you make? Explain why.

d. Is there a dominant strategy or equilibrium in this case? If so, list. If not, why not?

2. You are playing the game “rock, paper, scissors” with a friend. In this game, each of you makes the symbol for one of the three items (rock, paper, or scissors) with your hand and then you simultaneously reveal your choices. The winner of the game is determined by the following: rock smashes scissors (rock wins), paper covers rock (paper wins) and scissors cut paper (scissors win). If you each select the same item, it is a tie, and you play again.

a. Who are the players and what are the strategies in this game?

b. Is there a dominant strategy in the game? Explain.

c. Construct the payoff matrix for the game.
You are deciding whether to open your own fruit stand in your hometown this summer or just hang around your parents’ house. The returns to your decision depend on whether someone else also opens a fruit stand. The payoff matrix for your decision shows your summer earnings and is given below.

<table>
<thead>
<tr>
<th></th>
<th>Produce</th>
<th>Don’t produce</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>You</strong></td>
<td></td>
<td>You: $0</td>
</tr>
<tr>
<td>Produce</td>
<td>-$100 each</td>
<td>Someone else: $1000</td>
</tr>
<tr>
<td><strong>Someone else</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t produce</td>
<td>You: $1000</td>
<td>$0 each</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Someone else: $0</td>
</tr>
</tbody>
</table>

a. Identify two possible equilibrium outcomes in this game.
b. Suppose your parents decide to subsidize you with a $200 payment if you open your fruit stand. Revise the payoff matrix to account for the subsidy.
c. Why might your parents be willing to give you the subsidy (hint: use cost-benefit analysis).
d. What is the new equilibrium with the subsidy? Has the subsidy served your parents’ purpose?

**Multiple Choice Quiz**

1. Which of the following is a basic element of any game?
   a. Rules
   b. Winners
   c. Strategies
   d. All of the above
   e. None of the above

2. If a strategy yields a higher payoff no matter what other players in a game choose, it is called a(n) _______ strategy.
   a. dominant
   b. dominated
   c. winning
   d. optimal
   e. equilibrium

3. A Nash equilibrium occurs when
   a. one player has an incentive to change strategies.
   b. each player’s strategy is the best choice, given others’ strategies.
   c. each player in the game has a dominant strategy.
   d. no player in the game has a dominant strategy.
   e. none of the above.
4. Suppose each player follows a dominant strategy and the result is a smaller payoff for the group as a whole. This is an example of

a. a dominated strategy.
b. a cartel.
c. the ultimate bargaining game.
d. a prisoner’s dilemma.
e. none of the above.

5. The purpose of a cartel agreement is to

a. avoid conflict.
b. cover up illegal behaviour.
c. maximize risk.
d. decrease costs.
e. none of the above.

6. Cartel agreements often fail because of

a. increased profit.
b. increased cost.
c. incentives to cheat.
d. the lack of a dominant strategy.
e. all of the above.

7. When timing matters in a game, it is useful to summarize the game information using a(n)

a. decision tree.
b. payoff matrix.
c. demand/marginal revenue graph.
d. Jenkins Box.
e. all of the above.

Refer to the payoff matrix below for Question 8.

<table>
<thead>
<tr>
<th></th>
<th>Advertise</th>
<th>Don’t advertise</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RJR</strong></td>
<td>Advertise</td>
<td>$10 million each</td>
</tr>
<tr>
<td></td>
<td>Don’t advertise</td>
<td>RJR: $5 million Philip Morris: $5 million</td>
</tr>
<tr>
<td><strong>Philip Morris</strong></td>
<td>Advertise</td>
<td>RJR: $35 million Philip Morris: $5 million</td>
</tr>
<tr>
<td></td>
<td>Don’t advertise</td>
<td>$10 million</td>
</tr>
</tbody>
</table>

8. What are the dominant strategies for Phillip Morris and RJR?

a. Advertise, Advertise
b. Don’t advertise, Don’t advertise
c. Advertise, Don’t advertise
d. Don’t advertise, Advertise
e. They cannot be determined
Refer to the following decision tree for questions 9 and 10.

You: $100
Them: $100

You Choose

A
They choose

B
They choose

You: $60
Them: $105

You: $100
Them: $100

C
They choose

D
You: $500
Them: $400

E
You: $50
Them: $420

9. Which choice is dominant for you?
   a. A
   b. B
   c. Either A or B
   d. Neither A nor B
   e. D or F

10. If you choose B, which choice is dominant for them?
    a. E
    b. F
    c. Either E or F
    d. Neither E nor F
    e. C or D

Problems/Short Answer

1. Suppose your economics class is graded such that the average score on any exam is considered a C (i.e., average and passing). All you need to receive an A for the course is to pass the final exam. You make an agreement with your classmates to all skip the final (thus saving the cost of studying economics and giving you more time to study for other classes) so that the exam average is 0 and you all receive Cs.
   a. Do you decide to skip the final exam? Explain.
   b. What possible problem could result if you skip the final exam?
   c. What factors might affect your decision to skip the final exam (i.e., make you more or less likely to skip it)?
2. You and a competitor are each selling t-shirts with the university logo at a table on campus. You must decide whether to sell your t-shirts for $15 each or $20 each. The profit you receive will depend on how much you decide to charge and on how much your competitor decides to charge. The payoff matrix for the decision is given below.

<table>
<thead>
<tr>
<th>Your competitor</th>
<th>$15</th>
<th>$20</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15</td>
<td>$200 each</td>
<td>You: $0 Competitor: $400</td>
</tr>
<tr>
<td>$20</td>
<td>You: $400 Competitor: $0</td>
<td>$300 each</td>
</tr>
</tbody>
</table>

a. If $15 and $20 are the only two price choices, what are the dominant strategies for you and your competitor?
b. Is there an equilibrium? If so, what is it?
c. If each firm knows that cutting price a little further from $15 has the same effect as cutting it from $20 to $15, what will price equal in the end? Explain

Answer Key to Extra Questions in Instructor’s Manual

Sample Homework Assignment

1a. Players: you and your classmates (as a group). Strategies: study and not study.

b. 

<table>
<thead>
<tr>
<th>Classmates</th>
<th>Study</th>
<th>Not study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study</td>
<td>All Bs</td>
<td>You: F Classmates: A</td>
</tr>
<tr>
<td>Not study</td>
<td>You: A Classmates: F</td>
<td>All Cs</td>
</tr>
</tbody>
</table>

c. If your classmates study, your best response is to also study. If your classmates do not study, your best response is still to study. So you will choose to study.
d. Both you and your classmates have a dominant strategy of studying. The equilibrium is where all study, and all receive Bs.

b. There is no dominant strategy, since each strategy has an equal chance of winning and you don’t know your friend’s choice.
3a. The equilibria are: 1) you produce, someone else doesn’t; and 2) someone else produces, you do not.

b. The payoffs when you produce will be increased by $200 in each case.

c. Your parents offer the subsidy because the benefit of having you work rather than hang around the house exceeds the cost of $200.

d. Your new equilibrium is to produce. Yes, the subsidy has made certain you work rather than hang around the house.

Multiple Choice

1. c  
2. a  
3. b  
4. d  
5. e  
6. c  
7. a  
8. a  
9. a  
10. b
Problems/Short Answer

1a. The choice to skip or not depends on the student’s perception of classmates’ behaviour, risk aversion, desire for an A in the class, etc.
b. The possible problem is that other students may not skip the final and then those who skip it will fail the exam. This is a prisoner’s dilemma.
c. Factors such as the number of students, how well students know each other, if there is a mechanism for enforcement (e.g., all students will meet somewhere during the final exam), students’ grades, etc. will affect the likelihood of the agreement succeeding.

2a. The dominant strategy for each is $15.
b. Yes, at $15.
c. Price will eventually fall to equal marginal cost, since each firm knows that further cuts will lead to increased profit.