CHAPTERS 1 and 2

Introduction and General Principles

TEACHING SUGGESTIONS

These chapters try to arouse the students' interest and prepare the groundwork for the analysis to come. Chapter 1 uses several stories or examples to illustrate different kinds of strategic games, and Chapter 2 begins to connect them to a framework of concepts and terminology. Some teachers may find it better to mingle the two—pause after each story to define the concepts and terms relevant to it and then do the same with the next story. Others may prefer to present the stories from Chapter 1 as a way of stimulating student interest and capturing student attention, following their presentation with a summary of the terminology and the classifications found in Chapter 2.

Much of Chapter 2 may be most useful to students as a reference source—somewhere for them to turn to remind themselves about the difference between decisions and games, the game-theoretic meaning of rationality, or what distinguishes cooperative games from noncooperative games. You will certainly want to define those terms and concepts that you will focus on during the semester and emphasize the connections between the stories and the technical jargon used in analyzing them. It is probably not necessary at this stage to go into great detail about each level of classification, each term, and each assumption. A brief summary or discussion in the context of various stories will allow you to move forward; you can always return to specific concepts when they become crucial to your anlaysis later in the term.

Some of you will find that it is not a good idea to retell our stories from Chapter 1. Students can easily read them in advance, and depending on the culture of the institution at which you teach, many may do so. Others of you will find that you *can* retell our stories on the first day of class; while a few students may have read into the book already, the majority may be waiting for a syllabus (or even to buy the book). In either case, you can use our stories as the basis for variation or discussion. You can provide your own variations on the stories or ask the students to come up with stories of their own.

Whether you tell our stories or your own or have students think of their own, you can then start the discussion of a story by posing questions such as: Was this a game with strategic interaction or only a decision problem? If a game, who were the strategically active players? What were the strategies available to the players—not merely what they did but what else they could have done? In the light of their strategies, can we make sense of why they did what they did? And so on. This can quickly build up to a framework for understanding that a strategy is a complete plan of action, rollback, each player's simultaneously thinking of what everyone else is doing, or even equilibrium. This is also a good way to make the transition from the stories to the concepts of Chapter 2.

Most students in an elementary course will not have an extensive background in economics or politics or business studies. Therfore motivating them by using examples from these disciplines to introduce the ideas of strategies and games may not work. We have chosen the stories in Chapter 1 to relate to the lives of the students—relations with parents, siblings and friends, sports, and so on. If your class has some specific background, you should of course use it for sources of stories or cases. Thus, economics or business teachers may be able to use the OPEC cartel to motivate the prisoners' dilemma, repeated play, and the different strategic situations of large and small players, or a very simple version of a Keynesian low-level equilibrium trap (no firm invests and creates jobs because each doesn't think that it can sell the output profitably, because incomes are low, because firms aren't investing) to motivate the idea of lock-in equilibria in games with positive feedbacks. In courses more specifically targeted for political science students, teachers may be able to use campaign advertising or special-interest lobbying stories to introduce the prisoners' dilemma.

In later chapters, of course, we do develop examples from economics, politics, and so on, in each case explaining the discipline-specific contexts to the extent necessary.

You will find that there is no shortage of stories; by keeping an eye on recent news events, you will be able to get several with topical interest. More than likely, you will find examples of various concepts throughout the semester that help you make even clearer your points about multiperson prisoners' dilemmas or the importance of establishing the credibility of strategic moves, and so on. For example, the impeachment trial taking place in January and February of 1999 provided ample fodder for in-class analysis as did the Kosovo negotiations and air strikes ongoing that spring.

One way to increase your students' willingness or desire to apply what they are learning to actual events is to provide a semester-long assignment requiring each of them to add to a class collection of real-world events amenable to analysis using the theory of games and analyze them. It may take them a few weeks before they are able to do the appropriate analysis on their own, but you can add weekly event analyses to the collection until such time as they are able to take over that role. You do not have to restrict their examples to newsworthy events; many interesting and relevant examples can be culled from recent films or novels. The film *Waking Ned Devine*, for instance, has a wonderful example of a collective-action game and shows how individual incentives can be different from those of the group as a whole.

There are plenty of other sources for examples. The following books have several cases and stories, varying greatly in their context and relevance, sometimes with an explicitly game-theoretic analysis and sometimes without:

Steven J. Brams, *The Presidential Election Game* (New Haven, Conn.: Yale University Press, 1978).
Steven J. Brams, *Biblical Games* (Cambridge, Mass.: MIT Press, 1980).
Steven J. Brams, *Superpower Games* (New Haven, Conn.: Yale University Press, 1985).
Steven J. Brams and Alan D. Taylor, *Fair Division* (London/New York: Cambridge University Press, 1996).
Adam Brandenburger and Barry Nalebuff, *Co-opetition* (New York: Doubleday, 1996).
Avinash Dixit and Barry Nalebuff, *Thinking Strategically* (New York: Norton, 1991).
Erving Goffman, *The Presentation of Self in Everyday Life* (New York: Doubleday, 1959).
John Kay, *Why Firms Succeed?* (London/New York: Oxford University Press. 1995).
Paul Kennedy, ed., *Grand Strategies in War and Peace* (New Haven, Conn.: Yale University Press, 1991).
John McMillan, *Games, Strategies and Managers* (London/New York: Oxford University Press, 1996).
Howard Raiffa, *The Art and Science of Negotiation* (Cambridge, Mass.: Harvard University Press, 1982).
Richard Thaler, *The Winner's Curse: Paradoxes and Anomalies of Economic Life* (Princeton, N.J.: Princeton University Press, 1992).

In addition, there are several web sites dealing with game theory from the perspectives of research, teaching, and history of thought. Here are a few URLs:

Marko Grobelnik, Robert A. Miller, and Vesna Prasnikar have some downloadable software (for matrix games and extensive-form games) for running classroom experiments on the website http://www.cmu.edu/comlabgames

For teaching and research resources and many additional links, see:

David Levine, UCLA, for a focus on economic theory http://levine.sscnet.ucla.edu/
Alvin Roth, University of Pittsburgh, for a focus on laboratory experiments http://www.economics.harvard.edu/~aroth/alroth.html
David Epstein, Columbia University, for a focus on political science http://www.columbia.edu/~de11/gamethry.html

and for ideas on in-class experiments, some of which are appropriate for use with topics covered in this text

http://www.marietta.edu/~delemeeg/expernom.html

There is also a short history of the subject by Thomas Fent of the University of Vienna

http://www.math.tuwien.ac.at:1063/OR/Fent/Game/timetable.html

and a more-detailed history by Paul Walker of the University of Canterbury, New Zealand

http://william-king.www.drexel.edu/top/class/histf.html

GAME PLAYING IN CLASS

There are several games that are appropriate for use on the first or second day of class. These games are simple but can be used to convey important points about basic tools and concepts, including rollback analysis, multiple equilibria, focal points, and so on. Some of the games involve paying out or taking in small amounts of change in dimes or nickels. If you choose to play these, you should take enough rolls of coins to class with you; students usually do not have the right change. In addition, some of these games may be better suited for use later in the semester when you are covering the material relevant to the game. We have noted those games that are repeated later in the *Instructor's Manual* and the chapter in which they reappear.

GAME 1 Claim a Pile of Dimes

Two players A and B are chosen. The instructor places a dime on the table. Player A can say Stop or Pass. If Stop, then A gets the dime and the game is over. If Pass, then a second dime is added and it is B's turn to say Stop or Pass. This goes on to the maximum of a dollar (five turns each). The players are told these rules in advance. Play this game five times in succession with different pairs of players for each game. Keep a record of where the game stops for each pair.

This game is discussed in the text (Chapter 3, Figure 3.7), but most students will not have read that far ahead at this stage. Our experience is that the simple, theoretical subgame-perfect equilibrium of immediate pickup is never observed. Most games go to 60 or 70 cents, but you do see the students thinking further ahead. Later pairs learn from observing the outcomes of earlier pairs, but the direction of this learning is not always the same. Sometimes they collude better; sometimes they get closer to the subgame-perfect outcome.

After the five pairs have played, hold a brief discussion. Ask people why they did this or that. Develop the idea of rollback (or backward induction). Investigate why they did not achieve the rollback equilibrium; did they fail to figure it out, or did they understand it instinctively but have different objective functions? Don't prolong the discussion too much; you'll want time to get a few other games played.

This game could also be played to motivate the ideas of rollback right before they are covered with the material in Chapter 3. If you prefer to cover simultaneous-move games first, then you might want to save this game until after you have completed that material. However, if you are following the order of the material in the book, rollback is likely to be the subject of your lectures within the first two weeks; you could use this game to motivate the following week's lectures.

GAME 2 The Tire Story

Another game that we have successfully played in the first lecture is based on the "We can't take the exam; we had a flat tire" story from Section 2 of Chapter 1. Even if the students have read ahead, the discussion in the text makes it clear that there is no obvious focal answer to the question, "Which tire?"

Bring along a stack of index cards and, when you are ready to play this game, hand one card to each student. After relating the story, ask each student to pretend he is one of those taking the exam and must answer the tire question on the card. Collect the cards and tabulate the answers on the board. Start a discussion about why different students chose different tires; focus on the difficulties of obtaining a focal equilibrium when players have different backgrounds or concerns. You can also relate the discussion back to the material in the text regarding the necessity of being prepared to face a strategically savvy opponent at any time.

GAME 3 Bargaining

Two players A and B are chosen. Player A offers a split of a dollar (whole dimes only). If B agrees, both get paid the agreed coins and the game is over. If B refuses, it is B's turn but now the sum is only 80 cents. If A accepts B's offer, the two get paid the agreed coins. If A refuses, the game is over and neither gets anything.

Do this five times in succession with different pairs and the second-round totals falling successively to 70, 60, 50, and 40 cents. Keep a record of the successive outcomes.

Again hold a brief discussion. The aim is to get the students to start thinking about rollback and subgame perfectness and, if the students understand these strategies but still don't play them, why they don't. Also, consider how the discrepancy changes with the second-round fraction.

GAME 4 Auctioning a Penny Jar (Winner's Curse)

Show a jar of pennies; pass it around so each student can have a closer look and form an estimate of the contents. Show the students a stack of 100 pennies to give them a better idea of what the jar might contain. While the jar is going around, explain the rules. Everyone submits a "sealed bid"; hand out blank cards and ask the students to write their names and bids and return the cards. (This is also a good way for you to get to remember their names during the first meeting of the class or the section.) The winner will pay his bid and get money (paper and silver, not pennies) equal to that in the jar. Ties for a positive top bid split both prize and payment equally. When you explain the rules, emphasize that the winner must pay his bid on the spot in cash.

After you have collected and sorted the cards, write the whole distribution of bids on the board. Our experience is that if the jar contains approximately $5, the bids average to $3.50 (including a few zeros). Thus the estimates are on the average conservative. But the winner usually bids about $6. Hold a brief discussion with the goal of getting across the idea of the winner's curse.

The emphasis of this game is a concept relating to auctions which are not covered in the text until Chapter 15. It is a simple enough game to play early in the semester if you want to increase interest in the topics or hook additional students. One could certainly save this game until ready to cover auctions.

GAME 5 All-Pay Acution of $10

Everyone plays. Show the students a $10 bill, and announce that it is the prize; the known value of the prize guarantees that there is no winer's curse. Hand out cards. Ask each student to write his name and a bid (in whole quarters). Collect the cards. The highest positive bid wins $10; if two or more tie with the highest positive bids, they share the $10 equally. *All* players pay the instructor what they bid, win or lose.

Be sure to emphasize before bids are submitted that "This is for real money; you must pay your bid in cash on the spot. You can make sure of not losing money by writing $0.00. But of course if almost everyone does that, then someone can win with $0.25 and walk away with a tidy profit of $9.75."

Once you have collected the cards, write the distribution of bids on the board. Hold a brief discussion about the distribution and the value of the optimal bid. This game usually leads to gross overbidding; a profit of $50 in a class or section of 20 is not uncommon. If that happens, you will have to find ways of returning the profit to the class; we have done this by having a party if the sum is large enough or by bringing cookies to the next meeting if the sum is small. Of course, do not announce this plan in advance.

This game is also treated in Chapter 15. If you play the game on the first day, you can lead up to at least some of the points made there, even though the analysis at this early stage cannot go anywhere close to that level. If you prefer to follow this game with a more in-depth discussion and, perhaps, the derivation of the formula for the optimal bid, then you want to wait and play it when you get to Chapter 15.

ANSWERS TO EXERCISES FOR CHAPTER 2

1. (a) Not an interaction between mutually aware players, so a decision.
   (b) Again, probably not an interaction between mutually aware players. (There may be a strategic component to dress choice if girls are aware that each is buying one and if there is some benefit to being different from the others.)
   (c) For a college senior, the choice here is a decision.
   (d) Definitely a strategic interaction between mutually aware rival firms.
   (e) The choice of running mate is a game played between different gubernatorial candidates looking forward to the payoffs of votes in an upcoming election.
2. (a) (i) Simultaneous play; (ii) zero-sum; (iii) can be repeated, although description is of a single play; (iv) imperfect information (no information about what the other will do); (v) fixed rules; (vi) no external force available for enforcement.
   (b) (i) Sequential play; (ii) nonzero-sum game for voters; (iii) not repeated; (iv) full information; (v) fixed rules; (vi) party apparatus may provide mechanism for enforcement of agreements among voters in same party (if voters are elected officials).
   (c) (i) Simultaneous play; (ii) nonzero-sum; (iii) not repeated; (iv) imperfect information; (v) fixed rules; (vi) noncooperative.
3. False. This statement rules out the possibility that individuals may be concerned about fairness.
4. (a) Expected payoff = 0.5(20) + 0.1(50) + 0.4(0) = 15.
   (b) Expected payoff = 0.5(50) + 0.5(0) = 25.
   (c) Expected payoff = 0.8(0) + 0.1(50) + 0.1(20) = 7.
5. Prediction is about looking into the future to foresee which actions and outcomes will arise, while prescription is about giving advice regarding which actions should be taken. Prediction is important for individuals outside a game who want to determine what will happen in it. Prescriptive game theory can be used to help game players make good choices.