



Game Theory and Business Strategy

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Class times: Thursdays 6:00-9:00pm

Office hours: Fridays 2:00-5:00pm

1. Overview

This is a course on game theory and its application to business strategy. We will develop the basic tools of game theory through lectures and exercises, and we will put the tools to work by applying them to business examples and cases.*

2. Game Theory

Game theory studies competitive and cooperative behavior in strategic environments, where the fortunes of several players are intertwined. It provides methods for identifying optimal strategies and predicting the outcome of strategic interactions.

The field of game theory began around 1900 when mathematicians began asking whether there are optimal strategies for parlor games such as chess and poker, and, if so, what these strategies might look like. The first comprehensive formulation of the subject came in 1944 with the

*The course was developed jointly with Ken Cortis. I thank him for the many hours spent working on it together.

publication of the book *Theory of Games and Economic Behavior* by famous mathematician John von Neumann and eminent economist Oskar Morgenstern. As its title indicates, this book also marked the beginning of the application of game theory to economics. Since then, game theory has been applied to many other fields, including political science, military strategy, law, computer science, and biology, among other areas. In 1994 three pioneers in game theory were awarded a Nobel Prize, marking the ‘arrival’ of the field.

Among the other applications, game theory today is finding its way into the world of business. (Pick up a business magazine or book and there is a good chance that it will use some game-theory jargon: zero-sum game, Prisoner’s Dilemma, win-win game, etc.) As well as learning the underlying theory in the course, we’ll be looking at how game theory can indeed be applied to business.

3. Course Content

The course consists of five modules, which proceed from simpler games to progressively more complicated ones. (You can find a detailed day-by-day schedule in Section 7 below.)

Module: Thinking About What They’re Thinking

In this module we begin with a tour of some of the best-known games studied in game theory. With these games in mind, we then ask the basic question: How can a player choose a good strategy when the best choice depends on what strategies the other players in the game choose? To answer, we will introduce techniques for thinking through the game from the positions of the other players, and anticipating their choices. Topics covered in this module include:

- The Prisoner’s Dilemma, the Battle of the Sexes, the Coordination Game, market entry, innovation games, promotions strategy, “upping the ante,” ...

Module: Valuing the Players’ Positions

In this module, we will examine how value is created by the players in a game and how that value is divided up among them. We will ask: What determines how much value each player gets? To answer, we’ll define the concept of added value, and we’ll look at ways in which players can change their own added values and also the added values of other players. Topics covered in this module include:

- Generic strategies, buyer power, strategic positioning, “pay me to play,” globalization, multibusiness strategy, ...

Module: Moving First or Second

In this module, we look at games in which one player goes first, and then another player has to make a choice in response to what the first player did. We will ask: When is there a first-mover advantage in games of this kind, and when is there a second-mover advantage? To answer, we will look at how to analyze a game by starting at the end of the game and reasoning backwards to the beginning. We’ll also see the importance of being able to commit to particular moves in the game. Topics covered in this module include:

- Strategic commitment, incentives to innovate, entry and exit, “eating-your-own-lunch” strategy, “fast follower” strategy, ...

Module: Being Rational or Irrational

In this module, we look at more complicated games in which one player moves, then another player responds, then the first player moves again, etc. This is where strategies of bluffing, signaling, etc. come into play. We will ask: How can the players try to shape or influence what other players think about the game? We will see that a player will sometimes want other players to believe that it is acting rationally; and sometimes want other players to believe that it is acting irrationally! Topics covered in this module include:

- Games of bluffing, games of signaling, entry, betting, wars of attrition, contract negotiations, ...

Module: Linking Games

In this final module, we look at how separate games can be linked together to make a larger game. We will ask: When does a player do better—or worse—by playing the larger game rather than the smaller ones? Topics covered in this module include:

- Repeated games, bundling, complements, judo strategy, ...

4. Philosophy of the Course

This section describes some of the ‘design rules’ that are behind the course, and that we shall follow in the classroom.

4.1. Role of Mathematics Game theory is a mathematical field, and we will use some mathematics in the course. But this doesn’t mean that there’ll be lots of numbers or techniques. It just means that we’ll be extremely clear about what we are assuming and about what follows from our assumptions. The ability to be clear in this way is, in fact, the essence of mathematics! So, think of what we’ll do as more an exercise in careful logic—with some simple calculations thrown in. The mathematics in the course shouldn’t be a hurdle for anyone. (But, for those interested there will also be additional technical readings available.)

4.2 A First or Second Course? The course presupposes no knowledge of game theory. This said, it should also be of interest to people who have already taken a course in the subject, since it contains quite a bit of theory that isn’t covered in many courses. Also, most of the applications to business were developed especially for this course.

4.3 Legal and Ethical Aspects Discussions of game theory and business strategy may touch on legal issues. For example, antitrust laws determine, among other things, what types of business contracts are legal and what types are not. In this course, we will try to note some of the legal issues that can arise. This is the important domain of courses on the law and business. The course—like any course on business—will also likely raise very basic questions about what is ethical behavior in business, what is the purpose of business, etc. These are legitimate—indeed, vital—matters for discussion.

4.4 The Course and Beyond Some of the ideas I’ll bring to this course I have taught many times. But some course materials will be untested, as I try out new ideas that I think are important. I hope we’ll have many successes together in the classroom, but there are bound to be

a few failures as well. Still, I hope that even the failures will be, to use the language of the Apollo 13 mission, “successful failures.” (And I am pretty confident that we’ll arrive at the end of the course in one piece.) Most important, I consider the course only the start of a conversation among us that I hope continues long after the course itself is over.

5. Course Format

Most classes will have the following two-part format.

In the first part of the class, I’ll introduce the game theory we’ll learn that day, going over any notes on the theory that were assigned. We’ll then learn the theory by working through the assigned exercises together. We’ll go over the exercises in detail, making sure not just to calculate but also to understand! (I’ll also put complete solutions on Blackboard at the end of each class.)

In the second part of the class, we’ll connect the theory to business via the illustrations you were assigned to read. I’ll also have slides giving various applications of the theory.

6. Grading and Participation

There will be two graded pieces of work. One is a short, take-home midterm exam. This is designed so you’ll be able to test your understanding of the course concepts covered to that point. You’ll be asked to state definitions given in the readings, and to work through some simple exercises. The midterm will count for 25% of the overall grade.

The other piece of graded work is a short paper (a limit of 15 double-spaced pages), which you are expected to write in teams of four or more members. The paper will count for 75% of the overall grade. It should be a game-theoretic analysis of a real-world situation. I expect most students will write about business situations (either for-profit or non-profit), but some may choose to write about other areas. The paper should have four sections: (i) a short introduction describing the situation being analyzed; (ii) a game model of the situation; (iii) a discussion of the strategies employed by the players; and (iv) brief comments on issues outside the scope of the formal model. The emphasis of the paper should be on clear logic rather than lots of calculations.

On participation, everyone is expected to attend all classes and to participate actively in class. In class, we’ll go through the exercises together and discuss readings. Going through the exercises will be a very important part of how we learn game theory. You are expected to have prepared the exercises, and to come to class ready to try out your analyses, ask questions, and help all of us along. Over the course, I will make a judgment about each student’s level of involvement in class discussions, and, if a student’s written work falls between two grades, use this to decide the grade.

If you need to miss a class, please send me an email (in advance, if at all possible) letting me know. Remember that the course depends on each of us being present and participating.

7. Detailed Schedule

The table below gives a detailed schedule of classes, topics, materials, and assignments. You will see that there are three headings referring to course materials:

- a. **Materials** are the required readings for the classes. Most of these will be posted on Blackboard. A few items will be distributed separately.
- b. **Readings** are mostly illustrations of the theory, and will help a lot in seeing how to apply the theory we develop. You should cover these as well. Several of these items are from the books *Co-opetition* (by Adam Brandenburger and Barry Nalebuff, Doubleday, 1996) and *Thinking Strategically* (by Avinash Dixit and Barry Nalebuff, Norton, 1991). Please read through these books alongside the course. Articles listed in this section will be distributed separately.
- c. **Technical Background Material** is optional. This will be of interest to those of you who want to delve more deeply into the formal development of game theory, but it is okay to omit this set of materials.

<i>Date</i>	<i>Topic</i>	<i>Materials</i>	<i>Readings</i>	<i>Assignment</i>	<i>Technical Background Material</i> (Available at www.stern.nyu.edu/~abranden)
MODULE 1: THINKING ABOUT WHAT THEY'RE THINKING					
1. 2/12	Introduction to Matrix Games	Syllabus "Two-by-Two Games"	<i>Co-opetition</i> , Ch.1 <i>Thinking Strategically</i> , Ch.3	Please read the note "Two-by-Two Games" and also the readings from the two books. In class, I'll introduce the course, and then we'll go through "Two-by-Two Games" together and discuss applications.	"Technical Note on Dominance and Iterated Dominance" "Technical Notes on Nash Equilibrium: Definition; Existence; Self-Enforcing Agreement, Self-Fulfilling Beliefs, Randomization, Evolution"
MODULE 2: VALUING THE PLAYERS' POSITIONS					
2. 2/19	Introduction to Added Value	"Bargaining Games" "Exercises on Added Value"	<i>Co-opetition</i> , Ch.3, pp.40-49	Please read "Bargaining Games" and also the reading. Then work through "Exercises on Added Value." In class, we'll finish our discussion of "Two-by-Two Games," and then turn to the new material.	"Technical Notes on Cooperative Game Theory: Characteristic Functions, Allocations, Marginal Contribution; The Core"
3. 2/26	Added Value Contd.	"Added Value and Buyer Power"	<i>Co-opetition</i> , Ch.4, pp.71-76; Ch.5, pp.110-117 "Value-Based Business Strategy," by A. Brandenburger and H. Stuart, <i>Journal of Economics & Management Strategy</i> , 1996 "The Mousetrap Whodunit Turns 50," by M. Wolf, <i>Road Runner News</i> , 11/25/02	Please work through the exercise "Added Value and Buyer Power," and do the reading. In class, we'll continue going through "Exercises on Added Value," then look at some applications of the added-value concept, and then turn to the new exercise.	
4. 3/4	Strategic Positioning	"A Positioning Game" Excerpt from <i>All the Right Moves</i> , by C. Markides, Harvard Business School Press, 2000		Please read the exercise "A Positioning Game" and the excerpt from <i>All the Right Moves</i> , and then work through the questions in the exercise.	

MODULE 3: MOVING FIRST OR SECOND					
5. 3/11	Timing (Midterm exam handed out this week)	“Timing” “First-Mover Advantage?”	<i>Thinking Strategically</i> , Chs. 2, 5, 6	Please read “Timing” and work through the “First-Mover Advantage?” exercise. In class, I’ll introduce the module, and then we’ll turn to the exercise.	“Technical Note on Game Trees” “Technical Note on Backward Induction”
3/18	SPRING BREAK				
6. 3/25	Incentive to Innovate	“The Incentive to Innovate” Excerpt from “Airbus vs. Boeing in Superjumbos,” by B. Esty and P. Ghemawat, Harvard Business School, August 2001	“For Jet Rivals, Caution Here, Swagger There,” by E. Wong, <i>The New York Times</i> , 07/28/02	Please read the exercise “The Incentive to Innovate” and the excerpt from “Airbus vs. Boeing in Superjumbos,” and then work through the questions in the exercise.	
MODULE 4: BEING RATIONAL OR IRRATIONAL					
7. 4/1	Rationality and Irrationality	“Rationality and Irrationality” “An Entry Game” “A Good Bet?”	<i>Co-opetition</i> , Ch.3, pp.59-64 “Why We’re So Nice: We’re Wired to Cooperate,” by N. Anger, <i>The New York Times</i> , 07/23/02	Please work through the exercises “An Entry Game” and “A Good Bet?” and read the article “Why We’re So Nice.” In class, I’ll introduce the module, and then we’ll turn to the exercises.	“Technical Note on Common Knowledge”
8. 4/8	Signalling	“Signalling Games”	<i>Co-opetition</i> , Ch.7, pp.198-211 “Logic Behind Air Fares Often Defies Economics,” by Scott McCartney, <i>The Wall Street Journal Online</i> , 10/01/03 Excerpt from <i>The Handicap Principle: A Missing Piece of Darwin’s Puzzle</i> , by A. and A. Zahavi, Oxford University Press, 1997, xiii-xvi	Please work through the exercise “Signalling Games” and also the readings.	“Technical Note on Forward Induction”

MODULE 5: LINKING GAMES					
9. 4/15	Bundling	“Bundling”	<i>Co-opetition</i> , Ch.3, pp.57-58	Please work through the exercise “Bundling.” In class, I’ll introduce the module, and then we’ll turn to the exercise.	
10. 4/22	Complements	“Cheap Complements”	<i>Co-opetition</i> , Ch.2, pp.11-34; Ch.4, pp.100-103 “Reckonings; Microsoft: What Next?” by P. Krugman, <i>The New York Times</i> , 04/26/00	Please work through the exercise “Cheap Complements.” Also, read the article “Reckonings; Microsoft: What Next?”	
11. 4/29	Judo Strategy Course Summary	“Judo Strategy: Fear of Failure” “Judo in Action” “Judo Strategy: Fear of Fighting”	<i>Co-opetition</i> , Ch.8, pp.236-245 Excerpt from <i>Judo Strategy</i> , by D. Yoffie and M. Kwak, Harvard Business School, 2001	Please work through the exercise “Judo Strategy: Fear of Failure.” Also, read “Judo in Action” and answer Question 1 there. If time permits, we’ll start on “Judo Strategy: Fear of Fighting,” so please start preparing this exercise, too.	
12. 5/6	Judo Strategy Contd. Course Summary (Papers due)		Review of <i>Judo Strategy</i> , by A. Brandenburger, <i>Manageris</i> , February 2002	We’ll continue going through “Judo Strategy: Fear of Fighting,” and also discuss Question 2 in “Judo in Action.” After that, I’ll give a summary of the course.	