



Game Theory and Business Strategy

B65.3323
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Class times: T 1:30-4:20pm or W 6:00-9:00pm or R 1:30-4:20pm

Office hours: R 5:00-7:00pm

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 outcomes 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 publication of the book *Theory of Games and Economic Behavior* by famous mathematician

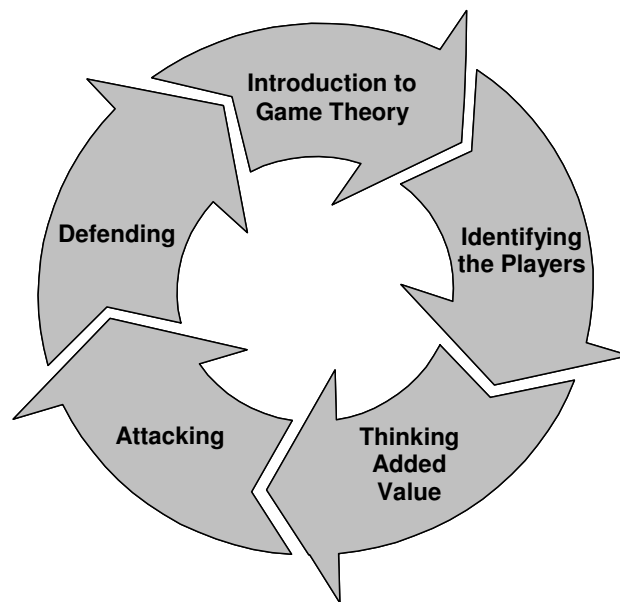
*This course draws on much work with my colleagues Ken Cortis, Elon Kohlberg, Vijay Krishna, and Harborne Stuart. I am greatly indebted to them. May Cowan (Stern MBA 2003) and SeungEun Lee (Stern MBA 2004) provided valuable assistance.

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. In 2005, two other prominent researchers in game theory were awarded a Nobel Prize.

Nowadays, the use of game-theory jargon—zero-sum game, Prisoner’s Dilemma, win-win game, etc.—is widespread. In this course, we will go beneath the jargon to learn the underlying theory.

3. Course Content

Here is an outline of the course. (You can find a detailed day-by-day schedule in Section 7 below.)



Module 1: Introduction to Game Theory

The question of this module is: What is a game? To answer, we will introduce the basic building blocks of game theory: game matrices and methods of analysis of matrices. We will also develop a complete classification of two-by-two game matrices, and apply this scheme to a number of game situations.

Module 2: Identifying the Players

The question of this module is: Who are the players in a game? To answer, we will list the different types of players that are possible. We will also look at the multiple roles that players can occupy.

Module 3: Thinking Added Value

The question of this module is: How much does a player get in a game? To answer, we will introduce the game-theoretic concept of added value. We will look at ways in which players can change their own added values and also the added values of other players.

Module 4: Attacking

The question of this module is: How can a player win as a challenger? To answer, we will develop some more building blocks of game theory: game trees and methods of analysis of game trees. We will also examine the significance of rationality and irrationality in games. We will then study some specific strategies for attacking.

Module 5: Defending

The question of this module is: How can a player outrun rivals? To answer, we will again develop some general theory and consider some specific strategies.

4. Philosophy of the Course

This section describes some of the “design rules” behind the course and which 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 does not mean that there will be lots of numbers or techniques. Rather, it means that we will be extremely clear about what we are assuming and about what follows from our assumptions. The ability to be clear in this way can be said, in fact, to be the essence of mathematics! So, think of what we will 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. (A useful reference is “A Note on Antitrust and Competitive Tactics,” by Dennis Yao, 9-703-493, Harvard Business School.) 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 will 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 will 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.” 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 will introduce the game theory we will learn that day, going over any notes on the theory that were assigned. We will then learn the theory by working through the assigned exercises together. We will go over the exercises in detail, making sure not just to calculate but also to understand! (I will also put complete solutions on Blackboard at the end of each class.)

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

6. Grading and Participation

There will be three graded pieces of work. One is a short, take-home midterm exam. This is designed so you will be able to test your understanding of the course concepts covered to that point. You will be asked to state definitions given in the readings, and to work through some simple exercises. The midterm will count for 30% of the overall grade.

There will be a short take-home quiz, handed out towards the end of the course. This will ask you to analyze a specific game, and counts for 15% of the overall grade.

Finally, there is a short paper (a limit of 10 pages), which you should write in teams of four or more members. The paper will count for 55% 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 five sections: (i) a short executive summary; (ii) a short description of the situation being analyzed; (iii) a game model of the situation; (iv) a discussion of the strategies employed by the players; and (v) 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 will 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, to ask questions, and to 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.

(If you have a qualified disability and will require academic accommodation during this course, please contact the Moses Center for Students with Disabilities (CSD, 998-4980) and provide me with a letter from them verifying your registration and outlining the accommodations they recommend. If you will need to take an exam at the CSD, you must submit a completed Exam Accommodations Form to them at least one week prior to the scheduled exam time to be guaranteed accommodation.)

7. Detailed Schedule

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

- a. **Materials and Exercises** are the basic readings for the classes. Most of these will be posted on Blackboard. There are readings from the books *Co-opetition* (by Adam Brandenburger and Barry Nalebuff, Doubleday, 1996) and *Thinking Strategically* (by Avinash Dixit and Barry Nalebuff, Norton, 1991). A few items are in the XanEdu coursepack.
- b. **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 and Exercises</i>	<i>Assignment</i>	<i>Technical Background Material</i> (Available at www.stern.nyu.edu/~abranden)
INTRODUCTION				
1. 1/29	Introduction to Games	a. Syllabus b. "Introduction to Game Theory" note c. "Game Theory and Business Strategy" slides d. "Introduction to Game Theory" slides e. <i>Co-opetition</i> , Ch.1 f. <i>Thinking Strategically</i> , Ch.3	Please read the note "Introduction to Game Theory." In class, I will introduce the course, and then we will go through the note together and discuss applications.	a. "Dominance and Iterated Dominance" b. "Nash Equilibrium: Definition; Existence; Self-Enforcing Agreement, Self-Fulfilling Beliefs, Randomization, Evolution"
IDENTIFYING THE PLAYERS				
2. 2/5	The Players	a. "Example of Game Analysis" slides b. "The Players" slides c. "Cheap Complements" exercise d. "Complements Strategy" slides e. <i>Co-opetition</i> , Ch.2 f. "Automakers in the Driver's Seat" note	Please work through the exercise "Cheap Complements."	
THINKING ADDED VALUE				
3. 2/12	Added Value	a. "Added Value" note b. "Value Creation" slides c. "Added Value" slides d. "Exercises on Added Value" exercise	Please read the note "Added Value" and then work through "Exercises on Added Value."	a. "Cooperative Game Theory: Characteristic Functions, Allocations, Marginal Contribution"
4. 2/19	Added Value contd.	a. "Example of Value Calculation" slides b. "Applications of Added Value" slides c. <i>Co-opetition</i> , Ch.5, pp.110-117 d. "Value-Based Business Strategy," by Adam Brandenburger and Harborne Stuart, <i>Journal of Economics &</i>	In class, we will continue going through "Exercises on Added Value," and then look at some applications of the added-value concept.	a. "Biform Games," by Adam Brandenburger and Harborne Stuart, <i>Management Science</i> , 53, 2007, 537-549

		<i>Management Strategy</i> , 5, 1996, 5-24		
5. 2/26	Added Value contd.	a. "Theory of Added Value Continued" slides	We will finish our investigation of the added-value concept.	
ATTACKING				
6. 3/4	Game Trees	a. "Game Trees" note b. "Decision Trees" slides c. "Game Trees" slides d. "Exercises on Game Trees" exercise e. <i>Thinking Strategically</i> , Chs. 2, 5, 6 f. "Aspens Return to Yellowstone, With Help From Some Wolves," by Virginia Morell, <i>Science</i> , 07/27/07	Please read the note "Game Trees," work through "Exercises on Game Trees," and read the article "Aspens Return to Yellowstone, With Help From Some Wolves."	a. "Game Trees" b. "Backward Induction"
7. 3/11	Rationality and Irrationality (Midterm exam handed out this week)	a. "Rationality and Irrationality" slides b. "An Entry Game" exercise c. "A Good Bet?" exercise d. "Analysis of Rationality and Irrationality" slides e. <i>Co-opetition</i> , Ch.3, pp.59-64 f. "Why We're So Nice: We're Wired to Cooperate," by Natalie Angier, <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."	a. "Common Knowledge"
3/18	Spring Break			
8. 3/25	Judo Strategy	a. "Judo Strategy" slides b. "Judo Strategy: Fear of Failure" exercise c. "Judo in Action" note d. "Analysis of Judo" slides e. <i>Co-opetition</i> , Ch.8, pp.236-245 f. Excerpt from <i>Judo Strategy</i> , by David Yoffie and Mary Kwak, Harvard Business School Press, 2001	Please work through the exercise "Judo Strategy: Fear of Failure." Also, read "Judo in Action" and answer Question 1 there.	
9. 4/1	Judo Strategy contd.	a. "Judo Strategy: Fear of	Please work through the exercise	

		Fighting” exercise b. “Incumbency and Irrationality” slides	“Judo Strategy: Fear of Fighting.” Also, answer Question 2 in “Judo in Action.”	
DEFENDING				
10. 4/8	Signalling	a. “Signalling Games” exercise b. “Signalling” slides c. <i>Co-opetition</i> , Ch.7, pp.198-211 d. Excerpt from <i>The Handicap Principle: A Missing Piece of Darwin’s Puzzle</i> , by Amotz and Avishag Zahavi, Oxford University Press, 1997	Please work through the exercise “Signalling Games.”	a. “Forward Induction”
11. 4/15	Bundling	a. “Introduction to Bundling” slides b. “Bundling” exercise	Please work through the exercise “Bundling.”	
12. 4/22	Bundling contd. (Take-home quiz handed out this week)	a. “Application of Bundling” slides b. “Linking Games” slides		
13. 4/29	Course Summary			
14. 5/6	Papers due			

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