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

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

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 will be looking at how game theory can indeed be applied to business.

3. Course Content
The course consists of five modules. (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’ 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 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 is, in fact, 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, 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 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.
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<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Materials and Exercises</th>
<th>Assignment</th>
<th>Technical Background Material</th>
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<tr>
<td>1/23</td>
<td>Introduction to Games</td>
<td>a. Syllabus b. “Introduction to Game Theory” note c. “Game Theory and Business Strategy” slides d. “Introduction to Game Theory” slides e. Co-opetition, Ch.1 f. Thinking Strategically, Ch.3</td>
<td>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.</td>
<td>a. “Dominance and Iterated Dominance” b. “Nash Equilibrium: Definition; Existence; Self-Enforcing Agreement, Self-Fulfilling Beliefs, Randomization, Evolution”</td>
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<td>2/13</td>
<td>Added Value contd.</td>
<td>a. “Example of Value Calculation” slides b. “Applications of Added Value” slides c. “More on Value Spreads” slides d. Co-opetition, Ch.5, pp.110-117</td>
<td>In class, we will continue going through “Exercises on Added Value,” and then look at some applications of the added-value concept.</td>
<td>a. “Biform Games,” by Adam Brandenburger and Harborne Stuart, forthcoming in Management Science</td>
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<td>Date</td>
<td>Theme</td>
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| 5. 2/20 | Strategic Positioning | a. “Strategic Positioning” slides  
b. “A Positioning Game” exercise  
c. “Analysis of Strategic Positioning” slides  
Please work through the exercise “A Positioning Game.” |
| 6. 2/27 | Game Trees | a. “Game Trees” note  
b. “Decision Trees” slides  
c. “Game Trees” slides  
d. “Thinking Strategically”, Chs. 2, 5, 6  
Please read the note “Game Trees.”  
a. “Game Trees”  
b. “Backward Induction” |
| 7. 3/6 | 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. Co-peration, Ch.3, pp.59-64  
f. “Why We’re So Nice: We’re Wired to Cooperate,” by Natalie Angier, The New York Times, 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” |
| 3/13 | Spring Break | |
b. “Judo Strategy: Fear of Failure” exercise  
c. “Judo in Action” note  
d. Co-peration, Ch.8, pp.236-245  
Please work through the exercise “Judo Strategy: Fear of Failure.”  
Also, read “Judo in Action” and answer Question 1 there. |
Please work through the exercise “Judo Strategy: Fear of Fighting.” |
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<th>Date</th>
<th>Activity</th>
<th>Notes</th>
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<tr>
<td>10. 4/3</td>
<td>Signalling</td>
<td>b. “Signalling Games” exercise</td>
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<td>a. “Signalling Games” exercise</td>
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<td>a. “Signalling Games” exercise</td>
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<td>b. “Signalling” slides</td>
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<td>c. Co-opetition, Ch.7, pp.198-211</td>
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<td>Please work through the exercise</td>
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<td>“Signalling Games.”</td>
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<td>a. “Forward Induction”</td>
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<td>11. 4/10</td>
<td>Bundling</td>
<td>a. “Introduction to Bundling” slides</td>
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<td>b. “Bundling” exercise</td>
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<td>Please work through the exercise</td>
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<td>“Bundling.”</td>
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<td>12. 4/17</td>
<td>Bundling contd.</td>
<td>a. “Application of Bundling” slides</td>
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<td>(Take-home quiz handed out this week)</td>
<td>b. “Linking Games” slides</td>
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<td>13. 4/24</td>
<td>Course Summary</td>
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<td>14. 5/1</td>
<td>Papers due</td>
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