MGRECON402: Game Theory for Strategic Advantage
Course Outline (Not Complete Syllabus)

LOGISTICS

Professor: David McAdams
Offered: Spring Term 1
Time: see Fuquaworld
Location: see Fuquaworld

OVERVIEW

People rarely make decisions in a vacuum. The choices we make affect others, and their choices impact us. Such situations are known as “games” and game-playing, while sounding whimsical, is serious business. Managers frequently play games both within the firm with other divisions and subordinates, etc. as well as outside the firm with competitors, customers, regulators, and even capital markets! The goal of this course is to enhance your ability to think strategically in complex, interactive environments. Knowledge of game theory will give you an advantage in such strategic settings.

The course is structured around three “themes for acquiring advantage in games”:

1. Limited rationality: How to play when others may not be fully rational, and when others are uncertain about your rationality.
2. Commitment / strategic moves: Credibility, threats, and promises as ways to change the game being played.
3. Exploiting hidden information: When to reveal information or not, including when to surprise an opponent. Adverse selection as a strategic force.

Specific issues that arise in business strategy will act as motivation, but this is not a course about business tactics. For instance, you will not necessarily become a better trader or a better negotiator. Rather the goal is to provide you with a deeper understanding of key issues that arise in a wide variety of strategic situations.

As a core discipline of economics, game theory is applied in many other courses offered at Fuqua. We will discuss a wide variety of these examples, but this course is designed

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primarily to provide you with deeper intuitions and a framework for thinking about interactive strategic settings. While the course is designed to complement Fuqua’s other economics and strategy offerings, it is self-contained. There are no prerequisites beyond the Core economics course.

My view is that the important ideas of game theory are best mastered not at the level of some abstract theory but through the flesh and blood of real examples. For this reason, we will discuss numerous real-world examples and analyze games that arise in business settings. Indeed, the most important element of the course is a team project in which students will identify a real-world game of interest, analyze it using the tools of the course, and offer concrete strategic advice to some player in the game.

In the same spirit, my goal is to teach game theory, not mathematics. Actually, students will discover a fascinating paradox: the more transparent the mathematics, the more interesting and challenging the issues that can arise. For example, in the other microeconomics courses offered at Fuqua, students learn how to calculate the Nash equilibria of a given game, but such mathematical analysis is not in itself very illuminating. We will of course use reaction curves and such as tools but only ultimately to get to ideas that are mathematics-free. So when someone asks you a simple question without all of the equations and curves (say “Should we pursue a cost-reducing innovation that will ultimately lower both our costs and our competitors?”) you will have a ready understanding of the key strategic issues involved.

GRADES

The determinants of grades may change somewhat from year to year, as I add / remove some of the smaller assignments each year. (A syllabus will be distributed on the first day of class that provides full details.) However, the most important elements of the class will remain the same every year:

1. **Final Project** is the most important deliverable of the course and constitutes the largest percentage of the grade – typically at least 40%. (See below.)
2. **Participation** constitutes the second-largest percentage of the grade – typically at least 25%. (See below.)
3. **There is no Final Exam**.

AUDITORS / LISTENERS

There will be no auditors or listeners.

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2 These applications are wide-ranging: games played between rival firms in competitive analysis; games played between firms and their suppliers and between managers and their employees in strategy; not to mention applications in negotiations, international macoeconomics, corporate finance, etc…
PARTICIPATION

The participation grade is based on several factors. In particular, your participation grade will be outstanding if you can answer “Yes” to all of the following questions.

- Have you shown respect to your classmates, by (i) refraining from rude or insulting comments, (ii) arriving on time, etc?
- Have you played all of the online games and participated in both of the online tournaments?
- For each of the in-class games, did you treat the worksheet assignment seriously enough to provide thoughtful answers (not just “I would do X” but a coherent explanation for your choice)?
- Have you made meaningful contributions to the online discussion board?

There are additional factors – extra credit based on your performance in the tournaments, or in certain games to be played in class – as well as a qualitative assessment on my part of your overall contribution to the class dynamic. (Your grade will NOT depend on how many times you speak during class.)

GAMES

ONLINE GAMES: Prior to several of the lectures, students will play an online game. Preparation is unnecessary. Most games require about 5-15 minutes to play. Full participation credit will be given for playing the game, regardless of your “score”. (However, results will be announced in class.)

LOGISTICS OF ONLINE GAMES: Online games will be available from the course website as surveys. Games will become available on the day of the lecture in which they are announced and must be played by 5:00 PM the day prior to the next lecture.

IN-CLASS GAMES: In most of the lectures, we will play a game in class that requires preparation before class. This will involve reading and completing a 1-2 page worksheet. Full participation credit will be given for a thoughtfully completed worksheet (given to the TA at or before the beginning of class), regardless of whether your reasoning is correct.

TOURNAMENTS: You will submit a strategy and a robot will play that strategy on your behalf in two computerized tournaments. Full participation credit will be given for submitting a strategy. The top three finishers – Gold, Silver, Bronze – will get extra credit as well.
QUizzes

There will be three in-class quizzes. Quizzes are open notes and occur at the beginning of class. Sample questions with solutions will be provided. Quiz problems will be very similar to sample questions.

Your overall quiz-grade will be based on your best two out of three quizzes.

Final Project

Provide strategic advice to a player of a “real-world” game. (You need not gather actual data. It suffices to consider a hypothetical scenario that could be real.)

Deliverable: memo of any length\(^3\) -- the best memos are often fairly brief -- addressed to the relevant party in the game, as well as an appendix addressed to Professor McAdams that contains supporting analysis.

Collaborating with the Professor is encouraged:

This is the most important element of the course. As such, you should begin thinking about your final project as early as possible. In particular, during the middle of the course, I will be available for collaborative “brainstorming sessions” to talk with you and your team about your ideas. (These sessions are not required.) Coming to these sessions, you should have an idea of a game (or two) you’d like to study. I can then work with you to explore ways to make that game as interesting and “juicy” as possible from a game theory perspective.

Please do not be shy about approaching me regarding your final project. Interacting with you as you work on your final project is the most satisfying part of the course for me.

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\(^3\) The most successful memos will clearly convey the “bottom line” of your motivation, assumptions, analysis, and conclusions to the relevant player. As long as it is effective and helpful to this player, it may be short or long. The very best projects will, as appropriate, include a careful, correct, and creative application of game theoretic ideas and techniques in the appendix.
Course Outline [subject to change]

D&S refers to “Games of Strategy, 2nd edition” by Avinash Dixit and Susan Skeath. [Readings may change if we adopt a newer edition of the textbook.]

Readings denoted by (**) are the most important readings in the course. (There are only three such readings.) Readings denoted by (*) contain material that will be discussed in class, and I expect you to have read it prior to class. Other readings provide valuable background but need not be completed prior to class.

Class 1

Topics: Games businesses play. Raymond Smith’s “game theory way of business”. Warren Buffett’s “billionaire’s buyout plan”.

Preparation (beyond reading): None

Reading:

D&S Chapter 1 (Introduction), 2 (Basics), 4 - 4.2 (Nash)

We cover a lot of ground in this course, and I will not spend much time on the basics. For example, you should know (i) the meaning of dominated strategy, (ii) how to compute each the Nash equilibria in a simultaneous-move game and (iii) how to draw a game-tree and compute the equilibria in a sequential-move game. These concepts were introduced in the core Managerial Economics course.


This is one of the most important readings in the course. Raymond Smith has clearly internalized the mind-set of a game-theorist, which he credits as the secret of his success at the helm of Bell Atlantic during the 1990s. Read this article before the first class, and then re-read it after the last class.


Warren Buffett describes a game that he would like politicians to play. We shall discuss this game in class, so consider it carefully. What do you think about Buffett’s idea? Would it work? Why or why not?
Class 2


Preparation: (1) Play online games “Beauty Contest” and “Entry” by 5:00PM on the day before class. (2) Prepare worksheet for “Partnership Game” and turn it in to TA at/before the beginning of class.

Other notes: Class will begin with a movie clip from “Princess Bride”.

Reading:

D&S Chapter 4.3 - 4.4 (Dominance, Best response), 5.2 – 5.3 (Critique of Nash)

(**) “The Game Menagerie” by David McAdams.

Quiz #1 will focus on identifying each type of game catalogued in the Game Menagerie. (The quiz will be open notes.) This reading will take weeks to digest fully. For now, focus on how to identify each type of game – not on optimal strategy in each game. A handout with practice problems and solutions will supplement this reading.

(*) “On the Persistence of Consumer Myopia” by Cabot Henderson (MBA 2007) and David McAdams.

This note explores how more rational decision-making may (or may not!) emerge as the result of games played among firms. Namely, will competition among firms lead to more rational decision-making by consumers? When should we expect competitive firms to educate consumers more or less than a monopolist?


The field of “behavioral economics” brings insights from psychology into economics, exploring the implications of human limitations (e.g. “bounded rationality” and limited willpower) for economic decision-making.

Class 3

Topics: Group (ir)rationality: When should one (not) trust “the wisdom of crowds”? Strategic imitation (management fads, fashion leadership) and information cascades.

Preparation: (1) Complete online survey “Who Wants to be a Millionaire?” by 5:00PM on the day before class. (2) Prepare worksheet for “Guessing Game” and turn it in to TA at/before the beginning of class.
Reading:

D&S Chapter 3 (Sequential moves)


A major topic for today’s class is “informational cascades”, which arise when people’s decisions convey information that can influence others’ decisions.


A competing paradigm, reflected in various approaches from "crowd-sourcing" to "prediction markets", holds that groups of decision-makers can be trusted to "get it right". In what sorts of environments is crowd-sourcing (in)appropriate?


Class 4

Topics: More on games with dominated strategies: Defensive innovation and the “Master & Servant Game”. Escaping the Prisoners’ Dilemma, Parts I-II: Change strategies (e.g. regulation) or change payoffs (e.g. social sanctions).

Preparation: (1) Prepare worksheet for “Go Nuclear!” and turn it in to TA at/before the beginning of class. (2) Prepare for open-notes quiz at start of class (Quiz #1 on Game Menagerie).

Reading:

(*) Dixit & Skeath 11.6 [Prisoners’ Dilemma examples]


This paper advances the idea that many economic agents base decisions not on the basis of “pure self-interest” but also on considerations of “reciprocity”, and that this helps explain some puzzling features of labor market interactions, public goods, and social norms. Such “social concerns” will be a major topic of today’s lecture, and a theme to which we will return during the course.

In class, we shall discuss the cat-and-mouse game played among firms attempting to collude and regulatory agencies attempting to detect their collusion. For those especially interested in this topic, this discussion paper by a leading researcher of cartel dynamics delves more deeply into this topic.

Class 5.

Topics: Case: DeBeers’ Diamond Dilemma. Introduction to strategic randomness: Hide & Seek Game, with application to bluffing and monitoring effort.

Preparation: (1) Complete online survey for “DeBeers Diamond Dilemma” case by midnight on the day before class. (2) Play online game “Monitoring” by 5:00PM on the day before class. (3) Prepare worksheet for “Bluffling Game” and turn it in to TA at/before the beginning of class. (4) Submit tournament strategy for “Bluffling Madness” by 5:00PM after class.

Reading:


How can DeBeers face the threats posed by synthetic diamonds and its diminished power? As part of your case preparation, be sure to complete the online survey. I will incorporate survey responses into class discussion.


Other precious stones, such as emeralds, are produced and distributed in a much more decentralized fashion than diamonds. How has this impacted their “value”? Do structural features of the market for emeralds make that market more or less vulnerable than diamonds to the threat of man-made precious stones?

(*) Dixit & Skeath 7.1-7.3 [Mixed strategies]

“Mating Games and Lizards” by Ivars Peterson, Mathland, April 15, 1996.

Who knew lizards could play “rock-paper-scissors” (RPS)? We will play a game in class based on RPS. If you want to win, this article is worth a careful read.
Class 6. Tournament debrief: “Bluffing Madness”. **Cooperation and conflict.** Introduction to Assurance Game and Chicken Game, with applications to standards adoption, negotiation, and conflict intermediation. Commitment as a solution to miscoordination in the Assurance Game. Differentiation as a solution to conflict in the Chicken Game.

**Preparation:** (1) **Play online game** “New Market” case by 5:00PM on the day before class. (2) **Deliver team assignment** “American Airlines Strategy Memo” at start of class.

**Reading:**

(*) **D&S 8.1 [More on mixed strategies]**

This reading provides more detail on the analytics of mixed strategies – useful for the upcoming quiz – as well as a discussion of one useful interpretation of mixed strategies as beliefs.

**D&S 8.2 [Yet more on mixed strategies]**

It’s not essential that you master the details of how to solve for mixed strategies in games with more than two actions – no such game will appear on the quiz – but some students may find this section interesting.

(*) **D&S 4.7, 13.3-13.5 [Assurance, Chicken games]**

The Assurance and Chicken games will play a recurring role throughout the course, as examples to highlight and organize key ideas surrounding coordination and conflict.

(*) **“Genetic Mutiny and Gender” by Matt Ridley**

This reading makes a fascinating case that gender – the labeling of creatures as “male” and “female” and the fact that males can only sexually reproduce with females, and vice verda – evolved as the solution to a “war” waged among genes. In class, we will discuss how this example suggests a general approach to gain an advantage in games of conflict.

Class 7. First-mover (dis)advantage, with application to counter-insurgency. **Escaping the Prisoners’ Dilemma, Part III:** change timing of moves. Ingredients of first-mover (dis)advantage, with application to counter-insurgency. **Threats and promises.** Delegation and third-party enforcement. Credibility in dynamic games.

**Preparation:** (1) **Prepare worksheet** for “Dynamic Pricing” and turn it in to TA at/before the beginning of class. (2) **Prepare for open-notes quiz** at start of class (Quiz #2 on Mixed Strategies).
Reading:

(*) Dixit and Skeath, Chapter 10

Promises, threats, and other so-called “strategic moves” – in which a player commits to respond to the other player’s move in some way – are among the most interesting and important ways to transform a game to one’s advantage. They play a central role in the course and, most probably, in many of your final projects.

(*) “Counterinsurgency warfare: theory and practice” by David Galula

This article is drawn from the reading list of the US Military Academy’s introductory course on counter-insurgency. As you read this, think about “who moves first” and how counter-insurgency strategy attempts to transform a first-mover disadvantage into a first-mover advantage. We will discuss the example of counter-insurgency in class.


This article provides a fairly comprehensive, strategy-oriented discussion of various sources of first-mover advantage and disadvantage. This reading is a natural follow-up to the content of today’s class, for those interested in more.

Class 8. GMSI visit. Executives from General Motors Strategic Initiative (GMSI) will visit today’s class and present for the first hour. [GMSI Visit depends on executive availability.] Strategic substitutes and complements. Optimal pre-emptive moves.

Preparation: None.

Reading:

(**) Lecture Note on Strategic Substitutes and Strategic Complements by David McAdams.

The concepts of strategic substitutes and complements tie together many of the key ideas of the course and, as such, this is one of the most important readings of the course. It is also probably the most difficult reading in the course; don’t expect to fully digest the details on the first reading. Part I is the most important section to study for now. Part II explores the topic of first-mover advantage (discussed in an earlier class) through the lens of strategic substitutes and complements.

Preparation: (1) Complete online survey for “Rebuilding New Orleans” case by midnight on the day before class. (2) Prepare worksheet for “Switching Game” and turn it in to TA at/before the beginning of class.

Reading:

(*) Chapter 4 of “The Evolution of Cooperation” by Robert Axelrod.

This fascinating book helps us understand the driving forces behind the evolution of cooperative enterprise – as well as the reasons for the breakdown of cooperation – with profound implications. The assigned chapter explores one interesting example, the rise and fall of cooperative behavior among enemy combatants in the trench warfare of WWI. The book as a whole is well worth your time, if you are interested in more.

(*) Case: “Rebuilding New Orleans” by Dan Gagne (Game Theory TA), 2006.

New Orleans was devastated by Hurricane Katrina on August 29th, 2005. This case picks up the story on January 1st, 2006, when Vice Admiral Thad Allen was named to lead the federal response. As part of your case preparation, be sure to complete the online survey.


The police department in High Point, North Carolina faces the opposite sort of problem as the authorities in New Orleans, as they struggle to break up a thriving community of drug dealers and users.


Like other economic activity, entrepreneurship and technological innovation tend to spark in coordinated clusters. Does this mean that Silicon Valley’s pre-eminence is threatened by the rise of other entrepreneurial centers (such as Bangalore)?


Preparation: (1) Prepare worksheet for “Angry Negotiation Game” and turn it in to TA at/before the beginning of class. (2) Prepare for open-notes quiz at start of class (Quiz
Submit tournament strategy for “Angry Madness” by 5:00PM after class.

Reading:


Schelling was awarded the 2005 Nobel Memorial Prize in Economics for “having enhanced our understanding of conflict and cooperation through game-theory analysis”. This book is probably his most influential work.

(*) D&S Chapter 14 (Brinkmanship) and 9.5-9.6 (Signaling games - skip 9.5C-9.5D)

Brinkmanship will be a major topic of today’s class, with the Cuban Missile Crisis as one example developed in the textbook. Unwillingness to yield in a brinkmanship game is a credible “signal” of toughness. We shall discuss other applications of signaling in this and later classes, culminating in the “Crazy(?) Incumbent Game” to be played in Class #12, in which players’ actions can function as credible signals of their “irrationality”!!

Class 11. Tournament debrief: Angry Madness. Auctions and auction design. How many competitive interactions can be viewed as “auctions in disguise”. Designing auctions to maximize revenue.

Preparation: Play online game “Takeover Bidding” by 5:00PM on the day before class.

Reading:

(*) Lecture Note on Auction Theory by David McAdams.


This article provides an up-close look at a multi-party negotiation. We will use this example to illustrate how auction theory – namely, the “Revenue Equivalence Theorem” discussed in the lecture note – can guide negotiation design.


In the past decade, game theorists have played a major role in designing the auctions used by the federal government to allocate spectrum rights, raising billions of dollars in the process. This early article by one of the influential players highlights some of the pitfalls encountered in early implementations.

**Preparation:** (1) **Play online game** “Beauty Contest: Reprise” by 5:00PM on the day before class. (2) **Prepare worksheet** for “Crazy(?) Incumbent Game” and turn it in to TA at/before the beginning of class. (3) **Deliver Final Project at start of class.**

**Reading:**


How can one interpret “unexpected” behavior, especially behavior that appears to be “irrational”? This is a crucial issue, especially in games in which each player’s rationality is uncertain.