15.025 and 15.0251  Game Theory for Strategic Advantage

LOGISTICS

Professor: Alessandro Bonatti (bonatti@mit.edu)  E62-521

TA:
Section A  TBA
Section B  TBA

Meeting:
Section A  10:00-11:30 AM  Tue-Thu  E52-164
Section B  1:00-2:30 PM  Tue-Thu  E52-164

Office Hours: Please e-mail to arrange

OVERVIEW

A game is a multi-person decision problem: tic-tac-toe and chess are games, but game-playing is also serious business. Managers frequently play games both within their firm (with other divisions and subordinates) as well as outside (with competitors, customers, and even capital markets). In turn, politicians, lobbyists, and other stakeholders play games with firms (e.g., when designing auctions or regulations).

The goal of this course is to enhance your ability to think strategically in such complex, interactive environments. In particular, the course emphasizes four themes for acquiring advantage in games:

1. **Identifying structures:** Being able to identify the key elements of the situation is critical for strategic thinking.

2. **Selecting strategic moves:** Changing the game being played to your advantage through credible commitments, threats, and promises.

3. **Exploiting hidden information:** When to reveal information or not, and how to handle uncertainty about others’ information.

4. **Recognizing the limits of rationality:** How to play when others may not be fully rational, and when others may be uncertain about your rationality.

APPROACH

My view is that the important ideas of game theory are best mastered not at the level of some abstract theory but in the context of real examples. For this reason, we will discuss numerous real-world examples and analyze games that arise frequently in business settings.

To deepen your thinking in a concrete setting, a crucial 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.
My goal is to teach game theory, not mathematics. That being said, examples and cases alone do not suffice to get a deeper appreciation and understanding of the material, so some general parts of game theory will be introduced as well. You will discover a fascinating paradox: the more transparent the mathematics, the more interesting and challenging the issues that can arise.

To complement the formal analysis, we will use an interactive approach that includes in-class live games and discussion of cases and take-home assignments aimed at applying game theory to real-world experience.

COURSE PLAN

The course will move from the abstract towards the concrete. In the first part of the course (Classes 1-11), we will cover the foundations and a wide spectrum of applications of game theory. In the second part (Classes 12-22) we will put the foundations to work in three multi-week, advanced applied segments. The advanced applications will be:

Classes 12-14: Long-Run Relationships
Classes 15-18: Auctions and Market Design
Classes 19-22: Communication, Credibility and Reputation

Exemplary team projects will be presented and discussed in the final week (Classes 23-24).

PREREQUISITE

Game theory is applied in many other courses offered at Sloan.¹ A single course could not suffice to study even a fraction of these particular applications in any depth. While the course is designed to complement Sloan’s other economics and strategy offerings, it is self-contained. Therefore, there are no prerequisites beyond the core economics course (15.010 or equivalent).

READINGS

There is no required textbook for the course. Required and supplementary readings are available on Stellar. For further reading, beyond what is on Stellar, the following text is a good source (note that earlier editions would work fine):


In addition, we will assign a number of HBS (and other) cases; they are not available on Stellar, but instead can be purchased from Studynet. (A link to the study.net website, along with access information, is on the Materials page of the course Stellar site.)

¹ These applications are wide-ranging: games played between competing firms in 15.013 (Industrial Economics); games played between firms and their suppliers in 15.S70 (Managing Strategic Supply Relationships), and between managers and their employees in 15.903 (Managing the Modern Organization); not to mention applications in strategy, negotiations, international macroeconomics, and corporate finance.
GRADING

Grading will depend on class participation, take-home assignments, and a team project. Class participation will include games played during class, discussion of games to be prepared ahead of class, as well as presentations of individual assignments.

These components of the course will receive the following weights:

- Team Project: 40%
- Take-home assignments: 40%
- Class Participation: 20%

CLASS PARTICIPATION

The class participation grade is equally determined by the following factors.

IN-CLASS GAMES: In several lectures, we will play a game in class that will need everyone’s participation. It will be important for your own learning and your classmates’ that you attend and participate.

BEFORE-CLASS GAMES: A few games require preparation before class. This will involve completing and submitting a 1-2 page worksheet, or a web form, taking no more than 20 minutes per game. Full participation credit will be given for a thoughtful effort.

INDIVIDUAL ASSIGNMENTS: Occasionally, I will ask you to apply a game theory concept that we covered in class (e.g., commitment, auctions) to current events (e.g., in business or politics). This assignment consists of writing a one-page essay using a few questions as guidelines. Students are encouraged to volunteer and discuss their findings with the class.

TEAM PROJECT

The Team Project is a “team assignment with type-3 collaboration” (see below). You must provide strategic advice to a player of a “real-world” game. (You need not gather actual data, although that would be ideal. It suffices to consider a hypothetical scenario that could be real.)

DELIVERABLES

Initial Proposal: a 1-2 page description of the question being investigated; the necessary game-theoretic tools and data (if applicable), and the player(s) receiving advice.

Crafting a detailed proposal is meant to serve as a study guide. As such, none of the proposal’s contents are binding for the final version of the project, and the proposal itself is not graded.

Final Project: a 3-8 page memo addressed to the relevant party, as well as a 2-5 page appendix addressed to a game-theory expert (supporting graphs, calculations, etc.).

A successful memo will clearly convey the “bottom line” of your motivation, assumptions, analysis, and conclusions to the relevant player. The very best projects, furthermore, will include a careful, correct, and creative application of game-theoretic ideas and techniques in the appendix.
COLLABORATING with the Professor is encouraged: The team project is the most important element of the course. You should begin thinking about it as early as possible. On Friday, March 4th, the TAs and I will hold a project brainstorming session to talk with you and your team about your ideas. (This session is not required.) Coming to the session, you should have an idea of a game (or two) you would like to study.

TIMELINE: the team project has the following parts: (i) team formation by February 25, (ii) project proposal by March 11, (iii) project progress report by May 5, and (iv) final project on May 12. A progress report (which is not graded) is due on May 5 because some projects will be selected for in-class presentations on May 10 and 12.

DELIVERY: All project deliverables should be submitted on Stellar. Examples of successful projects will be discussed in class and also posted on Stellar.

MIT SLOAN ACADEMIC STANDARDS

The following is an excerpt from Sloan’s “Academic Standards” document, meant to clarify what the type of work I expect on the team project.

Team Project is “Type 3”

When you are asked to work in teams, there is a broad spectrum of faculty expectations.

Type-1 collaboration: the professor states that collaboration is allowed, but the final product must be individual.

Type-2 collaboration: the professor states that collaboration is encouraged but that each person's contribution to the deliverable does not have to be substantial (taking a “divide and conquer” approach).

Type-3 collaboration: the professor states that collaboration is expected and that each team member must contribute substantially to the deliverable. An example of this might be the FYC or the OP project.

- Each team member must make a substantial contribution to the assignment. It is not, for example, acceptable to divide the assignments amongst the team members (e.g., part of the team does the FYC and the other part does another project), though the team may divide the work of any one assignment to complete it as they deem appropriate.
- The team may not collaborate with other students outside of the team unless the professor explicitly permits such collaboration.
Course Outline and Supplementary Readings

DSR = “Games of Strategy” 4th edition, by Dixit, Skeath, and Reiley

Underlined items should be given to the TA at or prior to lecture

Required readings prior to lecture are denoted by (*). All readings are helpful for getting as much as possible from lecture.

Feb. 2  Class 1:   Introduction


DSR Chapter 1 (Basic Ideas and Principles).

Feb. 4  Class 2:   Rationality


DSR Chapter 2 (How to Think about Strategic Games).

Feb. 9  Class 3:   Nash Equilibrium

DSR Chapters 4.2 (Nash Equilibrium), 4.6 (Multiple Equilibria), and 5.3 (Rationalizability).

Feb. 11 Class 4:   (Un)predictable Outcomes

DSR Chapter 7.1-4 (Mixed Strategies) and 7.9 (Evidence).

Feb. 16 NO CLASS  (MIT Holiday)

Feb. 18 Class 5:   Designing Games and Influencing Outcomes

DSR Chapter 9 (Strategic Moves)

**Assignment on Game-Changers: the Greek Bailout**

**Feb. 23** Class 6: **Strategic Trade Policy** *(Roberto Rigobon)*


Please submit your list of team members to the TAs

**Feb. 25** Class 7: **Market Entry**


Case questions due before class

**Mar. 1** Class 8: **Backward Induction**


DSR Chapter 3 (Sequential moves)

**Mar. 3** Class 9: **Bargaining**

Take-home game: Right of First Refusal


DSR Chapter 17 (Bargaining).
Mar. 4  Project Brainstorming Day

Mar. 8  Class 10:  Wars of Attrition


Case questions due before class

Mar. 10 Class 11:  Team Presentations: Project Proposals

Project proposals due at 5pm

Mar. 14—18  NO CLASS (Sloan Innovation Period)

Mar. 21—25  NO CLASS (Spring Vacation)

Mar. 29  Class 12:  Dynamic Price Competition


Mar. 31  Class 13:  Introduction to Repeated Interaction


DSR Chapter 11 (Prisoners’ Dilemma and Repeated Games)

Apr. 5  Class 14:  Long-Run Relationships


(*) “Taking the Dare” by James Stewart, The New Yorker, July 26, 1993.

Case questions due before class (choose one case)
Apr. 7  Class 15:  Application: Tacit Coordination


Case questions due before class

Apr. 12  Class 16: Games with Asymmetric Information

DSR Chapter 9.1-2 (Uncertainty and Information)

Apr. 14  Class 17: Introduction to Auctions

DSR Chapter 17 (Auctions)

Apr. 19  NO CLASS (Patriots Day)

Apr. 21  Class 18: Online Auctions


Apr. 26  Class 19: Designing Auctions and Other Markets

Assignment on Auctions in Disguise


Apr. 28  Class 20: Costly Signaling vs. Cheap Talk

Take-home game: Poker

DSR Chapter 9.3-6 (Cheap Talk & Signaling)

May 3  Class 21: Credibility and Reputation


May 5  Class 22: Application: Cold War Politics


D&S Chapter 14 (Brinkmanship: the Cuban Missile Crisis)

Project progress reports due after class

May 10 Class 23: Team Project Presentations

May 12 Class 24: Team Project Presentations

Takeaways from team projects and in-class games.

Final projects due in class