Bowdoin College
Department of Economics
Fall 2017

ECON 3305: Game Theory and Strategic Behavior

"*Unless you really understand game theory, you can't begin to actually understand human behavior.*"
—Rory Sutherland (https://www.edge.org/conversation/rory_sutherland-this-thing-for-which-we-have-no-name)

Time & Class Location:	T,Th 2:30-3:55, Hubbard 213 (Pickering room)
Professor:	Dan Stone
Email:	dstone@bowdoin.edu
Office/Drop-in Hours:	Hubbard 108; M and W, 2:00-3:30. If you'd like to meet and can't make it at those times, please email me to set up an appointment.

Prerequisite: Intermediate micro (Econ 2555) and Math 1600 (intro calculus). I will teach/review appropriate math methods as they comes up (e.g. probability theory, set theory, methods of proof).

Course description and learning goals: This course will cover the main topics of non-cooperative game theory in a mathematically rigorous way. Game theory is the mathematical study of behavior in strategic settings: situations in which an individual must think about other individuals' perspectives and choices to determine one's own optimal choice(s). Nobel Laureate Robert Aumann suggested that the field should be called "interactive decision theory." Game theory began as a sub-field of applied mathematics and is now immensely influential and widely used across the social and natural sciences.

We'll emphasize mathematical rigor for three reasons:1) to discuss game theoretic ideas with more precision and clarity; 2) to improve the precision and clarity of your thinking in general; and 3) to help prepare students who are interested for graduate study in economics, which involves plenty of math. We will be following the textbook closely, as it uses the appropriate level of math for our purposes, without being too dry, and still includes many applications, but there will also be a number of readings from other contexts, including academic journal articles.

In addition to of course learning the substance of game theory and improving your mathematical skills and logical thinking, I'm hoping this class will help to both enhance your understanding of strategic interactions—and to improve your own performance (i.e. your strategic thinking and choices, and your understanding of the perspectives and choices of others)—in everyday life.

Books/resources: Watson, J., *Strategy: An Introduction to Game Theory, 3/e*. I like this book very much because it is concise but still clear, complete, uses the right level of math and provides a good number of well-written problems. You're welcome to try another edition; the material will be only slightly different; however, the problems might be different, and I will assign some of them as homework. Non-technical supplemental books I'd recommend considering, if you're interested in this sort of thing, are: *Thinking Strategically: The Competitive Edge in Business, Politics, and Everyday Life* by Dixit and Nalebuff, *Jane Austen: Game Theorist* by Chwe, and *Game-changer* by McAdams; *Auctions* by Hubbard and Paarsch; *Economics Rules* by Rodrik (on models not GT per se).

There are many free game theory resources available on the web. Here are a handful of somewhat scattered examples. Here's the site for Yale's free course: http://oyc.yale.edu/economics/econ-159#sessions. Here are shorter video lessons on many key topics - http://gametheory101.com/Home.html. An Excel 'calculator' by creator of those videos: https://williamspaniel.com/game-theory-calculator/. And another website that allows you to create and solve games using (but not with Excel)- http://www.gametheoryexplorer.org/

Web/email: All (or almost all) course documents (including slides, homework and test solutions) and grades will be posted to blackboard. In general, I'll make announcements/reminders in class, but will also sometimes email you announcements and clarifications of material from class.

Teaching philosophy/methods for this course: I'll use a combination of interactive lecture, classroom versions of game theory games, in class group and individual problem solving, and teaching technologies (Blackboard, clickers). I encourage you to interrupt me during lecture with questions and comments often—this will usually help to clarify something that others were wondering about as well, keep you more engaged, improve your public speaking skills (yes, not really public speaking, I know, but close), help me learn from you, and will help prevent me from doing too much of the talking. If your question is on a topic most appropriately addressed outside of class, I'll let you know. I expect and hope that the level of interaction will be especially high given that you are all seniors this year.

I use somewhat bare-bones powerpoint slides to guide the lectures (these are my lecture notes), and post the slides to blackboard, but, to be clear, the slides will often be incomplete. The slides will only make complete sense in conjunction with class notes/experience. I recommend that you take notes in class as if the slides won't be posted, and then just refer to them as necessary. If you have questions later, first try asking classmates, then ask me. Some of the material we'll discuss in class is background you won't be tested on; some of the material you need to know will be straightforward and basically common sense; and some is abstract and fairly deep. I will try to go over the background and straightforward parts quickly, assuming you can easily clarify with the book if necessary, and spend more time on the tougher and more interesting material, including going beyond the textbook where I feel it is useful and/or appropriate.

Since learning this material requires hands-on work—problem solving—some class time will be devoted to working through problems, and I also ask you to work on problems on your own as homework. This will prepare you for tests, where you will also be asked to solve problems on your own, as this is the best way to demonstrate knowledge of the material. And since game theory is indeed the study of games, we'll explore playing games ourselves in the classroom. This is useful pedagogically—and fun.

Assignments: There will be three homeworks, two journal article assignments, two midterms, and a final. Homeworks are due at start of class and there is a 10% penalty per day turned in late (0-24 hrs late = 10% off; 24-48 hrs later = 20% off, etc). You should work on homework problems primarily on your own, and the answers you submit should be your own, but you are allowed to consult with classmates and work together on problems you are stuck on. For the journal article assignments: I will randomly assign each of you two articles from the list below, and ask you to give a 5 minute presentation on one article, and write a 300-500 word essay on the other. Both the presentation and essay should consist of a brief summary, analysis and critique. These assignments are to help you

gain a more in-depth understanding of advanced game theoretic ideas and related scholarship. The journal articles are:

- Rationalizability and iterated dominance: Duffy and Nagel, EJ, 1997; Bosch-Domènech et al, AER, 2002; Kocher and Sutter, EJ, 2005; Grosskopf and Nagel, GEB, 2008
- Nash: Cooper et al, AER, 1990; Mailath, JEL, 1998; List, ReStat, 2006; van dem Assem et al, MS, 2012; Schüller et al, JEconPsych, 2014
- Bargaining: Neelin et al, AER, 1988; Ochs and Roth, AER, 1989; Hoffman et al, GEB, 1994; Cameron, EI, 1999; Henrich, AER, 2000
- Repeated prisoners' dilemmas: Andreoni and Miller, EJ, 1993; Dal Bo, AER, 2005; Dreber et al, Nature, 2008; Dal Bo and Frechette, AER, 2011
- Auctions: Lucking-Reiley, AER, 1999; List and Lucking-Reiley, AER, 2000; Kagel and Levin, Ecta, 2000; Bajari and Hortascu, Rand, 2003; Carpenter et al, EJ, 2008
- Signaling: Prendergast and Stole, JPE, 1996; Morris, JPE, 2001; Gentzkow and Shapiro, JPE, 2006; Han et al, JM, 2010; McDevitt, JPE, 2014; Stone, SEJ, 2016; Stone, JPublicE, 2013

The tentative dates for all assignments and readings are on the course schedule below. Make-up finals/midterms will only be given when you are not able to attend for a verifiable reason, with documentation. You should email me as soon as possible if you require a make-up test (this will almost always be before the test has actually taken place).

Grading: Your final course numerical grade will be a weighted average of the homework/journal grade, and each of the three tests as follows: 20% HW/journal article assignments; 25% midterm 1; 25% midterm 2; 30% final exam. The homework/journal grade will put equal weight (1/5) on each of the five components (3 homeworks and 2 journal articles). I use a 10 pt grading scale for the course letter grade with 3 pt ranges for +/- (>=93 is A; >=90 and < 93 is A-; etc) with the possibility of curving up, which tends to happen more often for the lower scores. Following a policy used in other classes in the department, final grades on the margin between two letter grades (e.g. B+/A-) may be adjusted based on class participation.

Advice on how to succeed in this course, and feedback: First and foremost, focus in class, and work hard on the homeworks. Read the chapters ideally before lecture. If some topic doesn't make sense after lecture and looking at the book, talk to others (classmates and/or me) to clarify. If you miss a class, or part of a class, try to get notes from a classmate, and compare to slides from blackboard and make sure everything makes sense—if not, talk to classmate(s) and/or me. Start on HW problems by yourself early, work on them until you get stuck. Step away for a day and come back to it; fresh eyes can make a big difference. Hopefully you can make more progress on your own. Then talk to classmates if stuck – at least a couple days before the assignment is due. If you're still stuck on something, come to office hours for help. If you get homework/test problems wrong, and even if you get them right, check the solutions and be sure you understand them. If not, talk to others and/or me. Given that the solutions are posted, I may not write detailed solutions/comments on your graded assignments. You'll get a lot of feedback just by doing problems and seeing how well you can solve them, and what you need help with. But I'd be happy to discuss additional feedback with you anytime, and if I think I need to communicate something specific to you I will reach out to let you know.

Course schedule and readings

(subject to change; chapters all from Watson)

Parts I-II: Representations and assumptions, Behavior in static settings

31-Aug	Syllabus, intro to the field and history (recommended readings: Chwe, ch. 1; Harford, ch 2; Rodrik, chs 1-2)
5-Sep	Chs 1-2, Extensive form
7-Sep	Set theory; Ch 3, Strategy, normal form
12-Sep	Ch 4-5, Beliefs, mixed strategies, other assumptions
14-Sep	Ch 6; Dominance, best response
19-Sep	Ch 7, Rationalizability, iterated dominance
21-Sep	Ch 8, Rationalizability applications; **rationalizability papers**
26-Sep	Ch. 9, Nash equilibrium
28-Sep	Ch 10, Nash applications; **HW 1 due**
3-Oct	Review/catchup; **Nash papers**
5-Oct	Midterm 1
10-Oct	Fall break

Part III: Behavior in dynamic settings

12-Oct	Ch 11, Mixed strategy NE
17-Oct	Ch 14-15, Backward induction, subgame perfection (skip forward induction and conditional dominance)
19-Oct	Ch 16-17, IO applications
24-Oct	Ch 18, Bargaining
26-Oct	Ch 19, Bargaining ctd
31-Oct	Ch 22, Repeated games, reputation; **bargaining papers**
2-Nov	Ch 23, Collusion; **HW 2 due**
7-Nov	Review/catchup; **repeated games papers**
9-Nov	Midterm 2

Part IV: Information

14-Nov	Ch 24-5, Incomplete info; risk in contracting; principal-agent models
16-Nov	Principal-agent models ctd
21-Nov	Ch 26-27, Bayesian Nash; markets with lemons; auctions; Hubbard and Paarsch reading
23-Nov	Thanksgiving
28-Nov	Auctions ctd; **auctions papers**
30-Nov	Ch 28-29, Perfect Bayesian equilibrium, signaling games
5-Dec	PBE ctd, applications as time allows (disclosure, observational learning, counter-signaling); **signaling papers**
7-Dec	Review/catchup; **HW 3 due**
13-Dec-17	Final exam (9:00am)