

BEPP 284 - Game Theory for Business and Life (Fall 2019)

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Office: Vance Hall 331, Office Hours: Tu 10:30-11:45, Th 4:30-6:00

The objective of this course is to make you *more strategic*, by which I mean enhancing your capacity for making intelligent and creative choices when interacting with your fellow human beings. The approach to doing so is game theory, which has been the focus of two rounds of Nobel Prizes in Economics. Game theory is a framework and a set of tools for solving the puzzles and tackling the challenges put forth by a collection of conscious, purposeful agents, whether they comprise a household, a team, a fraternity or sorority, a village, a company, an army, a market, a government, or a society. While the focus is primarily on the use of game theory in business, game theory has such broad relevance that we will also apply it in the arenas of politics, international relations, war, sports, history, crime, theology, and everyday life.

BEPP 284 satisfies the “Technology, Innovation and Analytics” requirement for the Wharton undergraduate major. Game theory is a valuable tool for determining the appropriate business strategies to complement new technologies, which will be exemplified by using game theory to analyze products with network effects (e.g., computer operating systems) and two-sided markets (e.g., online platforms).

BEPP 284 satisfies the BEPP Fundamental requirement for the BEPP major.

Pre-requisites: None

Book

Joseph Harrington, *Games, Strategies, and Decision Making*, 2nd Edition, Worth Publishers, 2015. [GSDM]

“But it's so simple. All I have to do is divine from what I know of you: are you the sort of man who would put the poison into his own goblet or his enemy's? Now, a clever man would put the poison into his own goblet, because he would know that only a great fool would reach for what he was given. I am not a great fool, so I can clearly not choose the wine in front of you. But you must have known I was not a great fool, you would have counted on it, so I can clearly not choose the wine in front of me.”

- Vizzini,
The Princess Bride

Optional Readings

Basu, Kaushik, "Why, for a Class of Bribes, the Act of *Giving* a Bribe should be Treated as Legal," March 2011.

Brandenburger, Adam, "Bitter Competition: The Holland Sweetener Company versus Nutrasweet," HBS Case 9-794-079, November 13, 2000.

Capobianco, Antonio and Pedro Gonzaga, "Algorithms and Competition: Friends or Foes?," *CPI Antitrust Chronicle*, August 2017.

Dr. Seuss, *The Sneetches*, 1953.

Eisenmann, Thomas R., Geoffrey Parker, and Marshall W. Van Alstyne, "Strategies for Two-Sided Markets," *Harvard Business Review*, 84 (2006), 92-101.

"Football Penalties: A Practical Guide to the Most Nail-biting Part of the World Cup," *The Economist*, June 21, 2018

Hammond, Scott D., "The Evolution of Criminal Antitrust Enforcement Over the Last Two Decades," February 25, 2010.

Khazan, Olga, "Can Game Theory Help Prevent Rape?," *The Atlantic*, September 17, 2015.

Shapiro, Carl and Hal R. Varian, "Networks and Positive Feedback" (Chp 7) in *Information Rules: A Strategic Guide to the Network Economy*, HBS Press, 1999.

Course Requirements

Problem Sets (6): 10% (average of your best five problem sets; lowest problem set grade is dropped)

Two tests: 30% each

Paper: 30%

Virtual Corporate Reality: Extra credit (see below)

"I can calculate the motions of heavenly bodies, but not the madness of people."
- Sir Isaac Newton
(upon losing £20,000 in the South Sea Bubble in 1720)

"Game theory forces you to see a business situation over many periods from two perspectives: yours and your competitor's."
- Judy Lewent, CFO Merck

Lectures (with Applications)

Introduction to game theory - GSDM (Chp 1)

Modelling a strategic situation as a game - GSDM (Chp 2)

- Kidnapping

Optimal play by eliminating dominated strategies - GSDM (Chp 3; skip Appendix on Rationalizability)

- Advertising: cooperative vs. predatory
- Existence of God
- Product introduction: cookies and cigarettes
- Doping in sports

Strategic play and Nash equilibrium - GSDM (Chps 4, 5, 6.1-6.2)

- Catching cartels (Reading: Hammond)
- Sneetches (Reading: Dr. Seuss)
- Average bid procurement auctions in Italy
- Network effects and the computer industry (Reading: Shapiro & Varian)
- Braess' Paradox
- Two-sided markets (Reading: Eisenmann et al)
- Vaccination
- Rent-seeking and lobbying

Randomizing play - GSDM (Chp 7)

- Avranches Gap in World War II
- Penalty kick in soccer (Reading: "Football Penalties")
- Volunteers' Dilemma and the Bystander Effect

"At Bell Atlantic, we've found that the lessons of game theory give us a wider view of our business situation and provide us a more nimble approach to corporate planning."

- Raymond W. Smith, Chairman

"If the human mind was simple enough to understand, we'd be too simple to understand it."

- Emerson Pugh

Strategic play in sequential-move environments with perfect information - GSDM (Chp 8)

- Investment and hold-up (Reading: Brandenburger)
- Racial discrimination and sports
- Bribery in India (Reading: Basu)
- Bargaining

Strategic play in sequential-move environments with imperfect information - GSDM (Chp 9)

- Strategic delegation
- Agenda control
- Sexual harassment (Reading: Khazan, 2015) -
Trigger Warning

“Imagine how hard physics would be if electrons could think.”
- Murray Gell-Mann
(Nobel Laureate, Physics)

Strategic play when there is repeated interaction

- Trench warfare in World War I (Chp 13)
- Bidding rings (GSDM, Chp 14)
- Medieval Law Merchant (Chp 15)
- Cooperation by bats (GSDM, Chps 14, 16.1)
- Cooperation by software programs (Reading: Capobianco & Gonzaga)

“If there is any one secret of success it lies in the ability to get the other person's point of view and see things from their angle as well as your own.”
- Henry Ford

Electronics

The use of laptops, tablets, phablets, smartphones, smartwatches, tin cans with string, carrier pigeons, telepathy, or any other method that connects you to the world outside of this classroom is *verboten* during class, unless an exception is given (such as you have written permission to hold a séance to contact your great-great-grand mother.)

Problem Sets

Problem set due dates are in the schedule at the end of the syllabus. Note that numbered exercises refer to the 2nd edition (not the 1st edition) of *Games, Strategies & Decision Making*. Problem sets are to be turned in at the beginning of class. Given that answers will be posted immediately after class, late problem sets cannot be accepted.

Paper

You are to use game theory to model and make predictive statements about the behavior of people for either a real-world, historical, or fictional situation. A real-world situation is one that routinely occurs in human or non-human society. A fictional situation can be drawn from a story, poem, play, television show, movie, or computer software program but it is not to be a product of your imagination. Your imagination can be used to model a situation but not in creating the situation. Also, the situation cannot be one that we have gone over in class. The paper is to be original work and will be graded on: i) how creative, sophisticated, and accurate is your model; and ii) how compelling, insightful, and correct is your analysis. The project should be typed (though figures can be hand-drawn) and be at least five and no more than ten double-spaced pages (including figures). **The paper is due December 3rd**. Late papers will be penalized 1/3rd of a letter grade for each two days that they are late (e.g., if the grade without a penalty is B+ then the grade with a one-third penalty is B).

“One of the reasons game theory has finally been discovered by managers is the rapidity with which companies can now respond to changes in product, technologies and prices. Game theory helps you pay attention to your interactions with competitors, customers and suppliers, and to focus on the end-game so that your near-term actions promote your long-term interest by influencing what these players do.”

- F. William Barnett,
McKinsey &
Company

Virtual Corporate Reality

VCR is an industry simulation package co-developed with Prof. Christopher Ruebeck at Lafayette College. Students form teams and compete in a market setting. Your performance in VCR is an opportunity for extra credit of up to 3 additional points which would be added to your course grade. The number of points is based on the final value of your firm according to the following formula: extra credit points = $\min\{3, .015 \times FV\}$ where FV is the “final value measured in millions of dollars.” For example, if $FV = 100$ (so your firm is valued \$100 million) then your final numerical course grade (on a scale of 0 to 100) is increased by $.015 \times 100 = 1.5$ points. If $FV = 200$ then it is raised by 3 points. If FV exceeds 200 then you get the maximum of 3 points. After numerical grades are determined (and before adding extra credit), I will set the mapping from numerical grades to letter grades (at which time a curve is typically applied). Only after that mapping is set are extra credit points added. Hence, lowering another team’s FV will *not* benefit your course grade because extra credit is added *after* grades are curved. Maximizing your firm’s value is what will maximize the number of extra credit points you receive. Details on VCR are provided in a separate document, and the VCR program can be found at <https://vcr.lafayette.edu/cgi-bin/login.cgi>

“Only the paranoid survive.”

- Andy Grove, Co-founder of Intel

“I think that God in creating Man somewhat overestimated his ability.”

- Oscar Wilde

Ethics

You are expected to review and abide by the University of Pennsylvania's Code of Academic Integrity. Violations of the code carry serious sanctions. All cases of code violations will be turned over to the Office of Student Conduct and I reserve the right to impose additional sanctions, including a failing grade for the assignment or test or even the course.

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Lecture	Date	Topic	Due Dates	Problem Set	GSDM Readings	Optional Reading
1	8/27/2019	Introduction			GSDM - Chp 1	
2	8/29/2019	Extensive Form Games			GSDM - Chp 2	
3	9/3/2019	Strategic Form Games				
4	9/5/2019	Iterative Deletion of Dominated Strategies			GSDM - Chp 3	
5	9/10/2019	Iterative Deletion of Dominated Strategies				
6	9/12/2019	Iterative Deletion of Dominated Strategies				
7	9/17/2019	Nash Equilibrium	PS #1 is due	Chp. 2: Exercise 5; Chp. 3: Ex. 6	GSDM - Chps 4, 5	Hammond
8	9/19/2019	Nash Equilibrium				Dr. Seuss
9	9/24/2019	Nash Equilibrium with Randomized Actions	PS #2 is due	Chp. 4: Ex. 4; Chp. 5: Ex. 7	GSDM - Chp 7	Football Penalties
10	9/26/2019	Nash Equilibrium with Randomized Actions				
11	10/1/2019	Nash Equilibrium: Tipping & Congestion	PS #3 is due	Chp. 7: Ex. 2, 12		Shapiro & Varian
12	10/3/2019	Nash Equilibrium: Tipping & Congestion				Eisenmann et al
13	10/8/2019	Nash Equilibrium: More Applications			GSDM - Chp 6.1, 6.2	
	10/10/2019	FALL BREAK - No class				
14	10/15/2019	Test #1 (evening)			GSDM - Chp 6.1, 6.2	
15	10/17/2019	Nash Equilibrium: More Applications				
16	10/22/2019	Sequential Play and Perfect Information			GSDM - Chp 8	Brandenburger
17	10/24/2019	Sequential Play and Perfect Information				
18	10/29/2019	Sequential Play and Perfect Information	PS #4 is due	Chp. 8: Ex. 7, 14		Basu
19	10/31/2019	Sequential Play and Imperfect Information			GSDM - Chp 9	
20	11/5/2019	Sequential Play and Imperfect Information				
21	11/7/2019	Sequential Play and Imperfect Information				Khazan
22	11/12/2019	Cooperation and Reputation	PS #5 is due	Chp. 9: Ex. 7, 11	GSDM - Chp 13	
23	11/14/2019	Cooperation and Reputation				
24	11/19/2019	Cooperation and Reputation			GSDM - Chp 14, 16.1	
25	11/21/2019	Debrief: Virtual Corporate Reality	PS #6 is due	Chp. 13: Ex. 2; Chp. 14: Ex. 2	GSDM - Chp 15	
26	11/26/2019	Cooperation and Reputation				
	11/28/2019	THANKSGIVING				
27	12/3/2019	Cooperation and Reputation	Paper is due			Capobianco & Gonzaga
28	12/5/2019	Test #2 (evening)				

Note: Problem sets refer to numbered exercises from the 2nd edition (not the 1st edition) of Games, Strategies & Decision Making