Department of Business Economics & Public Policy
The Wharton School - University of Pennsylvania

BEPP 284 - Game Theory for Business and Life (Fall 2020)

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Virtual Office Hours: TBD

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 Concentration.

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.

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

Quizzes (10): 55% [based on 8 highest quiz grades; lowest two grades are dropped; if you miss quizzes due to illness or for some other reason, those missed quizzes count towards your two "dropped" quizzes]

Paper (due December 8th): 30%

Virtual Corporate Reality: 15%

"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
- 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)

- Sexual harassment (Reading: Khazan, 2015) - *Trigger Warning*
- Agenda control
- Group formation

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)

Quizzes

Starting on Sept 15th, there will be a Canvas quiz during the first 30 minutes of each Tuesday's class (with the exception of October 27 and November 24). The dates of all quizzes are listed at the end of the syllabus. Quizzes are open book and open notes. In addition to attending lectures and reading the appropriate material in the textbook, I recommend that you work through the problems on Canvas as preparation for these quizzes.

Warning: Quizzes are to be solely your work and to be taken without the assistance of anyone else**. If you are caught cheating on a quiz, you will fail the course.** (Sorry to be so draconian but the intent is to create incentives not to cheat should one be tempted to do so.)

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 5-10 double-spaced typed pages including figures (which can be hand drawn). **The paper is to be uploaded on Canvas by December 8th.** Late papers will be penalized 1/3rd of a letter grade for each two days 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 will form teams and compete in a market setting. 50% of your grade will be based on the value of your company at the end of the semester. (It is to be emphasized that your team's value will NOT be compared to the value of other teams in your industry but rather to a benchmark based on past semesters.) The other 50% of your grade will be based on five short reports that you will turn in over the course of the simulation. 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

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.

"I think that God in creating Man somewhat overestimated his ability."
- Oscar Wilde

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Lecture	Date	Topic	Required Readings	Quizzes and Paper	Optional Readings	VCR Reports
1	9/1/2020	Introduction	GSDM - Chp 1			
2	9/3/2020	Extensive Form Games	GSDM - Chp 2			
3	9/8/2020	Strategic Form Games				
4	9/10/2020	Iterative Deletion of Dominated Strategies	GSDM - Chp 3			
5	9/15/2020	Iterative Deletion of Dominated Strategies		Quiz #1 (extensive form games)		
6	9/17/2020	Iterative Deletion of Dominated Strategies				
7	9/22/2020	Iterative Deletion of Dominated Strategies		Quiz #2 (strategic form games)		Plan is due
8	9/24/2020	Nash Equilibrium	GSDM - Chps 4, 5		Hammond	
9	9/29/2020	Nash Equilibrium		Quiz #3 (IDSDS)		
10	10/1/2020	Nash Equilibrium: Tipping & Congestion			Shapiro & Varian	
11	10/6/2020	Nash Equilibrium: Tipping & Congestion		Quiz #4 (Nash equilibrium)	Eisenmann et al	
12	10/8/2020	Nash Equilibrium with Randomized Actions	GSDM - Chp 7			
13	10/13/2020	Nash Equilibrium with Randomized Actions		Quiz #5 (NE with tipping/congestion)	Football Penalties	Update is due
14	10/15/2020	Nash Equilibrium: More Applications	GSDM - Chp 6.1, 6.2			
15	10/20/2020	Sequential Play and Perfect Information	GSDM - Chp 8	Quiz #6 (Mixed strategy equilibria)		
16	10/22/2020	Sequential Play and Perfect Information			Brandenburger	
17	10/27/2020	Sequential Play and Perfect Information		NO QUIZ		
18	10/29/2020	Sequential Play and Perfect Information	GSDM - Chp 9		Basu	
19	11/3/2020	Sequential Play and Imperfect Information		Quiz #7 (Backward induction)		Update is due
20	11/5/2020	Sequential Play and Imperfect Information				
21	11/10/2020	Sequential Play and Imperfect Information		Quiz #8 (SPNE - perfect information)	Khazan	
22	11/12/2020	Cooperation and Reputation	GSDM - Chp 13			
23	11/17/2020	Cooperation and Reputation		Quiz #9 (SPNE - imperfect information)		
24	11/19/2020	Cooperation and Reputation	GSDM - Chp 14, 16.1			
25	11/24/2020	Cooperation and Reputation	GSDM - Chp 15			
	11/26/2020	THANKSGIVING				
26	12/1/2020	Cooperation and Reputation		Quiz #10 (Repeated games)		Final report is due
27	12/3/2020	Debrief: Virtual Corporate Reality				
28	12/8/2020	Debrief: Virtual Corporate Reality		Paper is due		