BDS 509: Applied Game Theory

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Zoom link: https://upenn.zoom.us/j/96556565990
M,W,F — 1:00-2:15pm — July 1 - Aug 6

Course description

This course covers basic concepts in game theory and applies these concepts to the social sciences. By the end of the course students will know how to identify Nash equilibria and Pareto optima, understand how to diagram simultaneous and sequential games, and be able to explain how different strategies apply to single play games and repeated games. Topics will include why conflict and cooperation occur among organisms with diverse goals and scarce resources, and how pro-social emotions and norms can alter human behavior in ways that facilitate cooperation.

Required Books

Thomas Schelling, *Micromotives and Macrobehavior*
Robert Frank, *Passions within Reason: The Strategic Role of the Emotions*

Grades are determined by one quiz that involves diagraming and analyzing some simple games, and two short exams that involve explaining concepts from the readings.

All articles will be posted on Canvas. You'll need to buy the books. The Encyclopedia entry on game theory is hyperlinked below, or you can find it with a quick internet search.

Reading Schedule

1. Basic Concepts
July 2: Class introduction, basics of game theory
July 5: No class

July 7, 9:
Don Ross, Game Theory
§1 Philosophical Motivation (all), §2 Basic Elements (end at 2.7: p. 48), §6 Commitment (all)
Watch Game Theory PPE Videos (click here)

Read game theory handouts and do practice problem set (posted with answers on Canvas)
Key concepts: be able to identify the five main games, be able to find Nash Equilibria and Pareto Optima, understand single play vs repeated games, diagram normal form vs extensive form games

July 12:
Quiz (in class)
Schelling, Chapter 3: Models

2. Emergent Orders
July 14:
Schelling, Chapter 4: Sorting and Mixing
Schelling, Chapter 6: Choosing our Children's Genes

July 16:
Gyngell and Douglas, "Stocking the Genetic Supermarket: reproductive choices and collective action problems"
Anomaly, Gyngell, and Savulescu, "Great Minds Think Different: preserving cognitive diversity in an age of gene editing"

3. Repeated Games
July 19:
Axelrod and Hamilton, "The Evolution of Cooperation"
Robert Trivers, "The Evolution of Reciprocal Altruism"
Robert Axelrod, "The Live-and-Let-Live System of Trench Warfare in WW1"

4. Commitment Devices: Incentives, Emotions, and Social Norms
July 21:
Wilson and Wilson, "Survival of the Selfless"
Robert Frank, *Passions within Reason: The Strategic Role of the Emotions*, chapter 1-2
*First exam emailed tonight

July 23: Exam review – open Q&A

July 25: First exam due at 11pm EST (send to anomaly@upenn.edu)

July 26: Frank, chapters 3-4

July 28: Frank, chapters 5-6

July 30: Frank, chapters 10-12

August 2:
Fehr and Gachter, "Altruistic Punishment in Humans"
Abbink, Thrasher, et al, "Peer Punishment Promotes Enforcement of Bad Social Norms"

5. Collective Action
August 4:
Mancur Olson, "The Logic of Collective Action"
Elinor Ostrom, "Collective Action and the Evolution of Social Norms"
*I'll email **final exam** today, **due August 8 (Sunday) at 11pm**

August 6:
Robert Frank et al, "Does Studying Economics Inhibit Cooperation?"
Exam review – open Q&A

Game Theory Quiz

1. For each of the following diagrams, identify the Nash equilibria and say what kind of game it is. (The numbers in the boxes are utilities, not ordered rankings or monetary payoffs).

i.

A's action

	a1	a2
b1	2, 3	0, 2
b2	1, 1	3, 2

B's action

ii.

A's action

	a1	a2
b1	2, 4	5, 3
b2	1, 5	3, 5

B's action

iii.

A's action

	a1	a2
b1	4, 5	2, 7
b2	6, 1	0, 0

B's action

2. Ren and Stimpy, two strangers who have just been released from prison in the Australian Outback, are hungry. Each of them sees a couple of wombats and an emu. If they go their own way, each ex-convict can easily catch a wombat and be temporarily sated. But if they coordinate, they can trap a much speedier emu and have enough food for several days. If one goes for the emu while the other traps a wombat, the emu-chaser goes hungry.

i. Diagram this problem using ordered rankings or utilities, and identify the Nash equilibria.
ii. Is there a uniquely rational choice in this problem? Explain your answer.

3. Romeo, the son of Montague, and Juliet, the daughter of Capulet, are suspected by the Prince of Verona of having an affair. Since the Prince has forbidden Montagues and Capulets from consorting, he imposes the following conditional punishments on Romeo and Juliet: if both confess, each gets 1 year in prison; if neither confesses each gets 5 years; if one confesses and the other does not, the confessor gets 10 years while the non-confessor goes free.

Suppose Romeo and Juliet care only about each other: each wants to minimize the other's sentence, even if it entails a larger sentence for themselves.

Construct a payoff matrix with years in prison rather than cardinal utilities or ordinal rankings in the boxes, and then answer each of the following questions.

i. Is there a Nash equilibrium in this game? If so, what is it?
ii. Is this game a prisoner's dilemma?
iii.a) If it is a PD, diagram it and identify the Nash equilibrium and the point that Pareto-dominates it.
iii.b) If not, can the Prince of Verona change the payoff structure so that Romeo and Juliet are in a PD?
iv. What would happen, given the sentences described in the prompt, if the Prince of Verona ordered J to choose for R and R to choose for J – would the game be a PD?

Final Exam – Game Theory – Summer 2021

Answer the following questions, using no more than 500 words for each question. You are not permitted to devise answers in groups (though you may discuss ideas in groups), and you should abide by the Penn honor code. You should cite all sources, but no outside sources are needed, and no bibliography is needed. Just use (Author, p. x) for quotes and citations. Completed exams should be emailed to me by August 8 at 11:00pm. anomaly@upenn.edu

1. What is **Robert Frank's commitment model**, and how does it explain moral emotions that seem to impose costs on those who have them, while also potentially benefiting other people or predators? Consider a specific example, such as guilt, love, or indignation.

2. In the final chapter, Robert Frank explains **how moral emotions can solve *and create* commitment problems**. Given an example of a situation in which an emotion, or an action motivated by an emotion, can do both.

3. **Fehr and Gacther** argue that altruistic punishment can increase cooperation in IPDs (iterated Prisoner's Dilemmas). Explain the evidence they give for this thesis via public goods games, explain why Abbink (et al) think this can produce negative outcomes, and give an original example to illustrate the Abbink thesis.

4. **Elinor Ostrom** argues that **Mancur Olson** is only partly right – that people in small groups under certain conditions often find ways of solving collective action problems without the need for state coercion. What are some of the conditions Ostrom mentions, and how might these conditions help inform our view about the optimal size and scope of government power? That is, how might Ostrom's findings help us design political institutions to foster cooperation rather than conflict?

5. What are **Robert Frank's** two explanations for why economics majors tend to contribute less to public goods games and defect more in prisoner's dilemma games? Which is most plausible and why?[1] You should review Frank's evidence in answering the question.

[1] Remember that this research has not been replicated much, and there may be other confounding variables at work besides simply majoring in economics.