Economics 4010: Game Theory
University of Virginia, Fall 2021

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``Game Theory can be defined as the study of mathematical models of conflict and cooperation between intelligent rational decision-makers. Game Theory provides general mathematical techniques for analyzing situations in which two or more individuals make decisions that will influence on another's welfare. As such, game theory offers insights of fundamental importance for scholars in all branches of the social sciences, as well as for practical decision-makers. The situations that game theorists study are not merely recreational activities, as the term 'game' might unfortunately suggest. 'Conflict analysis' or 'interactive decision theory' might be more descriptively accurate names for the subject, but the name 'game theory' seems to be here her to stay."

—Roger Myerson, *Game Theory: Analysis of Conflict*

Course description: The course will focus on non-cooperative game theory. Static, dynamic and repeated games of perfect andThe course will focus on non-cooperative game theory. Static, dynamic and repeated games of perfect and imperfect information will be covered in detail. Nash equilibrium and related concepts (subgame perfection, Bayesian and perfect Bayesian equilibria, the Folk Theorem) will play a central role. Applications from economics, political science and other disciplines will be considered. imperfect information will be covered in detail. Nash equilibrium and related concepts (subgame perfection, Bayesian and perfect Bayesian equilibria, the Folk Theorem) will play a central role. Applications from economics, political science and other disciplines will be considered.

Grading:
1. There will be a homework assignment approximately once per week, for a total of 25% of the final grade. Students have 7 days from the class session to turn in the problem set on Collab, unless other arrangements are made.
2. There will be three exams, each counting for 25% of the final grade. They will be "traditional" 75 minute exams, held during class time. Exams are open book/open note, and you can take them anywhere you have a reliable Internet connection and can download the exam and upload your solutions to Collab.

Class Procedures: Slides, notes, and problem sets will be posted on Collab. All homework will be assigned, submitted, graded, and returned to students through Collab. Pre-recorded videos of all lectures will be posted on Collab through Panopto, broken into shorter lessons of about 10 to 15 minutes each. For students concerned about their health, I will leave a Zoom link to each class session available so that you do not have to attend in person, but this is a courtesy to be accommodating to those who do not want to attend in person and the class is

not an "online synchronous" or "hybrid" class: I will not be monitoring the chat and the microphone will not be turned on after the first 10 or 15 minutes, when the class lecture begins. In principle, you can take this class in an entirely "online asynchronous" way by watching the pre-recorded videos or live lectures, doing the homework, and taking the exams at home and turning them in online.

Meeting Times: Lectures are with Johnson on Tuesday/Thursday, 3:30p.m.–4:45p.m., Monroe Hall 124. Discussions are with Yang on Monday from 5:50p.m.—5:50p.m. in New Cabell Hall 485 and Monday from 6:00p.m.—6:50p.m. in Physics Bldg 205.

Office Hours: Tuesday 1:00–2:00 p.m. Due to the covid pandemic, I will hold office hours online through Zoom for now.

Course Materials: Course materials will be available through Collab. There are three units (Static Games of Complete Information, Dynamic Games, and Games of Incomplete Information), and each unit is divided into a set of classes, and each class is divided into four to six lessons. Videos for each lesson (about 7 to 14 minutes each) will be made available on Collab. Problems and solutions for each class will also be posted on Collab. Practice exams and solutions will be provided in advance of the exams.

Textbook: The game theory curriculum is very standard, so there are five books you might use, depending on your interests, ranked from easiest to hardest:
- Harrington, J. *Games, Strategy, and Decision-Making*, Worth Publishers, 2008. This is the friendliest introduction to game theory available. This is best if you find economics or math challenging or want something a bit easier than the class to fall back on.
- Osborne, M. *An Introduction to Game Theory*, Oxford University Press, 2003. This option is pretty close to how the material will be presented in class. Its biggest advantage is that there are many problems in it, and a publicly available solution manual.
- Gintis, H. *Game Theory Evolving*, Princeton University Press, 2009. This is a quirkier, more intellectual and critical take on game theory and quantitative social science. It is a fun book that puts ideas first. If you think of yourself as more of an intellectual, this might be a fun option.
- Gibbons, R. *Game Theory for Applied Economists*, MIT Press, 1992. This book is more abstract, but shorter and is extremely clear. If you really like math or think you might continue studying econ at a master's or PhD level, you might enjoy this book.
- Fudenberg, D. and Tirole, J. *Game Theory*, MIT Press, 1991. If you are dual majoring in math and/or want to study game theory or economics at a graduate level, this is the standard text. It is comprehensive and covers all of the material in class (and much more), but at a significantly higher level of abstraction.

I think that for most students, the slides/handouts and problem sets/solutions are sufficient to take the class, and a book will not be especially helpful. But some students really like to have one as a reference, and any of these are a great option.

Prerequisites: Intermediate microeconomics and calculus.

Academic Integrity: (Wording suggested by the administration) ``I trust every student in this course to fully comply with all of the provisions of the University's Honor Code. By enrolling in this course, you have agreed to abide by and uphold the Honor System of the University of Virginia. All graded assignments must be pledged, including homework and exams. All suspected violations will be forwarded to the Honor Committee. Please let me know if you have any questions regarding the course Honor policy. If you believe you may have committed an Honor Offense, you may wish to file a Conscientious Retraction by calling the Honor Offices at (434) 924-7602."

Absences, late work, make-up exams, extra credit: If you are unable to turn in homework on time, please contact me in advance to explain the situation. If you, for some reason, are unable to take an exam at the scheduled time, please contact me in advance. There is no extra credit.

Students with Disabilities: If you are entitled to any arrangements, particularly for exams, please get in touch with me as soon as possible.

Class Schedule: There are three units (Static Games of Complete Information, Dynamic Games, and Games of Incomplete Information) that each correspond to an exam. Each unit is comprised of classes, and each class is comprised of four to six lessons. Exams cover a single unit and are not cumulative, although later content borrows and builds on the models, results, and language of earlier units.

Date	*Topic*
08/24/21	Games; Review of Pareto Optimality, Utilitarianism
08/26/21	Best Responses, Strategy Dominance, Iterated Deletion of Dominated Strategies
08/31/21	Pure Strategy Nash Equilibrium
09/02/21	PSNE: Examples
09/07/21	Mixed Strategy Nash Eqm
09/09/21	MSE: Examples and Advanced Theory
09/14/21	Continuous Games, I
09/16/21	Continuous Games, II
09/21/21	Extensive form games
09/23/21	Review
09/28/21	**EXAM 1: Lectures from 8/24 to 9/16**
09/30/21	Subgame Perfect Nash Eqm
10/05/21	Dynamic IO games
10/07/21	Bargaining Games
10/08/21	Intro to Repeated Games
10/12/21	**READING DAY**
10/14/21	The Folk Theorem
10/19/21	Topics in Repeated Games
10/21/21	Topics in Repeated Games
10/26/21	Types and Incomplete Information, The Lemons Model
10/28/21	Review
11/02/21	**EXAM 2: Lectures from 9/21 to 10/21**
11/04/21	Bayesian Nash Eqm, I
11/09/21	Bayesian Nash Eqm, II
11/11/21	Auctions
11/16/21	Auctions
11/18/21	Dynamic Games with Incomplete Information, Perfect Bayesian Equilibrium
11/23/21	Signaling Games, Separating and Pooling Equilibria
11/25/21	**THANKSGIVING BREAK**
11/30/21	Signaling Games, Separating and Pooling Equilibria
12/02/21	Hybrid Equilibria and Poker
12/07/21	Review
12/14/21	**EXAM 3: Lectures from 10/26 to 11/30; 9:00 a.m. to Noon**