INTA 4803/8803 - Introduction to Game Theory

Spring 2025
Class Hours: TR 3:30-4:45pm
Classroom: Howey Physics S106

Professor: Dr. Jenny Jun
Office: Habersham 214
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Office Hours: By appointment

Core Impact Statement

This is a Core IMPACTS course that is part of the Social Sciences area.

Core IMPACTS refers to the core curriculum, which provides students with essential knowledge in foundational academic areas. This course will help master course content, and support students' broad academic and career goals.

This course should direct students toward a broad Orienting Question:

- How do I understand human experiences and connections?

Completion of this course should enable students to meet the following Learning Outcome:

- Students will effectively analyze the complexity of human behavior, and how historical, economic, political, social or geographic relationships develop, persist or change.

Course content, activities and exercises in this course should help students develop the following Career-Ready Competencies:

- Intercultural Competence
- Perspective-Taking

- Persuasion

Course Description

This course provides an introduction to game theory. While this course is designed to be suitable for students in any discipline, students of International Affairs and/or Political Science may find the contents of this course particularly of interest. One of the goals of this course is to provide conceptual clarity to phrases that are often used (and abused) in Political Science, such as “costly signaling” and “credible commitment.” Another goal of the course is to aid graduate students in improving their research design, by coming up with hypotheses with clear assumptions that can be mathematically articulated and comparative statics derived from equilibria. While this course will be taught at the graduate level, the course is open to both graduate and undergraduate students. (In fact, undergraduate students have been some of the most successful performers in my past classes!) There are no prerequisites for this course beyond knowledge of high school math, although a few problems may involve simple calculus and we can do a quick refresher if needed.

The course will proceed as follows. We will first cover the concept of a nash equilibrium through normal form (aka. strategic form) games, in which players move “simultaneously” without knowledge of the other player(s)’ action(s). Normal form games are further divided into games of pure strategy nash equilibria (ex. Prisoner’s Dilemma), where players optimally choose a single action in the action set, and also games of mixed strategy nash equilibria (ex. Rock Paper Scissors), where players optimally choose a probability distribution among multiple actions in the action set. In the second half of the course, we will cover the concept of a subgame perfect equilibrium (SPE) and backward induction, mainly through extensive form games, in which players move sequentially. We will first cover extensive form games with perfect information (ex. Tic Tac Toe), in which players have all the payoff-relevant information they need. Finally, we will then cover (normal and extensive form) games of imperfect information and the concept of a perfect bayesian equilibrium (PBE). We will cover games of incomplete information (Bayesian games) involving “types”, and costly signaling/cheap talk.

Course Evaluation

Performance in this course will be evaluated through the following assessments:

Problem Sets	50%
Midterm	20%
Final Exam	25%
Attendance	5%

Problem Sets: There will be five problem sets each worth 10% of the final grade, assigned after class on Thursday and **due the following Thursday at 3:00pm** before class begins. Each problem set will consist of several exercises and proofs designed to further explore concepts covered in class up to that date.

The problem sets are a group assignment - students will form groups of 2 (or 3 if odd number) and complete the problem sets as a team. There will only be one grade for each problem set submitted, meaning students in the same group will receive the same grade. Students are encouraged to meet to work on problems together, whether with team members or other classmates outside of the team. I'm creating this arrangement on purpose to encourage teaching each other - I've often found that teaching others is a great way to precisely master the concept. It also gets students to articulate and communicate their logic, which helps refine the clarity of proofs and catch mistakes.

All problem sets should be typed in LaTeX and submitted in PDF via Canvas by the due date. See "Student Resources" below for a guide on how to get started with LaTeX. Do not attempt to type answers in Word/Google Docs - it will get messy very soon.

Out of fairness to others, late assignments will receive deductions according to below:

0-24 hours	30% of total available points
24-48 hours	50% of total available points
48-72 hours	70% of total available points
72 hours-	100% of total available points

Midterm: The midterm will be held in person during class time on **Thursday, February 27** and will cover all material up to and including mixed strategy nash equilibria (Parts 1 and 2). This will be a handwritten exam.

Final Exam: The final exam will be held in person on **Thursday, April 24** and will cover all material after mixed strategy nash equilibria (Parts 3 and 4). The final exam is NOT cumulative. This will be a handwritten exam. I will hold a Q&A session on the last day of classes, Tuesday, April 22.

Attendance: I've allocated a small percentage of the grade to attendance as a way to encourage you to attend every lecture. Game theory is one of those classes where knowledge is cumulative, and missing a lecture in the middle can affect your ability to understand subsequent material. With the exception of reasonable and necessary excused absences, I highly recommend attending every lecture.

Grading

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Per Georgia Tech policy, grades are awarded on a scale of A-F with no +/- grades permitted. Additional information regarding Georgia Tech's grading system is provided by the Registrar here.

Incompletes (I): Students may be assigned an "incomplete" when they were doing satisfactory work, but for nonacademic reasons beyond their control and deemed acceptable by the instructor, the student was unable to meet the full requirements of the course.

Withdrawals (W): Withdrawals from individual courses without penalty will not be permitted after 60 percent of the term has been completed, as specified by the official calendar, except in cases of hardship.

Student Resources

Textbook:
The textbook for this class will be *An Introduction to Game Theory* by Martin J. Osborne. The electronic PDFs of all of the textbook chapters we will be using will be made available on Canvas. A hard copy of the textbook is also available in the GT library. You are welcome to purchase a hard copy of the textbook, though it is entirely not necessary.

Getting Started with LaTeX:
LaTeX is a typesetting system that is great for writing mathematical expressions and proofs, among other things. I've uploaded a short LaTeX "starter pack" document on Canvas to help you get started with typing math equations and proofs in LaTeX. I've also uploaded the .tex file for the document so you can see the corresponding code. Please get familiar with the system on Week 1, before your first problem set assignment.

Accommodations for Students with Disabilities:
Georgia Institute of Technology is committed to creating a learning environment that meets the needs of its diverse student body. Students with disabilities, whether physical, learning, or psychological, who believe that they need accommodations, are encouraged to contact the Office of Disability Services as soon as possible to ensure accommodations are implemented promptly. Students must provide documentation of their disability to ODS by uploading the forms into the AIM portal. Per Georgia Tech policy, accommodations are not retroactive, which means the accommodations are applied once the student has conversed with the instructor either in person, by phone, or by email to discuss accommodation needs. During this exchange, the student and instructor will discuss how the student's accommodations will be applied in the course. The student needs to inform the professor and/or ODS of the intention to use specific accommodations prior to the course event and with a reasonable amount of time for accommodations to be adequately facilitated. Students can find more information about the Office of Disability Services, including contact information, at disabilityservices.gatech.edu, or call ODS at 404.894.2563 or in person at Smithgall Student Services Building, 353 Ferst Drive, Suite 221.

Course Policies and Expectations

Academic Integrity:
Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For a clear description of what counts as plagiarism, cheating, and/or the use of unauthorized sources, please see the Student Code of Conduct. For more information about Georgia Tech's standards with respect to academic integrity, please see Georgia Tech's Honor Code.

Any student suspected of cheating or plagiarizing on a quiz or exam will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

On the use of generative AI tools:
Generative AI is great at LaTeX formatting/troubleshooting; it's (so far) not so great at mathematical reasoning. My general rule for this class is that you may use generative AI for typing up your answers in LaTeX, but not for actually solving the exercises in the problem set. You can try to feed the problem set exercises into the model, but chances are that this will lead to a poor grade in the problem set and you will most likely not be prepared for the midterm and final exam, which are in-person.

However, I am often interested in how each model performs (or fails to perform) on a given game theory exercise, especially over time. If you have interesting examples of model responses to exercises in the problem set, I encourage you to submit them to the designated folder on Canvas!

Class Schedule

Other than the problem set and exam dates, consider the following week-to-week class schedule only as a rough guide - I've found that every group of students are unique year to year and sometimes need extra time to go over a concept in particular places, or fly through certain material. We will adjust lecture speed accordingly. After you get your graded problem sets back, we will also spend a bit of time at the beginning of class to go over common mistakes.

Part 1: Normal (Strategic) Form Games - Pure Strategy Nash Equilibria
Osborne Chapters 2~3

Week 1: Why learn game theory? / Normal form games and PSNE

1/7 (Tue)
1/9 (Thu) - (Get familiar with LaTeX this week)

Week 2: Normal form games and PSNE

1/14 (Tue)

1/16 (Thu) - Problem Set 1 Assigned

Week 3: Preferences and Utility ; Normal form games with continuous preferences

1/21 (Tue)
1/23 (Thu) - Problem Set 1 Due

Week 4: More PSNE games

1/28 (Tue)
1/30 (Thu) - Problem Set 2 Assigned

Part 2: Normal (Strategic) Form Games - Mixed Strategy Nash Equilibria

Osborne Chapter 4

Week 5: More PSNE games / Intro to MSNE

2/4 (Tue)
2/6 (Thu) - Problem Set 2 Due

Week 6: More MSNE games

2/11 (Tue)
2/13 (Thu) - Problem Set 3 Assigned

Week 7: More MSNE games / Midterm Q&A

2/18 (Tue)
2/20 (Thu) - Problem Set 3 Due

Part 3: Extensive Games with Perfect Information

Osborne Chapters 5~6

Week 8: Intro to extensive form games / Backward Induction

2/25 (Tue)
2/27 (Thu) - MIDTERM (Exam material only Parts 1 and 2)

Week 9: Subgame Perfect Equilibrium (SPE) / SPE games

3/4 (Tue)
3/6 (Thu) - Problem Set 4 Assigned

Week 10: More SPE games

3/11 (Tue)
3/13 (Thu) - Problem Set 4 Due

Week 11: Spring Break

3/18 (Tue) - No Class
3/20 (Thu) - No Class

Part 4: Games with Imperfect Information

Osborne Chapters 9~10

Week 12: Perfect Bayesian Equilibrium (PBE) / Games of Incomplete Information

3/25 (Tue)
3/27 (Thu)

Week 13: Games of Incomplete Information / Games of Imperfect Information

4/1 (Tue)
4/3 (Thu) - Problem Set 5 Assigned

Week 14: Illustration: Costly Signaling

4/8 (Tue)
4/10 (Thu) - Problem Set 5 Due

Week 15: Illustration: Cheap Talk

4/15 (Tue)
4/17 (Thu) - LAST DAY OF CLASSES

Week 16:

4/22 (Tue) - FINAL EXAM Q&A SESSION

4/24 (Thu) - FINAL EXAM (Exam material only Parts 3 and 4)
2:40 PM - 5:30 PM (Set by the registrar)