SYLLABUS
MATHEMATICAL GAME THEORY
MA 460, SPRING 2025

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF ALABAMA AT BIRMINGHAM

Course Instructor: Dr. Milena Stanislavova
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Wednesday 1:30-2:30pm, UH 4059

Course Info

Meeting times: MWF 9:00am-9:50am
Meeting location: UH 4004
Prerequisite: Grade of C or better in MA 125 or MA126 or MA 168.
Credits: 3 semester hours
Textbook: Game theory in action, an introduction to classical and evolutionary models by S. Schecter and H. Gintis, Princeton University Press, 2016; ISBN-13: 978-0-691-16765-7
Topics to be covered: Chapters 1, 2, 3, 4, 5, 7, 8, 9 and 10.

Important Dates

First day of classes: January 13, 2025
MLK Day: January 20, 2025
Last Day to drop (without paying full tuition): January 21, 2025
Spring Break: March 10-16, 2025
Last Day of class: April 25, 2025
Final Exam: Wednesday, April 30, 2025 8-10:30am

Course Description

This course is an introduction to mathematical game theory for those that have good understanding of calculus. Game theory is the study of multi person decision problems. Unlike calculus and optimization, where one learns how to maximize functions when the payout depends only on your own choices, game theory deals with situations in which payout depends not only on your own choices but also on the choices of others. Such problems arise frequently in economics. Like optimization, game theory is defined by the problems it deals with, not by the mathematical techniques that are used to solve them. These problems come from diverse fields ranging from evolutionary biology and animal behavior to political science and economics. Examples are drawn from scenarios such as trafic accidents, crime-control strategies, climate change negotiations, politicians competing for votes, jury members deciding on a verdict, etc.

In addition, the course provides substantial treatment of evolutionary game theory, where strategies are not chosen through rational analysis, but emerge by virtue of being successful. This part of game theory requires understanding of calculus and some differential equations and is the most relevant to biology. It also explains how human societies evolve. Like other sciences, game theory consists of a collection of models. Problem sets to help develop the ability necessary to master the understanding of game theory models and tools will be discussed and assigned as homework at the end of each chapter. Quantitative literacy is an important component of this course.

Learning Outcomes

Upon successful completion of this course students can:

- understand the idea of backward induction for games in extensive form
- understand the idea of elimination of dominated strategies for games in normal form
- understand the concept of Nash equilibrium, the most important idea in game theory
- understand the theory of games in extensive form with incomplete information
- understand mixed strategy Nash equilibria and the alternatives to Nash equilibrium
- understand evolutionary dynamics with the use of tools from differential equations and linearization

Homework and Exams

There will be 6 homework sets, assigned at the end of each chapter. There will be one midterm exam and one final exam.

Assessment Procedures

There are 1000 total points possible in the course as follows:
Homework - 300 points, Midterm - 300 points, Final Exam - 400 points.
Grading scale: 900 points needed for an A, 800 for a B, 700 for a C, 600 for a D, bellow 500 - F.

DSS Accessibility Statement

UAB is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under the Americans with Disabilities Act (ADA) or Section 504 of the Rehabilitation Act, and you require accommodations, contact Disability Support Services for information on accommodations, registration and procedures. Requests for reasonable accommodations involve an interactive process and consist of a collaborative effort among the student, DSS, faculty and staff. If you are registered with DSS, please contact me to discuss accommodations that may be necessary in this course. If you have a disability but have not contacted DSS, please call (205) 934-4205 or visit the DSS website.

Title IX Statement

UAB is committed to providing an environment that is free from sexual misconduct, which includes gender-based assault, harassment, exploitation, dating and domestic violence, stalking, as well as discrimination based on sex, sexual orientation, gender identity, and gender expression. If you have experienced any of the aforementioned conduct we encourage you to report the incident. UAB provides several avenues for reporting. For more information about Title IX, policy, reporting, protections, resources and supports, please visit the UAB Title IX webpage for UAB's Title IX Sex Discrimination, Sexual Harassment, and Sexual Violence Policy; UAB's Equal Opportunity and Discriminatory Harassment Policy; and the Duty to Report and Non-Retaliation Policy.