COURSE DESCRIPTION
MATHEMATICAL GAME THEORY
MA 419-1F
SPRING 2022

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF ALABAMA AT BIRMINGHAM

Course Instructor: Dr. Milena Stanislavova
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Office Hours: Monday 11am-noon, Wednesday 3-4pm

Course Info

Meeting times: MWF 1:25pm-2:15pm
Meeting location: HHB 422
Prerequisite: Grade of C or better in MA 125, 225 or equivalent.
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, 10

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 payoff depends only on your own choices, game theory deals with situations in which payoff 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 traffic 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 others 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.

Important Dates

First day of classes: January 10, 2022
MLK Day: January 17, 2022
Spring Break: March 14-20
Midterm: March 28, 2022
Final Exam: April 29, 2022

Objectives of the Course

Upon successful completion of the course, a student can

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

Assessment Procedures

There are 1000 total points possible in the course as follows:
Homework - 300 points
Midterm - 300 points
Final Exam - 400 points.
Standard grading scale will be used with 900 points needed for an A, 800 for a B, 700 for a C.

Masking Requirements

Masking has proven to be one of the most successful mitigation strategies used to combat the spread of the various variants of the COVID-19 virus. UAB requires face coverings indoors on campus.