

Game Theory and Applications Syllabus

(ECO 4400, Spring 2023)

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Course Prerequisites: ECO 3101 or ECP 3703 and MAC 2233 (or higher calculus)

Textbook: Harrington, J.E., *Games, Strategies, and Decision Making*, 2nd edition, Worth Publishers: Macmillan Ed., 2015. Macmillan has sent me a link to their online store, the url being: <https://store.macmillanlearning.com/us>, where they indicate it provides good pricing options for students. Have a look!

Canvas Course Website: The website is used mainly to post some resources for the course. Four types of files have and will be posted: (i) Detailed lecture notes are posted under Files > Lectures. *It will be very useful for you to download these and have them in class to follow along and add to.* See the Topical Outline below for when the particular files are relevant. (ii) Practice questions from the book are under Files > Practice Questions and are titled: Practice Problems in Harrington Ch X. *It is crucial that you do these to learn the material.* Some sample exams are in this file as well. (iii) Answers to the end-of-chapter problems in the textbook, part of the assigned problems in (ii), are also provided under Files > Practice Questions and are titled: harrington2e_sm_chX. (iv) Last the syllabus and some handouts are posted under Files > Course Resources. I will also post things like answers to the midterms. Regarding the handouts, I will let you know when you want to read each particular one.

About this Course: We study the basic framework and principles of classic game theory and apply these to a variety of strategic problems. The realm of game theory concerns settings having decision makers preferred (strategy) choices depend on others' (strategy) choices. A variety of environments have this property including economic problems, political competition, social interactions, international relations, military choices, and sports and parlor games. While this is a course in the economics program and we examine many economic problems, a number of applications we examine are not classic economic problems. This is a course in applied theory. Game theory is a branch of mathematics. As such, the course is fairly technical. We will use differential calculus at times (to solve continuous optimization problems), integration in a few problems, and sometimes calculate expected values (when a decision maker's payoff is uncertain).

Learning Game Theory: We will work through many examples of games in class that illustrate how to apply the principles of game theory. It is one thing to follow what we do in class and quite another to do it yourself. It is *essential* to carefully read the book (multiple times), study, and do problems to learn

game theory. It is not a matter of applying a bunch of formulas. I have provided problems in the book to do, all with answers available (either in the book itself or at the course website). Sometimes problems and concepts are easy; sometimes not. Do the problems!

Comments on Textbook: The textbook is far and away the best for a serious first course in game theory. It is well written, comprehensive, and has a huge number of good examples and problems. I will follow it quite closely in teaching this class. A caveat about the book is that some of the examples involve stereotyped players, which the author makes clear are stereotyped and not to be taken seriously.

Topical Outline, Tentative Timing,¹ Textbook Reading,² Relevant Course Notes³:

Topic 1: Introduction, Setting up Games, Rationality and Analyzing Games with Just Rationality
~ 4 classes; Reading: Chapters 1,2, & 3; Relevant Course Note Files are ‘Game Lectures Introduction Presentation 1 and ‘Game Lectures Rationality Presentation.’

Topic 2: Nash Equilibrium and Discrete Games
~ 4 ½ classes; Reading: Chapters 4 & 5; Relevant Course Notes Files are ‘Game Lectures Nash Equilibrium Discrete Games’

Midterm 1: February 13

Topic 3: Nash Equilibrium and Continuous Games
~ 3 classes; Reading: Chapter 6; Relevant Course Notes Files are ‘Game Lectures Nash Equilibrium Continuous Strategies’

Topic 4: Mixed Strategies
~ 3 classes; Reading: Chapter 7; Relevant Course Notes Files are ‘Game Lectures Randomization Presentation.’ Optional: ‘Example Games w Continuous Mixed Strategy Equilibria_Contests’

Topic 5: Sequential Games with Perfect Information
~ 4 classes; Reading: Chapter 8; Relevant Course Notes Files are ‘Lectures Sequential Games Perfect Info Presentation.’ We’ll likely review ‘Football Overtime Rule_SequentialGameExample’

Midterm 2: March 29

Topic 6: Sequential Games with Imperfect Information
~ 4 classes; Reading: Chapter 9 (skip 9.5); Chapter 10, just pp. 359-368; Relevant Course Notes Files are ‘Game Lecture Imperfect and Incomplete Information Presentation.’

Topic 7: Repeated Play

¹The classes devoted to each topic are estimates. I will keep you informed as to where we are. I will adapt the coverage if we fall behind. We will stick to the exam dates unless something extraordinary happens.

² You are not expected to read any of the appendices to the assigned chapters unless I tell you otherwise.

³ The Course Notes are at Canvas. Beginning at left menu, Files > Lectures. They are *not* ordered at Canvas in the order they will be covered, so pay attention to the file titles.

~ 4 classes; Reading: Chapter 13; Chapter 14 (skip 14.5); Relevant Course Note Files are 'Game Lectures Repeated Games 1 Presentation' and 'Game Lectures Repeated Games 2 Coop and Rep Presentation.'

Final Exam: April 26

Grading: The course grade is determined by the performance on the three equally weighted non-cumulative exams (see above for dates). I will curve each exam as needed to have a fair distribution of grades, *no more stringent* than an equal number of A's, A-'s, B+'s, B's, B-'s, and C and lower grades combined. Scores below 60% on exams will result in D or lower grades (below 50% an E grade).

Make-up Policy: Students are permitted to make up exams only for good (and documented) medical reasons or real (and documented) family emergencies.

Classroom Expectations:

- **Attendance is required with the exceptions summarized in the UF Attendance Policy. These exceptions include illness. Of course, do not attend if ill!** (Please see [UF Attendance Policy](#) for exceptions to attendance.) Students are expected to be punctual in class attendance and remain in the classroom for the entire class session, unless an urgent need arises or prior arrangements have been made with the instructor.
- Students are expected to arrive for class prepared to meet classroom obligations and to devote full attention and commitment to the work of that class, as well as to actively participate in the class.
- **Laptops and other electronic devices (phones!) should not be turned on. If you take notes on your laptop, clear this with me.**
- I hold myself to the same standards of behavior that I expect of students!

Academic Honesty: Students are bound to not cheat or plagiarize, and are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: 'On my honor, I have neither given nor received unauthorized aid in doing this assignment.'"

You should familiarize yourself with the [UF Student Honor Code](#). Cheating and plagiarism are not the only violations of this policy. Importantly, ignorance of a policy is not a valid reason for violating it.

Students Requiring Accommodations: Students with disabilities requesting accommodations should first register with the Disabilities Resource Center (392-8565; <https://disability.ufl.edu/>), providing appropriate documentation. Once registered, students will receive an accommodation letter that can be presented to the instructor when requesting accommodations. Please register at the beginning of the course if seeking accommodations.

Recording Lectures: (The language that follows is from university guidelines.) Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.