

Game Theory and Applications

ECO 4400 Section: 0150

Class Periods: Monday/Wednesday, Periods 7-8, 1:55-3:50pm

Location: MAT 0112

Academic Term: Fall 2021

Instructor:

Professor Daniel Wagner

wagnerdnlj@ufl.edu

352.294.0989

Office Hours: [T 2:00-3:00pm](#) and [R 11:00am-12:00pm](#) via Zoom, or by appointment

Course Description

Introduces modern game theory, including the formal theory of Nash equilibrium and solutions techniques.

Applications include strategic barriers of entry; cooperative behavior in oligopoly, auctions and bidding strategies; and durable goods sales.

4 credits

Face-to-Face ONLY

This class will be held face-to-face. All students are expected to attend class in person. Lectures will not be streamed or recorded. **Masks are expected** in all economics classes. <https://coronavirus.ufl.edu/health-guidance/>.

Course Pre-Requisites

Intermediate Microeconomics(ECO 3101) and Calculus I(MAC 2311) or equivalents.

Game Theory is an advanced interdisciplinary topic that is as much mathematics as it is economics. This course builds heavily on the calculus and firm optimization explored in ECO 3101 and equivalents and it is important to not just have taken these courses but be comfortable with the material and algebra skills in general. Most students do well in this course but those who do not usually struggle with the calculus, probability, and manipulating firm profit functions in particular.

Course Objectives

Analyze and model strategic decision making by rational actors under perfect and imperfect information, study industrial organization and pricing decisions in a more mathematically rigorous context and conclude with longer games and decisions under uncertainty.

Required Textbook

- Games, Strategies, and Decision Making
- Joseph E. Harrington Jr.
- 2015, 2009, 2nd Edition
- ISBN number: 978-1-4292-3996-7

Recommended Materials

- [Partial Derivatives- Khan Academy Review](#)
- Dixit, Skeath, and McAdams- textbook used in Professor Lee's Game Theory section

Module 1: Introduction to Game Theory

This module provides an introduction to Game Theory and develops concepts that will be used through the rest of the course. We will study how equilibrium is achieved in simultaneous and sequential move games with 2 players, allowing modeling of topics such as firm duopolies and the Cold War, and setting the stage for more complex games.

Week 1: Simultaneous Move Games and Strict Dominance *August 23 – August 27*

- Read: Harrington Chapter 1 and 2 for Monday, 3 for Wednesday
 - Optional reading- Dixit, Skeath, McAdams: Chapter 1 and 2
- Syllabus Quiz Wednesday, Math Assessment Quiz asynchronously due Friday

Week 2: Nash Equilibrium and Best Responses *August 30 – September 3rd*

- Read: Harrington Chapter 4, up to part 4.5 for Monday, remainder for Wednesday
 - Dixit Chapter 4
- Problem Set 1 given Wednesday, due next Wednesday
- Quiz 1 Wednesday

Week 3: Sequential Move Games and Subgame Perfection *September 6 – September 10*

- Holiday Monday- Labor Day
- Read: Harrington Chapter 8 to 8.4 Wednesday, remainder next week
 - Dixit Chapter 3
- Problem Set 1 due Wednesday

Week 4: Subgame Perfection Wrapup/Relationship between Normal Form and Extensive Form *September 13 – September 17*

- Read: Review Harrington Chapter 8 and 2
 - Dixit Chapter 6
- Quiz 2 Wednesday
- Problem Set 2 Given Wednesday, Due next Wednesday

Week 5: Relationship between Normal Form and Extensive Form & Review *September 20 - September 24*

- Problem Set 2 Due Wednesday
- Pre-exam Review Session Friday online (optional)

Week 6: *September 27*

- Exam 1 Monday
- Module 2 begins Wednesday

Module 2: Mixed Strategies, Continuous Strategies, and Repeated Games

This module integrates probabilities and calculus to introduce mixed and continuous strategies, respectively, before moving on to repeated games, building on the framework from the previous module with a wider range of moves, including randomizing moves, infinite strategy choices, and negotiating agreements.

Week 1: Mixed Strategies Part 1 *September 29 – October 1*

- Read: Harrington Chapter 7, Through 7.3 for Monday, Remainder for next Monday
 - Dixit Chapter 7
- Problem Set 3 Given Wednesday, due next Wednesday

Week 2: Mixed Strategies Finish/ Continuous Strategies 1 *October 4 – October 8*

- Read: Harrington Chapter 6, part 6.1 and 6.2 for Wednesday, and 6.3 for next Monday
 - Review Derivatives and Partial Derivatives on Khan Academy
 - Dixit Chapter 5
- Problem Set 3 due Wednesday
- Homecoming Friday

Week 3: Continuous Strategies 2 *October 11 – October 15*

- Read: Harrington Chapter 6
 - Dixit Chapter 5
- Quiz 3 Wednesday
- Problem Set 4 Given Wednesday, due Monday after next

Week 4: Continuous Wrap up, Repeated Games and Tacit Collusion *October 18 – October 22nd*

- Read: Harrington Chapter 13 for Monday and 14 for Wednesday
- Quiz 4 Wednesday

Week 5: Repeated Games and Tacit Collusion, Exam 2 *October 25 – October 29*

- Problem Set 4 due Monday
- Review Session Tuesday online (optional)
- Exam 2 Wednesday

Module 3: Incomplete Information and Applications

This module introduces games with incomplete information, and applications of Game Theory to more complex real world examples and other disciplines. We study Bayesian and Perfect Bayesian Nash Equilibrium concerning players who are unsure who their rival(s) are. Continuing more complex real world games we will study N-Player Games- games with many or infinite players and more complex strategic scenarios such as purchase of durable goods. These topics further integrate probability for actions under uncertainty and combine calculus with discount rates to model Tacit Collusion, or implicit restrictions of supply used to form cartels without direct communication.

Week 1: Bayesian Games and Tacit Collusion Wrap up *November 1– November 5*

- Read: Harrington Chapter 9, up to 9.4 for Wednesday, Remainder for next Monday
 - Dixit Chapter 8 and 9
- Quiz 5 Wednesday

Week 2: Bayesian Games/Signaling *November 8 – November 12*

- Read: Harrington Chapter 10, up to 10.4 for Wednesday, Remainder for next Monday
- Problem Set 5 given Monday, due next Monday

Week 3: Signaling/N Player Games *November 15 – November 19*

- Read: Harrington Chapter 5 for Wednesday
- Problem Set 6 given Wednesday, due Wednesday after break
- Quiz 6 Wednesday

Week 4: Thanksgiving Break *November 22– November 27*

- Off week- Professor Absence + Thanksgiving
- UF withdrawal deadline Monday
- Faculty Evaluations Open Tuesday

Week 5: N Player Games and Durable Goods *November 29 – December 3*

- Read: Harrington Chapter 5
- Problem Set 6 Due Wednesday

Week 6: Durable Goods Wrap Up and Final Review *December 6 – December 10*

- Quiz 7 Monday
- Final Review Session Wednesday
- Reading Days begin Thursday

Final Exam: December 15th, 10am to 12pm, during assigned UF final exam slot

If you have a conflict in final exams, as per UF policy:

- If two exams are scheduled at the same time, assembly exams take priority over time-of-class exams.
- When two assembly exams or two time-of-class exams conflict, the course with the higher number will take priority. Instructors giving make-up exams will make the necessary adjustments.

If the conflicting course has a code of less than 4400, contact that instructor to arrange a makeup.

Attendance Policy, Class Expectations, and Make-Up Policy

While not graded, attendance is required. You are responsible for the material covered in lecture. This course covers a fairly large amount of material in one semester and attendance is crucial to avoid falling behind. You may obtain notes from your classmates, but class is most effective when attended in person, and quizzes must be completed in class unless otherwise stated.

For record keeping purposes office hours will also be recorded, but not posted.

Late work will be accepted at a letter grade penalty per day. Work without a name will receive a one letter grade penalty, but this should not be an issue with all assignments submitted via Canvas.

- The problem sets, readings, and quizzes are intended to prepare you for the exams. Similarly to Intermediate Microeconomics this course involves intuition that can be difficult to grasp; practice is key.

The course is designed with the assumption that you are practicing examples of the material, if you do not complete the quizzes and problem sets yourself you will not be prepared for the exams.

- Problem sets are due at the beginning of class on Canvas and students will be selected at random without replacement to present solutions. I will assist you if you are unsure of the answer but presenting answers is not optional.
- It is your responsibility to inspect your uploads on Canvas and make sure your problem set submission is legible and a usable file- corrupted files will receive a 0.
- Quizzes are on alternate weeks to when the problem sets are due, first individually and then a second time with groups of up to 4. This is intended to encourage study groups but both quizzes will count as the final grade is an average of the two attempts; you are responsible for the materials in the lectures and readings which will prepare you for the quizzes. Your lowest quiz grade will be dropped. Skipping the first attempt of a quiz and completing it only with your group is an automatic 0.
- While collaboration on problem sets and group quizzes is allowed this is again intended as a study tool; your classmates are a valuable resource but if you do not work through the problems yourself it is easy to falsely think you understand the material.
 - I have seen students blindly copy incorrect answers from each other, not engage with the material, and go on to do poorly on the exams. If you cannot put pencil to paper and work the problems yourself, you are not going to be able to during exams.

Laptops are not recommended for note taking as course notes will heavily rely on diagrams that are easier to draw by hand. Quizzes on Canvas can be taken on laptops or smartphones with a web browser or the Canvas application.

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.

Excused absences must be consistent with university policies in the Undergraduate Catalog and require appropriate documentation. Please notify me in advance if you will be absent during a quiz or exam or when a problem set is due if at all possible. Additional information can be found here:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Evaluation of Grades

Assignment	Percentage of Final Grade
Problem Sets	15%
Quizzes	10%
Midterm Exam 1	25%
Midterm Exam 2	25%
Final Exam	25%
	100%

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.99	B+	3.33
80.0 - 86.99	B	3.00
77.0 - 79.99	C+	2.33
70.0 - 76.99	C	2.00
67.0 - 69.99	D+	1.33
60.0 - 66.99	D	1.00
0 - 59.9	E	0.00

Grades will not be rounded, an 89.99 is a B+. A curve will be implemented on exams only if the class average is below 70, which has not yet been necessary in a year and a half of teaching this course. Quizzes will also be curved if the average is below 70%. The homework and quizzes are intended as a buffer in addition to preparing you for the exams.

If you feel there is an error in an assigned grade, you may submit a written request via email with the specific error(s) outlined with an explanation of why the readings, lectures, problem sets, and quizzes did not prepare you for these question(s) or why your answer is correct and the entire assignment will be regraded.

Substitute work will not be offered except in cases of excused absences or other accommodations. If an assignment without a name can be identified, it will be accepted at a letter grade penalty. If ownership is disputed and cannot be identified it will not be accepted.

Makeup exams must be prearranged and only for UF approved conflicts.

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

In the interests of fairness I will not deviate from the syllabus. I will not deviate from the grading scheme outlined no matter the consequence of a particular letter grade for you; I do not enjoy giving low grades but deviating from the syllabus is not fair to other students. This message is not necessary for the vast majority of students but has been added to this syllabus out of hard experience- it is your responsibility to attend class, complete the problem sets and quizzes, study, and make a rational assessment of your chances before the withdrawal period closes.

If you are struggling with the material or think you do not understand, seek help from me or your study group- do not wait for the exam or ask for extra credit after the fact.

Email

Most of our one-on-one communication will occur via email. There are two important course policies regarding email:

- 1) I expect that you are reading your email at least once per day, and
- 2) All emails that you send must follow basic rules for professional correspondence. If you are unsure of what constitutes professionalism, feel free to ask or simply err on the side of caution.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Present your accommodation letter to me as early in the semester as possible to allow time for accommodations to be arranged.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

University Honesty Policy

UF students 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." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

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If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.

In response to COVID-19, the following practices are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

- If you are not vaccinated, get vaccinated. Vaccines are readily available at no cost and have been demonstrated to be safe and effective against the COVID-19 virus. Visit this link for details on where to get your shot, including options that do not require an appointment:
<https://coronavirus.ufhealth.org/vaccinations/vaccine-availability/>. Students who receive the first dose of the vaccine somewhere off-campus and/or outside of Gainesville can still receive their second dose on campus.
- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.
 - Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
 - Hand sanitizing stations will be located in every classroom.

- If you sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
 - Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.
 - If you are withheld from campus by the Department of Health through Screen, Test & Protect you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- Continue to regularly visit coronavirus.UFHealth.org and coronavirus.ufl.edu for up-to-date information about COVID-19 and vaccination.