

Game Theory and Applications

ALL DATES AND TIMES IN THIS SYLLABUS ARE ACCORDING TO EASTERN STANDARD TIME (GAINESVILLE TIME.)

Instructor: Jay Lee
Email: jeongwoo@ufl.edu
Office: Zoom link in Canvas.
Office Hours: M & W 4:00PM - 5:00PM or by appointment.

Classroom

- All Tuesday classes will be held through zoom except the following exam dates.
 - Exams (in person): Feb 9th, Mar 16th, and Apr 20th.
 - Zoom link is available in Canvas.
- All Thursday classes will be held in the designated classroom.

Course Description We study modern game theory. Topics include Nash equilibrium in simultaneous-move and sequential-move games, repeated games, Bayesian games, and their applications. Applications include firm competition, trade wars, sports, voting, auctions, education, and systems biology.

Prerequisites

- Survey of Calculus (MAC 2233) or higher level of math courses.
- Intermediate Microeconomics (ECO 3101)

You are expected to have familiarity with basic calculus. You should be comfortable with drawing and interpreting graphs, taking partial derivatives and using algebra to manipulate equations. If you have any questions on this matter, I will be happy to discuss this in the first week of this semester.

Course Materials Two main recommended textbooks are as follows.

- “Games, Strategies, and Decision Making” 2nd edition by Harrington.
- “Games of Strategy” 5th edition by Dixit, Skeath, and McAdams.

However, I will not be following the textbooks. You can use them when you do not understand something that happened in class or when you want to reinforce an idea that came up in class. Also, you can use the textbook problems for your own studying. I will inform you which chapters are relevant for each class.

Covid-19 Related Policy: Safety Protocols

1. Only students who are tested at least every two weeks can attend in-person classes.
2. All students must sit at least 6 feet apart in specially designated seats.
3. Everyone must wear a face covering for the entirety of the class. For this reason, prohibitions on eating and drinking in class are strictly enforced.
4. If a student does not comply with these rules, I will ask them to comply once and then ask them to leave class if they refuse to comply. If they then refuse to leave, I will end class and report the incident to Dean of Students.

Check UF's policies for social distancing and face coverings. ¹ Not following these rules could result in disciplinary action, and I take this very seriously and would advocate for such action. The University will test all students who are enrolled in face-to-face sections at least every two weeks. Failing to get testing when instructed to do so could result in them being withheld from campus. Students can also be withheld by self-reporting symptoms or exposure to a COVID-positive individual, or because they were identified as a "close contact" by UF Screen, Test, Protect's contact tracing program.

You can still attend the classes through zoom when you are withheld from campus or even when you have Covid-like symptoms. If this is the case, you should inform me at least two hours before the class begins. Then I will set up the equipment in the classroom, and let you know the zoom link. THIS OPTION IS PROVIDED FOR THOSE WHO ARE IMPACTED BY COVID-19, NOT FOR THOSE WHO DO NOT GET TESTED.

Covid-19 Related Policy: Online Class All Tuesday classes except exams will be held through zoom. ² I strongly encourage you to activate your cameras in class whenever possible, though you have a right to turn your camera off. For your privacy, I also encourage you to use virtual backgrounds or reposition your cameras. For your engagement and interaction in class, I will use the "polling" feature very often.

Covid-19 Related Policy: Recording Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Covid-19 Related Policy: Office Hours I will hold virtual office hours in Zoom. If these hours conflict with other courses, you should identify and resolve such conflicts before the end of the first week of classes.

¹<https://policy.ufl.edu/policy/student-behavioral-expectations-in-response-to-covid-19/>

²All face-to-face classes are required to meet in their assigned classroom for at least 51% of scheduled class meeting times.

Evaluation Your grade will depend on your performance on exams, problem sets, and quizzes. Your final grade will be calculated as follows:

Exam 1	25%
Exam 2	25%
Exam 3	25%
Problem Sets	20%
Quizzes	5%

Your final letter grade³ will be determined as follows:

93 – 100	<i>A</i>
90 – 92.99	<i>A–</i>
87 – 89.99	<i>B+</i>
83 – 86.99	<i>B</i>
80 – 82.99	<i>B–</i>
75 – 79.99	<i>C+</i>
70 – 74.99	<i>C</i>
65 – 69.99	<i>C–</i>
60 – 64.99	<i>D+</i>
55 – 59.99	<i>D</i>
0 – 54.99	<i>E</i>

Exam Dates

Exam 1: Tuesday, Feb 9th in class.
 Exam 2: Tuesday, Mar 16th in class.
 Exam 3: Tuesday, Apr 20th in class.

Exams will take place in the classroom. (Honorlock proctoring is not provided for our class.) You need to bring your fully-charged laptop to take the exam. We will use the Canvas quiz for exams to reduce contacts even though it is in-person exams. You can use a calculator that has NO communication functions. You are NOT allowed to use the calculator feature in your phone or your laptop. The exams will involve solving for an equilibrium and interpreting results with economic intuition. There will be NO cumulative exams, but you will need to understand the concepts in the earlier chapters to proceed to the advanced chapters.

Make-up Exams If you have an excused conflict (e.g., a religious holiday) with any exam this semester, please email me by the end of the first week of class.

Make-up exams will be administered only on those circumstances in which you cannot take an exam for a valid reason according to UF policy. In that case, you should notify me prior to the start of the examination. In addition, you will need to provide valid documentation (within a week) justifying your absence. Supporting documentation related to excuses for missed exams must include contact information for verification purposes. Failure to comply with these rules will result in a zero score in the missed exam. Providing false documentation or creating a false excuse constitutes cheating under the University guidelines. UF's policy on academic honesty will be strongly enforced.

³More information on grades and grading policies is here: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Problem Sets There will be 8 problem sets. I encourage you to work together, but each student has to submit their own solutions. Solutions should be scanned and submitted in Canvas. Your scanned submission should be high-quality and professionally presented. All problem sets are due the class time before the class starts on the due date. Late submissions will not be accepted and will receive zero credit. The due dates are as follows.

Problem Set 1: Tuesday, Jan 26th in class.

Problem Set 2: Tuesday, Feb 2nd in class.

Problem Set 3: Tuesday, Feb 23rd in class.

Problem Set 4: Tuesday, Mar 2nd in class.

Problem Set 5: Tuesday, Mar 9th in class.

Problem Set 6: Tuesday, Mar 30th in class.

Problem Set 7: Tuesday, Apr 6th in class.

Problem Set 8: Tuesday, Apr 13th in class.

Quizzes There will be approximately one quiz for a class. (The total of 20+ quizzes.) You are free to refer to the textbooks or your notes when you solve these quizzes. These quizzes should be done through the Canvas by 11:59PM of the next day after each class. Late submissions will not be accepted and will receive zero credit. At the end of the semester, only the best 15 quizzes are used for calculation of the final quiz score. Each of the 15 scores will be equally weighted to determine your overall quiz average.

Extra Credit I will provide several opportunities for extra credit in class throughout the semester. We will actually play games in class, and credits will be given by the game rules. All games are designed FOR CLASS ATTENDEES WHO GET TESTED FOR COVID-19, and I expect that these games will facilitate your learning new concepts.

Another opportunity for extra credit will be given if you volunteer for presentation of solutions to problem sets. We will use several classes for presentations including Feb 4th, March 11th, and Apr 15th. (Classes before exams.) I will announce more dates if we can use more classes for presentations depending on our progress. You can choose at most two problems in each problem set, and we will arrange who presents which problems in the class before each presentation date. These presentations are graded based on completion. You will be given five points for each solution you provide. Even if you get wrong answers, you will be given the full extra credit (5 points) as long as you present your solution.

If you are withheld from campus but attend the synchronous class through zoom, you will still be able to join games or presentations. If you do not attend classes or do not get tested for Covid-19, I will not provide any additional chances for the credit. I do not think this credit would greatly impact on your final grade, but it could change your letter grade if you are on the edge. All extra points will be added to problem sets. It is possible that your grade for problem sets exceeds the full score, and makes up exam grades.

Course Communications All class activities will take place during our assigned class time. You are expected to be available during those times. Since this class is a face-to-face course, you are expected to stay in Gainesville throughout this semester. You are responsible for all information made available through classes and Canvas. You should confirm your availability (exams, problem sets, quizzes, presentations) before the end of Drop/Add Week and adjust your schedule accordingly.

Most of our one-on-one communication will occur via email. There are three important course policies regarding email: 1) I expect that you are reading your email at least once per day, 2) All emails that you send must follow basic rules for professional correspondence, and 3) I will not respond to the Canvas messages. Use emails.

Class Attendance Class attendance is required. Excused absences are consistent with university policies in the undergraduate catalog⁴ and require appropriate documentation. If you are withheld from campus or you have Covid-19-like symptoms, attendance is not required, and recordings will be provided. In the Covid-19 case, you are expected to inform me prior to the class but you do not need to provide any additional documentation.⁵ You can still attend classes through zoom when you are withheld from campus. If this is the case, you should inform me at least two hours prior to the class in order to have access to the zoom link for the class.

Students with Disabilities Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, 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.

Course Evaluation Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-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 Code⁶ 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 in this class.

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

⁴<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

⁵The UF system provides instructors with students test dates and results.

⁶<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

Course Outline

1. Introduction to Game Theory

- Week 1: [Simultaneous Move Game and Nash Equilibrium]
- Week 2: [Dominance and Best Response]
- Week 3: [Sequential Move Game and Subgame Perfection]
- Week 4: [Combining Normal form and Extensive form]
- Week 5: [Exam 1]

2. More Players, Mixed Strategies and Continuous Strategies

- Week 1: [Games with More than Three Players]
- Week 2: [Mixed Strategies 1]
- Week 3: [Mixed Strategies 2]
- Week 4: [Continuous Strategies]
- Week 5: [Exam 2]

3. Repeated Games, Incomplete Information and Applications

- Week 1: [Repeated Games]
- Week 2: [Bayesian Games and Auctions]
- Week 3: [Signaling Games]
- Week 4: [Evolutionary Games]
- Week 5: [Exam 3]

Week-by-Week Checklist

H : “Games, Strategies, and Decision Making” 2nd edition by Harrington.

DSM : “Games of Strategy” 5th edition by Dixit, Skeath, and McAdams.

Dates	[DSM]	[H]	Important Dates
Jan 12 // Jan 14	[DSM] 1, 2, 4.1 and 4.2.	[H] 1, 2 and 3.	
Jan 19 // Jan 21	[DSM] 4	[H] 4.	
Jan 26 // Jan 28	[DSM] 3 and 6.	[H] 8.	Jan 26th: Problem Set 1 Due
Feb 2 // Feb 4	[DSM] 8.	[H] 9.	Feb 2nd: Problem Set 2 Due
Feb 9			Feb 9th: Exam 1
Feb 11 // Feb 16	[DSM] 5.	[H] 5.	
Feb 18 // Feb 23	[DSM] 7.	[H] 7.	Feb 23rd: Problem Set 3 Due
Mar 2 // Mar 4	[DSM] 7.	[H] 7.	Mar 2nd: Problem Set 4 Due
Mar 9 // Mar 11	[DSM] 5.	[H] 6.	Mar 9th: Problem Set 5 Due
Mar 16			Mar 16th: Exam 2
Mar 18 // Mar 23	[DSM] 10.	[H] 13 and 14.	
Mar 25 // Mar 30	[DSM] 10.	[H] 14 and 10.	Mar 30th: Problem Set 6 Due
Apr 1 // Apr 6	[DSM] 9 and 15.	[H] 10 and 11.	Apr 6th: Problem Set 7 Due
Apr 8 // Apr 13	[DSM] 9.	[H] 10 and 11.	Apr 13th: Problem Set 8 Due
Apr 15 // Apr 20	[DSM] 12.	[H] 16 and 17.	Apr 20th: Exam 3
February 25			*Recharge Day
April 10 - April 19			*Faculty Course Evaluation