ECON 309H — GAME THEORY
FALL 2021

Instructor: Ass. Prof. Ceren Soylu
Email: csoylu@econs.umass.edu
Office Hours: TuTh 8:30am-9:30am
Lectures: TuTh 2:30pm - 3:45pm

Course Description

How do agents – people, firms, communities and governments – make choices?
What economic, social and political outcomes should we expect as a result of these choices?

When does the pursuit of self-interest by all individuals lead to socially efficient outcomes?
When does it lead to outcomes that no one likes?

How are the activities of free individuals, each seeking their own objectives, coordinated so as to achieve socially desirable results? (David Hume, the 18th century British philosopher and economist, poses this question as the most important problem facing society.)

These questions are certainly older than economics and have occupied many brilliant minds across centuries and disciplines; and, these will be the questions that we will address using the analytical tools of Game Theory.

Game Theory provides a framework for understanding various social interactions, classified as strategic interactions, that is, situations in which there is interdependence among the parties to the interaction. As such, it is a way of understanding how agents interact based on the constraints that limit their actions, their motives, and their beliefs about what others will do. Hence, each agent needs to anticipate their opponents’ next moves and, accordingly, decide on how to act, while also knowing that their opponents are trying to do the same thing. Sounds familiar? It is possible to find many examples for such strategic interactions between individuals, businesses, political parties, nations etc. Game theory offers a way of analytical thinking, some of which is common sense and some of which is counterintuitive, that helps explain and predict such interactions. So, it is no surprise that game theory has applications in several fields ranging from economics, political science, sociology, business, law, biology, computer science etc.

Learning Outcomes

- By using the game theoretical tools, you will be able to model a given interaction, as well as simulating changes to it. In doing so, you will develop a commitment to finding effective strategies for agents – people, firms, communities, governments – in strategic situations to address social, economic and political issues, formulate predictions for likely outcomes of a given situation, or develop insights into the realized outcomes of past events.

- **Interdisciplinary Outcome:** This course will help you cross disciplinary boundaries to reveal new patterns and connections that reframe your knowledge about human behavior. At the end, you will have acquired a new set of tools to analyze social behavior from multiple perspectives.

- **Intellectual Skills Outcome:** You are expected to gain many skills that have applications beyond the topic of this course. The modeling experience you will gain will improve your ability to analyze and process information more efficiently by identifying and focusing on the most relevant aspects. You will also improve
your quantitative reasoning and will be able to develop and apply appropriate quantitative problem-solving skills in the context of various economic and social issues.

Textbook


[Recommended] The Art of Strategy, Dixit, A. and Barry J. Nalebuff. W. W. Norton Publishers, 2008. (This is a popular, quasi-academic book that introduces the basic ideas and concepts in a non-technical way.)

Additional readings and lecture notes will be made available on the course website on Moodle.

Requirements and Grading

The final grade will have the following components:

- two midterm exams (15% each): both exams will be online
  - Midterm 1 on Thursday, Oct 7th
  - Midterm 2 on Thursday, Nov 18th
- final exam (15%) (online, date TBD)
- take-home assignments (problem sets) (45%) – each assignment will be posted on Moodle upon completion of a topic (at least one week before the due date); see the course plan below for the corresponding due dates. The assignments will be submitted on Moodle. See below for detailed guidelines on problem sets submission and grading.
- short essay (10%) – For this assignment, you will choose a situation or event that can be analyzed from the perspective of game theory. This can be from real life, business, movies, books…etc. In your essay, you will first formulate this as a game and analyze it using the concepts that you learn in this course. See below for detailed instructions.

Exams, assignments and quizzes will cover textbook chapters, lecture notes and extra materials posted on the course Moodle website. You will be tested on all the topics covered in the lectures including those that are not covered in the textbook. You will not be tested on any topic that is not covered in class unless you are explicitly assigned to study it.

Letter grades are typically as follows: A (94+), A- (90+), B+ (84+), B (80+), B- (77+), C+ (74+), C (70+), C- (64+), D+ (60+), D (55+) and F (below 55). As the end-of-semester performance of all students in class might call for an adjustment and/or scaling of grades, I reserve the right to make small changes to these cut-offs in the students’ favor.
Course policies

Lectures:
This is a fully remote class with synchronous sessions at our scheduled class time.

Each lecture video will be recorded and posted on the course website on Moodle, and it will be available for viewing until the end of the semester. (Also see the related note at the beginning of this syllabus.) Lecture notes, readings and other resources will be posted on Moodle as well.

The “Virtual Classroom” on Moodle:
As an additional virtual meeting space, we also have an online platform, the “Virtual Classroom” forum on the course Moodle site, for discussing course-related questions. You can post questions and answer each other’s questions on this forum. I want you to be able to communicate with each other about content in the course and to collaborate when you need help. You can learn a lot by asking questions, helping to answer other people’s questions, and thinking out loud about different ideas you have. Also, when you post, you’re providing a public service, a resource that others can use which is a helpful and community-minded thing to do. While responding to/commenting on someone else’s post, you should not worry about providing incorrect or incomplete information as I will be monitoring the forum to clarify any confusions and respond to your questions. So, in the process, you will have checked your understanding as well by way of your comments on others’ questions.

I will kindly ask you to post any questions regarding the course logistics, course material and the assignments on this forum rather than sending me an email. In all likelihood, you want to ask a question the answer to which many people will benefit from, which is why I strongly recommend posting to the forum.

I am always happy to provide hints and help out with the assignments. I am more comfortable doing so, and I provide more extensive help, if the question is posted on this forum as I know that the information/instruction that I provide will be available to everyone in the class; hence, eliminating any issues of fairness.

Email & Communication Policy:
I encourage you to email me about issues that pertain to you personally. I shall do my best to respond to email within 24 (business) hours, i.e. within one day during the week and by the end of Monday if you sent the email on Friday or over the weekend.

I will not answer detailed conceptual questions about problems sets or course material in emails. If you have such questions, come by my office hour or schedule a meeting, or post to the Virtual Forum on Moodle (see above).

For course related questions, please first check the syllabus, Moodle and your emails for the announcements I send to the class.

Missed Assignments and exams:
Late submissions of assignments will not be accepted, as solutions will be posted right after the due date. In documented extenuating circumstances, I reserve the right to make reasonable arrangements.

Make-up exams will be given only in case of documented medical emergency, bereavement, court appearance, and in accordance with the University regulations concerning exam conflicts.

Academic Honesty Policy Statement:
Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst.

Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be
imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. The procedures outlined below are intended to provide an efficient and orderly process by which action may be taken if it appears that academic dishonesty has occurred and by which students may appeal such actions.

Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent.

For more information about what constitutes academic dishonesty, please see the Dean of Students’ website: http://umass.edu/dean_students/codeofconduct/acadhonesty/

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), Learning Disabilities Support Services (LDSS), or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.
Tips

Learning game theory is similar to learning a new programming language. As with any new language/tool, the learning process can be a challenging, but it can also be very rewarding.

At this background, here are some keys to doing well in this class:

*Keep up:* Concepts build on each other and we will move quickly through topics. If you wait until right before a problem set due date or exam to make sure you understand the material, you may find yourself overwhelmed. Review each lecture and make sure that you clarify any confusions either in the next lecture or during office hours. Start working on the problem sets as soon as they are posted, and once the solutions are available, make sure to review your answers.

*Explain:* Practice explaining in addition to doing problems. This course may seem like math-heavy and theoretical, yet the intuitive component is just as, if not more, important than the analytical methods. To succeed in this course, you need to be comfortable solving specific problems, to understand why your answers are correct, and to apply ideas in different contexts. Always check your understanding of the intuition behind the technical components. Be like a toddler and tirelessly ask “WHY?” for each and every step of the analysis that we conduct. Practice explaining new ideas to your classmates, your roommates, your friends, your parents or anyone else you can convince to listen. Try to find examples of what we learn in class in your life and in real life. Read in the newspaper, the Economist, economic blogs, or other sources and try to use the models from class to explain the article.

*Ask for help:* If you find yourself struggling with an idea, ask for help as soon as you can. You can post your questions to the aforementioned Virtual Classroom forum on Moodle to get a discussion started with me and others in the class. If I believe that your question will be better addressed by way of a meeting, I will ask to set up a Zoom meeting. Also, I’m always available during my office hours. I’m also happy to make appointments outside of office hours.

*Problem Sets:* The problem sets are designed to be learning experiences, giving you practice working with and applying the concepts from class. The questions are intentionally challenging and not simply examples from class with different numbers. In many cases, you may need to think about a problem for a while before you will see how to answer the question.

I strongly encourage you to work on these problems (and your problem sets) in groups, with two caveats: First, you must prepare and submit your own answers - your own explanations of how you arrived at a solution, your own step (or mis-step) when arriving at a mathematical answer, etc. Second, I highly recommend that you try the assignment individually first. This will be helpful in two ways. First, you are more likely to do well on the midterm and final by getting practice through the assignments. (Remember, you can’t work together on the midterm and final exams.) Second, both you and your classmate are more likely to do well on the assignment itself by putting two separate minds on it.

Always review your answers as soon as the solutions are available, while your memory of your reasonings is still fresh. You should do so regardless of the point grade you get: Given my grading method, you may get a high point grade but get many parts of the problem set incorrect.

*Feedback – sooner rather than later!* If you have feedback or concerns, bring them up with me sooner rather than later. If there’s something that we can adjust right away, I will try my best to do so.
Take-home Assignments (Problem Sets) Submissions and Grading

Submission For submission of each problem set, you will follow the steps outlined below. The report (steps 3 and 4 below) is not required but I strongly recommend that you work on it as it will significantly improve your understanding of the topic, and it will help your grade!

1) You will submit your answers to the questions of the assignment on Moodle by the deadline stated on the assignment.
   ! The file you submit on Moodle has to be a .pdf file named as follows: [LASTNAME]_PS[#]
   ! You are not required to type your answers. You can submit a scan of your handwritten solutions. (There are many scanning apps available free of charge for smart phones. Using your phone may be more practical than having to find a scanner.)

   *****If you submit in another format, or you name your file differently you will lose 2 points.*****

   Please contact me ASAP if you have any difficulty or need help with converting files to .pdf and scanning your solutions.

2) I will post the solutions for that assignment on Moodle right after the deadline. Accordingly, late submissions of assignments as defined in (1) cannot be accepted.

3) With the solutions available, you will review the answers you have submitted. The aim of this part is to make sure that we have an opportunity to address any confusions sooner rather than later as the course material is cumulative; what you learn/not learn now will have significant effects on your learning future topics! The basic idea is that you review your answers given the solutions and identify the parts you missed or answered incorrectly. For each such part you need to write a short reflection/report explaining why you answered the way you did and what was mistaken about it. (My most important advice is to always ask yourself “why do we think/analyze this way” when studying the material, and, of course, during the lectures.)

Below are some example templates to give you a better idea, but you are free to write it in any way that works for you and can be easily interpreted by someone else (i.e. me).

- I answered as … because I had thought that … . I was mistaken because …
- I had thought that … because … . I understand the solutions but I don’t see what is wrong with my thinking/answer.
- I had thought that … because … . I don’t understand why the answer is … rather than …

4) You will submit your report on Moodle by the stated due-date.

Grading Your grade from each assignment will be calculated as follows: After you submit your self-reflections, I will grade your initial submission, as defined in (1) above, taking into account your reflections, for each part of the assignment where you missed points. If your corresponding reflections is satisfactory (as explained in (3) above) you will earn half of the points you had initially missed. For example, say your initial submission earned 15 out of 25 points on one of the questions. You may earn half the points you missed (0.5*10 = 5) based on the reflection/report you submitted, hence get 20 points rather than 15.
Short Essay Assignment

The purpose of this essay is to apply some of the game theoretical concepts we have learned in class to a situation or event you picked from real life, business, movies, books…. etc. We defined the subject-matter of game theory as “strategic interactions”, and, throughout the semester, we applied tools of game theoretical analysis to different types of strategic interactions, namely, simultaneous-move, sequential-move with perfect-information, sequential-move with imperfect information, and incomplete information interactions. In doing so, we always started with the description of the strategic interaction to be analyzed, and then represented the interaction with the appropriate game theoretical representation (payoff matrix or game tree), and lastly applied appropriate solution concepts to make predictions about the outcome(s) of that interaction. Your essay should follow a similar structure.

The essay will be completed in two components. First you will write a brief (1-2 paragraphs) description of the situation you picked consider for your essay. Without my approval of this proposal; you will not earn credit on the essay. You may be asked to change the topic, for example if a similar topic has been already picked by someone else (first-come basis) or explained in any easily accessible resource.

The essay should be 2-3 pages, not to exceed 1,500 words, single-spaced, in 12pt Times New Roman font, with 1 inch margins. Do not use a cover page or folder; simply write your name at the top of the first page and use a title for your essay.

Your essay should have one paragraph for introduction that clearly, yet very briefly explains which game theoretical concept(s) you will be using. The introduction should also briefly outline what will follow in the rest of the essay. The body of the essay should start by describing the chosen situation as a game with its components: who the players are, what strategies are available to them, what are the possible outcomes of the game, what are the preferences of the players over these outcomes, what is the information structure (specify perfect/imperfect and complete/incomplete)—what do players know when they are making decisions in the game— which game theoretical concept(s) and tools you will be using (e.g. “I will model this …. as a simultaneous move game and find the Nash Equilibrium”).

Below is a guide for the outline:

1. Introduction:
You should start with a brief introduction that briefly describes the interaction you picked to model and provide the source of the strategic interaction you will analyze (is it from your own experience? from the news? etc.).

2. Description of the strategic interaction:
The body of the essay should start by describing the chosen situation as a game with its components:
- who the players are,
- what strategies are available to them,
- what are the possible outcomes of the interaction,
- what are the preferences of the players over these outcomes,
- what is the information structure (specify perfect/imperfect and complete/incomplete)—what do players know when they are making decisions in the game
- which game theoretical concept(s) and tools you will be using (e.g. “I will model this …. as a simultaneous move game and find the Nash Equilibrium”).

3. The Model and Equilibrium Analysis:
- Representation: You should represent the interaction described in section (2) with the appropriate game theoretical representation (game tree or payoff matrix). If this is not possible, say, for example if you have a continuous strategy game or you are describing a principal-agent problem, you can skip this part.
- Analysis: In the analysis part, try to present as complete an analysis as possible. If you need to make assumptions to complete the model, make sure to explicitly state them.

4. Conclusion:
- Reflect on how the actual decisions by the parties involved and the outcome of the interaction compare to your predictions from the equilibrium analysis in section (3), or if this is an ongoing interaction discuss what you expect the parties do based on your analysis.
- The conclusion should also highlight how the use of game theory contributed to your understanding of the issue at hand and what you learned about game theory from this exercise.
Course Plan

Following is a tentative schedule for the course. Take it as a broad indication: it is subject to change based on how fast or slow we are able to go as a group. Accordingly, the assignment (problem set) due dates are subject to change as well. As a general rule, you will have a problem set upon completion of each topic listed below, and you will have at least one week to work on your problem set. Any change will be announced in advance as much as possible. Please refer to Moodle for the updated schedule and for additional readings.

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<td>Introduction</td>
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<td>Simultaneous Move Games: Discrete Strategies, Ch 4</td>
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