The interactions of human beings with other individuals, within groups, and with the earth lead us to ponder many questions concerning the ways in which people coordinate and structure their actions. It is to these questions that we turn, in trying to understand the strategic decisions that people make on a daily basis. Will it make a difference if I throw my candy wrapper in the street instead of waiting to find a trash can? How much should I bid on my favorite item on eBay? Should I buy a used car instead of a new one? How will our family decide who does the household work? Is it feasible for a firm to enter the market for a new product? Why do “price wars” emerge in certain industries? Under what conditions would a union go on strike during labor contract negotiations?

In this course students learn the basic tools of game theory in order to analyze these various economic and social situations. We start by providing a background and introduction to both game theory and economics. We then proceed to define the terminology used in both fields. Our section on games begins with an analysis of normal form (strategic form) games in which we have a static setting and players move simultaneously. Concepts such as a player’s best response, dominant strategies, and the Nash equilibrium are presented, along with various examples of applications. The three classic games of chicken (hawk-dove), coordination (battle of preferences) and the prisoners’ dilemma are introduced, with an extension to the mixed strategy Nash equilibrium.

Next we turn to extensive form games in order to analyze dynamic games in which players move sequentially. The notion of a subgame perfect Nash equilibrium is discussed, and the technique of backward induction is taught, with an illustration using the “centipede game.” Repeated interactions between players are then considered as we discuss both infinitely repeated games and finitely repeated games. The effects of threats, reputations, and trigger strategies are analyzed. Topics in public and environmental economics are introduced in order to apply these game theory concepts to situations pervaded by free-riding and collective action problems. Evolutionary stable strategies are also discussed, allowing us to understand how repeated games can lead to the unfortunate stability of social inequalities by class, gender, race, and ethnicity. The role of institutions (such as norms, customs, traditions, beliefs, and property rights) in maintaining these inequalities is discussed from a game theoretic standpoint.

Lastly, we study situations of asymmetric information between players. We give specific references to issues of principal-agent problems, moral hazard, and adverse selection as applied to monitoring, bargaining models, auctions, signaling, and “lemons” markets. The course concludes with a critical analysis of the theories and assumptions used in game theory. In particular, students debate the usefulness of concepts of “rationality.”
Course goals and objectives

Overall, students in this class:

• Learn basic game theory tools concerning normal and extensive form games, repeated games, and games with asymmetric information.
• Gain a background in diverse fields of economics including microeconomics, macroeconomics, feminist economics, public economics, and environmental economics.
• Obtain the ability to apply game theory tools and concepts in order to analyze real life situations and learn how to build and test models in the social sciences.

Required Text


Additional Readings

Occasionally, book chapters, websites, journal articles, films, and television shows may be assigned for reading or viewing. These will be accessible either through blackboard, e-reserves, or at the library.

Notes/Comments:

- The registrar’s office requires that professors submit mid-semester grades for first-year students. These will be submitted on October 9th.
- If you contact me by email, please allow 24 hours for a response.
- I do not keep a formal attendance record. However, the class is small enough that it will be noticed if you are absent. If you are absent or you are late to class, it is your responsibility to catch up on the course material and to get notes from a classmate. I do not provide class-notes to students.
- Students are expected to uphold the strict guidelines of academic honesty and integrity to which the University adheres.

Grade scale:

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**Evaluation and Assignments**

**Homework:** Three homework assignments will be given. However, only two assignments will count towards the grade, so that students may opt out of one assignment during the semester. Once a student decides to opt out of an assignment, they must email me or notify me in writing at least 24 hours before the assignment is due. There will be no extra-credit given for additional assignments handed in. If three assignments are handed in, then the first two will be counted towards the grade and the third/last assignment will be disregarded. Assignments are due in-person, in-class, and on time. (10%)

**Game points:** (Based on a syllabus by C. F. Stumph, Indiana University/Purdue University Fort Wayne) You will start the semester with 500 game points. We will play games in class. Some games will be played as individuals, some will be played as small group, or the class may play as one player. You may win or lose points, depending upon how you play. The three players with the top three scores at the end of the semester will receive full credit for this portion of the grade. All other class members will be graded accordingly. Scores will be recorded on blackboard, but will only be updated periodically. (5%)

**Exams:** Four in-class exams. Make-up exams will not be given without an excused absence, which requires you to email me within 24 hours of the exam and to provide me with a Dean’s note, doctor’s note, or other proof of extenuating circumstances. (15% each exam, for a total of 60%)

**Final project:** Students will be assigned to work in groups of two on a project of their choice in game theory. Group assignments will be given out in early September. Each group will submit a one page research project proposal to me by September 25th. The proposal should state your main topic and thesis argument. It should also explain how you will go about proving or disproving the argument. Will you provide a theoretical model? Are you providing an historical analysis of a famous game theorist? Will you conduct independent games, simulations, or experiments? After your topic has been approved, you may begin working on a draft of your group project. An 8-10 page draft is due on October 23rd. The final paper will be turned in, in-person, on the last day of class (12/4). The paper should be double-spaced, 12 point font, with a maximum of one-inch margins. The paper may be printed out double-sided. The paper must be 18-22 pages. This is a minimum and maximum page length, and points will be deducted for failing to comply with the page limitations. Papers must also be stapled and have page numbers and appropriate citations. In addition, during the last few classes, each group will provide a brief, 15-20 minute presentation of their project, allowing an additional 5-10 minutes for questions at the end. Each presentation must include a simulation, experiment, or other activity for the entire class to participate in, in order to illustrate your findings from your research. Each student is expected to ask a minimum of one question during each of their classmates’ presentations. Students whose project involves use of human subjects for testing theories and conducting games, must speak with me when they submit their drafts, so that we can discuss the University’s policy regarding this issue. (15%)

**Participation, effort, & diary entries:** Students are expected to actively contribute to class discussions, and to engage with the course material. In addition, students will keep a “game theory diary” throughout the semester. In this diary, students will record events and experiences that relate to the game theories that we have discussed in class. These events and experiences may be from students’ own lives, from television or films, from books, from friends or family, from the news, etc. Students will be randomly called upon to discuss their diary entries. Students are expected to record a minimum of two diary entries per week. (10%)
Course outline (This schedule is subject to change based on class interests and pace)

Aug. 26 (W) Introduction

We begin with a review of the syllabus, assignments, and evaluation criteria. We then consider the following questions: What is economics? How do we distinguish between its main branches of microeconomics and macroeconomics? What is game theory? How can we apply the concepts of game theory to economic and social situations? In answering these questions we also define the basic terminology used in applying game theory tools to economic topics. This includes concepts such as rationality, utility, expectations, Pareto optimality, players, actions, information, strategies, payoffs, outcomes, and equilibrium. We also distinguish between cooperative and non-cooperative games, as well as zero-sum and variable-sum games. A background in experimental economics is also provided, in order to understand past experiments in game theory behavior. In order to illustrate some of the concepts used in game theory and to provide a primer in probability, Schelling’s (1963) focal point game is played and a coin toss is conducted by students. A brief discussion of the ethics involved with experiments and data collection on human subjects is also provided.


Aug. 28 (F) Normal form/strategic form games; Homework #1 given

The simplest games of coordination are often those in which players move simultaneously. These games can be best represented in what is called their normal or strategic form. Here we introduce and define the normal/strategic form game. Examples are provided using the three classic games of chicken (hawk-dove), coordination (battle of preferences) and the prisoners’ dilemma. In order to understand the distinctions between the different games, students experiment by participating in simulated games.

Assignments: Skim Osborne, Ch. 2 “Nash Equilibrium: Theory” pp. 21-54. Work on homework #1

Sept. 2 (W) Strategies; Homework #1 due

Strategic actions are discussed here, including a player’s best response strategy. Particular emphasis is placed on understanding dominant and dominated strategies, as well as distinguishing between weakly dominated and strictly dominated strategies.

Assignments: Read Osborne, Ch. 2 “Nash Equilibrium: Theory” pp. 21-54, and skim Ch. 3 “Nash Equilibrium: Illustrations.” View the film A Beautiful Mind (2001). The film is on reserve at Lilly Library. The film provides a look at the life of John Nash, developer of the Nash equilibrium concept and Nobel Prize winner. Be prepared to participate in a class discussion that analyzes the film for game theory applications as well as for an understanding of how Nash’s life experiences affected his mathematical analyses.
The concept of a Nash equilibrium is presented, as students practice determining the Nash equilibrium in numerous games and examples. The film *A Beautiful Mind* is also discussed.

Assignment: STUDY!

Sept. 9 (W)  
1st Exam

Assignments: Read Osborne, Ch. 4 “Mixed Strategy Equilibrium”

Sept. 11 (F)  
Mixed strategy Nash equilibrium; Discussion of 9/11; Homework #2 given; Research groups assigned and grading rubric provided

Here we differentiate between pure strategy and mixed strategy Nash equilibria, giving students examples to practice.

Assignments: Read Osborne, Ch. 5 “Extensive Games with Perfect Information: Theory,” pp. 153-163.

Sept. 16 (W)  
Extensive form/dynamic form games

Dynamic games in which players move sequentially are presented using the extensive form game, in which we fully describe the different aspects of a game tree. Students practice drawing and interpreting game trees.


Sept. 18 (F)  
Subgame perfect Nash equilibrium; Backward induction; Homework #2 due

Next, we turn to solving the extensive form games. To do this, we introduce the concept of a subgame perfect Nash equilibrium, a refinement of the Nash equilibrium. We also discuss the concept of backward induction in determining the solution to a sequentially played game. Here, the centipede game is played in order for students to get first-hand experience with applying the technique of backward induction.

Assignments: Read Osborne, Ch. 14 “Repeated Games: The Prisoner’s Dilemma,” and skim Ch. 15 “Repeated Games: General Results” pp. 455-464.
Sept. 23 (W)  Repeated games: Homework #2 returned

In considering dynamic games we also introduce games that are repeated over time. First, concepts of discounting are briefly reviewed in order to consider players’ time preferences for payoffs. We then consider interactions that are repeated infinitely, with no clear end in sight. The case of finitely repeated games, which have a definite end point, are then analyzed. Trigger strategies are also discussed.

Assignments: Read Osborne, Ch. 14 “Repeated Games: The Prisoner’s Dilemma,” and skim Ch. 15 “Repeated Games: General Results” pp. 455-464.
Read “Kibbitzing on the Kibbutz” on blackboard,
See on-line comments on “public goods” in the 2009 Star Trek film.

Sept. 25 (F)  Repeated games, continued; Review for 2nd exam; Research proposals due

In analyzing games that are repeated over time, we discuss mechanisms that may guide or alter game outcomes. These mechanisms include threats and trembling hands, trigger strategies, tacit collusion, altruism, learning, communication, and reputations. In understanding how to apply these concepts to real-life situations we introduce the concepts of public goods and the collective action problem. Specific illustrations of how collective action problems can be over-come are given through examples of the worker cooperative movement and the role of gossip in the Israeli Kibbutz system.

Assignment: STUDY!

Sept. 30 (W)  2nd Exam

Assignments: Read Romp Ch. 10 “Environmental Economics” (on blackboard).
Read Hargreaves-Heap& Varoufakis p.151 (on blackboard).

Oct. 2 (F)  Collective action problems; Research proposals returned; Homework #3 given

The collective action problem under repeated games is applied to issues of environmental concerns, where we discuss the meaning of positive and negative externalities. The possibility of side-payments in order to induce cooperation is considered. We also investigate the collective aspects of household work within families, asking, “Who will do the household work?” Students play simulated games of environmental treaty negotiation, as well as a game concerning household chores. The class also participates in a voluntary contributions game in relation to a discussion of group-based lending in microfinance.

Assignments: Read Osborne, Ch. 13 “Evolutionary Equilibrium” and work on homework #3.

Oct. 7 (W)  Evolutionary stable strategy

Dynamic games are analyzed with respect to their potential to obtain evolutionarily stable strategies over time. We examine the possibility of obtaining evolutionarily stable strategies for both pure strategy and mixed strategy equilibriums, in the case of symmetric situations.

Assignments: Read Osborne, Ch. 13 “Evolutionary Equilibrium” and work on homework #3.
Oct. 9 (F)  Evolutionary stable strategy, continued; Midsemester grades; Homework #3 due

Evolutionary stable strategies are analyzed in the case of asymmetric situations between players. Students participate in an experimental game designed to test for the presence of an evolutionarily stable strategy.

Assignments: Read Hargreaves-Heap & Varoufakis, Ch. 7 “Evolutionary Games”, pp. 197-233 (on blackboard)

Oct. 14 (W)  Institutions and inequalities; Homework #3 returned

The development of social institutions is discussed in relation to evolutionarily stable strategies, with references to property rights, laws, norms, customs, habits, and traditions. We discuss Old and New Institutionalism as economic paradigms in understanding social institutions. We also discuss other economic paradigms, including feminist economics, Marxism, and postmodernism, in analyzing social institutions and systems of inequality. We then link these theories with the concepts developed in game theory, in order to generate a wide array of theoretical tools to use in analyzing social institutions.

Assignments: Read Hargreaves-Heap & Varoufakis, Ch. 7 “Evolutionary Games”, pp. 197-233 (on blackboard)

Oct. 16 (F)  Institutions and inequalities, continued; Review for 3rd exam

After understanding the ways in which social institutions emerge from the viewpoint of game theory, we use these tools to analyze systems of inequality that are upheld by social institutions. This includes analyses of social inequalities by class, gender, race, and ethnicity.

Assignments: STUDY!

Oct. 21 (W)  3rd Exam

Assignments: Skim Osborne, Ch. 9 “Bayesian Games” pp.273 – 291 and Ch. 10 “Extensive Games with Imperfect Information” pp. 313-331. Read Gintis Game Theory Evolving, Ch. 7 “Principal-Agent Models” (on blackboard). Skim Rasmusen Ch. 7 “Moral Hazard: Hidden Actions” and Ch. 8 “Topics in Moral Hazard” (on blackboard).

Oct. 23 (F)  Asymmetric information; Draft of research project due

Games of asymmetric information are discussed. These are situations in which one player has more and/or better information about the game than the other player. We introduce the concept of the principal-agent problem to elaborate on this concept. Issues of moral hazard are also discussed, with the game of insurance and the game of contracting. We will also distinguish between ex ante and ex post moral hazard.

Assignments: Skim Rasmusen Ch. 9 “Adverse Selection” (on blackboard). Read Dixit & Nalebuff pp. 243-247 (about Akerlof) and Ch. 13 “Incentives” (on blackboard).
Oct. 28 (W)  Adverse selection

As a special case of asymmetric information we discuss the problem of adverse selection. We give examples of wage determination, incentives, and monitoring under employment contracts. An example of adverse selection is also provided with Akerlof’s famous “lemon’s market” for used cars.

Assignments: Read Osborne, Ch. 10, “Extensive Games with Imperfect Information” pp. 331-349

Oct. 30 (F)  Signaling; Drafts returned

We continue our discussion of adverse selection, by noting the ways in which a player can signal in order to indicate or share information. Signaling is discussed in relation to job markets and other examples.

Assignments: Read Osborne, Ch. 16 “Bargaining,” and Ch. 6 “Extensive Games with Perfect Information,” pp. 181-185 (ultimatum game). Read Hargreaves-Heap& Varoufakis, pp. 128-137 (about Rubinstein bargaining model; on blackboard) Read Gintis Game Theory Evolving pp. 94-96 (about Rubinstein bargaining model; on blackboard)

Nov. 4 (W)  Bargaining

Asymmetric information often plays out in situations of bargaining and auctions. We apply our game theory tools to these two situations. Bargaining models are displayed first, including the alternating offers game and the “splitting the pie” example. Students play an ultimatum (take-it-or-leave-it) game and experiment with both pre-communication and post-communication. We also discuss the specific case of the Rubinstein bargaining model.

Assignments: Read Osborne, Ch. 3 “Nash Equilibrium: Illustrations,” pp. 80-91 (auctions), and Ch 9, “Bayesian Games,” pp. 291-301 (auctions)

Nov. 6 (F)  Auctions

Applications of asymmetric information are further discussed with respect to auctions and on-line bidding.

Assignments: Read Romp Ch. 12 “Criticisms of Game Theory” (on blackboard). Read Gintis The Bounds of Reason Ch. 3 “Game Theory and Human Behavior” & Ch. 12 “The Unification of the Behavioral Sciences” (on blackboard) Read Hargreaves-Heap& Varoufakis Ch. 1 “An Overview” & pp. 57-62 (on blackboard)

Nov. 11 (W)  Critical analysis of game theory; Review for 4th exam

Our course concludes with a critical review of game theory, during which we critique the assumptions used in game theory. In particular, we discuss the applicability of concepts of “rationality” and “individualism.”

Assignment: STUDY!
Nov. 13 (F)      4th Exam
Assignment: Prepare presentation

Nov. 18 (W)      Presentations

Nov. 20 (F)      Presentations

Nov. 25 (W)      THANKSGIVING RECESS

Nov. 27 (F)      THANKSGIVING RECESS

Dec. 2 (W)       Presentations & Course evaluations
Assignment: Prepare final paper.

Dec. 4 (F)       Last Class; Presentations; Final paper due IN CLASS; Class party!