



# Understanding Game Theory

Prof. Yoonho Choi, Kent State University

## SHORT COURSE DESCRIPTION

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Game theory is the study of strategic interactions and decisions among individuals, organizations, or groups in a certain situation. This course provides fundamental concepts of Game Theory and some of its applications to economics, business, and political science. We focus on analyses of the strategic behavior of business and industrial organizations with various examples. By studying game theory, students can think strategically and understand and explain various problems.

Through this course, we aim to teach and learn the following concepts and skills:

1. To represent any strategic situation as an extensive-form game (game tree), and convert it into a normal-form game (payoff matrix);
2. To analyze a game formally using solution concepts (Nash, subgame-perfect, Bayesian, perfect Bayesian);
3. To study repeated games and reputation building;
4. To develop your own “games” for economic analyses.

- Instructor Office: TBA
- Office Phone: TBA
- Email: ychoi12@kent.edu
- Office hours: TBA

## READING MATERIALS

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### Class Materials

#### Required:

- a. Harrington, Joseph E. Jr., Games, Strategies and Decision Making (2nd Edition)
- b. **Other materials distributed by an instructor**
- c. Lecture notes and group activities will be on *Icampus*
- d. A calculator (capable of addition, subtraction, multiplication, and division)

## COURSE REQUIREMENTS AND GRADING

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### Grade Guideline:

The assessment and grading will be based on a combination of students' in-class activities, homework, economic analysis, and three exams. In particular, students will be organized into small groups and choose a group project topic from a list of topics provided by the lecturer, proposed by the students, and approved by the lecturer. **All ISS classes are pass/fail on the student's academic achievement evaluated by grades on a scale of 100 points (a grade of 60 or above is a Pass).**

Note that SKKU regulations **require students to attend at least 80% of all classes**. Students are expected to familiarize themselves with SKKU policies about plagiarism, academic dishonesty, etc.

## Course Structure:

### Grading breaks:

Activity	Weight
Analysis	20%
Participation	10%
Projects	40%
Presentation	10%
Exam	20%
<b>Total</b>	<b>100%</b>

1. **Teams:** Team-based learning is a teaching strategy designed to promote active, collaborative learning and improve understanding of course materials. At the beginning of the first class, groups will be formed.
2. **Participation:** Students will score participation points through playing (and playing well) strategic games both in and outside of class. These games and experiments will facilitate a more intuitive understanding of the often-formal concepts in game theory, and we need everyone's participation to make these work optimally.
3. **Analysis:** Students will be given team in-class analysis and case studies throughout the course. These activities include discussion groups, problem-solving activities, and business experiments. These in-class problems and discussions are meant for students to apply the material learned in class. The problems, discussions, and economic experiments are ways of mastering the student's understanding of the course.
4. **Problem Sets:** Several homework assignments requiring the solving and analyzing of several strategic games will be required during the semester. While the games we play in and out of class will often provide intuition, the problem sets will help to solidify intuition into a more rigorous understanding.
5. **Projects:** The purpose of the projects is to give students a more enjoyable and creative opportunity to apply game theoretic principles to real-world issues that interest them and escape the "here is a problem, solve it. Here is another problem, solve it" grind. The project will be tailored to the interests and needs of each particular class.
6. **Exam:** Each exam is open-book, open-notes. **The exam is on July 10th** during the last class meeting (a two-hour long test). Financial calculators are allowed, but graphing calculators with alphabetical keyboards, wireless devices, and mobile phones are **NOT** allowed.
7. **Attendance Policy:** There are **15 class periods** during the semester. A student is expected to attend every class. However, SKKU regulations **require students to attend at least 80% of all classes**. Unexcused absences will result in missed points for team activities. An excused absence must be supported by written documentation about the medical or family emergency.
8. **Valid Excuses:** If your medical emergency or an illness or death in your family causes you to miss class, you must inform me of the emergency before class (e.g., send me an email) and soon afterward submit a written explanation (including date of absence and documentation).

## COURSE SCHEDULE

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### – WEEK I –

#### Monday (30 June)

- Introductions, syllabus overview, expectations
- 1. Introduction to Strategic Reasoning
  - A Sampling of Strategic Situations
  - Whetting Your Appetite: The Game of Concentration
  - Dominance solvable games
- Activity 1: Playing the Gender Pronoun Game

#### Tuesday (1 July)

- 2. Building a Model of a Strategic Situation
  - Extensive Form Games: Perfect Information
  - Extensive Form Games: Imperfect Information
  - Strategic Form Games
  - Moving from the Extensive Form and Strategic Form
  - Going from the Strategic Form to the Extensive Form
- Activity 2: A Few More Issues in Modeling Games
- Activity 3: Common Knowledge

#### Wednesday (2 July)

- 3. Eliminating the Impossible: Solving a Game when Rationality Is Common Knowledge
  - Solving a Game when Players Are Rational
  - Solving a Game when Players Are Rational, and Players Know that Players Are Rational
- Activity 4: Do people believe that people are rational?

#### Thursday (3 July)

- (Continued Eliminating the Impossible: Solving a Game when Rationality Is Common Knowledge)
- Solving a Game when Rationality Is Common Knowledge
- Activity 5: Strict and Weak Dominance
- Activity 6: Strict Dominance with Randomization
- Group Project 1: Step 1 – Find two business examples

### – WEEK II –

#### Monday (7 July)

- 4. Stable Play: Nash Equilibria in Discrete Games with Two or Three Players
  - Defining Nash Equilibrium
  - Classic Two-Player Game
- Activity 7: Fictitious Play and Convergence to Nash Equilibrium
- Group Project: Step 2 – Make strategies and payoffs of your game

### Tuesday (8 July)

(Continued Stable Play: Nash Equilibria in Discrete Games with Two or Three Players)

- The Best-Reply Method
- Three-Player Games
- Foundations of Nash Equilibrium
- Activity 8: Formal Definition of Nash Equilibrium
- Group Project: Step 3 – Build a normal form(s) or an extensive form

### Wednesday (9 July)

5. Stable Play: Nash Equilibria in Discrete n-Player Games

- Symmetric Games
- Asymmetric Games
- Activity 9: Selecting among Nash Equilibria
- Project: Step 4 – Find equilibrium of your game

### Thursday (10 July)

**Exam for CHs 1, 2, 3, 4, and 5**

– WEEK III –

### Monday (14 July)

6. Stable Play: Nash Equilibria in Continuous Games

- Solving for Nash Equilibria without Calculus
- Solving for Nash Equilibria with Calculus
- Activity 10: International Trade Games

### Tuesday (15 July)

7. Keep Guessing: Randomized Strategies

- Making Decisions under Uncertainty
- Mixed Strategies and Nash Equilibrium
- Activity 11: Police Patrols and the Drug Trade
- Analysis 12: Pessimism and Games of Pure Conflict
- Project 2: Step 1 – Find one business example you want to analyze

### Wednesday (16 July)

8. Sequential Games with Perfect Information

- Backward Induction and Subgame Perfect Nash Equilibrium
- Activity 13: Waiting Games: Preemption and Attrition
- Activity 14: Do People Reason Using Backward Induction?
- Project: Step 2 – Build up your scenario

Thursday (17 July)

- 9. Sequential Games with Imperfect Information
  - Subgame Perfect Nash Equilibrium
  - Activity 15: Price competition
  - Project: Step 3 – Make strategies and payoffs for the case

– WEEK IV–

Monday (21 July)

(Continued Sequential Games with Imperfect Information)

- Commitment
- Forward Induction
- Activity 16: Monopolistic Competition and Oligopoly
- Group Project: Step 4 – Find the Nash Equilibrium for your game

Tuesday (22 July)

10. I Know Something You Don't Know: Games with Private Information

- A Game of Incomplete Information: The Munich Agreement
- Activity 17: When All Players Have Private Information: Auctions

**Project 2 Presentation 1**

Wednesday (23 July)

(Continued I Know Something You Don't Know: Games with Private Information)

- A Game of Incomplete Information: The Munich Agreement
- Bayesian Games and Bayes–Nash Equilibrium
- Activity 18: Voting on Committees and Juries
- Activity 19: First-Price, Sealed-Bid Auction

**Project 2 Presentation 2**