Game Theory

PURDUE UNIVERSITY

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Course Description

Game theory is a popular subject and became a powerful tool for analyzing **strategic interactions between players or decision making units**. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc.
Game theory describes strategic decision making processes. It analyzes situations in which players interact, and suggests strategies and solutions that are based on profit or utility maximizing concepts.
Economics: Cartels, Entry, Auctions, Multi Stage Games (R&D, Mergers), Entry deterrence
Political Science: Elections, Median Voter Models
Psychology/Marketing: Habit Persistence, Action today impacts state tomorrow, 'Myself today' plays against 'myself tomorrow'.

Game theory is a branch of applied mathematics created by John von Neumann and Oskar Morgenstern in the *Theory of Games and Economic Behavior* (Princeton University Press, 1944). Game Theory became more popular and well known in the population with the movie: "A Beautiful Mind" with Russell Crowe. The movie illustrates the life of John Nash, who was one of the Nobel Prize winners in 1994 with Harsanyi and Selten. They contributed to Game Theory. This course is a rather **Applied Game Theory** course and will concentrate on introducing the basic concepts and applies those concepts to economics and business applications.

GOAL

My main goal of this course is to provide a basis for a good understanding of the logical mechanics and to provide a good intuition which enables you to explain events you recognize in the daily press.
I concentrate on strategy and econ related applications. I will use applications that relate to Firm Behavior in Markets and different types of Market Structures. Therefore, the game theoretic decision making concepts will be applied to topics such as: Entry, R&D, Patent Races, Mergers, Cartel, Collusion, Advertisement, Auctions, Dynamic Games, New Product Introduction.
We mostly use graphs and calculus in order to illustrate the main mechanisms and to provide some intuition. You need to be able to do easy calculus and take very simple derivatives.

Textbooks

We use a managerial economics textbook that emphasizes business examples and applications with lots of exercises. It offers 3 different means: verbal, graphical, and calculus mode.

The mandatory textbook we will be using in this course is:

1. **P. Dutta, , *Strategies and Games*, MIT Press**
   Isbn10 | asin: 0262041693
   Ebook isbn13: 9780585070223

I use some chapters (which will be posted online in this case) from the following textbook:

L. Pepall, D. Richards, G. Norman, *Industrial Organization: Contemporary Theory and Empirical Applications*, 4th Edition, 2008, Wiley-Blackwell, ISBN 978-1-4051-7632-3 **(PRN)**

For further readings, I can recommend the following textbooks:

Charalambos D. Aliprantis and Subir K. Chakrabarti, *Games and Decision Making*, 2000.
David Besanko, D. Dranove, M. Shanley, S. Schaefer, *Economics of Strategy*, Wiley, 2007.
Avinash Dixit and Barry Nalebuff, *Thinking Strategically*, 1991.
Avinash Dixit and Susan Skeath, *Games of Strategy*, 1999.
Drew Fudenberg and Jean Tirole, *Game Theory*, 1991.
Robert Gibbons, *Game Theory for Applied Economists*, 1992.
Herbert Gintis, *Game Theory Evolving*, 2000.
Martin Osborne and Ariel Rubinstein, *A Course in Game Theory*, 1994.
Martin J. Osborne, 2004, *An Introduction to Game Theory*, Oxford University Press,.
Guillermo Owen, *Game Theory* (2nd edition), 1982.
Eric Rasmussen, *Games and Information*, (4th edition) 2007.
Martin Shubik, *Game Theory in the Social Sciences: Concepts and Solutions*, 1982.
Martin Shubik, *A Game Theoretic Approach to Political Economy*, 1984.
Joel Watson, *Strategy: An Introduction to Game Theory*, (2nd edition) 2008.

Course Requirements/Grades

Students will be evaluated on the basis of multiple choice questions, drawing figures, and applying some calculus.

1. **3 problem sets**: each set has a max of 15 percent. You are allowed to work in a team, max. 4 students. I will not accept any work submitted after the deadline. In this case the problem set will be evaluated with 0 points.
2. **1 simulation study:** 15 percent
3. **1 final exam**: covering all material in the class and counts 40 percent, individual task.

You will find the lectures, problems sets and the solutions as well as the grades on the course webpage.

Topics/Course Outline

Lecture 1:

- Content: Introduction to Game Theory
- Handout: Lecture notes 1

Lecture 2:

- Content: Games in Normal and Extensive Form, Dominant and Dominated Strategies, Prisoner's Dilemma
- Reading: Dutta, Chapters 2, 3, 4
- Handout: Lecture notes 2

Lecture 3:

- Content: Nash Equilibrium, Static Games, Simultaneous Move Games: Cournot, Experiment
- Reading: Dutta, Chapters 5, 6
- Handout: Lecture notes 3

Lecture 4:

- Content: Simultaneous Move Games Cont'd: Cournot and Bertrand, Experiments
- Handout: Lecture notes 4

Problem Set 1: Issued, Deadline: one week later, Feb 1

Lecture 5:

- Content: Pure Strategies and Mixed Strategies, Applications: Natural Monopoly and Others
- Reading: Dutta, Chapters 7, 8
- Handout: Lecture notes 5

Lecture 6:

- Content: Sequential Move Games, Stackelberg, Comparison of Simultaneous vs Sequential Move Games, First and Second Mover Advantages
- Reading: Dutta, Chapters 6 Cont'd and 11
- Handout: Lecture notes 6

Problem Set 2: Issued, Deadline: one week later, Feb 8

Lecture 7:

- Content: Subgame Perfection, Backward Induction, R&D Investment Games
- Reading: Dutta, Chapters 11, 12 and 13
- Handout: Lecture notes 7

Lecture 8:

- Lego Experiment
- Handout: Lecture notes 8

Simulation Study will be issued, Deadline: one week later, Feb 15

Lecture 9:

- Content: Finitely and Infinitely Repeated Games, Dynamic Games: Stability of Cartels (Punishment Strategies)
- Reading: Dutta, Chapters 14, 15 and PRN, Chapter14, pp. 323-337 (posted online)
- Handout: Lecture notes 9

Lecture 10:

- Content: Multi-Stage Games: Location, Product Variety
- Reading: PRN, Chapter 7, pp. 130-139 (posted online)
- Handout: Lecture notes 10

Problem Set 3: Issued, Deadline one week later, Feb 22

Lecture 11:

- Content: Preemption and Deterrence
- *Reading: PRN, Chapter12, pp. 265-287 (posted online)*
- Handout: Lecture notes 11

Lecture 12:

- Content: Mergers
- Reading: Dutta, Chapter 13 *and PRN, Chapter16 (posted online)*
- Handout: Lecture notes 12

Lecture 13:

- Content: Auctions, Different Auction Formats, Revenue Equivalence Theorem, Winner's Curse, **Review Session**
- Reading: Dutta, Chapter 23 *and PRN, Chapter 25, pp. 660-674 (posted online)*
- Handout: Lecture notes 13

FINAL EXAM: date TBA
120 minutes, comprehensive.

Simulation Study

You will granted access to a simulation study issued by Harvard Business School.
Details of the simulation study will be explained throughout the course.

Projects

- Foreclosure in the US
- The Introduction of the new IPhone: Process and practices
- The Introduction of Electric Cars The Global Electric Car Industry: Challenges and Impediments, Implementation Strategies
- Study on Minimum Wage
- Merger Case on Volvo Scania Case. Keywords: Mergers, Market Definition, Truck Market.
- Case: The Hawaiian Airline Industry 2001-2008

Case Studies
Some cases will be posted online.

Interesting Cases

- NINTENDO: DISRUPTOR BEING DISRUPTED
- Netflix. Keywords: Entry, Marketing and Consumer Satisfaction, Patents, New Product Introduction.
- Merger Case on Volvo Scania Case. Keywords: Mergers, Market Definition, Truck Market.
- Daimler Chrysler Merger
- The Hawaiian Airline Industry 2001-2008
- Paramount Pictures: The Transformers Dilemma
- Corporate Average Fuel Economy Standards

More Cases

- Apple Computer, 2006, David B. Yoffie.
- "Plugging In the Consumer: The Adoption of Electrically Powered Vehicles in the U.S." by Ofek and Ribatt. Keywords: New Technology and New Product Introduction.
- "The Global Electric Car Industry in 2009: Developments in the U.S., China and the Rest of the World" by Burgelman et al. Keywords: New Product Introduction, Governmental Strategies, Leaders in Innovation.
- "Cola Wars Continue: Coke vs. Pepsi in the Twenty-First Century" by David B. Yoffie, Yusi Wang. (Comment: History and Summary interesting)
- "Airbus vs. Boeing in Super Jumbos: A Case of Failed Preemption" by B.C. Esty and P. Ghemawat. Keywords: Aircraft Industry, New Product Introduction, Credible Preemption Strategies.
- Study on Minimum Wage
- Fiscal Cliff

Course Grade
Final course grades will usually be curved according to the Krannert policy. The target grade distribution is 40-50% A/A-, 40-55% B+/B, 5-10% B-, 0-5% C+ and hopefully no F.

Case Studies
Cases can be presented as a voluntary exercise which might improve your grade if you are at the margin. Notice has to be submitted at latest in lecture 9.The cases should be presented in a group between Lecture 12 and Lecture 15.
The presentations should last max 20 minutes. The case studies can be found on Katalyst. However, you can also suggest topics that are strongly related to Game Theory.
Cases will be assigned on a first come, first serve basis.

Katalyst
I will post the lecture notes, problem sets, and the solutions to the problem sets on Katalyst.

Class Participation
You have to come to class and I expect you to participate. Class participation may be counted at the margin.

Arriving on Time
Late arrivals are disruptive to both lectures and class discussion, and shows disrespect to those who are on time. Please be punctual.

Minimizing Disruptions
If you come to class I expect you to concentrate, listen and participate in class when questions are asked.
If you want to talk to other students or read the newspaper, you better leave the classroom, in order to **avoid destructing other students' concentration.**
All electronic devices should be turned off during class. You should try not to leave and re-enter when class is in session.

Please use your nameplate for each session.

I am looking forward to teaching the course and hope you will enjoy the course!!!