Course Syllabus

Course 2015-16

Game Theory and the Design of Institutions (21932)

Department/Area of Study: Business Management and Administration, Economics
Course: third
Term: second
Number of credits ECTS: 5
Hours dedicated by students: 125
Language: English
Professor: Rei Sayag

1. Course description

- **Objectives:** The objective of the course is to provide an intermediate course on Game Theory. Game theory is the science of strategy. It attempts to determine mathematically and logically the actions that "players" would take to secure the best outcomes for themselves in a wide array of "games." Game Theory can be used to analyze the possible outcomes of situations ranging from card games and sports to strategic price fixing, negotiation, group cooperation. Game theory aids in understanding the possible advantage of moving first, the credibility of threats, the strategic importance of having a last encounter, and the mechanisms to maintain cooperation alive. Students will learn to recognize strategic environments and to use Game Theory to gain a better understanding of interactions and outcomes within them.
- **Applications**: Many of the applications that we will cover will be in the area of economics and management. However, the theory has been successfully applied to sociology, biology, medicine, political science, and many other fields, and in the presentations students are encouraged to look at applications in virtually any of the above areas.
- **Requirements**: The course takes a deeper look at some of the topics already introduced in *Introduction to Game Theory*. This latter course is required for UPF students. Game theory allows the students to make objective and rigorous theoretical analysis of specific economic situations. The previous knowledge required to follow this class are divided into two parts:
    - *Knowledge of basic mathematics:* Algebra, Probability, Optimization. Most of this knowledge is basic, and students have acquired it before University. Other parts they have learned during the first year at the University in the courses of Mathematics and Data Analysis.
    - *Knowledge of economics*: Though not obligatory the basic knowledge acquired during the course *Microeconomics I and II* offers an interesting basis for the Game Theory course. In Microeconomics I and II students are introduced to the process of formalizing economic phenomena at an intermediate level, a process that in the Game Theory course is extended to situations of strategic interaction at a somewhat higher level of formalization.

2. Competences to be attained

General competences	*Special competences*
Instrumental • Ability to synthesize • Skills to manage information • Abstract thinking • Adaptation and clear understanding of the ideas ***Interpersonal*** • Ability to work in teams • Ability to criticize ***Systemic*** • Creativity (ability to generate new ideas) • Independence (ability to work independently)	• Analysis of rational decision models • Knowledge of economic reality • Ability to apply basic mathematical concepts of Game Theory to the economy • Analysis of situations from the perspective of strategic interaction.

3. Contents

1. Basic framework: games and decisions
2. Zero-sum games: secure strategy, minmax theorem, value of a game
3. Normal form games: dominance, iterated dominance, Nash equilibrium
4. Extensive form games: subgame perfection, sequential equilibrium
5. Bargaining: Rubinstein bargaining, Nash bargaining
6. Repeated games: Folk theorem and repeated prisoner's dilemma
7. Incomplete information games: Bayesian equilibrium, higher order beliefs
8. Auctions and mechanism design: Basic auctions, VCR mechanisms

4. Evaluations

- **Continued Obligatory Assessment:**
    a) *Experiments:* During (or perhaps before) the class sessions or the seminars, students have to participate in experiments. Experiments consist in acting as a player in a game theoretic situation, and playing against the rest of the class.
    b) *Problem sets:* Solving problem sets and practical cases for the classes and seminars. Attendance to the seminar is obligatory. Missing more than two seminars will automatically result in a **failing** grade. Seminar exemptions can be granted only for medical reasons.
    c) *Paper presentation:* Every student has to write and present (in groups of 3 or at most 4 students) a short overview paper of an **academic** work involving an application of game theory or a theoretical topic not covered in class (to be agreed and coordinated with the professor; concrete lists of examples will be given in class). The presentations are during the last two weeks of classes. The written overview should be 1000 to 2000 word long. Further details will be given in class.

- **Final Obligatory Evaluation:** final exam (passing grade in the final exam is required to pass the class)

Relative weight for each activity:
- Seminar and class participation, and experiments 10%
- Problem sets 10%
- Overview paper (written paper and its presentation) 20%
- Final exam 60% (passing grade required)

The final exam is in March 24. There is also a second chance in April/May that takes the same format as the final exam. Exact date will be announced.

5. Bibliography and didactic materials:

- ## Recommended bibliography

LEYTON-BROWN, K., SHOHAM, Y., *Essentials of Game Theory: A Concise, Multidisciplinary Introduction*, Morgan & Claypool Publishers. 2008.

OSBORNE, M.J., *Introduction to Game Theory*, Oxford Univ. Press. 2004.

OSBORNE, M.J., RUBINSTEIN, A., *A Course in Game Theory*, MIT Press. 1994.

- ## Additional bibliography

BINMORE, K., *Game Theory: A Very Short Introduction*, Oxford Univ. Press. 2007.

BINMORE, K., *Playing for Real, Course pack Edition: A Text on Game Theory*, Oxford University Press. 2012.
CAMERER, C.F., *Behavioral Game Theory: Experiments in Strategic Interaction*, Princeton University Press. 2003.

FUDENBERG, D., TIROLE, J., *Game Theory*, MIT Press. 1992.

HEIFETZ, A., *Game Theory: Interactive Strategies in Economics and Management*, Cambridge University Press, 2012.

MYERSON, R.B., *Game Theory: Analysis of Conflict*, Harvard Univ. Press. 1991.

WATSON, J., *Strategy: An Introduction to Game Theory*, Norton & Co., 2008.

VON NEUMANN, J., MORGENSTERN, O., *Theory of Games and Economic Behavior*, Princeton University Press. 1944.

6. Methodology

During the course the following activities will be carried out:

a) Participation in internet experiments where students take decisions in a context of strategic interaction. Previous theoretical knowledge is not required.
b) Theoretical sessions in a big group to introduce the concepts and their basic applications. Theoretical concepts are employed to discuss the behavior observed in the experiments.
c) Seminar sessions in a small group where different concepts introduced during the course are discussed in an interactive way.

7. Outline

Week	Week	Theory	Seminar
1.	From 11/01 to 15/01	Games and decisions	There is none.
2.	From 18/01 to 22/01	Zero-sum games	Basic normal form games
3.	From 25/01 to 29/01	Normal form games	Zero-sum and normal form games
4.	From 01/02 to 05/02	Extensive form games	Zero-sum and extensive form games
5.	From 08/02 to 12/02	Bargaining	extensive form games and bargaining
6.	From 15/02 to 19/02	Repeated games	Repeated games
7.	From 22/02 to 26/02	Incomplete information games	There is none.
8.	From 29/02 to 04/03	Auctions and mechanism design	There is none.
9.	From 07/03 to 11/03	Extensions of the basic theory: paper presentations	Incomplete information games, mechanisms and auctions
10.	From 14/03 to 18/03	Extensions of the basic theory: paper presentations	There is none.