Course Syllabus

Course 2013-14

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: Fabrizio Germano

1. Course description

- **Objectives:** The objective of the course is to provide an intermediate course on Game Theory. Game Theory is a method to analyze how to make choices when others are also making choices at the same time. It is not about winning in table games or playing card. Instead, Game Theory is about how to strategically fix prices, or how prepare a negotiation, or understanding the difficulties of group cooperation, or where to locate a company, or what is the role of incentives in big corporations, among many other topics. Game theory allows you to calculate the possible advantage of moving first, or the credibility of threats, the strategic importance of having a last encounter, and the mechanisms to maintain cooperation alive. Rather than learning new things, students will learn to think strategically, a skill that can only be mastered with lots of practice.
- **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, Real Analysis, 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. Evaluation

- **Continued Obligatory Assessment:**

  a) *Experiments:* Before the class sessions or the seminars, students have to participate in experiments using the Global Campus. 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 present (in groups of 3 or at most 4) a short overview paper of **academic** work involving an application of game theory or also 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.

- **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%
- Paper presentation 20%
- Final exam 60% (passing grade required)

The final exam is in March/April, and there is also a second chance in April/May that takes the same format as the final exam. Exact dates will be announced.

5. Bibliography and didactic materials:

5.1. Required bibliography

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

5.2. Recommended bibliography

BINMORE, K., *Playing for Real, Coursepack Edition: A Text on Game Theory*, Oxford University Press. 2012.

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

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

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

5.2. Additional bibliography

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

CAMERER, C.F., *Behavioral Game Theory: Experiments in Strategic Interaction*, Princeton University Press. 2003.

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

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

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

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

5.4. Didactic Recourses

For each of the eight chapters, there is an important set of didactic material that will be available every week in the Global Campus.

- Experiments through the Internet
- Exercises and problems
- Applications

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	Theory	Seminar
1.	From 7/01 to 10/01	Games and decisions	There is none.
2.	From 13/01 to 17/01	Zero-sum games	Basic normal form games
3.	From 20/01 to 24/01	Normal form games	Zero-sum and normal form games
4.	From 27/01 to 31/01	Extensive form games	There is none.
5.	From 3/02 to 7/02	Bargaining	Zero-sum and extensive form games
6.	From 10/02 to 14/02	Repeated games	extensive form games and bargaining
7.	From 17/02 to 21/02	Incomplete information games	Repeated games
8.	From 24/02 to 28/02	Auctions and mechanism design	There is none.
9.	From 3/03 to 7/03	Extensions of the basic theory: paper presentations	There is none.
10.	From 10/03 to 14/03	Extensions of the basic theory: paper presentations	Incomplete information games, mechanisms and auctions