

# ECON884 APPLIED GAME THEORY

Semester 2, 2009

*Department of Economics*

# ECON884

## APPLIED GAME THEORY

### MACQUARIE UNIVERSITY FACULTY OF BUSINESS AND ECONOMICS UNIT OUTLINE

**Second Semester - 2009**

**Unit convenor: Dr Stéphane Mahuteau**

Students in this unit should read this unit outline carefully at the start of semester. It contains important information about the unit. If anything in it is unclear, please consult one of the teaching staff in the unit.

#### INTRODUCTION

**Objective:** With the recent development of Experimental economics as a refutation tool, Game theory has emerged as an important field providing Economists with tools to deal with strategic and social interactions. The aim of this course is to introduce students to the methodology of Game theory with an emphasis on applications to real economics issues. The first half of the course will be more lecture-based in order to give the students the necessary tools to comprehend the wide literature on the subject. The second half will involve readings on a variety of topics where Game theory and Experimental economics constitute a relevant tool of analysis.

It is recommended that students attending this unit have a knowledge of Microeconomics at the intermediary level and be familiar with algebra and optimization.

This unit is worth four credit points.

**Prerequisites:** no prerequisite is imposed; however, knowledge of intermediary level Microeconomics is advisable. Students should also be familiar with basic algebra and optimization.

#### TEACHING STAFF

**Stéphane Mahuteau**

*Lecturer in Charge*

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## CLASSES

There is one three-hour lecture per week at the following time and place:

Lecture:            Wednesday    18 pm – 21 pm            E6A-133

The timetable for classes can be found on the University web site at: <http://www.timetables.mq.edu.au/>

*It is assumed that students will attend all lectures and tutorials. Students who miss classes put themselves at a significant disadvantage for several reasons, including:*

*(i) The text is only a support for the students and provides applications of the concepts discussed in class, most of the lectures content is therefore not included in the textbook.*

*(ii) The lectures will include significant guidance about the style and content of the final exam and recommendations about study technique.*

*(iii) It is difficult (and often impossible) for staff to provide meaningful assistance to students outside class times on topics for which they did not attend the relevant lectures and tutorials.*

## UNIT WEB PAGE

The web page for this unit can be accessed via [www.learn.mq.edu.au](http://www.learn.mq.edu.au) You should check this web page regularly. The lecture slides for each week's lecture will be posted on the web page. In order to maintain enough flexibility to the content of the lectures, some lecture notes may appear on the web page after the lecture.

We also use the web page to post important notices from time to time.

## TEXT

• THE PRESCRIBED TEXTBOOK IS:

Camerer C.F., (2003), *Behavioral Game Theory: Experiments in Strategic Interaction*, Russell Sage Foundation, New York, Princeton University Press, Princeton, New Jersey. ISBN 0-691-09039-4.

Copies of this textbook are available for purchase at the Co-opt bookshop.

• RECOMMENDED TEXTS:

Bierman H. Scott, Fernandez L., (1997), *Game Theory with Economic Applications*, 2nd ed., Addison Wesley.

Binmore K., (1991), *Fun and Games: A text on Game Theory*, D.C. Heath.

Dixit A.K., Skeath S., (1999), *Games of Strategy*, W.W. Norton & Co, New York.

Fudenberg D., Tirole J., (1998), *Game Theory*, 6th ed., MIT press.

Gibbons R., (1992), *A primer on Game Theory*, Prentice-Hall, Pearson Education Ltd, Harlow, England.

Kreps D., (1990), *Game Theory and Economic Modelling* (Clarendon Lectures in Economics), Oxford University Press, USA.

Rasmusen E., (2001), *Games and Information: An Introduction to Game Theory*, 3rd ed., Blackwell Publishers.

Varoufakis Y., Hargreaves-Heap S., (2004), *Game Theory: A critical Introduction*, Routledge.

## LEARNING OUTCOMES

After successfully completing this unit, you will:

- be familiar with the key concepts of Game Theory
- be able to use game theoretic tools to explain a wide range of economic situations
- be able to use game theory in a business environment
- be able to critically evaluate academic research and studies using Game Theory as an analytical tool, including having an understanding of the technical aspects of such studies.
- be able to continue any future studies in economics with increased confidence

All academic programs at Macquarie seek to develop students' generic skills in a range of areas. One aim of this unit is that you will develop your skills in literacy and numeracy; group-work and communication; problem solving and critical thinking; and creativity.

## LEARNING AND TEACHING STRATEGY

*Our role:* In the 3-hour "lecture" class, we will present new material in the form of lectures. No tutorial is formally scheduled but practice exercises will be an integral part of each. We will answer your questions during and after lectures. We will also answer questions during our consultation times and by e-mail.

*Your role:* We expect that you will attend all lectures and tutorials. We expect you to read all the material prescribed on the reading list. We expect you to be prepared to participate actively in the lectures. We also expect that you will make a good attempt at the assignment and final exam.

## RELATIONSHIP BETWEEN ASSESSMENT AND LEARNING OUTCOMES

Assessment will be based on the following **THREE** activities. Students must satisfactorily complete **ALL THREE** activities to be eligible to pass this unit. **In particular, you MUST pass the final exam to be eligible to pass the unit.**

### ACTIVITY 1: MULTIPLE CHOICE EXAM (10%)

The Exam will be held on **September 9<sup>th</sup>** during the normal lecture time. The exam will include questions on all material covered in the unit (lectures, practical exercises and readings) up to the week before the exam.

### ACTIVITY 2: PROJECT and PRESENTATION (30 %)

This activity comprises two stages:

#### STAGE 1:

One project of about 3000 words should be submitted no later than **6.00pm on Wednesday November 4<sup>th</sup>**. **It is a team work, students have the opportunity to form a team of two students to complete both stages of the project.**

Projects are to be placed in the Econ884 box in BESS. A photocopy of your essay should be retained. Further, an electronic copy should be sent to the lecturer in charge at the address: [smahutea@efs.mq.edu.au](mailto:smahutea@efs.mq.edu.au) by the due date.

A list of student identification numbers for all students from whom a project has been received will be posted on the Econ884 web page within 48 hours of the submission date. You must check this list immediately. If your number is not on the list, but you have submitted a project, contact Stéphane Mahuteau immediately. If you do not follow this procedure then you cannot claim at the end of the year that your project was submitted but not returned to you.

#### STAGE 2:

On the last week of lecture, each student team will present his (her) project in front of the class for 10 to 15 minutes, using powerpoint presentations.

The total mark awarded for this activity will take into account both the originality and quality of the written part of the project and the quality of the class presentation.

**The students will be free to choose their own topic or pick a suggested topic from the unit homepage.**

#### **ACTIVITY 3: FINAL EXAMINATION (60%)**

End of unit three hour written examination, to be taken during the end of year examination period. The examination will cover material drawn from all parts of the unit's subject matter.

#### **Requirements to Pass This Unit**

To pass ECON884, students must satisfy each of the following requirements:

- (1) An overall satisfactory performance in all assessment components;
- (2) **A pass in the final examination;** and
- (3) Submission of the assignment.

Under the current grading system, a **standardised numerical grade (SNG)** will be awarded together with a band grade HD, D, Cr, P, PC, or F.

It is important for students to note that the SNG is NOT the weighted aggregate of the raw marks for the above three assessment components. It is rather a detailed grade that is chosen from 0 to 100 based on other criteria as well as the raw marks. For instance, the SNG for a student who gains a raw aggregate mark of 55 but fails the final would be lower than 45 indicating that he/she fails the unit.

As such, a SNG of say 73 or 74 does **NOT** mean that the student's aggregate mark is one or two marks below the threshold for a D. It means that his/her work and performance in the unit is of predominantly good quality and did better than other students in the Cr band but not quite of superior quality needed for a D.

**The University Examination period in Second Half Year 2009 is from November 18<sup>th</sup> to December 4<sup>th</sup> inclusive.**

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form

approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations.

<http://www.timetables.mq.edu.au/exam>

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. Information about unavoidable disruption and the special consideration process is available at <http://www.reg.mq.edu.au/Forms/APSCon.pdf>. All claims have to be substantiated by a signed **Professional Authority Form**, and if they are based on non-medical grounds, supporting documentation (such as statutory declarations by independent witnesses, police reports, or statements from sufficiently senior officials in the place of employment) must also be provided.

If accepted, in most cases, the students will be required to sit a supplementary examination on a date set by the Faculty. So, students who intend to be away must take account of this rule in scheduling any travel after lodging the request.

The format of the supplementary examination may be different from the usual examination. To prevent students from abusing this facility and to protect only the students with genuine reasons, **the result of supplementary examination will replace the result of the usual examination if a student sits a supplementary examination as well as the usual examination.** This implies that a student will fail the unit if he/she fails the supplementary examination regardless of his/her performance in the usual examination. If you believe this rule unfairly disadvantages you, contact the lecturer in charge before lodging the request form.

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, i.e. the final day of the official examination period.

## PLAGIARISM

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the *Handbook of Undergraduate Studies* or on the web at: <http://www.student.mq.edu.au/plagiarism/>

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

## UNIVERSITY POLICY ON GRADING

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction. Your final result will include one of these grades plus a standardised numerical grade (SNG).

On occasion your raw mark for a unit (i.e., the total of your marks for each assessment item) may not be the same as the SNG which you receive. Under the Senate guidelines, results may be scaled to ensure that there is a degree of comparability across the university, so that units with the same past performances of their students should achieve similar results.

It is important that you realise that the policy does not require that a minimum number of students are to be failed in any unit. In fact it does something like the opposite, in requiring examiners to explain their actions if more than 20% of students fail in a unit.

The process of scaling does not change the order of marks among students. A student who receives a higher raw mark than another will also receive a higher final scaled mark.

For an explanation of the policy see

<http://www.mq.edu.au/senate/MQUonly/Issues/Guidelines2003.doc> or

<http://www.mq.edu.au/senate/MQUonly/Issues/detailedguidelines.doc>.

## STUDENT SUPPORT SERVICES

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at <http://www.student.mq.edu.au>.

The Faculty of Business and Economics offers additional support for its students such as EFS Resource and Information Centre commonly known as BESS, Peer Assisted Learning (PAL), etc... Details of these services can be accessed at <http://www.businessandconomics.mq.edu.au/current/undergraduate/bess>

## COURSE OUTLINE

Following is an indicative list of topics covered during the semester. These topics may be updated in order to cover some topics more in depth upon students' demand or in order to adapt the course content to the level of technical knowledge of the majority of students joining the unit.

### **Lecture 1: Introduction and reminder on decision under risk**

In this lecture we introduce the unit and discuss the modes of assessment that will be used in this unit. Moreover, we introduce the topic and define what is a game, how one classifies games and we'll discuss the topics that will be covered throughout the semester. We'll start the course with a first topic, namely: Decision under risk. Even though decision under risk involves a single decision maker (that has little to do with game theory per se), this lecture is important. It provides a reminder of expected utility formulations used in Economic Theory

and in Game Theory as the commonly used tool to express individuals' utility when the outcome of their decision involves risky outcomes.

## **Lecture 2: Static games of complete information (normal form games and Nash Equilibrium)**

In this lecture we define static games of complete information, introduce the concepts of dominance, iterated dominance, mixed strategies and Nash Equilibrium. We investigate the conditions of existence of a Nash equilibrium in such games and look at the issue of multiplicity of equilibria. We illustrate the concepts and their use through examples such as Cournot static competition, Hotelling model of differentiation, voting, etc...

## **Lecture 3: Static games of complete information 2 plus exercises session.**

This lecture continues the previous lecture on static games of complete information and moves to a more advanced topic: namely Quantal Response equilibrium whose aim is to model noise in individuals' responses to their beliefs when playing mixed strategies. The second part of the lecture will be dedicated to an exercise session where students will have the opportunity to apply the concepts discussed during the past lecture.

## **Lecture 4 and 5: Extensive Form Games and Subgame perfection**

In this lecture we'll first finish the exercise session of the previous week if need be. The lecture will move on to the introduction of extensive form games (or dynamic games of complete information). We'll define what is a game in extensive form, look at the Nash equilibria arising from such games. We'll show that the concept of Nash equilibrium is not satisfactory to come up with accurate predictions of the outcomes of such games. We introduce a first refinement of the Nash equilibrium, namely Subgame Perfect Nash Equilibria.

## **Lecture 6: Extensive form games: applications and introduction to bargaining**

This lecture continues the previous lecture and provides applications of dynamic games of complete information. In a second part of the lecture we introduce a particular type of multistage game of complete information: Bargaining. A significant part of the lecture will be dedicated to the alternating offers bargaining model of Rubinstein.

## **Lecture 7: Experimental results on the alternating offers bargaining game and improvements to the theory to account for extra material considerations**

In this lecture, we use experimental economics results to illustrate the predictive power, or lack thereof of the subgame perfect Nash equilibrium in alternating offer bargaining games. We discuss the recent literature that investigates the role of *others regarding preferences* in bargaining outcomes and propose a number of alternatives aimed at improving the predictive power of game theory in such games. A part of this lecture will be dedicated to the methodology of experimental economics in order to give students the necessary tools for them to conduct their own experiments (this last part may take up a bit of next week's lecture).

## Lecture 8: Repeated games

In this lecture, we introduce repeated games, namely situations where players have the opportunity to play several times. We introduce another refinement of the Nash equilibrium in these games and investigate the conditions of existence and stability of cooperation between two players. We discuss the Folk Theorem, renegotiation proofness and extend the Folk Theorem to situations where imperfect public information prevails.

## Lecture 9: Static games of incomplete information

In this lecture we look at games in which players have private information about something relevant to their decisions. We'll introduce yet another refinement of the Nash equilibrium, namely Bayesian Nash Equilibrium. The second part of the lecture will be dedicated to illustrative exercises.

## Lecture 10: Dynamic games of incomplete information (Perfect Bayesian Equilibrium, Sequential equilibrium, trembling hand perfection)

In this lecture we expand the previous concepts to situations where individuals have to take sequential decisions. We introduce the concept of perfect Bayesian equilibrium as a refinement of the SPNE used in dynamic games of complete information.

## Lecture 11: Dynamic Games of incomplete information 2, plus exercises

This week's lecture we look at the shortcomings of the concept of perfect Bayesian equilibrium in dynamic games of incomplete information and introduce alternative concepts such as Sequential equilibrium and Trembling Hand Perfection.

## Lecture 12: Open topic

## Lecture 13: Students presentations and revision session

### COURSE DIARY

Week	Dates	Indicative topic of lecture	
1	August 5	Introduction and reminder on decision under risk	
2	August 12	Static games of complete information (normal form games and Nash Equilibrium)	
3	August 19	Games of complete information 2 plus exercises session.	
4	August 26	Extensive Form Games and Subgame perfection	
5	September 2	Extensive Form Games and Subgame perfection	

<b>6</b>	September 9	Extensive form games: applications and introduction to bargaining	<b>MID-TERM EXAM</b>
<b>7</b>	September 16	Experimental results on the alternating offers bargaining game and improvements to the theory to account for extra material considerations	
September 23 – September 30		<b>Mid-semester Break</b>	
<b>8</b>	October 7	Repeated games	
<b>9</b>	October 14	Static games of incomplete information	
<b>10</b>	October 21	Dynamic games of incomplete information (Perfect Bayesian Equilibrium, Sequential equilibrium, trembling hand perfection)	
<b>11</b>	October 28	Dynamic Games of incomplete information 2, plus exercises	
<b>12</b>	November 4	Open topic	<b>Project due</b>
<b>13</b>	November 11	Students Presentations and revision session	<b>Project presentation due</b>

## PROJECT AND PRESENTATION

You are required to submit a project of approximately 3000 words in length by **6pm November 4<sup>th</sup>**.

**The students will form a team of two to complete this assignment.**

**On the last week of lecture, each team will present his (her) project in front of the class in the form of a powerpoint presentation. The presentation should not last more than 15 minutes.**

**Several indicative project topics will be available on the unit webpage but students are free (and encouraged) to find a topic of their own.**

### POINTS TO REMEMBER:

- To write an acceptable project YOU MUST read beyond the references you use. If you simply read and summarise your references you will not pass the assignment. We do not expect you to read everything that has been written on your chosen topic. That would be unreasonable given the volume of literature that exists and the 3000 word limit we have set for your project. However the quality of your project will be directly proportional to the research effort that you put into it. The more you read the clearer will be your own understanding of your chosen topic.
- Referencing  
The project must conform to an academically accepted system of referencing. Our preference is for you to use the “within text” system, also known as the “author-date” system. If you are in any doubt about how to write a project that conforms to university standards the first port-of-call is BESS which has copies of “Essay Writing in Economics” prepared by Prof. Rod O’Donnell for you to photocopy. You can also consult “The Style Manual” (PN147.S83) in the Reference section of the library.

In the evaluation of written work the following factors will be considered:

1. The standard displayed in English expression and sentence construction and the level attained in the written articulation of ideas.
2. The ability to exhibit critical analysis in the subject area.
3. The ability to develop ideas in a logical or sequential fashion.

### **DON'T CHEAT:**

The project must represent the student's own work. It is recognised that many of the points expressed in the project will have been derived from books and articles and other publications. However, students cannot simply directly copy from these or any other sources. The points made must be explained in your own words. However, to reinforce ideas explained in their essay, students may use quotes that are correctly referenced.

The following statement relating to collusion and plagiarism has been prepared by the University.

*"The integrity of learning and scholarship depends on a code of conduct governing good practice and acceptable academic behaviour. One of the most important elements of good practice involves acknowledging carefully the people whose ideas we have used, borrowed, or developed. All students and scholars are bound by these rules because all scholarly work depends in one way or another on the work of others."*

Therefore, there is nothing wrong in using the work of others as a basis for your own work, nor is it evidence of inadequacy on your part, provided you do not attempt to pass off someone else's work as your own.

To maintain good academic practice, so that you may be given credit for your own efforts, and so that your own contribution can be properly appreciated and evaluated, you should acknowledge your sources and you should ALWAYS:

(i) State clearly in the appropriate form where you found the material on which you have based your work.

(ii) Acknowledge the people whose concepts, experiments, or results you have extracted, developed, or summarised, even if you put these ideas into your own words.

(iii) Avoid excessive copying of passages by another author, even where the source is acknowledged. Find another form of words to show that you have thought about the material and understood it, but remember to state clearly where you found the ideas.

If you take and use the work of another person without clearly stating or acknowledging your source, you are falsely claiming that material as your own work and committing an act of PLAGIARISM. This is a very serious violation of good practice and an offence for which you will be penalised.

**YOU WILL BE GUILTY OF PLAGIARISM** if you do any of the following in an assignment, or in any piece of work which is to be assessed, without clearly acknowledging your source(s) for each quotation or piece of borrowed material:

- (a) Copy out part(s) of any document or audio-visual material, including computer-based material;
- (b) Use or extract someone else's concepts or experimental results or conclusions, even if you put them in your own words;
- (c) Copy out or take ideas from the work of another student, even if you put the borrowed material in your own words;
- (d) Submit substantially the same final version of any material as a fellow student. On occasions, you may be encouraged to prepare your work with someone else, but the final form of the assignment you hand in must be your own independent endeavour.”

The simplest way to avoid plagiarism is to be open about your sources. There is no academic demerit in this. Many of the ideas used in essays, articles and books inevitably build on the work of others, and it is only honest and courteous to acknowledge those to whom you are indebted.