

# GAME THEORY

## Bachelor in Economics BIE SEP-2023 GT-Ec.1.S.A

Area Economics

Number of sessions: 30

Academic year: 23-24

Degree course: FIRST

Number of credits: 6.0

Semester: 2<sup>o</sup>

Category: BASIC

Language: English

Professor: **NIKITAS KONSTANTINIDIS**

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**Nikitas Konstantinidis** currently holds the position of Associate Professor in International and Comparative Political Economy at the School of Politics, Economics, and Global Affairs, IE University, where he has also served as Acting Vice Dean of Academic Affairs. Previously he was University Lecturer in International Political Economy in the Department of Politics and International Studies (POLIS), Fellow in Political Science and Public Policy in the Department of Government of the London School of Economics and Political Science (LSE), and a post-doctoral researcher at the Institut Barcelona d'Estudis Internacionals (IBEI). He received his Ph.D. in Political Economy from the Princeton School of Public and International Affairs, Princeton University, and has further pursued postgraduate studies in public policy at the Kennedy School of Government, Harvard University, and undergraduate studies at the LSE. His main research interests lie in the areas of comparative and international political economy, applied formal theory, regional integration, international organizations, and European Union politics. Current research projects include the effects of globalization on democratic political systems, models of electoral accountability and party polarization under supranational policy constraints, and the formal analysis of government ownership of IFI conditional lending programs. His research material is available on his respective profiles in Google Scholar and Academia.edu. He has also been active in terms of blogging, writing op-eds, and tweeting (@nikkon7). Moreover, he is a member of the steering committee of the Greek Public Policy Forum, an academic initiative that seeks to derive concrete policy implications from multidisciplinary research, and foster cross-border dialogue and consultations on public policy issues in Greece and the EU.

### Office Hours

Office hours will be on request. Please contact at:

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## SUBJECT DESCRIPTION

Game Theory is the science of strategic decision-making. While first developed in the field of mathematics and micro-economics, game theory has since revolutionized a variety of academic fields, from political science to evolutionary biology; and is now an essential practical tool for work in a wide variety of professional disciplines. Beyond all of this, game theory is a beautiful and flexible tool that is a joy to discover! In this course, we will develop the basic skill-set associated with designing and solving game theoretic models, and learn to apply this tool-kit in a wide variety of settings.

In most social interactions (economic or political), individual behaviour depends on the choices of multiple actors. This course offers an introduction to a set of tools social scientists use to understand strategic interactions when individuals must anticipate other people's behaviour. We will introduce the theory of games in a systematic manner, along with applying the tools we learn to many settings in Economics and Political Science such as market competition, conflict, voting etc. We will cover basic solution concepts for simultaneous and sequential move games, with and without incomplete information. Conflict, cooperation, coordination, bargaining, auctions, and (tacit) communication are all topics that can be usefully analyzed within this framework.

## LEARNING OBJECTIVES

The primary objective is such that at the end of this course you should be able to:

1. Develop a logical framework to analyse strategic interaction.
2. Apply the tools we learn to understand patterns in human behaviour.

Fortunately (and simultaneously unfortunately) people have a tendency to think for themselves. What should be relatively straightforward effects of policies and decisions are anything but because the true effect is often buried under strategic interaction. This course provides one particular (non-exhaustive) method for you to parse such social interactions and understand the patterns that we observe.

A secondary objective is to develop general problem-solving and analytical skills. Game theory, like most disciplines in economic theory, relies on logically consistent arguments, and coming up with creative ways to solve models that may seem extremely complicated at first. These skills can be applied to contexts outside the realm of economic theory.

This course will teach you the fundamentals of game theory. It will be a rigorous introduction that does not shy away from technical detail but emphasizes modeling issues and solution concepts. Game theory emerged as a branch of applied mathematics and is still quite mathematical. Although we shall rarely use more than algebra, the course will be analytically demanding. The hard part of game theory is not the math but the logic, and mastering this takes time and effort.

## TEACHING METHODOLOGY

Lectures will be held weekly and will cover the broad theoretical topics of the course. In addition, we will work through example problems and activities. Students are expected to participate in class as we will be playing several games. Akin to how a carpenter's apprentice would learn by crafting a table or two herself, you will need to get your "hands on a hammer" (metaphorically speaking). There will be several problem sets during the course through which we will learn how to apply the tools we learn in the lectures. These problem sets will then be solved in class. Also, please note that we will not shy away from using more technical mathematical notation, which you need to familiarize yourselves with. Furthermore, we will discuss the proper use of AI for this course in class.

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. The instructor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

<b>Learning Activity</b>	<b>Weighting</b>	<b>Estimated time a student should dedicate to prepare for and participate in</b>
Lectures	20.0 %	30.0 hours
Discussions	6.67 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	33.33 %	50.0 hours
Group work	6.67 %	10.0 hours
Individual studying	33.33 %	50.0 hours
<b>TOTAL</b>	<b>100.0 %</b>	<b>150.0 hours</b>

## **PROGRAM**

### **SESSIONS 1 - 2 (LIVE IN-PERSON)**

#### **Course Overview and Introduction: The Science of "Games"**

##### **Elements of Basic Models:**

- Actions, strategies, games, and equilibrium concepts
- Expected utility theory and maximization

*Book Chapters: Osborne, "An Introduction to Game Theory" pages 1-8 (Chapter 1) (See Bibliography)*

### **SESSIONS 3 - 4 (LIVE IN-PERSON)**

#### **Strategic-Form Games:**

- Rationalizability, dominated strategies, iterated elimination of dominated strategies
- Best responses, Nash equilibrium in pure strategies
- Prisoner's dilemma, chicken, and coordination games

#### **In-Class Design Lab:**

- Utility functions

*Book Chapters: Osborne, "An Introduction to Game Theory" pages 13-45 (Chapter 2) and 80-91 (Chapter 3) (See Bibliography)*

*Book Chapters: Gibbons, "Game Theory for Applied Economists," pages 1-8 (Chapter 1) (See*

*Bibliography)*

## **SESSIONS 5 - 6 (LIVE IN-PERSON)**

### **Advanced Theory:**

- Expected utility
- Mixed-strategy Nash equilibrium

### **Applications:**

- Competition in Cournot and Bertrand duopoly models, price and quantity competition

*Book Chapters: Osborne, "An Introduction to Game Theory" pages 53-68 (Chapter 3) and 97-148 (Chapter 4) (See Bibliography)*

*Book Chapters: Gibbons, "Game Theory for Applied Economists," pages 14-53 (Chapter 1) (See Bibliography)*

## **SESSIONS 7 - 8 (LIVE IN-PERSON)**

### **Dynamics Games of Complete and Perfect Information:**

- Game trees, histories, subgames, and extensive-form games
- Subgame-perfect Nash equilibrium
- Backward induction

### **Applications:**

- First- and second-mover advantage
- Stackelberg's model of duopoly
- Wage bargaining, bank runs, and tariffs

*Book Chapters: Osborne, "An Introduction to Game Theory" pages 151-177 (Chapter 5) and 179-200 (Chapter 6) (See Bibliography)*

*Book Chapters: Gibbons, "Game Theory for Applied Economists," pages 55-82 and 115-129 (Chapter 2) (See Bibliography)*

## **SESSIONS 9 - 10 (LIVE IN-PERSON)**

### **Dynamic Games of Complete but Imperfect Information:**

- Information sets
- Ultimatum bargaining and the "chain-store paradox"
- Nash vs. subgame-perfect Nash equilibria

### **Applications:**

- Strategic credibility and nuclear deterrence

*Book Chapters: Osborne, "An Introduction to Game Theory" 179-200 (Chapter 6) (See Bibliography)*

*Book Chapters: Gibbons, "Game Theory for Applied Economists," 115-138 (Chapter 2) (See Bibliography)*

## **SESSIONS 11 - 12 (LIVE IN-PERSON)**

### **In-Class Design Lab: Credibility in Dynamic Games**

### **Midterm Exam Review Session**

## **SESSIONS 13 - 14 (LIVE IN-PERSON)**

### **MIDTERM EXAM**

## **SESSIONS 15 - 16 (LIVE IN-PERSON)**

### **Bayesian Games and Incomplete Information:**

- Updating beliefs about players' "types"
- Perfect Bayesian equilibrium

### **Applications:**

- Duopolies with incomplete information
- Auctions with incomplete information

*Book Chapters: Osborne, "An Introduction to Game Theory" pages 271-309 (Chapter 9) (See Bibliography)*

*Book Chapters: Gibbons, "Game Theory for Applied Economists," pages 143-168 (Chapter 3) (See Bibliography)*

## **SESSIONS 17 - 18 (LIVE IN-PERSON)**

### **Dynamic Bayesian Games**

### **Applications:**

- Job-market signaling, corporate investment, and monetary policy

*Book Chapters: Osborne, "An Introduction to Game Theory" pages 311-351 (Chapter 11) (See Bibliography)*

*Book Chapters: Gibbons, "Game Theory for Applied Economists," pages 173-244 (Chapter 4) (See Bibliography)*

## **SESSIONS 19 - 20 (LIVE IN-PERSON)**

### **(In)initely Repeated Games:**

- Sustaining cooperation in repeated interactions, renegotiation, the importance of "patience," and the probability the interaction continues into the future

### **Applications:**

- Duopolist collusion and trench warfare

*Book Chapters: Osborne, "An Introduction to Game Theory" pages 389-420 (Chapters 14 and 15) (See Bibliography)*

*Book Chapters: Gibbons, "Game Theory for Applied Economists" pages 82-115 (Chapter 2) (See Bibliography)*

## **SESSIONS 21 - 22 (LIVE IN-PERSON)**

### **Advanced Topics: Theories of Electoral Competition**

- The Hotelling-Downs model and the Median Voter Theorem
- The citizen-candidate model and candidate entry

*Book Chapters: Osborne, "An Introduction to Game Theory" pages 68-75 (Chapter 3.3) (See Bibliography)*

Article: Besley, T. and S. Coate (1997) "An Economic Model of Representative Democracy" (Quarterly Journal of Economics 112: 85-114) (CED)

## **SESSIONS 23 - 24 (LIVE IN-PERSON)**

**Advanced Topics: Bargaining Theory**

Book Chapters: Osborne, "An Introduction to Game Theory" Chapter 16 (See Bibliography)

## **SESSIONS 25 - 26 (LIVE IN-PERSON)**

**The Space Game: A Real-Time Strategic Simulation**

Games & Simulations: Facing New Challenges in Space & Cyber Affairs: SpaceGov (IRE090056-U-ENG-HTM)

## **SESSIONS 27 - 28 (LIVE IN-PERSON)**

**Final Exam Review Session**

## **SESSIONS 29 - 30 (LIVE IN-PERSON)**

**FINAL EXAM**

## **EVALUATION CRITERIA**

<b>criteria</b>	<b>percentage</b>	<b>Learning Objectives</b>	<b>Comments</b>
Final exam	30 %		
Midterm exam	30 %		Midterm exam
Problem sets	20 %		4 problem sets, 5% each
Class participation (plus simulation)	20 %		

## **RE-SIT / RE-TAKE POLICY**

Any student in their third call of a course, also known as a "Retaker" or "Re-Sit", is obliged to observe the following rules:

- Third call students must contact their professors before or during the first session to ask which work and or \*sessions will be required to obtain a passing grade. The professor will determine which work will be required in their course.  
\*(e.g. when presenting group work, sitting for examinations or other work done in class).
- Retakers are exempt from failing the call due to absences; however, they are not exempt from work the professor designates as necessary to obtain a passing grade. This means some sessions may be mandatory to attend in order to complete the work within.
- Students in their third call are responsible for managing the conflicts in their schedule, should students need advice on how to manage their conflicts they should visit the program office.

## **EXTRAORDINARY EXAMINATION POLICY:**

Any student whose weighted final grade is below 5 will be required to sit for the extraordinary exam to pass the course (except those not complying with the attendance rules, whom are banned from this possibility).

Grading for retakes will be subject to the following rules:

- The extraordinary call will consist of a comprehensive exam or equivalent assignment. The grade will depend only on the performance on this exam; continuous evaluation over the semester will not be taken into account.
- Dates and location of the retakes will be posted in advance and will not be changed.
- The exam/assignment will be designed bearing in mind that the passing grade is 5 and the maximum grade that can be attained is 8 out of 10.

#### **GENERAL OBSERVATIONS:**

Each student has four attempts over two consecutive academic years to pass this course.

For every BIR Program mandatory class aside from the IR Unplugged and BIR Electives, students are required to obtain the minimum grade of 5 required to pass the course. Students whose grade in the Final Exam (or the largest assignment) is below 5 will fail the course. The rule applies to whichever assignment carries the greatest weight to the final grade. Dates and location of the final exam will be posted in advance and will not be changed.

Students must attend 100% of the sessions. Students who do not maintain at least 80% attendance will receive a 0.0 on their first and second attempts and go directly to the third call (course enrollment required for the following academic year).

Students who are in the third or fourth attempt must contact the professor during the first two weeks of the course.

The Bachelor's in International Relations pursues to develop the knowledge, skills and attitudes for bringing transformative and sustainable change in today's world. Therefore, all the courses follow the principles of sustainability and diversity. Firstly, this course considers the agenda 2030 and builds upon the Sustainable Development Goals. Secondly, this course is committed to an inclusive learning environment and looks to be enriched and enhanced by diversity along numerous dimensions, including race, ethnicity and national origins, gender and gender identity, sexuality, class and religion.

#### **BIBLIOGRAPHY**

##### **Compulsory**

- Robert Gibbons. *Game Theory for Applied Economists*. Princeton University Press. ISBN 9780691003955 (Digital)
- Martin J. Osborne. *An Introduction to Game Theory*. Oxford University Press. ISBN 9780195128956 (Digital)

#### **BEHAVIOR RULES**

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

**The program fully supports the professor in enforcing any rules and policies.**

- Be aware that the IE University code of conduct specifically states that, "The use of laptops during lectures must be authorized by the professor".
- It is the students' responsibility to fully read and understand the code of conduct, attendance, and ethics policies of this university.
- Students breaking these rules and policies face disciplinary action.

## ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

Please do not contact your professor about attendance apart from notifying them out of courtesy, **all attendance related inquiries should be directed to the program office** (bir.biemadrid@ie.edu or bir.biesegovia@ie.edu).

## ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

For help with academic writing contact the Writing Center at [writingcenter@faculty.ie.edu](mailto:writingcenter@faculty.ie.edu)

