

Applied Game Theory: Modelling Politics and Business

Course code	<i>POL121</i>
Compulsory in the programmes	<i>Compulsory</i>
Level of studies	<i>Undergraduate</i>
Number of credits and	<i>6 ECTS (48 contact hours + 6 consultation hours, 106 individual work hours)</i>
Course coordinator (title and name)	<i>Dr. Pijus Krūminas</i>
Prerequisites	<i>Introduction to Politics</i>
Language of instruction	<i>English</i>

THE AIM OF THE COURSE:

The course aims to strengthen skills in game theory by focusing on its applicability to the problems of politics and business, especially through the lens of experiments. While at the first glance games often seem too abstract or distinct from the actual political and economic processes, they can be grounded in the empirics and, importantly, empirical tests can help us understand the models better. Thus, during the course we will look at how game theory models can help us improve our understanding of politics, economics and business and how we can test the models themselves and their implications. This will equip students with skills needed to develop and apply game theory models in research and practice, as well as introduce them to experimental research and critical assessment of models.

MAPPING OF COURSE LEVEL LEARNING OUTCOMES (OBJECTIVES) WITH DEGREE LEVEL LEARNING OBJECTIVES, ASSESMENT AND TEACHING METHODS

Course level learning outcomes (objectives)	Degree level learning objectives (Number of LO)	Assessment methods	Teaching methods
CLO1. Students will understand advanced game theory concepts and the applicability as well as shortcomings of the method.	ELO1.1.	Research project, progress presentation during seminar workshops, project presentation, final exam	Lectures, seminars
CLO2. Students will learn to identify arguments about causality and use game theory models to provide theoretical reasoning for causal relationships.	ELO1.2.	Research project, progress presentation during seminar workshops, project presentation, final exam	Lectures, seminars
CLO3. Students will learn to identify assumptions behind game theory model development and to test game theory models against human behaviour.	ELO1.2.	Research project, progress presentation during seminar workshops, project presentation, final exam	Lectures, seminars

CLO4. Students will engage with ethical considerations of applied and experiment-based research.	ELO2.1.	Research project, progress presentation during seminar workshops, project presentation	Lectures, seminars
CLO5. Students will repeatedly present and discuss the progress of their model development activities during the course seminars	ELO4.2	Research project, progress presentation during seminar workshops, project presentation	Lectures, seminars
CLO6. Students will develop a written paper presenting their game theory model and its implications	ELO4.3	Research project, progress presentation during seminar workshops	Lectures, seminars

ACADEMIC HONESTY AND INTEGRITY

The ISM University of Management and Economics Code of Ethics, including cheating and plagiarism are fully applicable and will be strictly enforced in the course. Academic dishonesty, and cheating can and will lead to a report to the ISM Committee of Ethics. With regard to remote learning, ISM remind students that they are expected to adhere and maintain the same academic honesty and integrity that they would in a classroom setting.

COURSE OUTLINE

Topic	In-class hours	Readings
Introduction Introduction to the course. A brief reminder on game theory. Workshop on modeling in social sciences. What is a model? Why do we need models? How do we differentiate between good and bad models?	4	Bonnano (2015) Jensen (2022)
Applications and assumptions of game theory A brief history of game theory and its applications. Criticism of game theory. Rationality, beliefs, constraints. Human behaviour and assumptions in game theory models. Workshop on identifying areas for game theoretic analysis.	4	Naveed et al. (2021) Gintis (2006)
Applying games to empirical data Empirics-informed game theory models. Application of mixed strategies in a business setting. Other uses of empirics-driven game theory modelling.	4	Mohammadi Limaei (2010)
Experiments and game theory Classical game theory models and their applicability. Testing game theory models. Experimental economics and experimental game theory.	4	Bonnano (2015) Smith (2002)
Auction games Auctions and game theory. Auctions as real-world experiments.	4	Milgrom (2020)

Mechanism design and experiments Mechanism design as a part of game theory. Economic experiments and policy.	4	Shapiro & Siegel (2007) Hommes (2018)
Cooperative game theory Differences between cooperative and non-cooperative game theory. Majority games. Power indices. Applicability of cooperative game theory.	4	Leimaire (1991) Skovsgaard & Jensen (2018)
Evolutionary game theory in social sciences The basics of evolutionary game theory. Hawk and dove game. Evolutionary game theory approach to global trade cooperation.	4	Krapohl, Ocelik & Walentek (2021)
Agent-based modelling and game theory Introduction to agent-based models. Agent-based models and game theory. Exploring agent-based models. Introduction to NetLogo.	4	Gilbert & Terna (2000)
AI and game theory Artificial intelligence and game theory. Applicability and risks. AI as agents in game theory models.	4	Fan et al. (2024)
Student game theory model presentations Presentations of game theory models that students developed in the class.	4	–
Final overview Overview of the course.	4	–
	Total: 48 hours	
CONSULTATIONS	6	
FINAL EXAM	2	

FINAL GRADE COMPOSITION

Type of assignment	%
<i>Group Components 35%</i>	
Research project	35%
<i>Individual Components 65%</i>	
Progress presentation during seminar workshops	15%
Project presentation	20%
Final exam	30%
Total:	100

DESCRIPTION AND GRADING CRITERIA OF EACH ASSIGNMENT

(Provide short descriptions and grading criteria of each assignment)

1. **Research project (35%).** Students will have to develop a game theory model within the scope of the topics covered. The approach may vary, and model can be data-driven, focused on experiments, or other. Projects will be developed in small groups, encouraging cooperation and exchange of ideas. Research projects will be graded on the basis of the relevance of the models, their theoretical soundness, and applicability to the selected problems.
2. **Progress presentation during seminar workshops (15%).** Several times during the course, student groups will be asked to present their progress on project development. Students' involvement in these activities will be assessed.
3. **Project presentation (20%).** Project presentations will be held towards the end of the course and student groups will have to present their projects. This will also include Q&A session and feedback from the audience. Students will be allowed to revise their research projects' written outputs based on this feedback. Presentations will be assessed based on content, clarity, and responses to questions.
4. **Final exam (30%).** The final exam will ask about game theory concepts covered in classes. The questions will be multiple choice and open. Each question will be assigned a number of points that will be used to calculate the evaluation mark.
5. **Retake exam (65%).** Students who receive a failing final grade shall have the right to retake the examination, which will comprise 65% of the final grade and cover all topics of the course. Research project, and final exam results will be annulled, and the retake will require to demonstrate both knowledge of game theory concepts and ability to apply it to a real situation. The task will provide a situation that students will have to describe in game-theoretic terms.

REQUIRED READINGS

Bonnano, G. (2015). *Game Theory: An open access textbook with 165 solved exercises*. Published by Giacomo Bonnano, University of California, Davis.

Fan, C., Chen, J., Jin, Y., & He, H. (2024, March). Can large language models serve as rational players in game theory? a systematic analysis. In: *Proceedings of the AAAI Conference on Artificial Intelligence* (Vol. 38, No. 16, pp. 17960-17967).

Gilbert, N., & Terna, P. (2000). How to build and use agent-based models in social science. *Mind & Society*, 1, 57-72.

Gintis, H. (2005). *Why the beliefs, preferences, and constraints model*. Rep. University of Massachusetts, 20.

Jensen, P. (2022). Introducing simple models of social systems. *American Journal of Physics*, 90(6), 462-468.

Krapohl, S., Ocelík, V. & Walentek, D.M. (2021). The instability of globalization: applying evolutionary game theory to global trade cooperation. *Public Choice*, 188, 31-51.

Lemaire, J. (1991). Cooperative game theory and its insurance applications. *ASTIN Bulletin: The Journal of the IAA*, 21(1), 17-40.

Milgrom, P.R. (2020). *Auction research evolving: theorems and market designs*. Nobel Prize Lecture.

Mohammadi Limaei, S. (2010). Mixed strategy game theory, application in forest industry. *Forest Policy and Economics*, 527-531.

Naveed, R. T., Hussam Al Halbusi, T. R., AlAbri, S., Fattah, F. A. M. A., & Uzir, M. U. H. (2021). Game Theory: Historical Overview and Synthesizing Critique. *International Journal of Social Sciences and Humanity Studies*, 13(1), 127-151.

Shapiro, J. N. & Siegel, D.A. (2007). Underfunding in Terrorist Organizations. *International Studies Quarterly*, 51, 405-429.

Skovsgaard, L. & Jensen, I.G. (2018). Recent trends in biogas value chains explained using cooperative game theory. *Energy Economics*, 74, 503-522.

Smith, V.L. (2002). *Constructivist and ecological rationality in economics*. Nobel Prize Lecture.

Weingast, B. R. (1997). The political foundations of democracy and the rule of the law. *American political science review*, 91(2), 245-263.

ADDITIONAL READINGS

TBA

ANNEX

DEGREE LEVEL LEARNING OBJECTIVES

Learning objectives for the Bachelor of Social Science

Programmes:

Economics and Data Analytics,

Economics and Politics

Learning Goals	Learning Objectives
Students will be critical thinkers	ELO1.1. Students will be able to understand core concepts and methods in the key economics disciplines
	ELO1.2. Students will be able to identify underlying assumptions and logical consistency of causal statements
Students will have skills to employ economic thought for the common good	ELO2.1. Students will have a keen sense of ethical criteria for practical problem-solving
Students will be technology agile	ELO3.1. Students will demonstrate proficiency in common business software packages
	ELO3.2. Students will be able to make decisions using appropriate IT tools
Students will be effective communicators	ELO4.1. Students will be able to communicate reasonably in different settings according to target audience tasks and situations
	ELO4.2. Students will be able to convey their ideas effectively through an oral presentation
	ELO4.3. Students will be able to convey their ideas effectively in a written paper