UCLouvain

linma2345

2026

Game theory

5.00 credits	30.0 h + 22.5 h	Q2

Teacher(s)	Jungers Raphaël ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Basic mathematics (bachelor level), applied math cursus is a plus.
Main themes	Game theory is a rich and pluridisciplinary theory which aims at modeling and optimizing the way people take a decision in a concurrent environment (that is, if one's decision impacts each other's profit). It is the legacy of some among the 20th century's greatest mathematicians, like Von Neumann, Nash,... It has ramifications in Sociology, Economy, Mathematics, Operations Research, etc. The course will survey the main concepts of Game Theory, among which decision theory, Nash Equilibria, Games with communication, Repeated Games, Bargaining and Coalitional games, and applications diverse fields of engineering.
Learning outcomes	**At the end of this learning unit, the student is able to :** • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2, AA2.3, AA2.4, AA2.5 • AA3.1, AA3.2, AA3.3, AA3.4 • AA4.2 • AA5.2, AA5.3 • AA6.2, AA6.3 At the end of the course, the student will be able to : • understand and explain the framework of Decision Theory, its intrinsic limitations and broad goals, and how it leads to Game Theory; • choose the particular tools in the game theorist's toolbox in order to properly model a 'real-life' situation; • study and solve a problem in game theory by the computation of equilibria; • criticize and analyze the results of these computations for practical implementations. Transversal L.O.: • During the course, the student will learn how to detect, model, and analyze practical situations and, based on this mathematical model, propose a relevant solution.
Evaluation methods	Written or oral exam. A continuous evaluation could take place. In case of a written exam, in case of doubt, the teacher might invite the student for a supplementary oral exam. The use of AI, and the exchange or diffusion of (parts of) solutions with other individuals are of course forbidden for any graded activity.
Teaching methods	The course will be given partly by the professor, and partly as a seminar with student presentations. Regular exercise sessions will be delivered. Some activities could be organized remotely, e.g. on MS Teams.
Content	1. Decision Theory: axioms, fundamental theorems, bayesian models, significance. 2. Elementary Game theory: strategic/extended form, Domination, Iterative deletion. 3. Nash equilibrium, Nash's theorem, 2 players zero-sum games. 4. Sequential equilibria, computation and significance. 5. Perfect, proper, robust equilibria. 6. Games with communication and correlated equilibria. 7. Repeated games. 8. Nash's bargaining theory. 9. Coalitional games: the core, Shapley's value,... 10. Applications to: Finance, auctions, voting,'
Inline resources	Please see the Moodle website.

Bibliography	**Main:** • Myerson, Roger B. Game Theory: Analysis of Conflict, Harvard University, 1991. **Others:** • Osborne, Martin J. An introduction to game theory, Oxford University Press, 2004. • Osborne, Martin J.; Rubinstein, Ariel. A course in game theory, MIT Press, 1994. • Nowak, Martin A. Evolutionary Dynamics: Exploring the Equations of Life. Harvard University Press, 2006.
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mathematics	MATH2M	5		🔍
Master [120] in Mathematical Engineering	MAP2M	5		🔍