

Cooperative Game Theory and Environment

Allocation rules, cost sharing and environmental applications



PROGRAMME
Master 1

SEMESTER
Semester 1

CREDITS
3 ECTS

CONTACT HOURS
24h Lectures

Course Description

This course introduces the main concepts and analytical tools of cooperative game theory. Cooperative games model situations in which a scarce resource, a cost or a collective benefit must be allocated among several participants who may cooperate.

Particular attention is given to cost-sharing problems and environmental applications. Students study major allocation rules, including the Shapley value and equal surplus division, as well as the core of a cooperative game. The course also introduces central theoretical results and shows how the axiomatic method can be used to characterize allocation principles.

This course is shared with Master 1 QAE

Learning Outcomes

- Model an economic or environmental situation as a cooperative game.
- Identify the players, coalitions and characteristic function of a game.
- Describe and calculate the principal allocation rules used in cooperative game theory.
- Compute and interpret the Shapley value.
- Explain equal surplus division and compare it with alternative allocation rules.
- Determine and illustrate the core allocations of a cooperative game.
- Understand the main axioms used to evaluate allocation rules.
- Explain the role and significance of the axiomatic method.

Indicative Content

1. **Foundations:** players, coalitions, characteristic functions and transferable utility.
2. **Economic modelling:** translating allocation and arbitration problems into cooperative games.
3. **Cost sharing:** allocation of common costs among participating agents.
4. **Environmental applications:** sharing costs, benefits and responsibilities in collective environmental problems.
5. **The Shapley value:** definition, computation and interpretation.
6. **Equal surplus division:** principles, calculation and comparison with other rules.
7. **The core:** stability, feasibility and graphical representation of core allocations.
8. **Axiomatic analysis:** fairness properties and characterization of allocation rules.

Teaching & Learning Approach

The course combines formal definitions, numerical exercises, graphical illustrations and applied examples. Students learn to formulate cooperative games, calculate allocation rules and interpret the economic meaning of stable and fair outcomes, particularly in cost-sharing and environmental contexts.

Assessment

Written examination