

# Syllabus

## Decision Theory and Game Theory

Number of ECTS: 6

Number of hours: 36

Teacher:

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### Brief Course Description

This course aims introducing substantial theoretical concepts and tools to be able to formalize and analyze strategic interactions in macro and microeconomics, and beyond to read theoretical and applied scholar articles on decision theory and game theory. Decision theory studies choices that result in either risky or uncertain outcomes, while game theory is the analysis of strategic interactions between rational agents. Both are dynamic fields, with substantial developments and numerous applications in economics (bargaining, taxation, industrial organization), political sciences (voting, government stability, climate policy), philosophy (social norms), biology (evolution, cooperative/aggressive behavior), computer science...

Students are expected to have a background knowledge in mathematics (analysis, optimization, probability).

## Course Outline

The course is organized around 12 main classes of 3 hours, 8 tutorials of 1.5 hours.

### Part I: Decision theory

1. Preferences and choice  
preference properties — continuity of preferences — existence of utility function — Utility maximization.
2. Demand Theory  
Walrasian Demand — Hicksian Demand — compensated law of demand — Slutsky equation — Roy's identity
3. Choice under risk  
preferences over lotteries — Von Neumann-Morgersten's theorem — Allais paradox — rank dependent utility model
4. Monotone Comparative Statics  
risk aversion — measures of risk aversion — stochastic dominance

### Part II: Game theory

1. Static games of complete information  
strategic form — dominance — Nash equilibrium — mixed strategies — equilibrium existence — correlated equilibrium — equilibrium selection and refinements
2. Dynamic games of complete information  
extensive form, subgame-perfection, backwards induction, repeated games
3. Static games of incomplete information  
beliefs — Bayesian Nash equilibrium — common knowledge — global games
4. Dynamic games incomplete information  
incomplete vs. imperfect information — perfect bayesian Nash equilibrium — signaling games
5. Introduction to Mechanism Design  
Direct mechanisms — Truthful implementation — Revelation principle — VCG mechanism — Implementation in dominant strategies — Implementation in Bayesian Nash equilibrium.

## Recommended Textbooks

Gibbons, R. Game Theory for Applied Economists. Princeton: Princeton University Press, 1992.

Mas Colell, A., Whinston, M.D. & Green, J.R. Microeconomic Theory, Chapters 1, 2, 3 & 6, Oxford University Press, 1995.

Maschler, M., Solan, E. & Zamir, S. Game theory, Cambridge university press, 2013.

Osborne, M.J. & Rubinstein, A. A Course in Game Theory. Cambridge, Massachusetts: MIT Press, 1994.  
It is free to download: <https://arielrubinstein.org/gt/arielDocs/>

## Advanced Readings

Fudenberg, D., and Tirole, J., Game Theory, MIT Press, 1991.

Gilboa, I., Theory of Decision under Uncertainty, Cambridge University Press, 2009.

Laraki R., Renault J. and Sorin S., Mathematical Foundations of Game Theory, Springer, 2019.

R. Myerson, Game Theory: Analysis of Conflict, Harvard University Press, 1991.

### Evaluation / Assessment

Grade are based on a midterm (1/3) and a final test (2/3).