



Course: Optimization

Faculty: Chara Papioti

Term: Fall

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Office Hours: Upon Request

This is a graduate level mathematics course for economists. The main objective of the course is to provide the students with the analytical tools needed to not only understand modern economic theory, but also technically develop their own research later on. We will define and interpret the most important mathematical objects found in graduate level Micro, Macro and Econometrics, master their definitions, study their properties and learn efficient methods to solve problems and provide proofs, both abstract and concrete.

Course Topics

Sets and Metric Spaces:

- 1) Ordered Sets (Equivalence Relations, Order Relations, Partially Ordered Sets, Weakly Ordered Sets)
- 2) Metric Spaces (Open and Closed Sets, Convergence)

Functions and Correspondences:

- 1) Monotonicity
- 2) Continuity
- 3) Fixed Point Theorems (Tarski, Banach, Brower)

Linear Spaces and Linear Algebra:

- 1) Subspaces
- 2) Basis and Dimension
- 3) Affine and Convex Sets
- 4) Normed Linear Spaces
- 5) The determinant
- 6) Systems of Linear Equations

Smooth functions, Optimization and Comparative Statics:

- 1) Linear Approximation and the derivative
- 2) Mean Value Theorem
- 3) Unconstrained Optimization, Equality and Inequality constraints
- 4) Envelope Theorem

Difference and Differential Equations:

- 1) Types and Solution concepts

Main References

Axler, S.J., 1997. *Linear algebra done right* (Vol. 2). New York: Springer.

Carter, M., 2001. *Foundations of mathematical economics*. MIT Press.

Sydsæter, K., Hammond, P., Seierstad, A. and Strom, A., 2008. *Further mathematics for economic analysis*. Pearson education.

Grading: 80% final exam, 5% quizzes, 15% problem sets