Optimization

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Term	First Semester, Year 1
Module	Quantitative Methods
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Description

A first graduate course on Mathematics for economists

Objective

To provide a mathematical background for advanced courses on Economic Theory

Outline

IDEA PROGRAM 2012-2013. OPTIMIZATION.

1. Topology

Distance on the Reals. Open and Closed Sets. Interior, Closure and Boundary. Convergent Sequences and Limits. Compact Sets. Completeness.

Metric Spaces and Normed Vector Spaces. Generalization of the Topological Notions. Contractions. Introduction to Blackwell's Lemma. Banach Fixed Point Theorem.

2. Continuity

Continuous Real Functions. Uniform Continuity. Continuity and Topological Notions. Continuity through Convergence. Properties of Continuous Functions. Continuity of Correspondences.

Generalization of Continuity to other Metric Spaces. Weirstrass' Theorem. Maximum Theorem. Dynamic Programming: the Principle of Optimality. Bellman equation, and Stationary Discounted Problems.

3. Differentiability

Derivative on Real Functions. Derivatives and Continuity. Mean-Value Theorem. Directional Derivatives. Partial Derivatives. Differentiability. Continuous Differentiability.

Inverse and Implicit Function Theorems. Comparative Statics.

4. Convexity

Convex Sets. Convex Hull. Linear Functionals and Hyperplanes. Separating and Supporting Theorems.

Concave functions. Superdifferentials. Quasi-concave Functions. Concavity for Smooth Functions. Hessian and Quadratic Forms.

5. Static Optimization

Linear and Non-Linear Programming. Optimization on Convex Sets. Optimization with equality constraints (Lagrange). Optimization with inequality constraints (Kuhn-Tucker). Linear programming.

6. Dynamical Systems

Difference and Differential Equations. Autonomous and non-Autonomous Systems. Systems of Difference and Differential Equations. Solution of Linear Systems. Non-Linear Systems: Phase Diagrams and Linearization.

References

1. Course Slides and Exercises.

2. de la Fuente, Angel: Mathematical methods and models for economists. Cambridge University Press, Cambridge, 2000.

3. Ok, Efe A.: Real analysis with economic applications. Princeton University Press, Princeton, NJ, 2007.

Grading

Primary: final exam. Secondary: problem sets