Université de Cergy-Pontoise
Masters in Economic Analysis

M2 Mathematics for Economics

Autumn 2019

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Course web site: <https://sites.google.com/site/mathematicsforeconomicsii/>

Lectures: Wednesday and Friday, 10h30 – 12h00.
Tutorials: Friday 15h00 – 16h30.

Textbooks:
First half: Simon, C. P. and Blume, L. (1994), *Mathematics for Economists*, Norton, New York NY.
Second half: Knut Sydsaeter, Peter Hammond, Atle Seierstad, and Arne Strøm (2005), *Further mathematics for economic analysis*, Prentice Hall.

Evaluation:
- Midterm exam: 50 %
- Final exam: 50 %

Exams will be based on a list of recommended problems.

Syllabus:

Linear Algebra
a) Matrix Algebra
b) Gauss-Jordan Elimination
c) Matrix Methods for Linear Systems
d) Determinants
e) Eigenvalues and Eigenvectors

Unconstrained Optimization
a) Maxima and Minima in $\mathbb{R}^n$
b) First Order Conditions
c) Second Order Conditions
d) Global Maxima and Minima
e) Concave, Convex, Quasiconcave and Quasiconvex functions

Constrained Optimization
a) Lagrange's method
b) Envelope Theorem
c) Maximization under several inequality constraints (Kuhn-Tucker method)
d) Non-negativity Constraints

Functions
a) Most common symbols
b) Introduction to Functions
c) Graphing Functions
d) Limit of a Function
e) Continuity

Calculus
a) Sequences
b) Infimum, Supremum, Minimum and Maximum

c) Differentiation in Several Variables
d) The Indefinite Integral: The Antiderivative
e) The Definite Integral: The Area under the Curve
f) The Leibniz integral rule

Difference equations (Sydsaeter et al. Chapter 11)
a) First order difference equations
b) Application: net present value
c) Second order difference equations
d) Stability analysis

Discrete time dynamic optimization (Sydsaeter et al. Chapter 12)
a) Euler equation,
b) Infinite horizon problems
c) The Maximum principle
d) Stochastic optimization
e) Stationary problems

General topology (Sydsaeter et al. Chapter 13)
a) Convergence
b) Continuity
c) Compactness
d) Maximum theorems
e) Convexity and separation theorems

Correspondences and Fixed point theorems (Sydsaeter et al. Chapter 14)
a) Contraction mapping theorem
b) Brouwer's Fixed Point Theorem
c) Correspondences. Upper/lower hemicontinuity
d) Kakutani's Fixed Point Theorem
e) Applications to existence of Nash and Walrasian equilibria
f) Tarski's Fixed Point Theorem

(time permitting) Differential equations (Sydsaeter et al. Chapter 16)
a) First order linear and nonlinear equations
b) Second order linear and nonlinear equations
c) Equilibria & stability analysis for linear systems
d) Phase plane analysis
e) Equilibria & stability analysis for nonlinear systems

Advice: We will follow the textbooks closely. Thus, it is *strongly recommended* that you obtain copies of the textbooks, and read the recommended sections of the book *before* each lecture. Come to class prepared to ask questions. Be an active learner. After each class, review the exercises solved in class, and solve the other assigned problems.