
*MASTER IN INTERNATIONAL TRADE, FINANCE AND DEVELOPMENT REVIEW
COURSE IN MATHEMATICS, STATISTICS AND COMPUTATIONAL TOOLS*

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INSTRUCTORS

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COURSE DESCRIPTION

This course is designed to review a number of mathematical concepts and statistical tools that are needed for the courses, such as matrix algebra, constrained optimization, differential equations. You will also learn how to use MATLAB and STATA.

REFERENCES

Given the diverse nature of this course, we will draw from a number of different references as we move along. The following list is subject to modifications.

Analysis Review:

Lawrence Blume and Carl P. Simon (1994), "Mathematics for Economists", W.W. Norton and Co., New York, London.

Martin J. Osborne, Mathematical methods for economic theory: a tutorial (2007),

<http://www.economics.utoronto.ca/osborne/MathTutorial/index.html>

Robert Barro and Xavier Sala-i-Martin (2003), "Economic Growth", Mathematical Appendix, MIT Press

Probability and Statistics Review:

James H. Stock and Mark W. Watson, Introduction to Econometrics - 2nd Edition (2007), Prentice Hall.

Computational Tools

Franco-Pereira, Alba, An introductory course in MATLAB: MATLAB for beginners (2010),

http://webs.uvigo.es/alba.franco/eng/Tutorial_completo.pdf

Interactive Matlab Course, 2012-2013, Eindhoven University of Technology

<http://www.imc.tue.nl/Downloads/IMCpdf.pdf>

Getting Started with Matlab (official page from MathWorks)

<https://uk.mathworks.com/help/matlab/getting-started-with-matlab.html>

COURSE OUTLINE

I. Review of Analysis and Linear Algebra (19h)

1. Analysis (5h)

- 1.1. Limits and Continuity
- 1.2. Differentiation
- 1.3. Total Differential and Taylor's Polynomial
- 1.4. Integration
- 1.5. Implicit Functions
- 1.6. Concave and Convex Functions
- 1.7. Homogeneous and Homothetic Functions

2. Optimization (5h)

- 2.1. Unconstrained Optimization
- 2.2. Constrained Optimization
 - 2.2.1. The Lagrange Multiplier Method
 - 2.2.2. The Kuhn-Tucker Method
 - 2.2.3. The Envelope Theorem

3. Difference Equations (2h)

- 3.1. First Order Difference Equations
- 3.2. Systems of First Order Difference Equations

4. Differential Equations (2h)

- 4.1. First Order Differential Equations
- 4.2. Systems of First Order Differential Equations

5. Matrix Algebra (5h)

- 5.1. Matrix Operations
- 5.2. Square Matrices: The Determinant and the Inverse
- 5.3. Quadratic Forms
- 5.4. Eigenvalues and Eigenvectors
- 5.5. Vector Spaces and Linear Transformations

2. Review of Probability and Statistics (15h)

1. Review of Probability

- 1.1. Random Variables and Probability Distributions
- 1.2. Expected Values, Mean and Variance
- 1.3. Two Random Variables
 - 1.3.1 Joint and Marginal Distributions
 - 1.3.2 Conditional Distributions

- 1.3.3. Bayes' Theorem
- 1.3.4. The Law of Iterated Expectations
- 1.3.5 Independence
- 1.3.6 Covariance and Correlation
- 1.4. Random Sampling
 - 1.4.1. Distribution of the Sample Average
- 1.5. Large-Sample Approximations
 - 1.5.1. Stochastic Convergence
 - 1.5.2. The Law of Large Numbers
 - 1.5.3. The Central Limit Theorem
- 2. Review of Statistics
 - 2.1. Estimators and their Properties
 - 2.2. Hypothesis Testing
 - 2.3. Confidence Intervals

3. Computational Tools

MATLAB (6h)

- Basics: Command window, m-files, scripts, help menu
- Creating arrays
- Text and Characters
- 'for', 'if' and 'while' commands
- Functions
- Nonlinear solvers: 'fzero' and 'fsolve'
- Numerical Integration and Differentiation
- 2D and 3D plots

STATA (10h)

- Basics: Menu, command and do files
- Creating empty datasets and copying/pasting data
- Importing data
- Describing data
- Manipulating data
 - Manipulating variables
 - Sorting
 - Recoding and grouping
 - Labelling variables and values
- Logical expressions
- Basic Statistical Routines
 - Mean, Standard Deviation, Correlation
 - t-tests
 - Performing OLS with one variable and interpreting the results
 - Post-estimation commands
- Graphing
 - Line graphs
 - Scatterplots