International Economics

Academic year 2024-2025

Mathematics and Statistics for Economists (Math Bootcamp)

EI071 - Autumn - 6 ECTS for the Master Students in International and Development Economics (but optional & non credited for the MAS students in Sustainable Finance and Development)

Course Description

The aim of the course is to give the incoming Master students in Economics the necessary mathematical and statistical skills to begin the core first-year courses. We will go over linear algebra, analysis, optimisation, probability and statistics. An introduction to the different software needed, such as Latex and Stata, will also be given. This three-week course consists of daily lectures and problem-solving sessions designed to bring students from heterogeneous academic backgrounds up to speed in terms of the quantitative methods used in economics.

> **PROFESSOR**

Office hours

> **ASSISTANT**

Yang Jiao

Office hours

IMPORTANT

Regular attendance is compulsory, and any absence must be promptly communicated to the teacher. In the event of missing more than two sessions, students are expected to provide well-documented justifications for unforeseeable circumstances (e.g. illness, accident, death of a relative), directly to the Direction of Studies. Failure to justify absences beyond two sessions will result in the assignment of code N.

Students are also reminded of the following legal rules:

The teacher owns the **copyright** on the material they created for this course. As such, any reproduction or distribution of this document, in whole or in part, as well as of any other material created by the teacher for the course, is prohibited unless permission is granted by the author.

Recording (as video or audio) a course without the consent of the teacher and other participants is strictly forbidden.

Syllabus

Pre-requisites

The material covered is at an intermediate bachelor-master level. A basic undergraduate knowledge of mathematics and statistics is of course needed, but the purpose of the course is also to refresh this knowledge, in particular for students who graduated a few years ago.

Organization

The course will be organized from Monday 19 August to Friday 6 September 2024 (3 weeks).

The lectures will take place:

- Week 1 (19/08 – 23/08): mornings (from 8:30 to 12:00) and afternoons (from 13:30 to 17:00)
- Week 2 (26/08 – 30/09): mornings (from 8:30 to 12:00)
- Week 3 (02/09 – 06/09): mornings (from 8:30 to 12:00)
- Exam on Monday 09/09 – morning (from 9:00 to 11:00)
- Winter bootcamp: (dates to be announced), mornings

Grading (for Master students in International and Development Economics only)

Please note that a pass/fail grading system will apply for this course. The grading will be based on your participation in the course, on group work (problem sets) and on a final examination.

Content of the course (Summer)

1) Introduction to LaTeX

2) Essential Math

- Sets & elementary notation
- Functions
    - o Differentiation
    - o Integration
- Vectors & Matrices
    - o Elementary operations & definitions
    - o Rank, invertibility, determinants and eigenvalues
    - o Revisiting functions
    - o Revisiting differentiation

3) Mathematical analysis

- Maxima and minima
- Homogeneous functions and Euler's formula
- Concave and quasiconcave functions
- The Implicit function theorem
- Convex sets and separating hyperplanes

4) Optimisation

- Optimisation with several variables
- Constrained optimisation
- Envelope theorem
- Inequality constraints
- Dynamic optimisation

5) Probability and statistics

- Univariate random variables
- Multivariate random variables
- Asymptotic theory
- Point estimation: Frequentist/Classical inference
- Hypothesis testing
- Confidence sets
- Common Probability Distributions

6) Introduction to R

Content of the course (Winter)

7) Integration

- Areas and integrals
- Rules of integration
- Integration by parts
- Integration by substitution
- Infinite integrals
- Differentiation under the integral sign
- Double integrals

8) Introduction to Stata

References:

- Carl P Simon and Lawrence Blume (1994): Mathematics for Economists
- Anton, H. (1987): Elementary Linear Algebra
- Glaister, S. (1984): Mathematical methods for economists
- Pemberton, M. and Rau, N. (2016): Mathematics for economists: An introductory textbook
- Sydsaeter K. Hammond P. and Strom A. (2012): Essential Mathematics for economic analysis.
- Hogg, McKean and Craig: Introduction to Mathematical Statistics (2018)