31C01100 Taloustieteen matemaattiset menetelmät - Mathematics for Economists
Aalto University – Fall 2020
Michele Crescenzi

Syllabus

Instructor Information

- Michele Crescenzi

- Email: michele.crescenzi@aalto.fi; michele.crescenzi@helsinki.fi

- *Office hours* will be held remotely via Zoom or Skype. Please send an email to make an appointment

Teaching assistant

- Lassi Tervonen

- Email: lassi.tervonen@aalto.fi

Course Information

- **Due to the current pandemic, the course will be held remotely**

- 22 lectures + 6 exercise sessions

- **MyCourses** page: https://mycourses.aalto.fi/course/view.php?id=27603

- The **lectures** will be livestreamed with Zoom. The lectures will be given in **English**. A link to the Zoom livestream will be posted on the class page in MyCourses. Lectures will be recorded and then made available on the class page.

- *Lecture slides* will be distributed but they are not meant to be self-contained. For each topic covered in class, you are required to read the corresponding parts in the textbook

- The **exercise sessions** will be conducted by the TA in **Finnish**. Exercise sessions will not be recorded.

- Prerequisites: 30A01100 and 30A03000. Students are assumed to be familiar with the content of Chapters 1-5 of the textbook.

- *Course overview and goals*: The aim of the course is to provide students with a thorough understanding of the main mathematical concepts and tools used in Economics. We will study:

  - linear algebra: we will focus on how to solve systems of linear equations;

  - calculus of several variables: we will analyze functions of several variables and learn how to apply differential calculus to them;

  - optimization: we will learn how to find the points in the domain of a function that maximize or minimize the function's value, with or without constraints;

  - dynamical systems: we will focus on how to solve difference and differential equations.

- Problem sets (exercises) will be distributed during the course. Students will be required to hand in their answers to MyCourses. Working through the exercises is indispensable, one cannot learn mathematics without doing the exercises. Solutions to the problem sets will be provided and some of the exercises in the problem sets will be discussed in the exercise sessions.

- Textbook: Carl P. Simon and Lawrence Blume, *Mathematics for Economists*, Norton, 1994

- List of topics (subject to change):

  - **First Period**:
    * Lectures 1-4: Linear Algebra: Systems of linear equations, matrix algebra, linear independence (Chapters 6-11)
    * Lectures 5-8: Calculus of Several Variables: Functions of several variables, differential calculus, implicit functions (Chapters 12-15)
    * Lectures 9-11: Convexity and Unconstrained Optimization: Convex, concave and quasiconcave functions, quadratic forms, unconstrained optimization (Chapters 16-17, 21)

  ∗ Lecture 12: Review

 – **Second Period**:

  ∗ Lectures 13-15: Constrained Optimization (Chapters 18-19)

  ∗ Lectures 16-17: Difference equations (Chapters 23)

  ∗ Lecture 18-21: Ordinary differential equations (Chapters 24-25)

  ∗ Lecture 22: Review

Course requirements and grading

The final grade will be determined by:

- (20%) problem sets;

- (80%) exam.

To meet the exam requirement, you can take two partial exams during the course (Midterm on 23.10.2020 and Final on 16.12.2020). The midterm will be on the material of the first period, and the final will cover the material of the second period. Each partial exam will be given equal weight. Alternatively, you can take an exam which covers the entire class material after the end of the course (8.2.2021 or 29.3.2021).

The points earned with the problem sets will be valid for the entire academic year.

The problem sets and exam questions will be in English. You can give answers in English or Finnish.

Detailed Schedule

- **Period I:**

 – Lecture 1: Friday 11.9, 10.15-12.00

 – Lecture 2: Monday 14.9, 10.15-12.00

 – **Problem Set 1**: Tuesday 15.9 (Due date: Tuesday 22.9 at 15.15)

 – Lecture 3: Thursday 17.9, 13.15-15.00

 – Lecture 4: Friday 18.9, 10.15-12.00

 – Lecture 5: Monday 21.9, 10.15-12.00

- **Problem Set 2**: Tuesday 22.9 (Due date: Tuesday 29.9 at 15.15)

- Exercise Session 1: Tuesday 22.9, 15.15-17.00

- Lecture 6: Thursday 24.9, 13.15-15.00

- Lecture 7: Monday 28.9, 10.15-12.00

- **Problem Set 3**: Tuesday 29.9 (Due date: Tuesday 6.10 at 15.15)

- Lecture 8: Thursday 1.10, 13.15-15.00

- Lecture 9: Monday 5.10, 10.15-12.00

- **Problem Set 4**: Tuesday 6.10 (Due date: Tuesday 13.10 at 15.15)

- Exercise Session 2: Tuesday 6.10, 15.15-17.00

- Lecture 10: Thursday 8.10, 13.15-15.00

- Lecture 11: Monday 12.10, 10.15-12.00

- Exercise Session 3: Tuesday 13.10, 15.15-17.00

- Lecture 12: Thursday 15.10, 13.15-15.00

- **Period II:**

  - Lecture 13: Thursday 29.10, 10.15-12.00

  - **Problem Set 5**: Tuesday 3.11 (Due date: Tuesday 10.11 at 15.15)

  - Lecture 14: Friday 30.10, 10.15-12.00

  - Exercise Session 4: Tuesday 10.11, 15.15-17.00

  - **Problem Set 6**: Tuesday 10.11 (Due date: Tuesday 17.11 at 15.15)

  - Lecture 15: Thursday 12.11, 10.15-12.00

  - Lecture 16: Friday 13.11, 10.15-12.00

  - **Problem Set 7**: Tuesday 17.11 (Due date: Tuesday 24.11 at 15.15)

  - Lecture 17: Thursday 19.11, 10.15-12.00

  - Lecture 18: Friday 20.11, 10.15-12.00

  - Exercise Session 5: Tuesday 24.11, 15.15-17.00

  - **Problem Set 8**: Tuesday 1.12 (Due date: Tuesday 8.12 at 15.15)

  - Lecture 19: Thursday 26.11, 10.15-12.00

- Lecture 20: Friday 27.11, 10.15-12.00

- Lecture 21: Thursday 3.12, 10.15-12.00

- Lecture 22: Friday 4.12, 10.15-12.00

- Exercise Session 6: Tuesday 8.12, 15.15-17.00

- **Midterm** exam: Friday 23.10, 9.00-11.00

- **Final** exam: Wednesday 16.12, 9.00-11.00