31C01100 Taloustieteen matemaattiset menetelmät - Mathematics for Economists
Aalto University – Fall 2021
Michele Crescenzi

Syllabus

Instructor Information

- Michele Crescenzi

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

Teaching assistant

- Hung Le

- Email: hung.h.le@aalto.fi

Course Information

- The course will be taught in **English**.

- **In the first teaching period, the course will be held remotely via Zoom. In the second period, lectures will be given in person.**

- 22 lectures + 6 exercise sessions

- **MyCourses** page: https://mycourses.aalto.fi/course/view.php?id=31218

- **Lectures** will be livestreamed with Zoom. A link to the Zoom livestream will be posted on the class page in MyCourses. All lectures will be recorded and then made available on the class page. In the second period, it is strongly recommended that you attend classes in person.

- *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 and livestreamed with Zoom. 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.

- Eight **problem sets** 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 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 29.10.2021 and Final on 16.12.2021). 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 (7.2.2022 or 28.3.2022).

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

The final score (obtained from the problem sets and the exam) will be converted into grades according to the following table:

Final score (out of 100)	Grade
$0 - 39.99$	0 (Fail)
$40.00 - 54.99$	1
$55.00 - 64.99$	2
$65.00 - 74.99$	3
$75.00 - 84.99$	4
$85.00 - 100$	5

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

Detailed Schedule

- **Period I:**

  - Lecture 1: Monday 13.9, 10.15-12.00

  - Lecture 2: Friday 17.9, 13.15-15.00

  - Lecture 3: Monday 20.9, 10.15-12.00

  - **Problem Set 1**: Tuesday 21.9 (Due date: Tuesday 28.9 at 15.15)

  - Lecture 4: Thursday 23.9, 13.15-15.00

  - Lecture 5: Monday 27.9, 10.15-12.00

  - **Problem Set 2**: Tuesday 28.9 (Due date: Tuesday 5.10 at 15.15)

  - *Exercise Session 1*: Tuesday 28.9, 15.15-17.00

  - Lecture 6: Thursday 30.9, 13.15-15.00

  - Lecture 7: Monday 4.10, 10.15-12.00

  - **Problem Set 3**: Tuesday 5.10 (Due date: Tuesday 12.10 at 15.15)

  - Lecture 8: Thursday 7.10, 13.15-15.00

  - Lecture 9: Monday 11.10, 10.15-12.00

  - **Problem Set 4**: Tuesday 12.10 (Due date: Tuesday 19.10 at 15.15)

  - *Exercise Session 2*: Tuesday 12.10, 15.15-17.00

  - Lecture 10: Thursday 14.10, 13.15-15.00

  - Lecture 11: Monday 18.10, 10.15-12.00

  - Lecture 12: Thursday 21.10, 13.15-15.00

  - *Exercise Session 3*: Friday 22.10, 10.15-12.00

  - **Midterm exam**: Friday 29.10, 9.00-11.00

- **Period II:**

  - Lecture 13: Tuesday 2.11, 13.15-15.00

  - Lecture 14: Thursday 4.11, 13.15-15.00

  - **Problem Set 5**: Friday 12.11 (Due date: Friday 19.11 at 10.15)

- Lecture 15: Tuesday 16.11, 13.15-15.00

- Lecture 16: Thursday 18.11, 13.15-15.00

- **Problem Set 6**: Friday 19.11 (Due date: Friday 26.11 at 10.15)

- *Exercise Session 4*: Friday 19.11, 10.15-12.00

- Lecture 17: Tuesday 23.11, 13.15-15.00

- Lecture 18: Thursday 25.11, 13.15-15.00

- **Problem Set 7**: Friday 26.11 (Due date: Friday 3.12 at 10.15)

- Lecture 19: Tuesday 30.11, 13.15-15.00

- Lecture 20: Thursday 2.12, 13.15-15.00

- **Problem Set 8**: Friday 3.12 (Due date: Friday 10.12 at 10.15)

- *Exercise Session 5*: Friday 3.12, 10.15-12.00

- Lecture 21: Tuesday 7.12, 13.15-15.00

- Lecture 22: Thursday 9.12, 13.15-15.00

- *Exercise Session 6*: Friday 10.12, 10.15-12.00

- **Final exam**: Thursday 16.12, 13.00-15.00