# Dynamic optimization

**Lecturers**
Thomas DEMUYNCK (Coordinator), Bram DE ROCK and Luca Paolo Merlino

**Course mnemonic**
MATH-S401

**ECTS credits**
5 credits

**Language(s) of instruction**
English

**Course period**
Second term

**Campus**
Solbosch

## Course content

Gives the theoretical background and tools for discrete dynamic programming.

- Vector spaces, norms, Banach spaces
- Contraction mappings, Blackwell's theorem
- Berge's optimization theorem,
- Discrete dynamic optimization under certainty,
- Algorithms to solve discrete dynamic optimization problems under certainty
  - Value function iteration,
  - Interpolation,
  - Howard improvement
  - Coding
- Discrete dynamic optimization under undertainty,
- Algorithms to solve discrete dynamic optimization problems under uncertainty.
- Finite horizon dynamic programming with applications to shortest path problems, currency exchange, knapsack problems, longest common subsequence, etc
  - analysis of problems, complexity analysis and coding

## Objectives (and/or specific learning outcomes)

The aim of this course is to provide students with some the mathematical and practical tools to set up, analyze and simulate discrete time dynamic optimization problems.

## Pre-requisits and co-requisits

### Required knowledge and skills

In addition to the list of courses, some programming experience in either Matlab, Python or Julia would be useful.

## Teaching method and learning activities

Lectures, group work, For some parts of the course podcasts are available.

The relevant learning objectives for this course are:

- LO 1.3: Identify and analyse an issue using the relevant analytical tools and methods.
- LO 2.1: Adopt a scientific approach to data collection, research and analysis and communicate results with clear, structured, and sophisticated arguments.
- LO 3.1: Apply quantitative and qualitative techniques to support data analysis using standard office and statistical software.

### References, bibliography and recommended reading


- Stokey, Lucas with Prescot, 1989, Recursive methods in economic dynamics, Harvard University Press
- Ljunqvist and Sargent, 2000, Recursive macroeconomic theory, MIT press
- Daron Acemoglu, 2009, Introduction to modern economic growth, Princeton University Press
- Ferguson and Lim, 2003, Discrete time dynamic economic models, Routledge


## Other information

### Place(s) of teaching

Solbosch

### Contact(s)

Thomas Demuynck (thomas.demuynck@ulb.be)

## Programmes

### Programmes proposing this course at the Solvay Brussels School of Economics and Management

MA-ECOE | Master in Economics : Econometrics | finalité Research in Economics/unit 1