Aim: This course has two major aims: 1) get you acquainted with the non-stochastic and stochastic versions of the neoclassical growth model and the consumption-savings problem, two of the main workhorses of modern macroeconomics. 2) get you acquainted with Dynamic Programming, a powerful tool for solving infinite-horizon optimization problems.

Readings: We will cover material from the first six chapters of Recursive Methods in Economic Dynamics by Stokey, Lucas, with Prescott (SLP), Harvard University Press (1989). These six chapters cover non-stochastic dynamic programming problems. We will also use chapters from Recursive Macroeconomic Theory by Lars Ljungqvist and Thomas Sargent (LS), MIT Press (2004).

As math supplements to Stokey, Lucas, with Prescott, you may find it helpful to consult A First Course in Optimization Theory, by R. Sundaram, Cambridge University Press (1996).

There will also be a set of lecture notes by Nezih Guner, referred to below as NG, and my own lecture notes on continuous-time material.

Grading: Assignments (20%), one midterm (20%), final (60%).

Please check my web page www.eco.uc3m.es/mkredler for announcements, problem sets etc.
Course Outline

1. Finite-Horizon Dynamic Programming (NG, Chapter 6.1; Sundaram (1996), Chapter 11)

- The life-cycle model and its implication, two-period search, computation of discrete one-sector growth model
- Additional Readings:

2. One-Sector Growth Model (NG, Chapter 6.2; LS Chapter 11)

- One-Sector Growth Model, Lagrangian Approach for Solving Infinite Horizon Problems (Euler equations and transversality conditions).
- Additional Readings:

3. Dynamic Programming under Certainty (Chapters 1-6, SLP; NG, Chapters 7-11).

- Mathematical Preliminaries: Metric Spaces, The Banach Fixed-Point Theorem, The Theorem of Maximum
  - NG, Chapter 7.
4. Dynamic Programming under Uncertainty (NG, Chapters 12).

- Stochastic version of one-sector growth model and consumption-savings problem: Event-tree formulation, Markov chains, Transition functions, convergence etc.
- Recursive Competitive Equilibrium.
  - NG, Chapter 12.6
  - LS, Chapter 12.
- Real Business Cycles (NG, chapter 12)
- Additional Readings:

5. Continuous-time dynamic programming (own lecture notes)

6. Search
   • LS, Chapter 6.