MATHEMATICS FOR ECONOMISTS-2

Module 2, 2018–2019
Professor: Andrei Savochkin
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Course information

Course Website: my.nes.ru

Instructor's Office Hours: TBD

Class Time: TBD

Room Number: TBD

TA:	Group A	A. Tonis atonis@nes.ru
	Group B	TBD

Course description

This course teaches mathematical tools that are essential for understanding, solving, and developing modern economic models that deal with agents who are rational and make choices in a dynamic setting. The core part of the course is the principle and applications of Dynamic Programming.

Course requirements, grading, and attendance policies

Student's achievements will be evaluated on the basis of problem sets (16% weight) and the final exam (84% weight). The format of the exam is open book. At least 70% lecture attendance and at least 20 point score in the final exam are required for getting a passing grade.

Course contents

1. Solving infinite horizon discrete time optimization problems using the Lagrangian. Deterministic case. Stochastic case, adaptability constraint.

2. Consumption-savings problem, ways to make progress towards solving it. Constraints at infinity. Linear recursive equations. Quadratic utility case.

3. Finite control sets and one-shot deviation principle. Applications to Game Theory.

4. Dynamic Programming. Deterministic and stochastic cases. Existence of the solution of the Bellman equation and its properties.
5. Markov processes. Consumption-savings problem revisited in the Markovian setting.
6. Elements of consumption-based asset pricing in the Markovian setting.
7. Optimization problems in search and matching. Models of job search. Continuous and Markovian cases.
8. Optimal control in continuous time. Pontryagin's maximum principle.

Description of course methodology

All course material will be presented in lectures and sections meetings. Taking notes in class is strongly recommended. Texbook reading in addition to class attendance may be helpful for some students but is not required.

Sample tasks for course evaluation

(Based on Ljungqvist and Sargent, Ex. 6.2) Consider an unemployed worker who each period can draw two independently and identically distributed wage offers from the cumulative probability distribution function $F(w)$. The worker will work forever at the same wage after having once accepted an offer. In the event of unemployment during a period, the worker receives unemployment compensation c. The worker derives a decision rule to maximize $\mathbb{E}\sum_{t=0}^{\infty}\beta^t y_t$, where $y_t = w$ or $y_t = c$, depending on whether she is employed or unemployed.

(a) Define the state variable.

(b) Formulate the Bellman equation for the worker's problem.

(c) Prove that the worker's reservation wage is higher than it would be had the worker faced the same c and been drawing only one offer from the same distribution $F(w)$ each period.

Course materials

Required textbooks and materials

There is no required textbook — all the material will be presented in class.

Additional materials

Some lectures and exercises will follow the material presented in Ljungqvist and Sargent's "Recursive Macroeconomic Theory" (Ch. 3–6). This book is a great reading on Dynamic Programming in general, and also on its use in modern macroeconomics, asset pricing, and, to an extent, labour.

Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics at NES are not tolerated.