Mathematics for Economists-1

Module 1, 2017-8

Ozgur Evren
New Economic School
oevren@nes.ru

Course information

Course Website: https://my.nes.ru

Instructor's Office Hours: By appointment

Class Time: TBA

Room Number: TBA

TAs: TBA

Course description

This is the first half of the Math for Economists sequence which aims to provide students with a good command of the basic mathematical tools used in economics. This first part of the sequence is dedicated to static optimization problems, parametric optimization/comparative statics, and fixed point theorems.

Course requirements, grading, and attendance policies

There will be a midterm (%40) and a final exam (%60). The final will be comprehensive. Following the general policy of NES, students are entitled to a make-up exam if they have missed the final with a valid reason or if they have failed to get a passing grade at the first try. The difficulty of tasks and the grading scheme in the make-up are likely to be different than those in the earlier exams. In addition, there will be weekly homework assignments, which won't be graded.

Course contents

1. Equality-constrained optimization (Ch. 5)

2. Inequality-constrained optimization (Ch. 6)

3. Convex optimization (Ch. 7)

4. Quasi-convex optimization (Ch. 8)

5. Parametric continuity, maximum theorem, Brouwer/Kakutani fixed point theorem (Ch. 9)

6. Supermodularity and parametric monotonicity (Ch. 10)

7. Contraction mappings and their fixed points (Ch. 12)

Description of course methodology

The instructor will use the traditional methods (i.e., a whiteboard, a marker and verbal discussions) to teach. Students are encouraged to participate in lectures with questions and comments.

Course materials

Required Textbook:

R. Sundaram, "A First Course in Optimization Theory."

(The chapter numbers in course contents refer to this book.)

Academic integrity policy

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

Sample tasks for course evaluation

(From the final exam of Prof. Bremzen, 2014)
Let

$$\begin{aligned}
&f(x_1,x_2) = ax_1 + x_2;\\
&g_1(x_1,x_2) = x_2^2 - x_1^2 - b;\\
&g_2(x_1,x_2) = 1 - x_2;\\
&D = \{(x_1,x_2) : g_1(x_1,x_2) \geq 0, g_2(x_1,x_2) \geq 0\},
\end{aligned}$$

where $a, b \in \mathbb{R}$ are parameters. Let $\hat{x}(a,b)$ be the set of all solutions (global maxima) to the optimization problem

$$f(x_1,x_2) \to \max_{x_1,x_2}$$
$$\text{s.t. } (x_1,x_2) \in D.$$

Find all pairs $(a,b) \in \mathbb{R}^2$ for which...

1. ...D is a convex set;
2. ...f is bounded from above on D;
3. ...the problem has a solution (let us denote by A the set of all such pairs (a,b));

4. ...there is $x \in D$ with the constraint qualification violated;
5. ...f has a local maximum but no global maximum on D;
6. ...f has more than one strict local maximum on D;
7. ...f has a strict local minimum on D with $g_2(x_1, x_2) > 0$;
8. ...f has a local maximum on D with $g_1(x_1, x_2) > 0$;
9. ...f has a local maximum on D which is not a strict local maximum;
10. ...$(a, b) \in \text{int}(A)$ and $\hat{x}(a, b)$ is not upper-semicontinuous in (a, b);
11. ...$(a, b) \in \text{int}(A)$ and $\hat{x}(a, b)$ is not lower-semicontinuous in (a, b).