COURSE DESCRIPTION

This course provides an introductory overview of the main mathematical concepts and tools employed in economic analysis. The starting point is the Euclidean space. Then, the course moves on to more abstract settings. Doing so will allow us to introduce tools to address many important questions and problems in economic analysis for which the tools of basic real analysis are insufficient.

Both the material and the homeworks for this course are largely proof based. A vast portion of the workload will involve working through proofs of propositions, rather than solving numerical problems.

Due to time constraints, some of the details will have to be omitted during class. Therefore, students are strongly encouraged to go over the lecture notes or other reading material ahead of the class, to get the most out of class discussion. In fact, some portions of the material may be left for the student to read outside class altogether.

To succeed in the course, it is essential that students do not fall behind with the material. Questions can be addressed to the instructor in class or during office hours; students should not hesitate to ask them.

TOPICS


COURSE PLAN
What follows is the plan for each of the 12 main lectures. The first two units, labelled “Lecture 0.a” and “Lecture 0.b” respectively, cover background material, and it is the responsibility of the students to go over this material before the course begins. Applications of the material will be discussed in class if time permits, but are meant for the student to refer to in the corresponding economics/finance/statistics courses.

0.a Basic properties of the real line. Suprema and infima. Real-valued sequences, convergence. The Bolzano-Weierstrass Theorem. (Handout 0, Sections 1-2.)

0.b Vectors and matrices. Matrix operations. Eigenvalues and eigenvectors. Quadratic forms. (Handout 0, Sections 3-5.)

1. Euclidean spaces. Open, closed, and compact sets. Sequences and limits. (Handout 1, Sections 1-4.)


3. Topological spaces; open and closed sets. Topological subspaces. (Handout 2, Sections 1-2.)

4. Interior and closure of arbitrary subsets. Compact and connected spaces. (Handout 2, Sections 3-4.)

5. Continuous functions between topological spaces. Characterizations and properties of continuity. (Handout 2, Section 5.)

6. Metric spaces. The metric topology. (Handout 3, Sections 1-4.)

7. Continuity under the metric topology. Further notions of continuity for functions between metric spaces. (Handout 3, Section 5.)

9. Linear spaces. Linear transformations. Convex sets. Linear, convex, and concave functionals. (Handout 4, Sections 1-4.)


11. Correspondences between finite-dimensional normed spaces. Continuity notions for correspondences. (Handout 4, Section 8.)

12. Parametric Optimization and Berge’s Theorem. Self maps on finite-dimensional normed spaces and Brouwer’s Fixed-Point Theorem. Self correspondences on finite-dimensional normed spaces and Kakutani’s Fixed-Point Theorem. (Handout 4, Section 9-10.)

BIBLIOGRAPHY

• Lecture notes / Handouts.
