

# Econ 898: Elementary Mathematics for Economists

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Econ 898 is a semester long course intended to review/provide the basic mathematical skills for economics study. I cover a condensed course in real analysis, treating useful topics such as fixed point theorems, dynamic programming, convex analysis etc. If time permits, we will also have a short introduction to measure theory and probability theory. The course emphasizes a thorough understanding of fundamental concepts. Whenever possible, special attention is devoted to elaborating how fundamental mathematical structures drive major results.

## Practical Matters

- (1) Instructor: Jing Li, McNeil 462, (tel)8-8484, jing.li@econ.upenn.edu
- (2) Office Hours: 4-6pm Wednesday & by appointment
- (3) Evaluation: homework (20 points), midterm exam (30 points) and final exam (50 points)

## References

The main course material is **Efe Ok**'s online book draft *Real Analysis with Economic Applications*. URL: <http://homepages.nyu.edu/~eo1/books.html>

We'll cover pretty much all of chapters A to E and a selection from chapters F to J.

Recommended reference for real analysis: *Principles of Mathematical Analysis* by **Rudin** is an excellent introductory book on real analysis. The level of the book is comparable to our course. For reference at a more advanced level, I recommend *Infinite Dimensional Analysis* by **Aliprantis** and **Border**.

For dynamic programming: we'll mainly use *Recursive Methods in Economic Dynamics* by **Stokey** and **Lucas**.

For probability theory: *Measure Theory and Probability* by **Adams** and **Guillemin** is concise and clear. For general reference, **Billingsley**'s book *Probability and Measure* provides a very accessible and comprehensive treatment.

## Course Plan

- (1) preliminaries: sets, relations, functions, the real number system;

- (2) fundamental mathematical structures in metric spaces: connectedness, separability, compactness, completeness;
- (3) continuity of functions, Stone-Weierstrass theorem, Brouwer fixed point theorem;
- (4) differentiability, the implicit function theorem;
- (5) introduction to convex analysis: separation theorems, Kuhn-Tucker theorem, minimax theorem;
- (6) continuity of correspondences, the maximum theorem;
- (7) dynamic programming;
- (8) Kakutani fixed point theorem;
- (9) introduction to measure theory.