ECONOMICS GR6410
Columbia Department of Economics
Fall 2023

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MATH METHODS FOR ECONOMISTS
COLUMBIA UNIVERSITY ECONOMICS DEPARTMENT
COURSE OUTLINE AND READING LIST

1. Analysis

Lecture Notes 1

Metric spaces and normed vector spaces, open balls, sequences and subsequences, limits and convergence, continuous functions, boundedness, inf and sup, Cauchy sequences, completeness, Banach spaces.

Recommended texts:

Rudin (1976). *Principles of Mathematical Analysis*. Chapters 1-4

Stokey, Lucas, Prescott (1989). *Recursive Methods in Economic Dynamics.* Chapter 3.

Ok (2007). *Real Analysis with Economic Applications*. Chapters A and C.

2. The Banach Fixed Point Theorem/The Contraction Mapping Theorem

Lecture Notes 2-3

Self-maps and contractions, the Banach Fixed Point Theorem/Contraction Mapping Theorem, Blackwell's sufficient conditions, an application.

Recommended texts:

Stokey, Lucas, Prescott (1989). *Recursive Methods in Economic Dynamics.* Chapter 3.

Ok (2007). *Real Analysis with Economic Applications*. Chapter C.6.

3. Optimization

Lecture Notes 4

Basic topology on R^N, open and closed sets, compactness, maximum and minimum, existence of extrema: the Weierstrass Theorem.

Recommended texts:

Rudin (1976). *Principles of Mathematical Analysis*. Chapter 2.

Ok (2007). *Real Analysis with Economic Applications*. Chapters D.1-D.3.

Sundaram (1996). *A First Course in Optimization Theory.* Chapters 1-3.

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4. Convex Structures in Optimization Theory

Lecture Notes 5

Convexity of sets, concave and convex functions, implications of convexity in optimization theory.

Recommended texts:

Sundaram (1996). *A First Course in Optimization Theory.* Chapter 7.

Ok (2007). *Real Analysis with Economic Applications*. Princeton University Press.

5. Theorem of the Maximum

Lecture Notes 6

Correspondences, upper and lower hemi continuity, Theorem of the Maximum, application to consumer theory.

Recommended texts:

Sundaram (1996). *A First Course in Optimization Theory.* Chapter 9.

Stokey, Lucas, Prescott (1989). *Recursive Methods in Economic Dynamics.* Chapter 3.

Ok (2007). *Real Analysis with Economic Applications*. Princeton University Press. Chapter E.

6. Dynamic Programming

Lecture Notes 7

The value function, the Bellman equation, Principle of Optimality, existence and uniqueness of the solution, application to macro.

Recommended texts:

Stokey, Lucas, Prescott (1989). *Recursive Methods in Economic Dynamics.* Chapter 4.

Ok (2007). *Real Analysis with Economic Applications*. Princeton University Press. Chapter E.4.

7. Brouwer's and Kakutani's Fixed Point Theorems

Lecture Notes 8

Brouwer's Fixed Point Theorem, Kakutani's Fixed Point theorem, application to game theory: existence of Nash Equilibria.

Recommended texts:

Ok (2007). *Real Analysis with Economic Applications*. Princeton University Press. Chapters D.8, E.5, E.6.

Sundaram (1996). *A First Course in Optimization Theory.* Chapter 9.

Osborne and Rubinstein (1994). *A Course in Game Theory.* Chapter 2.