Math Camp

This course is a brief review of basic mathematical concepts and an introduction to some more specialized tools that will be used throughout the first year PhD/rMSC coursework.

Logistics

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This course is intended for students preparing to take the first year coursework, familiarity with real analysis and linear algebra is encouraged.

Course Materials

Course Slides are posted to the course website. These slides are not exhaustive, and do not replace lectures.

The official textbook for this course is "Mathematics for Economists" (Simon and Blume 1994).

Course Structure

Due to COVID-19, this course is held entirely online. All materials are available on the Mycourses page. This course will be structured as follows.

- There are 5 series of videos on mycourses covering the material listed below.
- I'll post 7 problem sets
  - 1 initial problem set to review some concepts from undergraduate math
  - 5 corresponding to the videos
  - 1 review

- In the afternoon, from 1-3, we'll go over the day's problem set together over zoom. These sessions will not be recorded. Problem sets must be submitted before this session for credit.
- In the morning, I'll join the class zoom and answer any questions you may have about any of the content.

Grading

The course will be assessed through a final exam. Each problem set you submit on time is worth 5 bonus points on the final. Problem sets are graded based on "completion", in the sense that you'll receive full credit if you put in a good faith effort to complete the problem set. There are a total of 120 possible points on the final.

Topics to be Covered

- Topology in $\mathbb{R}^n$.
  - Open/Closed Sets
  - Sequences and Limits
  - Compactness
  - Continuity (of functions and correspondences)
- Analysis
  - Some linear algebra (Linear independence, quadratic forms)
  - Multivariate calculus (partial derivatives)
  - Implicit Function Theorem
  - Convexity/concavity
  - Fixed Point Theorems (Brouwer and Kakutani)
  - Separating Hyperplanes
  - Envelope Theorem
- Optimization
  - Existence and Uniqueness of Maxima/Minima

  - Unconstrained Optimization
  - Constrained Optimization with equality constraints (Lagrange Multipliers)
  - Constrained Optimization with inequality constraints (Karush Kuhn Tucker conditions)
  - Berge's Maximum Theorem

- Probability
  - Probability
  - Random Variables
  - Expected Value
  - Markov and Chebyshev's inequality
  - Joint distributions
  - The law of large numbers
  - Conditional distribution