University of Mannheim
School of Social Sciences

Chair of Political Economy
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Mathematics for Political Science

Syllabus Fall 2016

Course Description

This course is designed to understand mathematical tools useful for the rest of your Master program, especially for the upcoming, mandatory courses in statistics and game theory. The course reviews some mathematical concepts most of you will be familiar with from high school, such as functions, derivatives, integrals, vectors, matrices and distributions. However, we will introduce and study these topics more rigorously. To provide a deeper understanding of important results, we will also prove some fundamental theorems in class.

We will cover fundamentals in single and (partially) multivariable calculus, linear algebra and probability theory. Each day consists of lectures and exercise sessions. Mathematics cannot be understood without taking exercises seriously. Therefore, the exercise sessions are as important as the lectures! Students can schedule one-on-one meetings with the instructor to review parts of the material.

Attendance Policy

While the instructor strongly encourage attendance, this course is voluntary. If you decide to participate I expect you to attend the class actively and full time each session.

Schedule

Date	Day	Time	Room
30.08.2016	Tue	10.00am - 05.00pm	A 5, 6 Bauteil B - B 317
31.08.2016	Wed	10.00am - 02.00pm	A 5, 6 Bauteil B - B 317
01.09.2016	Thu	10.00am - 05.00pm	A 5, 6 Bauteil B - B 317
02.09.2016	Fri	10.00am - 02.00pm	A 5, 6 Bauteil B - B 317
07.09.2016	Wed	01.45pm - 05.00pm	A 5, 6 Bauteil B - B 144
08.09.2016	Thu	01.45pm - 05.00pm	A 5, 6 Bauteil B - B 244

- Tuesday, 30.08.
  - Introduction
  - Calculus I: Set Theory, Relations, Functions, Limits
  - Calculus II: Differentiation, Optimization
- Wednesday, 31.08.
  - Calculus III: Integration, Sequences, Series, Approximations
- Thursday, 01.09.
  - Linear Algebra I: Linear Combinations, Vector Spaces
  - Linear Algebra II: Matrices, Matrix Operations, Determinants, Eigenvalues
- Friday, 02.09.
  - Calculus/Linear Algebra: Multivariable Functions, Multivariable Optimization, Constrained Optimization, Implicit Differentiation
- Wednesday, 07.09.
  - Probability I: Combinatorics, Bayes' Rule
- Thursday, 08.09.
  - Probability II: Distributions

Readings

- General
  - Simon, C. P. & Blume, L. (1994). *Mathematics for Economists.* New York: Norton and Company
    A comprehensive treatment of mathematics for students of economics for both undergraduate and more advanced level.
  - Moore, W. H. & Siegel, D. A. (2013). *A Mathematics Course for Political and Social Research.* Princeton: Princeton University Press
    An introductory mathematics course aimed at social scientists, provides good intuitions for basic concepts and applications.
  - Sydsaeter, K. & Hammond, P. (2008). *Essential Mathematics for Economic Analysis.* Essex: Pearson, 3rd edition
    Another standard mathematics textbook for economics undergraduates.
- Calculus
  - Spivak, M. (2006). *Calculus.* Cambridge University Press, 3rd edition
    A classic standard textbook for a first class in Calculus for mathematics students at undergraduate level.
  - Protter, M. & Morrey, C. (1991). *A First Course in Real Analysis.* Undergraduate Texts in Mathematics. Springer, 2nd edition
    A typical theorem-proof book that covers introductory real analysis for mathematics students at undergraduate level. Short and to the point.

- Linear Algebra
  - Lay, D. C. (2011). *Linear Algebra and Its Applications.* London: Pearson
    A standard introduction for mathematics undergraduates.
  - Strang, G. (2005). *Linear Algebra and Its Applications.* Brooks Cole, 4th edition
    Another standard introduction for mathematics undergraduates. Strang's MIT video lectures accompanying the textbook are available online for free.
  - Hefferon, J. (2014). *Linear Algebra*
    A theorem-proof style introductory book for mathematics undergraduates with lots of examples and interesting applications. It is free.
  - Axler, S. (2015). *Linear Algebra Done Right.* Undergraduate Texts in Mathematics. Springer, 3rd edition *A more rigorous but intuitive treatment of linear algebra for mathematics undergraduates.*
  - The Matrix Cookbook[1]
    An overview over some more advanced matrix calculus.
- Probability Theory
  - DeGroot, M. H. & Schervish, M. J. (2011). *Probability and Statistics.* London: Pearson, 4th edition
    A comprehensive standard treatment of probability and statistics for mathematics undergraduate students. Intuitive and (relatively) rigorous at the same time with lots of exercises.

[1] `http://www2.imm.dtu.dk/pubdb/views/edoc_download.php/3274/pdf/imm3274.pdf`