

Math Camp 2009

Overview

The purpose of this course is to review basic mathematical concepts and techniques essential to social science. It is assumed that you have a solid background in high school algebra and have had some previous exposure to calculus, though you may have forgotten most of the details. We will cover topics from calculus that are useful in statistics and, to a lesser extent, game theory. A few social science applications will be discussed, though the emphasis will be on improving your skills at problem solving.

Requirements

Although the course is not graded (and not for credit), there will be daily problem sets and a short quiz. These are intended as an opportunity for you to practice the concepts we discuss in the sessions and a way for you to assess where you are with the material. They are *required* of all attendees.

Textbooks

The primary texts for the course are:

Carl P. Simon, Lawrence Blume. *Mathematics for Economists*.

Frank Morgan, *Calculus Lite*, 3rd ed. (AK Peters, 2001)

Class Meetings

The class meets daily from 9:00 a.m. to 12:00 p.m. in Encina Central 464. Class begins on Tuesday, September 8 and ends on Friday, September 18 (see schedule below).

Instructors

Maggie Peters

Chris Tausanovitch

Bobby Gulotty

Schedule and Syllabus (tentative)

Date	Topic	Description	References
Tuesday, Sept. 8	Functions, Sequences, Series	Topology, Set notation and functions, Open, Closed, Compact Sets; Review of Limits, convergence; Linear and nonlinear functions, onto, one-to-one functions, inverse functions; Sequences, Infinite Series, Taylor Series,	Simon-Blume Appendix A1, Ch. 12, Ch. 2.1-2.2, Ch. 13, Morgan Ch. 27-28
Wednesday, Sept. 9	Derivatives	More on limits, L'Hospital's rule, Epsilon-Delta proofs; Continuity, Differentiability, Product, Quotient, Chain rule, Exponentials, Logarithms, Second Derivative, anti-differentiation	Simon-Blume Ch. 2.3-2.7, Ch. 4, Ch. 5 Morgan Ch. 1-5, 9-14
Thursday, Sept. 10 AM	Multivariate Calculus	Multivariate Calculus, Partial Derivatives, Convexity, Maxima, Minima, Second order conditions, constrained optimization, Critical Points, Newton's Method	Simon-Blume Ch. 3, Ch. 17-19 Morgan Ch. 7, 8, 31, 33-34.
Thursday, Sept. 10 PM	Proof solving techniques; Applications of calculus	Proofs, Direct, Indirect, and Induction, Applications of calculus including: Definition of Random variable, pdf, cdf, pmf, cmf, Expectations	Handouts
Friday, Sept. 11	Integration I	Fundamental Theorem of Calculus, Definite and Indefinite Integrals, Recognition Substitution, Substitution with application to pdf.	Simon-Blume Appendix A4, A5, Handouts Morgan Ch. 15-19, 24-25.
Monday, Sept. 14	NO MATH CAMP - ORIENTATION		

Tuesday, Sept. 15	Integration II	Integration by parts, Partial Fractions, Partial derivatives, Multiple integrals Leibniz's rule	Handouts Morgan Ch 32
Wednesday, Sept. 16	Systems of linear Equations	Substitution, Elimination Row reductions, Rank, Vectors, Scalars, inner product, Vector Spaces, Geometry	Simon-Blume Ch. 7 Ch. 10.1-10.5
Thursday, Sept. 17	Matrix Algebra	Multiplication, Transposes, Inverses, Linear Independence, Hyperplanes, Bases	Simon-Blume Ch. 8 Ch. 11 Ch. 10.6
Friday, Sept. 18	Applications of Matrix Algebra; Introduction to Python	Eigen Decompositions, Solving Linear Difference Equations, Linear systems via Eigenvalues, Markov Processes, The Determinant	Simon-Blume Ch. 23, Ch. 25.2, Ch. 26

Each day (time permitting) will feature a 20-minute lesson on the R programming language for statistics. A good introduction to R can be found at : <http://cran.r-project.org/doc/manuals/R-intro.pdf>