ECON 603: Advanced Mathematical Analysis for Economists
Department of Economics – State University of New York at Binghamton
Summer/Fall – 2017

Instructor: Andrew Verdon
Lecture (Section I): M-S 8:30 am - 11:00 am Fine Arts (FA) 248
Lecture (Section II): F, 8:00-9:30am, Fine Arts (FA) 248
Office Hour: TBA
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Textbooks: Michael Hoy et al, *Mathematics for Economics*, 2nd edition (MIT Press, 2001)
Alpha C. Chiang, *Fundamental Methods of Mathematical Economics* 4th edition (McGraw-Hill 2005)
Gary Chartrand, Albert D. Polimeni, and Ping Zhang Mathematical Proofs: A Transition to Advanced Mathematics (3rd Edition) (Featured Titles for Transition to Advanced Mathematics) 3rd Edition
All of the textbooks are strongly ***recommended*** *as useful mathematics books for the duration of the PhD program.*

Overview:
This course provides an introduction to some important math topics in the area of calculus, linear algebra, real analysis. The above mentioned areas have widespread applications in the field of economics. The aim of this course is to equip students with good math intuitions and skills which are of great importance in their future graduate study. Throughout the course emphasis will be placed on basic math theories and problems of economic importance, including some classical microeconomics and macroeconomics models.

Course Assessment:
Grading is based on two parts of your performance:
1. Participation (20%). This includes attendance and class performance.
2. Assignments (80%). I will assign a number of problem sets as the course progresses. You are requested to finish all the homework independently. I will discuss formatting in class.

Course Outline:

1. Introduction
1.1 Lyx
1.2 R Software

2. Linear Algebra
2.1 Basic Linear Algebra
2.2 Vectors and Vector Projections
2.3 Gram-Schmidt Orthogonalization Algorithm
2.4 Linear Independence
2.5 The Rank of a Matrix
2.6 Eigenvalues and Eigen vectors
2.7 Matrix Diagonal Decomposition
2.8 Quadratic Forms
2.9 Partitioned Matrices and their Inverses

3. Real Analysis
3.1 Sets
3.2 Relations
3.3 Functions
3.4 Metric spaces
3.5 Sequences and Convergences
3.6 Compactness
3.7 Cauchy Sequences
3.8 Continuity
3.9 Weierstrass's Theorem
3.10 Limits of Functions
3.11 Truth Tables
3.12 Basic Proof Techniques

4. Multivariate Calculus
4.1 Derivatives
4.2 Gradients and Directional Derivatives
4.3 Homogeneity and Homotheticity
4.4 Mean Value Theorem and Intermediate Value Theorem
4.5 Convex Sets
4.6 Concave and Convex Functions
4.7 Quasiconcave and Quasiconvex Functions
4.8 Taylor's Expansion
4.9 Implicit Function Theorem

5. Integration
5.1 One-Variable Integration
5.2 Leibniz's Formula
5.3 Multiple Integrals
5.4 Jacobian Determinant

6. Static Optimization
6.1 Envelop Theorem
6.2 Equality Constraints: The Lagrange Problem
6.3 Local Second-Order Conditions
6.4 Inequality Constraints: The Kuhn-Tucker conditions
6.5 Comparative Statics Analysis

7. Fixed Points and Separation Theorem
7.1 Contraction Mapping
7.2 Fixed Points Theorem (Banach / Brower / Kakutani)
7.3 Separation Theorem