Economics PhD Mathematics Bootcamp

Instructor:	Brett Devine
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Dates:	Mon July 17th - Wed August 16th

Class Website

Go to my website (http://brettdevine.github.io) on Github.

Course Description

This course serves as a refresher for linear algebra, univariate calculus, and multivariate calculus. In addition, it will cover important topics meant to help you begin to acquire what is often called *mathematical maturity* through covering basic topics in logic, set theory and proofs. It is designed to help prepare you mathematically for the math course in the fall semester. This is an active-learning course. Lecture notes will be posted online. Please note that the instructor(s) of **Econ/S 506** course during the Fall semester may assess your knowledge of the topics covered in this summer course with an exam in the first week of the Fall semester, and **the score will affect your grade in the Econ/S 506 course**.

Course Learning Goals

At the end of this course, students should be able to:

> Understand and have working knowledge of mathematics used in PhD-level economics. Students will learn/review calculus of one variable and of several variables, linear algebra and matrix properties. Students will also learn some logic, set theory and proof strategies useful for learning and understanding more advanced mathematical concepts.

The following will address this outcome:

> Assigned readings and problem sets.

This outcome will be evaluated primarily by:

> Completion of problem sets and exams.

Course Materials

The following are some recommended textbooks. The primary book used for this course will be Simon & Blume's "*Mathematics for Economists*". However, Simon & Blume's text, by itself, is inadequate for modern mathematics, you should expect to consult other texts. I will provide other notes as additional resources, particularly for the set theory and proofs sections.

Graduate-level Course Books

Mathematics for Economists

- Carl Simon and Lawrence Blume. **Mathematics for Economists**. New York; W.W. Norton & Company, 1994.
- Michael Carter. **Foundations of Mathematical Economics**. MIT Press, 2001.
- Michael Hoy, John Livernois, Chris McKenna, Ray Rees and Thanasis Stengos. **Mathematics for Economics**. MIT Press 2011.
- Dean Corbae, Maxwell B. Stinchcombe. **An Introduction to Mathematical Analysis for Economic Theory and Econometrics**. Princeton University Press, 2009.
- Efe A. Ok. **Real Analysis with Economic Applications**. Princeton University Press, 2007.

Mathematical Proof

- Daniel J. Velleman. **How to Prove It: A Structured Approach**. Cambridge University Press, 2006.
- Gary Chartrand, Albert D. Polimeni, Ping Zhang. **Mathematical Proofs: A Transition to Advanced Mathematics**. Pearson; 2nd ed, 2007.

Linear Algebra and Matrix Algebra

- Sheldon Axler. **Linear Algebra Done Right**. Springer; 3rd ed, 2014.
- Roger A. Horn, Charles R. Johnson. **Matrix Analysis**. Cambridge University Press, 1990.

Undergraduate-level Course Books As Additional Reference

- Kevin Wainwright and Alpha C. Chiang. **Fundamental Methods of Mathematical Economics**. McGraw-Hill Education, 2004.
- Michael Klein. **Mathematical Methods for Economics**. Prentice Hall, 2001.

Grading, Exams, and Homework

Grading will be based off points accumulated through assignments and the exam.

Course Items	Points
Assignment 1	20
Assignment 2	20
Assignment 3	20
Exam	40
Total	**100**

Final Grade
The letter grade corresponding to the final point total is provided in the table below.

Point Range	Letter Grade
93–100	A
90–92.99	A-
87–89.99	B+
83–86.99	B
80–82.99	B-
77–79.99	C+
73–76.99	C
70–72.99	C-
67–69.99	D+
60–66.99	D
< 59.99	F

Workload

It is WSU policy that for every hour of faculty directed activities, students should expect a minimum of two hours engaged in supportive learning activities. Depending on your skills and knowledge as a learner, additional time may be required.

In this course, there will be no official "faculty directed time" and the workload will in all honesty be substantial for all individuals that have not had a significant amount of prior mathematics education.

Assignments

An assignment will be posted on the course website. Due dates are given below. **The assignments should be submitted as PDF files by 11:59 pm Pacific Standard Time on the due date**. Each assignment will be worth 20/100 points. The assignments will be problem sets that give the students practice applying the mathematical tools covered in the course texts.

Homework assignments, *including the math*, should be typed.

As a professional economist you will need to communicate mathematical arguments in a clear, well type-set document. You may type your homework assignments using TEX (recommended), MathType, Microsoft Word's equation editor, scientific word, etc. It is a good idea to invest time and effort gaining proficiency in these tools as you will use them later. It might seem slow at first, but these assignments will give you practice, making you more fluent in these tools and prepare you for assignments in your first year courses. If doing so will be a particular hardship for you, or you require an accomodation, then please email me to discuss it.

NOTE: If you are working on a chromebook or for some other reason are unable to use any of the above mentioned tools to type your assignments, I recommend using an online browser-based $LaTeX$ editor. Some good sites capable of doing simple to complex projects are Overleaf.com and ShareLatex.com. Both sites have free options that allow you full access without contributors.

For those using $LaTeX$ I will provide assignment templates for you to use.

Exam

There will be one exam at the end of the course and it is worth 40/100 points. The exam will cover all the material covered in the course. The exam will be proctored on campus in Hulbert Hall on *Wednesday August 16, 2017*.

Course Outline

Week	Topics	Readings	Assignments
Prereqs	Univariate Calculus & Logic	S&B 2,3,4,5; Provided notes	Prerequisite assignment to be completed early in the course.
1	Linear Systems and Matrix Algebra	S&B 6,7,8,9; Notes	—
2	Linear Spaces and Set Theory	S&B 10, 11; Provided Notes	Assignment 1 **Due July 31, 2017 11:59 PM**
3	Multivariate Calculus & Proofs	S&B 13, 14; Provided Notes	Assignment 2 **Due August 7, 2017 11:59 PM**
4	Multivariate Calculus & Proofs	S&B 13, 14; Provided Notes	Assignment 3 **Due August 14, 2017 11:59 PM**
Exam	Comprehensive	No Notes	**On Campus August 16**

S&B – Simon & Blume text

Prerequisite Assignment
The prerequisite assignment will not count toward your grade for the course, but you will be entirely accountable for the mastery of the related content in Econ/S 506. The assignment is given as a chance for you to review and practice the univariate calculus and assess your level of mastery of the content.

Students with Disabilities

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509–335–3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information contact a Disability Specialist at 509–335–3417, or on-line via http://accesscenter.wsu.edu or Access.Center@wsu.edu or Access.Center@wsu.edu

Pullman or WSU Online
Phone: (509) 335–3417
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WSU Academic Integrity Statement

As an institution of higher education, Washington State University is committed to principles of truth and academic honesty. All members of the University community share the responsibility for maintaining and supporting these principles. When a student enrolls in Washington State University, the student assumes an obligation to pursue academic endeavors in a manner consistent with the standards of academic integrity adopted by the University. To maintain the academic integrity of the community, the University cannot tolerate acts of academic dishonesty including any forms of cheating, plagiarism, or fabrication. Washington State University reserves the right and the power to discipline or to exclude students who engage in academic dishonesty. Students found responsible for academic integrity violations may receive an F on the particular assignment or exam, as well as an F for the course. Serious and/or repeated offenses may result in referral to the Office of Student Standards and Accountability and expulsion from WSU. Cheating is defined in the Standards for Student Conduct WAC 504–26–010 (3).

You can learn more about Academic Integrity on your campus using the URL listed in the Academic Regulations section or to http://academicintegrity.wsu.edu/. Please use these resources to ensure that you don't inadvertently violate WSU's standard of conduct. It is strongly suggested that every student read and understand these definitions.

Safety Statement

Washington State University is committed to enhancing the safety of the students, faculty, staff, and visitors. It is highly recommended that you review the Campus Safety Plan http://safetyplan.wsu.edu and visit the Office of Emergency Management web site http://oem.wsu.edu for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community.