# Ph.D. Math Camp

Summer 2017


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| **Instructor:** | Ziran (Josh) Ding | **Time:** | WTF 9am-4pm |
| **Email:** | econjosh@uw.edu | **Place:** | Denny Hall 213 |


## Introduction and Overview

- **Course Description** Welcome to the Macro portion of Math Camp! The purpose of this course is to provide incoming economics Ph.D. students with the mathematical background necessary for studying the first-year macro core classes (ECON 502, ECON 503 and ECON 509) in the fall. The broad objective is to help students re-familiarize with some of the basic mathematical techniques and ideas that will be used in the background of the various calculations, computations and proofs you will encounter in your first year of the Ph.D.
- **References** The math camp is very short so I dont require you to buy any textbooks.The lecture notes should be pretty much self-contained. I dont follow any textbook closely. So, it is completely fine if you dont have any of the textbooks below. However, here are the books that I would recommend:
  - The *Appendix on Mathematical Methods* of Barro, R., and X. Sala-i-Martin (2003): **Economic Growth** has a good treatment of differential equations and optimization theory.
  - The *Appendix* of **Microeconomic Theory** of Mas-Colell, Whinston and Green is a useful resource for the section in optimization theory.
  - **Mathematics for Economists** by C. Simon and L. Blume (1994). Except for computations, this book is all-inclusive in terms of the mathematical tools you need for your first-year Ph.D. classes.
  - **Economic Dynamics in Discrete Time** by J. Miao (2014). This book covers all the discrete-time macro dynamics you need for all the graduate coursework.
- **Homework** I will give daily problem sets relating to the material covered in class. We will go over the solutions during the afternoon sessions. Since this course is not for credit I will not be collecting these assignments but I encourage you to try the problems before you see the solutions. This will help you master the material, and it will give you a chance to start working in groups if you wish.

## Tentative Course Outline

| Session | Content |
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| Chapter 1 | • Introduction to Basic Statistics and the Log-linearization Technique<br>– Probability and Expectations<br>– Variance and Covariances<br>– Linearization and Log-linearization |
| Chapter 2 | • An Introduction to Dynamical System<br>– Differential Equations<br>– Steady-states and Phase Diagrams<br>– System of Differential Equations<br>– Difference Equations<br>– Non-linear difference equations |
| Chapter 3 | • Dynamic Optimization-An Introduction to Optimal Control Theory<br>– Optimization in Discrete Time<br>– The Lagrangian Methods<br>– Optimization in Continuous Time<br>– The Hamiltonian Methods |
| Chapter 4 | • Dynamic Optimization-An Introduction to Dynamic Programming<br>– The Principle of Optimality<br>– Solution Method for Deterministic Infinite Horizon Model<br>– Solution Method for Deterministic Finite Horizon Model |
| Chapter 5 | • An Introduction to Matlab and Mathematica<br>– Basic Features in Matlab<br>– Graphical tools in Matlab<br>– Flow control and functions<br>– Basic features in Mathematica<br>– Graphics in Mathematica<br>– Simulations |