2022 Winter Math Camp

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Class Hours: Feb 7^{th} – Feb 11^{th}, 10 am – 12 pm, 1 pm – 3 pm

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Course Description

This 5-day course aims to prepare incoming graduate students of Yonsei Economics for the first-year core courses (micro 1, macro 1, and metrics 1). This course touches briefly on topics of calculus, linear algebra, and statistics.

The first year core courses are highly quantitative and some topics require knowledge up to real analysis. The materials will not cover everything you need to sail through the first-year. However, I hope I can point out the topics that are important, and ambitious students MUST independently study more mathematics before the semester starts.

Resources and Textbooks

- Day 1 - 2, Calculus: Early Transcendentals (Stewart)
- Day 3 - 5, MIT OCW intro to stat lecture notes
  https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/class-slides/
- If time allows, Gilbert Strang (MIT)'s lecture note on Linear Algebra
  https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/related-resources/MIT18_06S10ZoomNotes.pdf

Prerequisites/Corequisites

Knowledge of high-school mathematics and basic knowledge of Calculus. If you do not know how to take derivatives, You must study the first two chapters of Stewart Calculus before the class begins.

Schedule

NOTE : The schedule is tentative and subject to change.

1 Day 1–2, Topic 1 : Calculus and Basic Linear Algebra

1.1 Single Variable Calculus and Optimization

1. Continuity, Derivatives, and Differentials
2. Unconstrained Optimization
3. Constrained Optimization
- Economic Interpretation of the Lagrangian Multiplier as Shadow Price
- Kuhn-Tucker

1.2 Multivariable Calculus and Optimization

1; Partial Derivatives, Hessian Matrix, Young's Theorem, Implicit Function
2. Multivariable Optimization

1.3 Linear Algebra

1. Basics of Linear Algebra (column and row space, matrix multiplication, dot products)
2. Vector Spaces, Subspaces, Dimension (the four fundamental subspaces)
3. Orthogonality, Least Squares, and Projection

2 Day 3–5, Topic 2 : Statistics

2.1 Linear Algebra Continued

1. Orthogonality, Least Squares, and Projection (Continued)

2.2 Mathematical Stats Pt.1

1. Definition of Random Variable
2. Probability Density Function, Moments
3. Important Distributions (Normal, t, F, χ^2 distribution)
4. Joint and Marginal PDF

2.3 Mathematical Stats Pt.2

1. Expectations
2. Conditional Expectation, Conditional Variance
3. Covariance and Independence