General Information

	Analysis	*Linear Algebra, Statistics*
Sequence	*Analysis*	*Linear Algebra, Statistics*
Instructor	ChienHsun Lin	Seonmin (Will) Heo
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Office Hours	Thursday 2:30 – 3:30 NH 2017	Monday 2:30 – 3:30 NH 3017
Classroom	North Hall 2111	
Dates	August 21 – September 8, M – F	
Time	10:00 AM – 11:30 AM; 1:00 PM – 2:30 PM	

Course Description

Math Camp is designed to bridge materials and concepts you encountered during your undergraduate preparation and new technical skills that will be covered extensively in your first-year Ph.D. sequences. The focus of the class is on mathematical concepts, tools, and skills useful in your classes (and more generally during your career as an economist). Most topics should be familiar to most students and are presented as a refresher; others will be new material that will be useful moving forward.

The course assumes that you have some familiarity with multivariate calculus, linear algebra, probability theory, and mathematical statistics. Brief reviews of these subjects will be provided, along with material from real analysis, set theory, optimization, and other relevant fields. When possible, topics will be motivated by their usefulness within the economics profession (e.g. as they relate to preference theory, econometrics, etc.).

The course will be split by subjects:

- Analysis Sequence: Logic, Real Analysis, and Optimization

- Linear Algebra and Statistics Sequence: Linear Algebra, Probability, and Statistics

We will also provide a brief introduction to LaTeX and R; the former is one of the most popular document preparation software systems, and the latter is one of the most used statistical analysis software nowadays. We will have a section each week introducing the basics of programming in these languages.

Assignments and Workload

To (re)familiarize yourself with this material, six problem sets will be provided for the topics covered in class. For each problem set, you will be assigned to a small group (2-3 people). Each group must work together to turn in one set of answers, typed neatly in LaTeX and submitted by Tuesday the following week.

You are strongly encouraged to work in groups in your first-year coursework, either with your office mates or others that you work well with. Our hope is that by assigning you to groups during Math Camp, you can get to know one another and get comfortable working together.

Note that everything in the first year should be oriented towards passing the preliminary exams. You need to understand when you are comfortable with a particular concept, so that you can move on to other material (there is always something else to study). Prioritize understanding core concepts over turning in perfect problem sets.

Textbooks

Below are some textbooks that you may find helpful during Math Camp and beyond. You are **not required to purchase any materials for Math Camp!** You might find them useful to have on hand, however, and some will be used in future classes. (Many can be found for free online, and answer keys often can be as well.)

- Casella, George, and Roger L. Berger. *Statistical Inference* (2nd edition). Brooks/Cole, 2002. **(used in Econ 241A – we found having a hard copy very useful)**

- Chiang, Alpha C., and Kevin Wainwright. *Fundamental Methods of Mathematical Economics* (4th edition). McGraw Hill, 2005.

- Hansen, Bruce E. *Econometrics*. 2022.

- Mas-Colell, Andreu, Michael D. Whinston, and Jerry R. Green. *Microeconomic Theory*. Oxford University Press, 1995. **(used in Econ 210A – we found having a hard copy very useful)**

- Simon, Carl P., and Lawrence Blume. *Mathematics for Economists* (7th edition). New York: Norton, 1994.

- Smith, Douglas, Maurice Eggen, and Richard St. Andre. *A Transition to Advanced Mathematics* (8th edition). Cengage Learning, 2014.

Other Resources

- Google and Stack Exchange (can range from not to extremely helpful, especially for coding)

- Jonathan Levin notes "Useful Math for Economists" (here, his other first quarter micro notes may be useful for 210A)

- Peter Troyan notes "Constrained Optimization" (here)

- University of Arizona Math Camp Videos (UAMathCamp on YouTube)

Evaluation

There is no grade for this class. While Math Camp will not directly affect your grades or academic standing, the class is provided as a tool to you. Use it as the first step towards preparing for the preliminary exams.

TIPS TO SUCCESS

The first year of the program can be stressful. It could be difficult especially if you are quantitatively less prepared than your peers. However, it's almost *never* the case that the first year can predict your success in academia, as research is very different from studying and cramming for assignments and exams, which is what you may face during your first year. Nevertheless, you will still (and we strongly hope!) nail it! Here are some tips that we found helpful for getting through the whole thing.

- **Work together.** It is important both intellectually and mentally. The understanding of the materials will deepen if you discuss them with your classmates. You can even *learn* if you try to teach others, as you will discover the holes that you didn't notice you have in your solid knowledge. More importantly, it helps keep your sanity—sometimes it is soothing to have other people scratching heads together.

- **Work by yourself.** You may receive/find some "solutions" of your problem sets or practice exams. DO NOT start looking for those solutions until you have been really stuck for eternity. Reading solutions gives you illusions that you have understood the parts you struggled with. Our rule of thumb is that don't look at the solutions unless you have spent 12 hours on one single question. Learning does not launch until you have enough suffering.

- **Go to office hours.** It might be attractive to lock yourselves in the office if you're a shy person, but it is important to reach out for help – especially from the TAs and the instructors. Use them as much as possible; they are paid to hold office hours for you. It is also important to practice chatting with the faculty.

- **Treat yourself well.** The goal of the first year is to pass the preliminary exams. If you find yourself struggling, please do not hesitate to reach out. UCSB has psychiatrists that provide free consulting services (CAPS). You can also reach out to people you trust; your classmates, friends not doing econ, faculty, etc.. Also spare some time for your hobbies or anything that makes you happy and relieved.

Topic List and Schedule

		Mon	Tue	Wed	Thu	Fri
week 1	AM	(SH) Vectors and Matrices	(SH) Matrix Operations and Quadratic Forms	(SH) Eigenvalues and Eigenvectors	(SH) Vector Spaces and Norms	(CL) Topology in Metric space, Sequence and limits
	PM	(CL) Sets and Logic	(CL) Proof Strategies	(CL) Functions	(CL) Topology in Metric space	(SH and CL) LaTeX R Programming
week 2	AM	(SH) Orthogonality, Projections, and OLS	(SH) Measure, Counting, Independence	(SH) Random Variables and Distribution Functions	(SH) Transformation and Moments	(SH) Multiple Random Variables, Random Sample, Statistics
	PM	(CL) Continuity Differentiation	(CL) Multivariate Derivative	(CL) Integral Techniques	(CL) Fundamental Theorem of Calculus First order ODE	(CL) Unconstrained Optimization
week 3	AM	**Labor Day**	(SH) Statistics and Estimation	(SH) Convergence and Hypothesis Testing	(SH) Methods in Applied Microeconometrics I	(SH) Methods in Applied Microeconometrics II
	PM	**No Class**	(CL) Constrained Optimization	(CL) Theorem of Maximum	(CL) Optimal Control	(SH and CL) R Programming

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