Illinois Political Science Math Camp '18

August 13th-17th
404 David Kinley Hall

This is a week-long program that is designed to review important topics in mathematics and probability, as well as introduce basics of R programming, to help you succeed in graduate methods courses in the department and elsewhere. The schedule has two components: (i) morning lecture sessions on calculus and probability and (ii) afternoon lab sessions on R basics. Lectures will be supplemented by short homework sessions where you will complete exercises, and a final assessment session. R labs are also designed to incorporate some of the material you learn during morning lectures. There are no prerequisites for this course, except knowledge of basic algebra.

Course Website

You can access the course site via GitHub at this page. There you will find the lectures, files for R labs, homeworks and solutions.

Policies and Evaluation

Homework Each day, students will be given short homework assignments that review material covered in the morning lecture. These will be completed in homework sessions prior to lunch.

Math Camp Assessment In the final day of math camp there will be an assessment about the concepts covered. This will be closed book, in class, and will take an hour. While there are no grades for the math camp, we encourage you to take homeworks and the final assessment session seriously to engage the course material.

Attendance and Participation Attendance is voluntary, but highly recommended. Students are strongly encouraged to participate in the class, and in particular, ask questions. Please ask a lot of questions, and ask them often.

Resources

The following is a list of resources that you can use over the summer to help you succeed in math camp/grad school. None are required, but reviewing at least some of these will help you immensely once you get to campus. Calculus and linear algebra will pop-up in quantitative methods and game theory courses. If you have never had exposure to calculus before, don't worry, we will cover it in Math Camp. That said, Math Camp is a short and intensive program, and it could be helpful to review the basics of univariate calculus (limits, derivatives, & integrals) over the summer using these books and web resources. Books 3-5 will give you an overview of the mathematics/methods used in political science and economics. You may also want to become familiar with the basics of R — we recommend DataCamp or Coursera for this. If you have only a limited amount of time to devote to this over the summer, we recommend doing the Introduction to R module on DataCamp (free) and taking a look at the Moore and Siegel book/video lectures.

Books

1. Kleppner, Daniel and Norman Ramsey. 1985. *Quick Calculus: A Self-Teaching Guide*, 2nd Edition. John Wiley & Sons.

    - A popular, accessible book for self-teaching differential and integral calculus.

2. Morgan, Frank. 2001 *Calculus Lite*. Natick, MA: K Peters.

   - Another popular book for self-studying. Good as a refresher.

3. Moore, Will and David Siegel. *A Mathematics Course for Political and Social Researchers*. Princeton Uni. Press.

   - Written by two political scientists, this is an intuitive introduction to a lot of the math you will need with political science examples. David Siegel also has a video course that go along with the book, which could be a good resource. David Siegel's video lectures and other related materials.

4. Simon, Carl and Lawrance Blume. 1994. *Mathematics for Economists*. Norton & Co.

   - This is a good reference book with more rigorous/advanced treatment of the topics compared to the other books listed here. This is a good book to have if you are interested in formal theory.

5. Fox, John. *Applied Regression Analysis and Generalized Linear Models*. Los Angeles: Sage, 2016.

   - This book explains basic concepts about linear models and regression very well.

Web Resources

1. Coursera

   - Includes numerous free online courses on math, computing, statistics, and more. You can usually enroll in these courses at certain times of the year though. Calculus (from OSU) and R (from JHU) courses are popular. For instance this is a course for programming in R.

2. MIT OpenCourseWare

   - This site makes a lot of MIT course materials available online. Sometimes this just includes a syllabus, other times video lectures and all course materials. Worth checking out for a lot of topics. For instance, Gilbert Strang's Linear Algebra course is popular, if you would like to learn about matrices.

3. Khan Academy

   - Similar to Coursera, but entirely free, Khan Academy is good for brushing up on algebra and calculus. Lectures are slow-paced and intuitive.

4. Datacamp

   - Good for learning coding in R. Lots of free content available.

5. For mathematical writing/reading

   - Check out these short guides on math writing: this one [first 6 pages], and this one
   - This is a list of math symbols by subject from Wikipedia
   - This cute site allows you to draw the symbol you are looking for, and gives you the LaTeX code associated with that symbol

Class Schedule

Daily Schedule

Morning Session I: 9.00 am – 11.00 am
Morning Session II: 11.10 am – 12.00 pm
Lunch Break: 12.00 pm – 1:30 pm
Afternoon Session: 1:30 pm – 3:30 pm

8/13 Monday

Morning Session I (lecture): Notation, sets and intervals, functions, sequences (Sanghoon Kim)
Morning Session II (lab): Intro to R (Sarah Leffingwell)
Afternoon Session (lecture): Limits and continuity, derivatives (James Steur)

8/14 Tuesday

Morning Session I (lecture): Integrals (Lucie Lu)
Morning Session II (homework): Integrals/derivatives practice problems (Lucie Lu)
Afternoon Session (lab): Logical statements, functions, optimization, integration in R (Gustavo Diaz)

8/15 Wednesday

Morning Session I (lecture): Probability I, basic set theory and probability (Ekrem Baser)
Morning Session II (homework): Probability practice problems (Ekrem Baser)
Afternoon Session (lab): Probability in R, loops (Miles Williams)

8/16 Thursday

Morning Session I (lecture): Probability II distributions, random variables (Nuole Chen)
Morning Session II (homework): Probability practice problems (Nuole Chen)
Afternoon Session (lab): Distributions and random variables in R, basic descriptive statistics (Chris Grady)

8/17 Friday

Morning Session I (lecture/lab): Hypothesis testing and p-values with R (Jaeseok Cho)
Morning Session II: Assessment session (Jaeseok Cho)
Afternoon Session: Workshop - Professionalization