

Illinois Political Science MathCamp '19

Political Science Graduate Student Association

August 12-16, 2019

Course Description

This is a week-long program designed to review important topics in mathematics and probability, and 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, linear algebra and probability and (ii) afternoon lab sessions on R basics.

Day 1 - Day 4's morning sessions focus on basic mathematics and probability. The formats of each morning session are a mixture of lecture and problem-solving. Students are expected to do daily homework on a voluntary basis. Afternoon sessions are software sessions that focus on basic programming skills in R. Day 5 is dedicated for students to learn skills to produce reproducible reports and do a small group project that reflects what they have learned in MathCamp.

Evaluation and Policies

Homework Each day, you will be given short homework assignments that review material covered in the morning lecture. You are expected to solve some problems on each day on a voluntary basis. Solutions will be provided.

Small Group Project In the final day of Mathcamp, there will be time for you to team up with other students to complete a small group project. The due date of the group project is August 18 at noon. While there are no grades for Mathcamp, we encourage you to take homework problems and the small group project 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 ask questions. For those who are familiar with the materials covered in the class, please take this as review time and use it as an opportunity to help your colleagues to learn. Please ask a lot of questions, and ask them often.

Course Website

You can assess the course site via Github at [this page](#). You can find lecture slides, R codes, final projects, classwork and solution there.

Resources

The following is a list of resources that you can use over the summer to help you succeed in Mathcamp/grad school. None are required, but reviewing at least some of these will help you immensely once you get to campus. Calculus, linear algebra and probability theory 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 MathCamp. That said, MathCamp 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 used in political science and economics.

Books

1. Kleppner, Daniel and Norman Ramsey. 1985. Quick Calculus: A Self-Teaching Guide, 2nd Edition. John Wiley and 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. Highly recommended. David Siegel also has a video course that go along with the book, which could be a good resource. For David Siegel's video lectures and other related materials, please see [David Siegel's online materials](#).

4. Gill, Jeff. 2006. Essential Mathematics for Political and Social Research (Analytical Methods for Social Research). Cambridge.

Covered most topics that will be presented in the Mathcamp. This is a book about building fundamentals in preparation for more advanced methods texts. Highly recommended.

5. Simon, Carl and Lawrance Blume. 1994. Mathematics for Economists. Norton and 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.

Online Resources for R and more

It is very important that you can take some time to get familiar with R, one of the programming languages you will predominantly use in the PhD program here. We highly recommend that you

can install [R](#) beforehand, and try [swirl](#), an R package designed to teach you R straight from the command line. Swirl provides exercises and feedback from within your R session to help you learn in a structured, interactive way. You are also encouraged to install and get familiar with [R Studio](#), a more user-friendly software to use R output.

You can also find many courses on programming, data science, calculus, probability and many more on [Coursera](#) (Calculus from OSU and R from JHU courses are popular). For advanced learners, feel free to check out [Kaggle](#). There are also many other open platforms offering online courses on a variety of topics, such as [MIT OpenCourseWare](#) and [Khan Academy](#).

Class Schedule

Daily Schedule

Morning Session A: 9:00 am - 10:20 am
 Morning Session B: 10:30 am - 11:50 pm
 Lunch Break: 12:00 pm - 1:30 pm
 Afternoon Session C: 1:30 pm - 3:20 pm

8/12 Monday

Morning Session A: Sets and intervals, functions (Sanghoon Kim)
 Morning Session B: Intro to linear algebra I (Sanghoon Kim)
 Lunch Break: Interdisciplinary opportunities for future methodologists (Sanghoon Kim, Gustavo Diaz and Lucie Lu)
 Afternoon Session C: Intro to R (Sarah Leffingwell and Kristin Bail)

8/13 Tuesday

Morning Session A: Intro to linear algebra II (James Steur)
 Morning Session B: Limits and continuity, derivatives (James Steur)
 Lunch Break: GEO informstion session (James Steur)
 Afternoon Session C: Playing with data I: data manipulation and logical statements (Gustavo Diaz and Lucie Lu)

8/14 Wednesday

Morning Session A: Probability I: basic set theory and probability (Lucie Lu)
 Morning Session B: Probability I cont. (Lucie Lu)
 Lunch Break: Mentoring session (Jim Kuklinski)
 Afternoon Session C: Loops and distributions in R (Miles Williams and Stephen Mullins)

8/15 Thursday

Morning Session A: Probability II: distributions and random variables (Nuole Chen)
 Morning Session B: Probability II cont. (Nuole Chen)
 Lunch Break: GSA Mentoring session
 Afternoon Session C: Playing with data II: data visualization and explore some relationships in data (Jaeseok Cho and Rebeca Agosto Rosa)

8/16 Friday

Morning Session A: Latex/R Markdown (Josh Holmes)

Morning Session B: Project Time (Facilitator: Stephen Mullins)

Lunch Break: What is GSA? (Sarah Leffingwell) + Maintaining a financial balance in graduate school (Josh Holmes)

Afternoon Session C: Project Time (Facilitator: Lucie Lu) + Workshop: Professionalization (Nuole Chen)

8/18 Sunday

Small Group Project Due. Please send your group project to Lucie Lu (lul3@illinois.edu) by noon.