

University of Georgia
Department of Public Administration and Policy
DPAP 8120: Data Analysis and Statistical Inference
Fall 2020

COURSE SYLLABUS

Professor: David Bradford

Office: 201C Baldwin Hall

E-mail: bradfowd@uga.edu

Phone: 706- 542-2731

Class Time: Monday, 7:15 – 10:00 PM

Class Location: Baldwin 301

Office Hours: by appointment

****** NOTICE: Special Fall 2020 COVID-19 policies appear on the last page of the syllabus ******

Description : This course is an introduction to the theory and application of linear modeling to economic and policy problems. The focus of this class will be to provide you with the theoretical and practical skills necessary to conduct your own empirical research. This will be accomplished by addressing two overarching sets of topics. First, the course will explore the mathematical bases for statistical analysis. Topics in this section will include introduction to calculus (both single variable and multivariate), linear (matrix) algebra, optimization, and measurement theory. Second the course will lay the groundwork for statistical inference. Topics in this section will include moments of distributions (mean and variance), forming hypotheses, simple bivariate hypothesis testing, and introduction to ordinary least squares regression. The course will also provide a basic introduction to the Stata software package for statistical analysis.

Goals: By the end of the course, students should be able to:

- Take derivatives of multi-variate functions and understand how those relate to marginal effects from regressions.
- Use matrixes effectively in statistical modeling.
- Optimize functions and understand how optimization relates to regression.
- Identify the most appropriate methodological techniques for analysis given a research question and available data, as well as identify, understand the implications, and offer resolution to various problems encountered during quantitative analysis.
- Conduct simple data analyses using the methodologies covered in the course. In particular, students should be able to test simple hypotheses and run a basic regression.
- Manage data and conduct analyses using Stata.

Optional Text: Wainwright, Kevin, Chiang, Alpha C. *Fundamental Methods of Mathematical Economics*. (NY: McGraw-Hill/Irwin, 2004). [Note: Nearly any edition of this book will be fine.]

Required Software: You will need to obtain your own copy of Stata for your own computer.

Organization of the Course: Class meetings will be primarily lecture and discussion. Class attendance is not required, though there is little prospect of success without it. Any student who is feeling ill, or who has come into contact with someone who is feeling ill, or who has come into contact with someone who has been diagnosed with COVID-19, must not attend class face-to-face and must attend virtually via Zoom. Following the Thanksgiving break, our remaining classes will be held via Zoom.

Grading: There are three components of the final grade:

- ***Homeworks – 30 points:*** Homework will be assigned every few weeks throughout semester. Students will have one week to complete each homework assignment.
- ***First Exam: 35 points (Administered online)***
- ***Second Exam: 35 points (Administered online)***

Academic Integrity: All students are responsible for maintaining the highest standards of honesty and integrity in every phase of their academic careers. The penalties for academic dishonesty are severe and ignorance is not an acceptable defense.

Mental Health and Wellness Resources:

- If you or someone you know needs assistance, you are encouraged to contact Student Care and Outreach in the Division of Student Affairs at 706-542-7774 or visit <https://sco.uga.edu>. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services.
- UGA has several resources for a student seeking mental health services (<https://www.uhs.uga.edu/bewelluga/bewelluga>) or crisis support (<https://www.uhs.uga.edu/info/emergencies>).
- If you need help managing stress anxiety, relationships, etc., please visit BeWellUGA (<https://www.uhs.uga.edu/bewelluga/bewelluga>) for a list of FREE workshops, classes, mentoring, and health coaching led by licensed clinicians and health educators in the University Health Center.
- Additional resources can be accessed through the UGA App.

Course Outline and Schedule (Week / Module number in parentheses)

NOTE: The following schedule is a general plan for the course; changes may be required as the semester progresses to accommodate speed of learning or student interest. Changes will be announced in advance by the instructor.

- (1) **Introduction to the class and discussion of the semester (8/24)**
- (2) **Functions (8/31)**
Key Concepts: Real valued functions in one dimension; linear vs. non-linear functions; slopes (algebraically); tangent lines; limits; continuity.
- (3) **Labor Day – No Class (9/7)**
- (4) **Introduction to derivatives (9/14)**
Key Concepts: Review of limits; first order derivatives; higher order derivatives; extrema; logs and exponents; graphing lines with derivative, minimum and maximum information.
- (5) **Multivariate calculus (9/21)**
Key Concepts: The chain rule; open, closed, bounded and compact sets; geometric representation of functions in N-dimensions.
- (6) **Multivariate calculus II (9/28)**
Key Concepts: The total differential; chain rule in N-dimensions; partial differentiation; implicit functions and the Implicit Function Theorem.
- (7) **Matrices (10/5)**
Key Concepts: matrices, vectors and scalars; transposes; matrix multiplication; matrix addition; square, diagonal, triangular, and identity matrices; the geometry of matrices in Euclidian space.
- (8) **Matrices continued (10/12)**
- (9) **First Test - Administered online (10/19)**
- (10) **Advanced matrix manipulations, I (10/26)**
Key Concepts: Determinants in \mathbb{R}^2 and \mathbb{R}^N ; matrix inversion.
- (11) **Advanced matrix manipulations, II (11/2)**
Key Concepts: Characteristic equations and roots; independence of rows; matrix rank; ill-conditioned matrices; solving simultaneous equations with matrices.
- (12) **Optimization (11/9)**
Key Concepts: Extrema in quadratic functions; extrema in general two-variable functions; intuition of optimization; First Order Conditions in \mathbb{R}^N using matrices; Second Order Conditions in \mathbb{R}^N using matrices; OLS as an optimization problem.
- (13) **Random Variables (11/16)**
Key Concepts: Random variable, probability distributions, cumulative probability functions, specific probability distributions.

(14) Moments of distributions (11/23)

Key Concepts: Random sampling, descriptive statistics, statistics as estimators, correlation, covariance, null hypotheses, bivariate hypothesis tests,

(15) Least Squares, II (11/30)

Key Concepts: Least squares regression.

(16) Second Test - *Administered online* (12/7)

Coronavirus Information for Students

Face Coverings:

Effective July 15, 2020, the University of Georgia—along with all University System of Georgia (USG) institutions—requires all faculty, staff, students and visitors to wear an appropriate face covering while inside campus facilities/buildings where six feet social distancing may not always be possible. Face covering use is in addition to and is not a substitute for social distancing. Anyone not using a face covering when required will be asked to wear one or must leave the area. Reasonable accommodations may be made for those who are unable to wear a face covering for documented health reasons. Students seeking an accommodation related to face coverings should contact Disability Services at <https://drc.uga.edu/>.

DawgCheck:

Please perform a quick symptom check each weekday on DawgCheck—on the UGA app or website—whether you feel sick or not. It will help health providers monitor the health situation on campus: <https://dawgcheck.uga.edu/>

What do I do if I have symptoms?

Students showing symptoms should self-isolate and schedule an appointment with the University Health Center by calling 706-542-1162 (Monday-Friday, 8 a.m.-5 p.m.). Please DO NOT walk-in. For emergencies and after-hours care, see <https://www.uhs.uga.edu/info/emergencies>.

What do I do if I am notified that I have been exposed?

Students who learn they have been directly exposed to COVID-19 but are not showing symptoms should self-quarantine for 14 days consistent with Department of Public Health (DPH) and Centers for Disease Control and Prevention (CDC) guidelines. Please correspond with your instructor via email, with a cc: to Student Care & Outreach at sco@uga.edu, to coordinate continuing your coursework while self-quarantined. If you develop symptoms, you should contact the University Health Center to make an appointment to be tested. You should continue to monitor your symptoms daily on DawgCheck.

How do I get a test?

Students who are demonstrating symptoms of COVID-19 should call the University Health Center. UHC is offering testing by appointment for students; appointments may be booked by calling 706-542-1162.

UGA will also be recruiting asymptomatic students to participate in surveillance tests. Students living in residence halls, Greek housing and off-campus apartment complexes are encouraged to participate.

What do I do if I test positive?

Any student with a positive COVID-19 test is required to report the test in DawgCheck and should self-isolate immediately. Students should not attend classes in-person until the isolation period is completed. Once you report the positive test through DawgCheck, UGA Student Care and Outreach will follow up with you.