

ENTO 8900: Advanced Quantitative Analysis

Instructor: Conor Fair (cfair13@uga.edu)

Fall 2022; 1-3 Credits

Meeting TR 9:35-10:50 AM; Room 412 Biological Sciences or via Zoom

Office Hours: by appointment [here](#)

Course Description

The ability to process and analyze data is an increasingly important skill in both academic and non-academic job markets. Data Literacy is a common gap in the knowledge mentioned by both graduate students and academic advisors. With that in mind, this course is designed to help you become more proficient in using R programming language to manage, analyze, and visualize your data. Understanding this coding language is key to be able to work with data/hypotheses/analyses and adapt online/textbook examples for your own use.

The course will help familiarize you with R coding language and packages, the procedures and assumptions for various statistical analyses, guidelines for creating informative publication quality data visualizations, and to develop troubleshooting skills. This will help you present and defend your analyses and data in professional presentations and publications.

Learning Objectives

By the end of this course, you will be able to:

- Recognize different functions and syntax/language used in R
- Interpret textbook/online example code to be used with your own data
- Complete various simple statistical analyses using various types of data
- Determine the appropriate analysis based on the type of data/experimental design
- Design and manipulate data visualizations of publication quality
- Effectively defend/explain data analyses and interpretation of results

Prerequisites

There are no specific prerequisites for this class, but prior graduate-level stats course experience is recommended. This course is intended to be an intermediate R course. Students are expected to be familiar with and have some experience analyzing data using R/RStudio software.

Required Materials

You will need a computer with R statistical software downloaded. Please contact the instructor with any concerns about technology/software issues. R is compatible with both PC and MAC computers.

There is no required textbook, but students who would like to use additional resources to supplement their learning should use the textbooks Beckerman, Andrew P. 2017. *Getting Started with R: An Introduction for Biologists* (free online access at UGA library), Bolker, Benjamin M. 2008. *Ecological Models and Data in R*. Princeton University Press, and Wickham, Hadley, and Grolemund, Garrett. 2017. *R for Data Science*. O'Riley (available for free: <https://r4ds.had.co.nz/>). Examples pulled from this and other sources to be used in class will be posted on eLC as needed.

Academic Honesty

Academic integrity is a core value of institutions of higher learning. All students, upon enrolling, must pledge: "I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others." It is your responsibility to avoid plagiarism, cheating, and dishonesty. The university policy on academic integrity is posted at: <http://www.uga.edu/honesty/>. To qualify the application of the policy in this course: exams and individual assignments should be entirely your own work with no assistance from anyone else. Any material drawn from other sources should be properly cited. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

Method of Instruction

This course will be held in-person and use face-to-face instruction throughout the semester. Options for virtual synchronous/asynchronous attendance must be discussed with the instructor. Synchronous lectures will be used sparingly to cover general topics. Other course time will be spent in a workshop-style discussion of relevant topics and problem solving. Resources may be provided for supplemental learning.

Communicating with the Instructor

The primary method of communicating with you outside of class time/office hours will be through e-mail and eLC. As emails sent via eLC can only be replied to using eLC, I am more likely to reply quickly via email than eLC. Assignment changes, important dates, and other valuable information may be shared on this page over the course of the term. Please check it regularly. I will do my best to answer questions within 24 hours (but rarely answer emails at night or on weekends).

I will be available during the 15 minutes before and after class. You may also set up separate appointments for office hours by contacting me via email.

Make-Up Policy

Whenever possible, you should contact the instructor as soon as possible whenever a makeup exam/assignment is requested. You will be requested to present proper documentation for doctor's appointments or other health issues that conflict with exams and assignment deadlines. Other requests for make-up work are up to the discretion of the instructor.

Late Work

The late submission of assignments will result in a **10% reduction in points per day** unless alternative arrangements are made with the instructor. *If you are worried about meeting deadlines or if something comes up, please talk to me.*

Changes to the Syllabus

The course syllabus is a general plan for the course; deviations by the instructor may be necessary. You should attend class and/or regularly check your email/eLC.

Course Requirements and Evaluation

Students have the option to enroll in 1-3 credits for this course. For each credit hour enrolled, you will be expected to complete one exam and one major assignment (of your choice) to be graded.

Package Reports

The intention of this assignment is to explain the syntax, structure, and functioning of various tools available in R. To develop this familiarity, you will select two different packages used in R. These packages can vary in complexity, but they should be relevant to your own research. The reports will include a brief presentation about the functions of the package and demonstration of how to use the package. Additional details can be found in the assignment document.

Script De-Bug

A near universal experience is having a carefully written script file that took hours to complete results in confusing or frustrating error messages. There are a few strategies to employ that will help minimize these errors from occurring. This assignment will test those skills and help you recognize where these mistakes in the coding language can easily occur. You will be given a dataset and script file and you will have to troubleshoot all the mistakes and error messages. Additional details can be found in the assignment document.

Student Presentations

The purpose of refining your statistics and data visualization knowledge is to be better able to communicate your hypotheses and results with your target audience. To test your growth in this skill, you will be required to present an analysis and data to your peers. This should include hypothesis development, data collection, management, analysis, and visualizations. Presentations should be approximately 20 minutes long. You should provide relevant background information to support your hypotheses, but the focus should be on the data collection, analysis, and visualization. Dates and additional information can be found in the assignment document.

Exam(s)

The goal is for you to be able to be given a data set, properly determine, and execute the appropriate analysis. This will be demonstrated by completing one or more practical exams with increasingly difficult/complex data sets. While I encourage you to complete these exams as independently as possible to best test your knowledge/familiarity, I value the collaborative approach to troubleshooting statistical analyses. Additional information/expectations will be given as the dates approach.

- Exam 1: Weeks 1-5 (Sep. 22)
- Exam 2: Weeks 7-10 (Oct. 27)
- Exam 3: Cumulative - including Advanced Topics (Dec. 8)

Participation/Attendance Policy (N/A)

Participation and attendance are necessary for success in this class. I recognize that you will have other professional/personal obligations and health concerns you must manage in addition to your course work. If you are unable to attend class or complete an assignment on time, please notify me as soon as possible. You are expected to review lectures and class discussions from missed classes and keep up with exams or assignments missed because of an absence.

Grading Scale

Grades reflect the university standards (http://bulletin.uga.edu/Bulletin_Files/acad/Grades.html) and are summarized below. You will be graded only on the number of assignments/exams you complete. Grades are based on how many points you earn according to the following distribution:

A 93-100 points, A- 90-92 points, B+ 87-89 points, B 83-86 points, B- 80-82 points, C+ 77-79 points, C 73-76 points, C- 70-72 points, D 60-69 points, F Fewer than 60 points

Student Resources

Students with Disabilities

Students with disabilities that have been certified by the UGA Disabilities Services Office will be accommodated according to university policy. For more information, contact Disabilities Services at (706) 542-8719 or visit their website at <https://drc.uga.edu/>.

Mental Health and Wellness Resources

Being a student can be difficult. Your lives are changing, and college can be a stressful environment. *There is no shame in struggling with this.* If you 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 or crisis support (<https://www.uhs.uga.edu/info/emergencies>). If you need help managing stress anxiety, relationships, etc., please visit BeWellUGA (<https://well-being.uga.edu/>) 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 found through UGA's Counseling and Psychiatric Services (CAPS) <https://caps.uga.edu/>

If you are experiencing financial hardships, UGA has several services that may help. These include, but are not limited to, food pantries, hygiene closets, school supply closets, provision of professional clothes, and work-study arrangements. There are *free* services. A summary of services provided by UGA can be found here: <https://financialhardship.uga.edu/food-necessities/>

Advanced Topics

We will be addressing two of the topics from the list below during the later portion of the semester. We will be voting on which topics will be covered during the first day of class.

Meta-Analysis
Bayesian Statistics
Multi-Variate Analysis (NMDS, etc.)
Time-Series Analysis
Multi-level (Hierarchical) Models
Structural Equation (Latent Variable) Models

Additional Resources

<https://people.ucsc.edu/~ggilbert/RTransition.html>

Preliminary Course Schedule

1	August 18	Introduction to the Course; Syllabus etc.
2	August 23 August 25	Basics of R, Loading Data (<i>Drop/Add Aug. 23</i>) Intro. Package Report, Types of Data
3	August 30 September 1	10:00 Start - Data Management and Transformations 10:00 Start - Basic Data Visualization
4	September 6 September 8	Analyses using Ordinary Least Squares (<i>Labor Day Sep. 5</i>) Data Visualization with OLS
5	September 13 September 15	Regression for Categorical Variables ANOVA Regression for Categorical Variables ANCOVA
6	September 20 September 22	Package Report Due , Intro. Script De-Bug, Exam Review Exam I
7	September 27 September 29	Experimental Design, Blocking and Replicates Analyses using Maximum Likelihood Estimation
8	October 4 October 6	Simple Logistic Regression Ordered Logistic Regression
9	October 11 October 13	No Class – Pollinator Conference (<i>Midterm Oct. 10</i>) Count Models
10	October 18 October 20	Overdispersion in Count Models Complex Data Visualization
11	October 25 October 27	Script De-Bug Due , Intro. Student Presentations (<i>Withdrawal Oct. 24</i>) Exam II (<i>Fall Break Oct. 28</i>)
12	November 1 November 3	Advanced Topic 1 – Time-Series Analysis Advanced Topic 1 continued
13	November 8 November 10	Advanced Topic 2 – Multi-Variate Analysis (NMDS, etc.) Advanced Topic 2 continued
14	November 15 November 17	Data Workshop (<i>ESA Meeting Nov. 13-16</i>) Data Workshop
15	November 22 November 24	Data Workshop (<i>Thanksgiving Nov. 23-25</i>)
16	November 29 December 1	Student Presentations Student Presentations
17	December 6	Student Presentations (<i>Reading Day Dec. 7</i>)
18	December 8	Final Exam (<i>Final Exams Dec. 8-14</i>)