Introduction to Applied Statistical Computing with R

SYLLABUS

Richard E.W. Berl

Spring 2019

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Contents

Course Information

Section
NR 592, Section 1: Seminar in Natural Resources (1 credit)

Instructor
Richard E.W. Berl, Human Dimensions of Natural Resources
(He/Him)
Forestry 201
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rewberl.github.io

Website
https://rewberl.github.io/nr592/

Meeting Times
Tuesdays and Thursdays, 10:00am - 10:50am, Animal Science 31
Office hours by appointment

Overview
In this course, you will learn how to program using the R statistical environment and become proficient in performing statistical analyses and data visualizations using real data relevant to your own research.

Objectives

- Set up a convenient computing workflow
- Write clean, thoroughly commented R code
- Recognize different types of data, how they are measured, and how they are handled in R
- Use the principle of 'tidy data' to effectively clean and format messy data sets
- Creatively explore data sets with descriptive statistics and rough visualizations prior to confirmatory analyses

- Clearly communicate results by visualizing data simply and effectively and by telling a compelling story with data
- Conduct basic statistical tests and linear regression modeling
- Explore advanced topics in data analysis, including dimensionality reduction and structural equation modeling
- Utilize R for your own research by developing a research question, collecting and wrangling data, and conducting the appropriate analyses
- Support reproducible research by documenting and embedding analyses in a written report
- Use the skills you have learned to communicate your process and results to a general audience

Course Materials

Prerequisites
This course is open to graduate students only. There are no prerequisite courses, but it is expected that students have had some exposure to statistics.

Time Commitment
The work load of this course is equivalent to a full semester 1-credit course, squeezed into half a semester of time. That means we will meet for 2 hours per week and you should expect to spend an average of 4 to 6 hours of time per week outside of class to accomplish class readings and assignments (per the CSU Catalog).

Texts and Resources
There are no required texts for you to purchase. We will utilize a variety of freely-available online resources and the occasional academic paper. Please refer to the Course Schedule for links to required weekly readings. These readings are generally brief and focus on important high-level concepts rather than the gnarly details of coding, which we will cover in class and in assignments.

You are encouraged to seek additional information on your own, especially to go into more depth on the concepts covered in this course or to explore additional topics of interest to you. Some useful general resources are listed below. In addition, resources specific to each week's topic are listed on the Course Schedule.

Official Manuals and References

- RStudio. RStudio cheat sheets. Available: https://www.rstudio.com/resources/cheatsheets/
- Short, T. R reference card. Available: https://cran.r-project.org/doc/contrib/Short-refcard.pdf
- Torfs, P., & Brauer, C. A (very) short introduction to R. Available: https://cran.r-project.org/doc/contrib/Torfs+Brauer-Short-R-Intro.pdf
- Venables, W. N., et al. An introduction to R. Available: https://cran.r-project.org/doc/manuals/R-intro.html

Online Textbooks

- Ismay, C., & Kim, A. Y. ModernDive: An introduction to statistical and data sciences via R. Available: https://moderndive.com/
- Mangiafico, S. S. Summary and analysis of extension program evaluation in R. Available: http://rcompanion.org/handbook/
- McDonald, J. H. Handbook of biological statistics. Available: http://www.biostathandbook.com/
  - Mangiafico, S. S. An R companion for the handbook of biological statistics. Available: http://rcompanion.org/rcompanion/
- Navarro, D. Learning statistics with R. Available: https://learningstatisticswithr.com/

- Peng, R. D. R programming for data science. Available: https://bookdown.org/rdpeng/rprogdatascience/
- Phillips, N. D. YaRrr! The pirate's guide to R. Available: https://bookdown.org/ndphillips/YaRrr/
- Wickham, H. Advanced R. Available: https://adv-r.hadley.nz/
- Wickham, H., & Grolemund, G. R for data science. Available: https://r4ds.had.co.nz/

Reference Websites

- Chang, W. Cookbook for R. Available: http://www.cookbook-r.com/
- Kabacoff, R. Quick-R. Available: https://www.statmethods.net/
- Rseek. Available: https://rseek.org/
- Stack Overflow. Questions tagged [R]. Available: https://stackoverflow.com/questions/tagged/r
- Trochim, W. M. K. Social research methods knowledge base. Available: https://www.socialresearchmethods.net/
- van der Laken, P. R resources. Available: https://paulvanderlaken.com/2017/08/10/r-resources-cheatsheets-tutorials-bool

Tools

- Kross, S., et al. swirl: Learn R, in R. Available: https://swirlstats.com/students.html

Course Schedule

See the Course Schedule page for details.

Lecture notes will be made available by the end of the day of class. They will not be exhaustive, so students should plan to attend class and take their own notes while working along.

Required reading should be done by the second class meeting (Thursday) of the week in which it is listed.

Weekly homework assignments are due by the beginning of the first class meeting (Tuesday at 10:00am) following the week in which they are listed. Due dates for each assignment are listed on the Course Schedule.

All assignments, the project proposal, and the project report should be submitted through Canvas. Assignment submissions should include your R script (*.R) or R Markdown (*.Rmd) file, as well as any other files specified in the assignment.

Course Policies

Assignments and Grading
Final grades for the course will be made up of contributions from the following assignments:

Assignment

Percentage of Final Grade

Due Date

Homework Assignments (x6)

10% each, drop lowest (50% total)

Weekly, 10:00am (see Course Schedule)

Project Proposal

5%

April 23, 11:59pm

Project Presentation

10%

Week of May 13

Project Report

30%

May 17, 11:59pm

Class Participation

5%

Ongoing

Letter grades will be assigned according to the following distribution:

Percentage Score

Letter Grade

98-100%

A+

92-97%

A

90-91%

A-

88-89%

B+

82-87%

B

80-81%

B-

78-79%

C+

72-77%

C

70-71%

C-

65-69%

D

<65%

F

Late Work
Late assignments will not be accepted unless the student has an unusual or extenuating circumstance that has been discussed with me at least two business days prior to the assignment due date, and has received confirmation of an extension.

Attendance
Attendance is expected at all class meetings. However, I will accommodate student participation in University-sanctioned extracurricular/co-curricular activities. Students must inform me prior to the anticipated absence and take the initiative to contact me or other students in the course to catch up on missed material. I will make reasonable efforts to enable students to make up work which must be accomplished under my supervision (e.g., presentations). In the event of a conflict in regard to this policy, individuals may appeal using established University procedures.

For the purposes of this regulation, University-sanctioned activities include competitions, events and professional meetings in which students are officially representing the institution.

Adapted from Section I.14.4 of the Academic Faculty & Administrative Professional Manual.

Academic Integrity & Plagiarism
This course will adhere to the CSU Academic Integrity Policy as found on the Student' Responsibilities page of the CSU General Catalog and in the Student Conduct Code.

Discussing weekly assignments with other students is allowed, but it is expected that all work you submit is your own. Any code or text in your assignments should be entirely developed and written by you. Any external content, such as functions, data sets, metadata, or images, should be fully cited in an established reference style of your choice. Representing work duplicated from other students or from external or online resources as your own, or reusing prior work, will be considered a violation.

At a minimum, violations will result in a grading penalty in this course and a report to the Student Resolution Center.

Please consult with me at least two business days prior to the deadline for submission of your work if you have any questions about whether it adheres to the Academic Integrity Policy.

Adapted from the Academic Integrity Program at The Institute for Learning and Teaching.

Disability Access
If you are a student who will need accommodations in this class due to a disability or chronic health condition, I will need an accommodation letter from the Student Disability Center (SDC) before they are implemented. Please contact me as soon as possible to arrange office hours to give me the letter and/or to further discuss your needs.

If you do not already have these letters, please contact the SDC as soon as possible to initiate the accommodation process. The SDC is located in room 121 of the TILT building. Contact them at 970-491-6385 or visit www.disabilitycenter.colostate.edu.

Adapted from the Faculty/GTA Information at the Student Disability Center.

Title IX Information
CSU's Discrimination, Harassment, Sexual Harassment, Sexual Misconduct, Domestic Violence, Dating Violence, Stalking, and Retaliation policy designates faculty and employees of the University as "Responsible Employees." This designation is consistent with federal law and guidance, and requires faculty to report information regarding students who may have experienced any form of sexual harassment, sexual misconduct, relationship violence, stalking or retaliation. This includes information shared with faculty in person, electronic communications or in class assignments. As "Responsible Employees," faculty may refer students to campus resources (see below), together with informing the Office of Support and Safety Assessment to help ensure student safety and welfare. Information regarding sexual harassment, sexual misconduct, relationship violence, stalking and retaliation is treated with the greatest degree of confidentiality possible while also ensuring student and campus safety.

Any student who may be the victim of sexual harassment, sexual misconduct, relationship violence, stalking or retaliation is encouraged to report to CSU through one or more of the following resources:

- Emergency Response 911
- Deputy Title IX Coordinator/Office of Support and Safety Assessment (970) 491-1350
- Colorado State University Police Department (non-emergency) (970) 491-6425

From Title IX - Sexual Assault, Sexual Violence, Sexual Harassment at the Office of Equal Opportunity.

Non-Discrimination Statement
Colorado State University does not discriminate on the basis of race, age, creed, color, religion, national origin or ancestry, sex, gender, disability, veteran status, genetic information, sexual orientation, gender identity or expression, or pregnancy and will not discharge or in any other manner discriminate against employees or applicants because they have inquired about, discussed, or disclosed their own pay or the pay of another employee or applicant. The University complies with the Titles VI and VII of the Civil Rights Act of 1964, as amended, related Executive Orders 11246 and 11375, Title IX of the Education Amendments Act of 1972, Sections 503 and 504 of the Rehabilitation Act of 1973, Section 402 of the Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, the Age Discrimination in Employment Act of 1967, as amended, The Pregnancy Discrimination Act of 1978, Americans with Disabilities Act of 1990, the Civil Rights Act of 1991, the ADA Amendments Act of 2008, the Genetic Information Nondiscrimination Act of 2008, and all civil rights laws of the State of Colorado. Accordingly, equal access and opportunity in treatment, employment, admissions, programs and activities shall be extended to all persons. The University shall promote equal opportunity and treatment in employment through a positive and continuing affirmative action program for ethnic minorities, women, persons with disabilities, and veterans. The Office of Equal Opportunity is located in 101 Student Services Building.

The Title IX Coordinator is the Executive Director of the Office of Support and Safety Assessment, 123 Student Services Building, Fort Collins, CO 80523-2026, (970) 491-7407.

The Section 504 and ADA Coordinator is the Associate Vice President for Human Capital, Office of Equal Opportunity, 101 Student Services Building, Fort Collins, CO 80523-0160, (970) 491-5836.

From the Non-Discrimination Statement at the Office of Equal Opportunity.

Land Acknowledgement
I acknowledge, with respect, that the land we are on today is the traditional and ancestral homelands of the Arapaho, Cheyenne, and Ute Nations and peoples. This was also a site of trade, gathering, and healing for numerous other Native tribes. I recognize the Indigenous peoples as original stewards of this land and all the relatives within it. As these words of acknowledgment are written and read, the ties Nations have to their traditional homelands are renewed and reaffirmed.

CSU is founded as a land grant institution, and I accept that our mission must encompass access to education and inclusion. And, significantly, that CSU's founding came at a dire cost to Native Nations and peoples whose land this university was built upon. This acknowledgment is the education and inclusion we must practice in recognizing our institutional history, responsibility, and commitment.

Adapted from Land Acknowledgment at CSU at the Office of the Vice President for Diversity.

(pdf / Rmd)