

EAS 538 Natural Resource Statistics - Fall 2019

Instructor: Meha Jain (mehajain@umich.edu)

GSI: Muhan Chen, Sabrina Vivian, Haowen Zhou

Lecture Meeting Times: M/W 6:00-7:30 PM; 1040 Dana

Lab Meeting Times: W 7:30-9:30 PM (Sabrina), Th 4:15-6:15 PM (Muhan), F 2:00-4:00 PM (Haowen), F 4:00-6:00 PM (Haowen); Sa 11-1 (Muhan); 3325 Dana

Office Hours: Meha Jain, MW 5:00-6:00 PM 3540 Dana

(If you are sick/contagious, especially with a fever, please make a Skype appointment instead of meeting in person!)

Haowen Zhou, Th 4-6 Dana 4046

Muhan Chen, Fr 9-11 Dana 4046

Sabrina Vivian, M 10-12 Dana 4046

Textbook(s): Required: Statistics (the Easier Way) with R by Nicole M. Radziwill. Available at the Union Campus Bookstore. First 82 pages are [available online](#) for free. The book is also on Reserve at Shapiro Library. You can buy any edition.

Optional: Statistics (any edition) by David Friedman, Robert Pisani, and Roger Purves - [Amazon](#); Statistics: An Introduction Using R (2nd Edition) by Michael Crawley (2014). [Free Online Access \(with UM ID\)](#).

Overview: The study of natural resources, sustainability, and the environment is increasingly focused on quantitative methods to characterize systems, test hypotheses, and develop solutions to real-world problems. As such, an understanding of statistical analyses is essential to anyone working in these fields. This course covers applied introductory statistics. Since the course is applied, we will focus on when and why different statistical techniques should be used to analyze different datasets, rather than deriving the mathematical underpinnings of these techniques. Additionally, through this course, you will be introduced to one of the most common statistical programming languages, R. There are no prerequisites to take the class.

Learning Mechanisms: (1) readings, (2) lectures, (3) in class assignments, (4) labs, (5) three quizzes, (6) two problem sets, (7) a final group project, and (8) a final exam. Readings will be from the required course textbook unless they are marked with an *. Additional readings, marked with an *, will be distributed through the Canvas website.

Evaluation: Final grades will be based on completion and accuracy of weekly labs (30%), online participation on the class blog (10%), three in class, closed book quizzes (10%), two problem sets (20%), a final group project (10%), and a cumulative final exam that has both an in class, closed book portion as well as an at home, open book portion (20%).

Note 1: If you need accommodations for a disability, please contact the Services for Students with Disabilities (SSD) office at 734-763-3000 or email ssdoffice@umich.edu. Since accommodations require early planning and are not retroactive, please contact the office as soon as possible (before September 23rd as the first quiz is September 30th).

Note 2: Students are expected to take personal responsibility for understanding and observing the Rackham Academic and Professional Integrity Policy. Zero credit will be given for any assignments involving acts of dishonesty, and additional acts can result in failing the class. Please see the following link for more details: <http://www.rackham.umich.edu/current-students/policies/academic-policies/section11>

Note 3: There are no make-up lab assignments, quizzes, problem sets, exams, projects, and in-class activities. Late labs and problem sets (even 1 minute late) = 0%. Extraordinary cases will be handled on a case-by-case basis.

Grading: Grades will be as follows:

Grade	Percentage Points
A+	Top 2 students
A	93-100+
A-	90-92.9
B+	87-89.9
B	83-86.9
B-	80-82.9
C+	77-79.9
C	73-76.9
C-	70-72.9
D+	67-69.9
D	63-66.9
D-	60-62.9
F	Below 60

Total grades are determined based on components 1-7 detailed below:

(1) Lectures: It is STRONGLY SUGGESTED that you attend all lectures. We will be covering important material in the lectures that is not covered in the readings or the labs. The material presented in lectures will form some of the material for quizzes, problem sets, and the final exam. You do not need to email us if you are unable to attend a lecture for any reason, but please get good notes from another classmate to learn what you missed. Lecture slides will be posted to Canvas by noon on the day of each lecture. Computer use: I strongly discourage the use of computers to take notes. We will, however, spend part of each lecture writing code in R so please bring laptops to class if possible for these in class activities. If you are unable to bring a laptop you can work with another student in class on these activities.

(2) Participation (10% of total grade): We will give participation points based on asking and answering questions and polls on the class blog. Participation is expected throughout the entire semester (we expect that you will post something on the blog for at least 10 out of the 15 weeks of the semester). All questions about lectures, labs, and the class in general should be posted on the blog – any questions sent via email to the GSIs and/or instructors will not be answered. You can post any questions or comments anonymously if you would like and you will still receive credit for posting (Piazza will show us you participated, but it will not show us which post you wrote if you select the ‘anonymous’ option).

(3) Lab Sections (30% of total grade): Attending your assigned lab section is MANDATORY each week. There will be 9 lab assignments throughout the semester, which are clearly marked in the detailed syllabus below – labs that are not marked with an assignment do not have anything to turn in. Lab assignments must be turned in using Canvas by 11:59 PM on the following Monday for those who attend the Wednesday or Thursday lab, by 11:59 PM on the following Tuesday for those who attend the Friday lab, and by 11:59 PM on the following Wednesday for those who attend the Saturday lab. No late assignments (even 1 minute late) will be accepted and you will automatically earn 0% for a lab if it is not turned in on time. It is therefore in your best interest to submit an incomplete lab over a late lab because you will at least earn points for what you have finished with an incomplete lab. 3% of your lab grade will be based on attendance. If you are unable to attend a lab section due to extenuating circumstances, please email the Instructor as well as the GSI in advance of the lab. Even if you are unable to attend the lab session, you will still be required to turn in all assignments on the typical deadline for your lab section and no extensions will be given except for extenuating circumstances that will be decided on a case-by-case basis. Please note that you may work with other students on labs, but you must complete every part of each lab and turn in a final document that you produced (and not a group document). While working together is encouraged, you cannot copy and paste another student's code and/or text – such copying will be considered against Rackham's integrity policy. Labs may require more than the two hour period to complete so any parts of the lab that are not completed by the end of the lab session must be completed at home.

(4) Quizzes (10% of total grade): We will have three, in class, closed book quizzes throughout the semester. The date of each quiz is listed in the detailed syllabus below. The quizzes will not be cumulative, and will only cover material that was discussed immediately after the previous quiz and immediately before the current quiz. We will drop your quiz that has the lowest grade, resulting in the two highest-scoring quizzes counting for 5% each of your total grade. There are no make up quizzes, however, if you have an extenuating case that results in you needing to miss a quiz you should email the Instructor in advance of the quiz and we will likely use this missed quiz as your lowest score quiz to drop. Doctor's notes will be required if you are too sick to take a quiz. No practice problems will be provided for preparation.

(5) Problem sets (20% of total grade): We will have two, at home, open book problem sets throughout the semester. The date of each problem set is listed in the detailed syllabus below. The problem set will be due on Sunday at 11:59 PM on the week that it was assigned. No late problem sets (even 1 minute late) will be accepted and you will automatically earn 0% for a problem set if it is not turned in on time. It is therefore in your best interest to submit an incomplete problem set over a late one because you will at least earn points for what you have finished. You should complete this problem set on your own and not work with others. Each problem set is worth 10% of your grade. You can ask GSIs and Instructor for help, but cannot post questions to Piazza.

(6) Group Project (10% of total grade): In the middle of the semester you will be assigned to a four-person group to complete a group project by the end of the semester. For this project, you will work with your team to select a dataset and you will be required to conduct three different statistical analyses on these data. Your group will present your results during a 5-minute presentation during one of the last two classes. Clear criteria for what is required for this project

will be added to Canvas as a separate document at a later date. All group members within a project will receive the same grade, unless there are clear cases where a group member did not contribute at all to the final project.

(7) Final Exam (20% of total grade): We will have one final exam at the end of the semester. This exam will be partially closed book (and will resemble the quizzes) and will be partially open book (and will resemble the labs and problem sets). Previous quizzes, labs, and problem sets can be used as samples for what types of questions we will ask during the final exam though you will never see the exact same question from a quiz, lab, or problem set on the final exam.

Getting Help and Asking Questions

- In this course we are trying to simulate how researchers ask and answer questions in the real world. The primary mode of asking and answering statistics and R coding questions is to use online blog sites, like stack overflow or statsexchange.com. Therefore for this class, we ask that you take the following strategy when you have a statistics or coding question related to the class.
 - o Step 1 – Google! You will be surprised by how many of your questions have already been asked and/or answered online. This is true both for conceptual questions about statistics as well as for coding questions in R.
 - o Step 2 – If after around 10 minutes of googling you cannot figure out an answer, you should go to the class online blog. This blog will take the format of similar statistics and coding blogs online (e.g. stack overflow). Before you ask your question, search to make sure someone has not already asked and answered your question. If your question has not already been asked, please post your question on the blog. Other students may answer your question, and these answers will be counted towards their participation points. The Instructor and GSIs will also check this blog periodically (1-2 times per week) to ensure that questions are being answered accurately and to identify any common themes of questions that we will address in class and/or lab section. The intention of the blog is not for the instructors to answer questions, but it is for the students to collaboratively help one another, which is the same way the real-world statistics community works. The instructor and GSIs will not reply to statistics questions that are emailed to us, so please post all questions you have to the blog. Remember, you can post anonymously if you would like, and you will still get participation points.
 - o Step 3 –If you feel that you have a question that has not been addressed by your peers on the blog, you may also stop by the Instructor or GSIs' office hours to ask any questions related to the course or to address any concerns. We are only available during posted office hours, and these office hours are not for us to provide guidance for non course-related statistics questions that may be related to your research outside of this class. For questions related to your research, please contact CSCAR (<http://cscar.research.umich.edu/>).
 - o Step 4 – We will address common problems and questions that we see from quizzes and the blog in review sessions during some class and lab periods (as shown in the detailed syllabus below).

Detailed Syllabus and Reading List (tentative and subject to change).

Week	Date	Topic	Lab	Readings (1 st Edition)	Readings (2 nd edition)
Week 1	Wed 9/4	Why do we care about statistics?	No lab – do SwirlR on your own & read stereotype threat article.	i-x; 3 – 8, 12-16, Article on stereotype threat.	i-x; 3 – 8, 12-16, Article on stereotype threat.
Week 2	Mon 9/9	Data and Descriptive Statistics	Basic R commands and data visualization. Lab Assignment 1	24-31 (up to Bessel’s correction), 34-39, 41-46, 84-90, 91-96 (up to Supplemental R code), 105-111, 113-117	24-31 (up to Bessel’s correction), 34-39, 41-45, 84-90, 91-96 (up to Supplemental R code), 105-112, 113-118
	Wed 9/11	Sampling, Bias, and Central Limit Theorem		162-172, 212-220	160-171, 215-223
Week 3	Mon 9/16	Confidence Intervals and Z + T distributions	Sampling, confidence intervals, central limit theorem. Lab Assignment 2	240-243, 247-251	240-243, 247-251
	Wed 9/18	CI continued, T distribution, Hypothesis testing		185-195	186-199
Week 4	Mon 9/23	T tests	T-test. Lab Assignment 3	305-352; 383-404	305-353; 383-405
	Wed 9/25	T tests continued; chi-square; Review Session			
Week 5	Mon 9/30	Quiz 1	ANOVA. Lab Assignment 4	No Reading	
	Wed 10/2	ANOVA & MANOVA		406-427	406-427
Week 6	Mon 10/7	Correlation, Intro to linear regression	Linear regression Part 1. Lab Assignment 5	140-143, 430-442	139-143, 430-442
	Wed 10/9	The importance of linear models			
Week 7	Mon 10/14	Fall Study Break	Non-parametric tests & data cleaning in R. Assignment 6	No Reading	
	Wed 10/16	Observational vs Experimental Studies; non-parametric tests			
Week 8	Mon 10/21	Power and Sample Size; Review Session	Problem Set 1	196-211	200-213
	Wed 10/23	Quiz 2		No Reading	
Week 9	Mon 10/28	Multiple Linear Regression, Multicollinearity	Multiple linear regression. Lab Assignment 7	444-463	444-463
	Wed 10/30	Model selection, interaction terms		No Reading	

Week 10	Mon 11/4	ANCOVA, interaction terms	ANCOVA + interaction terms. Lab Assignment 8	ANCOVA_Reading.pdf (mentions SAS and Minitab – don't worry about understanding how to code in these).
	Wed 11/6	When linear models fail....		Resampling.pdf; p 2- 6; p 15 - 17
Week 11	Mon 11/11	GLM	Fixed vs Random effects; Lab Assignment 9	GLM.pdf
	Wed 11/13	Fixed vs Random Variables; Review Session		Fixed_Random.pdf; Mixed_Models.pdf (skip Sections 15.4-15.7)
Week 12	Mon 11/18	Quiz 3	Problem Set 2	No Reading
	Wed 11/20	Conceptual Review Session		
Week 13	Mon 11/25	Group Project	No Lab	
	Wed 11/27	Thanksgiving Recess		
Week 14	Mon 12/2	Group Project	Lab – R coding review & final exam help	
	Wed 12/4	Student Presentations		
Week 15	Mon 12/9	Student Presentations	No Lab	
	Wed 12/11	Final Exam – conceptual multiple choice in class. Problem set style take home exam due on 12/18 at 11:59 PM – exam will be released after class on 12/11		