EAS 538 - Natural Resource Statistics

Fall 2021

Instructor: Inés Ibáñez (iibanez@umich.edu)
GSIs (teaching assistants): Laís Petri (petril@umich.edu)
Krysta December (solstice@umich.edu)

Lecture Meeting Times (EAS 538-001): Tue/Thu 4:00-5:30 PM; 1040 Dana. Class will start at 4:00 PM sharp and will end at 5:20 PM.
Recordings of Lecture Materials: live lectures will be recorded and made available right after each class, link will be shared as soon as it is available. In addition, lecture recordings from last semester will be posted in the course Canvas page. Be aware these second recordings may not exactly match this semester's lectures; these are meant as an additional study guide and not a replacement for lecture.

Lab Meeting Times:

(EAS 538-002): Thu 6:00-8:00 PM – Dana 1046 - GSI: Laís Petri
(EAS 538-003): Fri 9:00-11:00 AM – Remote - GSI: Krysta December
(EAS 538-004): Fri 11:00 AM-1:00 PM – Remote - GSI: Laís Petri
(EAS 538-005): Fri 1:00-3:00 PM – Dana 2024 - GSI: Krysta December

You can only attend the lab you have signed for.

Office Hours:
All office hours will both in person and remote. You can also reach us via email if any of those times do not work for you. We will not answer questions if the information requested is in the syllabus or in any of the class announcements.

Lecture (Inés Ibáñez):
Tue 2:00 - 4:00 PM - Dana 2546
Thur 10:00 AM- 12:00 PM - Dana 2546

Labs (Laís Petri):
Wed 8:00-9:00 AM remote: https://umich.zoom.us/j/93214468370
Wed 1:00-2:00 PM in person

Labs (Krysta December):
Mon 9:00-10:00 AM in person and remote: https://umich.zoom.us/j/93171960022
Wed 11:00 AM-12:00 PM remote: https://umich.zoom.us/j/92475745921

Textbook(s):
Required: Statistics (the Easier Way) with R by Nicole M. Radziwill. First 82 pages are available online for free. 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.

R is a statistical open-source program. We will go through the steps of installing it in the first lab. During labs, and also when working on your own if you want, you will be using RCloud and will have access to this platform during the semester.

Learning Mechanisms: (1) readings, (2) lectures, (3) class participation, (4) labs, (5) four quizzes, (6) two problem sets, (7) a final problem set. Readings will be from the required course textbook. Additional readings, marked with an *, will be distributed through the course Canvas website.

Evaluation: Final grades will be based on completion and accuracy of weekly labs (30%), online participation on the class blog in Piazza (10%), four quizzes (15%), two problem sets (20%), and a cumulative final problem set (25%). **WARNING**: you are responsible for keeping track of deadlines and requirements.

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.

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, class participation, or problem sets. You **are allowed two late submissions**, no justification needed, after that late assignments (even 1 minute late) = 0%. Extraordinary cases will be handled on a case-by-case basis.

Note 4: You may experience stressors that can impact both your academic experience and your personal well-being. These may include academic pressure and challenges associated with relationships, mental health, alcohol or other drugs, identities, finances, etc. If you are experiencing concerns, seeking help is a courageous thing to do for yourself and those who care about you. If the source of your stressors is academic, please contact me so that we can find solutions together. For personal concerns, U-M offers many resources, some of which are listed at Resources for Student Well-being on the Well-being for U-M Students website. You can also search for additional resources on that website.

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 1-6 detailed below:

(1) Lectures: It is STRONGLY SUGGESTED that you attend all lectures and that you follow the schedule (cramming will not work with statistics, we learn it by practicing). 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 and problem sets. You do not need to email us if you are unable to attend an in-person lecture for any reason, but please watch the lecture recordings to learn what you missed. Lecture slides and lecture recordings from last semester will be posted to Canvas the day before each lecture. In person lectures will also be recorded; you don't have to watch either if you come to class, this is just additional study material.

(2) Participation (10% of total grade): We will give participation points based on asking and answering questions in the class' blog. We will use Piazza (see link below) to write the blog. Participation is expected throughout the entire semester; to EARN FULL PARTICIPATION CREDIT you will have post ANSWERS at least 10 times during 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 instructor will not be answered. Any student can answer questions/comments posted by other students. We will explain in class why we do this exercise.

Piazza: This term we will be using Piazza for class discussion. The system is highly catered to getting help fast and efficiently from classmates. If you have any problems or feedback for the developers, email team@piazza.com.

Find our class signup link at:

https://piazza.com/umich/fall2021/eas538001fa2021

(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 within a week, by the beginning of the following lab. After your two allowed late assignments, 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 (doctor's notes are required for sick absences). 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 on your own. You can attend or login during office hours to ask questions about the labs.

(4) Quizzes (15% of total grade): We will have four take home open book quizzes throughout the semester (you will be given 24 hrs to complete each). There will be no lecture scheduled for the day of the quiz (you should be able to complete the quiz in 1 1/2 hours, the lecture scheduled time). 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 with the lowest grade, resulting in the three 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 Monday at 12:00 PM the week after it was assigned; problem sets will be available on Mondays at 12:00 PM. After your two allowed late assignments, 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 clarifications, but cannot post questions to the class blog.

(6) Final Exam (25% of total grade): We will have one final exam at the end of the semester. This exam will be open book. 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. This assignment can't be submitted after the due time/day.

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.
    - 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.
    - Step 2 – If after around 10 minutes of googling you cannot figure out an answer, you should go to the class blog (in Piazza). 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 Chat 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.

- Step 3 –If you feel that you have a question that has not been addressed by your peers on the blog, you may also attend or login into 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/).
- 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 (1st edition)	Readings (2nd edition)	Readings (3rd edition)
Week 1	Tue 8/31	Why do we care about statistics?	No lab – Read stereotype threat article.	i-x; 3 – 8, 12-16, Article on stereotype threat.*	i-x; 3 – 8, 12-16, Article on stereotype threat.*	i-x; 3 – 8, 12-16, Article on stereotype threat.*
	Thu 9/2	Data and Descriptive Statistics		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	24-31 (up to Bessel's correction), 34-39, 41-45, 84-90, 91-96 (up to Supplemental R code), 105-112, 113-119
Week 2	Tue 9/7	Sampling, Bias, and Central Limit Theorem	Basic R commands and data visualization. Lab Assignment 1	162-172, 212-220	160-171, 215-223	160-172, 215-224
	Thu 9/9	Confidence Intervals (CI)		240-243, 247-251	240-243, 247-251	242-244, 249-253

		and Z + T distributions				
Week 3	Tue 9/14	CI continued, T distribution, Hypothesis testing	Sampling, confidence intervals, central limit theorem. Lab Assignment 2	185-195	186-199	186-199
	Thu 9/16	T tests		305-352; 383-404	305-353; 383-405	304-350; 380-401
Week 4	Tue 9/21	T tests continued; chi-square	T-test. Lab Assignment 3			
	Thu 9/22	Quiz 1		No Reading		
Week 5	Tue 9/28	ANOVA & MANOVA	ANOVA. Lab Assignment 4	406-427	406-427	403-426
	Thu 9/30	T test and ANOVA in practice		No Reading		
Week 6	Tue 10/5	Correlation Intro to linear regression	Linear regression Part 1. Lab Assignment 5	140-143, 430-442	139-143, 430-442	140-144, 428-440
	Thu 10/7	The importance of linear models				
Week 7	Tue 10/12	Observational vs Experimental Studies; non-parametric tests	Non-parametric tests & data cleaning in R. Assignment 6	No Reading		
	Thu 10/14	Power and Sample Size		196-211	200-213	200-214
Week 8	Thu 10/21	Multiple Linear Regression Multicollin-earity	Multiple linear regression. Lab Assignment 7	444-463	444-463	444-462

Week 9	Tue 10/26	Quiz 2	Problem Set 1. Due Mon 11/1 at 12:00 pm	No Reading
	Thu 10/28	Linear regression in practice		
Week 10	Tue 11/2	Model selection, interaction terms	ANCOVA + interaction terms. Lab Assignment 8	No Reading
	Thu 11/4	ANCOVA, interaction terms		*ANCOVA_Reading.pdf (mentions SAS and Minitab – don't worry about understanding how to code in these).
Week 11	Tue 11/9	Quiz 3	Fixed vs Random effects; Lab Assignment 9	No Reading
	Thu 11/11	Fixed vs Random Variables		*Fixed_Random.pdf; *Mixed_Models.pdf (skip Sections 15.4-15.7)
Week 12	Tue 11/16	When linear models fail	Problem Set 2. Due Mon 11/22 at 12:00 pm	No Reading
	Thu 11/18	GLM		GLM.pdf
Week 13	Tue 11/23	GLM in practice I	No lab	No Reading
Week 14	Tue 11/30	Quiz 4	GLM; Lab Assignment 10, just for practice no need to turn in assignment	No Reading
	Thu 12/2	GLM in practice II		
Week 15	Tue 12/7	Another take on linear models	Final Problem Set Due Tue 12/14 at 3:30 pm	No Reading
	Thu 12/9	Course review		
Week 16	Tue 12/14	Final Exam –take home Problem Set **due on 12/14 at 3:30 PM** – exam will be posted a week before it is due		