ESM 206: Introduction to Statistics and Data Analysis in Environmental Science and Management (Fall 2022)
Bren School of Environmental Science & Management

Instructor: Dr. Christopher Jerde
Office: MSRB 3409 (Marine Science Institute)
Email: cjerde@ucsb.edu (preferred)
Phone: 574-276-8625 (cell/emergency)
Office hours: Monday 9:30-10:30 am

TA: Nathaniel Grimes
Email: ngrimes@bren.ucsb.edu
Office: Bren Hall 3007
Office hours: Thursday 12-2 pm,

TA: Renae Marshall
Email: rmarshall@umail.ucsb.edu
Office: Bren Hall 1001
Office hours: Friday 9-11 am

Overview: In ESM 206, you will build conceptual, technical, and communication skills to investigate and answer environmental questions using data. Topics include data manipulation, exploratory data analysis, descriptive statistics, regression, hypothesis testing, uncertainty, and data visualization. Skills for data exploration, analysis, and project management will be developed through analysis of real-world datasets using R and RStudio while building tools for and understanding of computational reproducibility and collaboration.

COURSE COMPONENTS:
All course materials will be posted to GauchoSpace. Enrolled students should refer to GauchoSpace as the primary course resource. Lectures will be in person and not recorded.

Weekly learning is through:
- Lectures: 2 weekly 75-minute lectures (M W 8 am in Bren 1414)
- Computer labs: 1 weekly 2-hour lab (M T 12:30pm - 2:20pm in Bren 1414)
- Assignments and readings: ~5 total assignments
- All lecture slides, lab materials, and keys will be posted on GauchoSpace the day before instruction

How to succeed in this course:
1. Attend lectures
2. Keep current in coding and assignments
3. Work collaboratively and actively with your classmates
4. Reach out to me or the TAs if you have any concerns
5. Use the slack channel to communicate with your peers on this course material: https://join.slack.com/t/esm206fall2022/shared_invite/zt-1ggsz16et-9Us_0PaUNuKvmxmuASvQEA

Before the first class, you must download and install R, RStudio, and the tidyverse package. These programs are free.
Step-by-step instructions Here (also found on GauchoSpace)
R: https://cran.r-project.org
RStudio: https://www.rstudio.com/products/rstudio/

Calendar of activities: This is a tentative schedule of topics and activities. We will adjust as the quarter progresses. Lecture slides and discussion notes will be posted on GauchoSpace at least the day before.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/26/2022</td>
<td>Introduction, Expectations, and Motivation; What is data science?</td>
</tr>
<tr>
<td>9/28/2022</td>
<td>Computational reproducibility &amp; reproducible workflows; introduction to R, tidy data structure</td>
</tr>
<tr>
<td>Discussion</td>
<td>Meet R/RStudio; project management in R projects; creating organized, well-annotated and reproducible scripts; reading in CSVs; basic data management with {dplyr}; {ggplot2} intro</td>
</tr>
<tr>
<td>10/3/2022</td>
<td>Exploring data; “Good enough practices” in data science;</td>
</tr>
<tr>
<td>10/5/2022</td>
<td>Engaging and responsible data visualization</td>
</tr>
<tr>
<td>Discussion</td>
<td>R Markdown intro; initial cleaning for messy(ish) data; data management with {dplyr} and {tidyr} continued; exploratory data analysis; dataviz with {ggplot2} continued (ASSIGNMENT)</td>
</tr>
<tr>
<td>10/10/2022</td>
<td>Version control with Git &amp; GitHub, metadata</td>
</tr>
<tr>
<td>10/12/2022</td>
<td>Population, sampling, bias, basic summary statistics (central tendency &amp; data spread)</td>
</tr>
<tr>
<td>Discussion</td>
<td>Basics of working between GitHub and RStudio; wrangling and data viz continued; {lubridate} for dealing with dates and times (ASSIGNMENT)</td>
</tr>
<tr>
<td>10/17/2022</td>
<td>Exploring differences between populations (effect size, actual differences, difference in context, intro to null hypothesis statistical testing)</td>
</tr>
<tr>
<td>10/19/2022</td>
<td>Continued (QUIZ)</td>
</tr>
<tr>
<td>Discussion</td>
<td>Frequency tables with {count}, {tally} and {n}; summary statistics; exploring normality; t-tests; project management with GitHub and R projects (ASSIGNMENT)</td>
</tr>
<tr>
<td>10/24/2022</td>
<td>Hypothesis testing pros &amp; cons, t-tests, ANOVA, pitfalls of null hypothesis statistical testing</td>
</tr>
<tr>
<td>10/26/2022</td>
<td>Errors, risk &amp; bias, communicating outcomes of hypothesis tests (and why the p-value should be the least interesting thing you present)</td>
</tr>
<tr>
<td>Discussion</td>
<td>GitHub continued; t-tests; ANOVA; responsibly visualizing differences between groups; reading in data from different sources/file types (URLs, .xlsx, etc.)</td>
</tr>
<tr>
<td>10/31/2022</td>
<td>Ordinary least squares, correlation, thinking critically about relationships</td>
</tr>
<tr>
<td>11/2/2022</td>
<td>Continued</td>
</tr>
</tbody>
</table>
GRADE BREAKDOWN:

Assignments (50%) are created to help you practice conceptual, computational, and critical thinking skills needed for environmental data science. You will submit your assignments via GauchoSpace. Expect five assignments during the quarter. Submit by midnight of the due date.

Quizzes (20%) two in-class quizzes will be conducted in discussion sessions. They will be announced the week before.

The final exam (30%) will be an individual take-home exam (this is an assignment that aggregates everything you’ve learned during the quarter). Submit by midnight of the due date.

Policies (Taken and slightly modified from UCSB suggested policies):

Schedule changes: The schedule is subject to change depending on the progress of the course.

Due dates: Late assignments will not be accepted. However, if a verifiable emergency arises, I will work with you. Yet, we will not grant extensions after the due date has come and gone. ALL TAKE-HOME ASSIGNMENTS AND THE FINAL EXAM/ASSIGNMENT ARE DUE BY MIDNIGHT OF THE DUE DATE.

Exam makeup policy: Any foreseeable reason for missing the exam must be reported to the instructor as soon as possible. In the case that you must miss the exam (or critical
due date) for a legitimate and documented reason, I must be notified at least a week in advance and a make-up exam will be provided or accommodation for other evaluated deliverables.

**Class participation:** In this course, we will work and learn together. That means that you need to be here, in class, for the learning to happen. I understand that you may encounter situations where you can’t attend class. Work with your classmates or me to get copies of notes and the information presented. Some lectures may be recorded.

**Plagiarism and academic integrity:** All students are expected to understand and comply with university policies regarding plagiarism and the originality of work. Plagiarism occurs when a writer deliberately passes off another's words or ideas without acknowledging their source. For example, turning another's work as your own is plagiarism. Plagiarized assignments will receive a grade of 0 and may result in additional disciplinary action. You can view the university’s policy on student conduct at [http://www.sa.ucsb.edu/Regulations/student_conduct.aspx](http://www.sa.ucsb.edu/Regulations/student_conduct.aspx).

Plagiarism is different from **misuse of sources**, occasions when a writer does not properly cite a source, misuses quotations, includes too much of an original source in a paraphrase or summary, or commits similar *unintentional* violations of academic protocol. If you misuse sources, we will work together on appropriately incorporating and/or citing the sources. Note that some audiences/instructors will consider misuse of sources to be plagiarism; for this reason, it is *extremely* important for you to identify the conventions associated with source use and citations in any class.

**Grade appeals** If you have a dispute with a grade you have received, you have the right to request a review by the instructor. Please keep in mind that an appeal will invoke a review of the full assignment and could result in a lower grade.

**Intellectual property and course materials:** All course materials (class lectures and discussions, handouts, examinations, web materials) and the intellectual content of the course itself are protected by United States Federal Copyright Law and the California Civil Code. UC Policy 102.23 expressly prohibits students (and all other persons) from recording lectures or discussions and from distributing or selling course materials without the prior written permission of the instructor (See [http://policy.ucop.edu/doc/2710530/PACAOS-100](http://policy.ucop.edu/doc/2710530/PACAOS-100)). Students are permitted to make notes solely for their own private educational use. Exceptions to accommodate students with disabilities may be granted with appropriate documentation.

**Students with disabilities:** If you are a student with a documented disability (registered with the DSP program: 893-2668, [www.sa.ucsb.edu/dsp](http://www.sa.ucsb.edu/dsp)) and would like to arrange accommodations, please contact me after class and I will be happy to discuss alternative arrangements.
**General academic support:** Campus Learning Assistance Services (CLAS) offers instructional groups, drop-in tutoring, writing and ESL services, skills workshops and one-on-one consultations. CLAS is located on the third floor of the Student Resource Building.

**Mandatory Reporting** As an instructor, one of my responsibilities is to help create a safe learning environment on our campus. I want to ensure that students feel they can speak to me, but I also want students to be informed that I have a mandatory reporting responsibility related to my role as a professor. I am required to share information regarding sexual misconduct or information about a crime that may have occurred on UCSB’s campus or in the community. A result of my mandated report will be that students will receive outreach and resources from the campus Title IX office. Students may speak to someone confidentially by contacting CARE, Campus Advocacy, Resources & Education at the 24/7 advocacy line at (805) 893-4613 or visit them in person at the Student Resource Building.