# Biometry for the Coastal Sciences (COA 606)

Date: 09 August 2021

Instructor: Dr. Robert Leaf

Office: GCRL Oceanography 119

Office Hours: I have an open door policy and welcome your questions and concerns. Stop in to see me or make an appointment. Unfortunately, sometimes I have deadlines and travel and will not be able to accommodate "drop in" students every time but will make every reasonable effort to accomodate your schedule.

Email: robert.leaf@usm.edu

Course Meeting Day and Time: MW, 4:00 to 5:15 PM

## COVID-19

- The global COVID-19 pandemic has prompted new health and safety protocols for face-to-face situations. In an effort to protect the community as much as possible, we need everyone to do their part. If you have not yet been vaccinated, please do so today. Appointments can be made via Moffitt Health Center's online health portal. If you prefer to schedule an appointment off-campus, please see the Mississippi Department of Health's website.
- We want everyone to follow the University's complete Community Standards, which are updated as needed based on changing patterns with the virus. Face coverings are required for all indoor activities, regardless of your vaccination status. Face coverings are also strongly recommended for any other setting where you are in close contact with others.
- It is important that everyone in the community closely monitor their own health and stay home when that may protect others. If you have been directly exposed to COVID-19 and are not vaccinated, call Moffit Health Center at 601-266-5390 for guidance. If you have the following symptoms, also call Moffit:
- Fever of 100.4 degrees or higher
- Cough
- Shortness of breath
- Sudden loss of taste or smell
- We ask you to follow these guidelines and get vaccinated so that we can hold our events, gather together on campus, and enjoy all the activities that are part of our Southern Miss traditions and community. Once you are vaccinated, please let us know by submitting your vaccine record online at usm.edu/gotmycovidvax.
- Upon submission, you will be entered in a weekly drawing for prizes (through October 15). We want to maintain our in-person classes and student activities, and we need your help to ensure our full return.

## Course Description and Objectives

This course addresses basic approaches to experimental design, statistical analysis, and presentation of quantitative information.

## At the conclusion of this course:

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

- Define what comprises the field of statistical analysis.

- What is meant by random samples, random sampling, and understanding how these aspects of sampling are critical for description and inference.
- Explain the differences and similaries among variables, statistics, and parameters.
- Define a cumulative density function and a probability density function and describe several common distributional families (e.g., normal, binomial, chi-square).
- Understand and be familiar with the applications of:
- Frequency distributions
- Power analysis
- Summary statistics as a tool for describing data
- Means comparison techniques for testing hypotheses
- ANOVA comparison techniques for testing hypothesis
- Linear regression techniques for describing relationships between random variables.
- Make appropriate decisions as a part of a statistical data analysis.

## Course Materials

Experimental Design and Data Analysis for Biologists by G. Quinn and M. Keough (2002).

Biostatistical analysis 4th or 5th edition, by Jerrold Zar, Prentice Hall (1999), ISBN-10:0131008463, ISBN-13:978-0131008465

Statistical Analysis, by Sam Kachigan, Radius Press (1982), ISBN-13: 978-0942154993, ISBN-10: 0942154991

Discovering Statistics Using R 1st edition, by Andy Field, Jeremy Miles, Zoe Field, SAGE Publications Ltd. (2012), ISBN-10: 1446200469, ISBN-13: 978-1446200469

Hilborn, R., & Mangel, M. (1997). The ecological detective?: confronting models with data. Princeton University Press.

## Course Scheduling

| Date | Section | Activity | Reading |
|---|---|---|---|
| 8/23/2021 | Introduction | Syllabus Review, Introduction, Questions | |
| 8/25/2021 | Fundamentals 01 | Types of Variables and Data Organization | Kachigan Ch 1 and 2<br><br>Zar Ch 1<br>Broman and Woo (2018) |
| 8/30/2021 | Fundamentals 02 | Frequency Distributions, measures of dispersion and central tendency, HW 01 Assigned | Kachigan Ch 3<br><br>Zar Ch 3 and 4 |
| 9/1/2021 | Fundamentals 03 | The Normal Distribution | Kachigan Ch 4, 5<br><br>Zar Ch 6 |
| 9/6/2021 | Labor Day Holiday | No Class | |
| 9/8/2021 | Fundamentals 04 | Statistical Models, Sampling, Parameter Estimation | Kachigan Ch 7, 8 |
| 9/13/2021 | Fundamentals 05 | Statistical Models and Parameter Estimation Exercise | Leaf Exercise Fundamentals 05 |
| 9/15/2021 | | | |

| Date | Section | Activity | Reading |
|---|---|---|---|
| 9/20/2021 | Fundamentals 06 | Hypothesis Testing and Statistical Power | Kachigan Ch 9, Zar Ch 7, Hurlburt (1984), Trafimow et al. (2017), Benjamin et al. (2017) |
| 9/22/2021 | | | |
| 9/27/2021 | Fundamentals 07 | No Class Tropical Storm | |
| 9/29/2021 | Fundamentals 01 to 07 | Statistical Power Exercise | Leaf Exercise Fundamentals 07 |
| 10/4/2021 | | | |
| 10/6/2021 | | Midterm 01 | |
| 10/11/2021 | Linear Models 01-02 | Correlation and Simple Linear Regression, HW 02 Assigned | Kachigan Ch 10, Zar Ch 19, Kachigan Ch 11.1 to 11.7, Zar Ch 17 |
| 10/13/2021 | | | |
| 10/18/2021 | | | |
| 10/20/2021 | Linear Models 03 | Multiple Linear Regression | Kachigan Ch 11.8 to 11.17, Zar Ch 20 |
| 10/25/2021 | Linear Models 04 | | |
| 10/27/2021 | Linear Models 05 | Comparing the equality of two mean values | Zar Ch 8 |
| 11/1/2021 | Linear Models 06 | Comparing the equality of two mean values exercise | Leaf Exercise Linear Models 06 |
| 11/3/2021 | Linear Models 07 | One-way ANOVA | Kachigan Ch 12.1 to 12.4, Zar Ch 10, 11 |
| 11/8/2021 | | | |
| 11/10/2021 | Linear Models 08 | One-way ANOVA Exercise | Leaf Exercise Linear Models 08 |
| 11/15/2021 | Linear Models 09 | Two-way ANOVA | Kachigan Ch 12.5 to 12.8, Zar Ch 12, 14 |
| 11/17/2021 | Linear Models 10 | Two-way ANOVA exercise | Leaf Exercise Linear Models 10 |
| 11/22/2021 | Linear Models 01 to 10 | Midterm 02 | |
| 11/24/2021 | Thankgiving Holiday | | |
| 11/29/2021 | Categorical Data Analysis 01 | Categorical Data Analysis, HW 03 Assigned | Kachigan Ch 13, Zar Ch 23 |
| 12/1/2021 | Categorical Data Analysis 02 | Categorical Data Analysis Exercise | Leaf Exercise Categorical Data Analysis 02 |

| Date | Section | Activity | Reading |
|---|---|---|---|
| 12/6/2021 | Fall Term Final Exam Week | | |
| 12/10/2021 | All HW Due (5 PM CST) | | |
| | Maximum Likelihood 01 | Parameter estimation using maximum likelihood | Myung (2003) |
| | Maximum Likelihood 02 | Parameter estimation using maximum likelihood exercise | Leaf Exercise Maximum Likelihood 02 |
| | AIC 01 | Akaike information criterion | Burnham and Anderson (2011) |
| | AIC 02 | Akaike information criterion exercise | Leaf Exercise AIC 02 |
| | Resampling Methods 01 | Permutation methods | Hesterberg (2015) |
| | Resampling Methods 02 | Permutation methods exercise - ALL HW DUE | Leaf Exercise Resampling Methods 02 |
| | Final Exam Week | | |

## Course Workload Statement

The expectation of the University of Southern Mississippi is that students should spend approximately 2 to 3 hours outside of class each week for every hour in class working on reading, assignments, studying, and other work for the course. Time management is thus critical for student success. All students should assess their personal circumstances and talk with their advisors about the appropriate number of credit hours to take each term. Resources for academic support can be found at https://www.usm.edu/success.

## Course Evaluation

| Percentage | Letter Grade |
|---|---|
| 93-100 | A |
| 90-92 | A- |
| 86-89 | B+ |
| 83-85 | B |
| 80-82 | B- |
| 76-79 | C+ |
| 73-75 | C |
| 70-72 | C- |
| 66-69 | D+ |
| 63-65 | D |
| 60-62 | D- |
| $< 60$ | F |

## Course Evaluation - Participation and Attendence

Attendance is not required, nor is participation. If the students have other obligations, they do not need to let me know, and I will never question your attendance. No questions are asked about missed classes, and nothing we do in class, other than exams, are graded.

## Homework policy

- There is no due date for the HW, you may turn it in anytime.
- Graded HW will be returned withing 5 working days of its receipt.
- You will upload your scanned .pdf HW labled with your last name and assignment (example "Leaf_HW01.pdf", "Smith_HW02.pdf", "Jones_HW03.pdf"). Each HW assignment will be comprised of a single and labeled PDF file.
- Load your files to this folder: https://www.dropbox.com/request/1AZ50fcAzrX59YyhpYYu
- However, no work will be accepted after 5 PM CST 12/10/2021. The upload window will close at that time.

## Grading scale

| Evaluation type | Number | Points per item | Total points |
|---|---|---|---|
| HW | 3 | 20 | 60 |
| Mid-term exams | 2 | 25 | 50 |
| Final exam | 1 | 50 | 50 |

## Exam Bank

The bank of exams and study material can be found here: https://www.dropbox.com/sh/8zjs3q6w5q3d0dx/AAAv452yGkhXbrYbSYqJL_vOa?dl=0

## Academic Support Resources

If a student knows or believes that they have a disability which is covered by the Americans with Disabilities Act (ADA) and makes them eligible to receive classroom accommodations, they should contact the Office for Disability Accommodations (ODA) for information regarding the registration process. Disabilities covered by the ADA may include but are not limited to ADHD, learning disabilities, psychiatric disabilities, physical disabilities, chronic health disorders, temporary illnesses or injuries and pregnancies. Students should contact ODA if they are not certain whether their documented medical condition qualifies for ODA services. Students are only required to disclose their disability to the Office for Disability Accommodations. All information submitted to ODA by the student is held with strict confidentiality.

## Mental Well-Being Statement

I recognize that students sometimes experience challenges that make learning difficult. If you find that life stressors such as anxiety, depression, relationship problems, difficulty concentrating, alcohol or drug problems, or other stressful experiences are interfering with your academic or personal success, consider contacting Student Counseling Services on campus at 601-266-4829. More information is also available at https://www.usm.edu/student-counseling- services. All students are eligible for free, confidential individual or group counseling services. In the event of emergency, please call 911 or contact the counselor on call at 601-606-HELP (4357).

## Nondiscrimination Statement

The University of Southern Mississippi offers to all persons equal access to educational, programmatic and employment opportunities without regard to age, sex, sexual orientation, disability, pregnancy, gender identity, genetic information, religion, race, color, national origin, and/or veteran status pursuant to applicable state and federal law.

## Confidentiality and Mandatory Reporting

As an instructor, one of my responsibilities is to help create and maintain a safe learning environment. I have a mandatory reporting responsibility related to my role as a faculty member. I am required to share information regarding sexual misconduct or information about a crime that may have occurred on USMs campus with certain University officials responsible for the investigation and remediation of sexual misconduct. The information will remain private and will only be shared with those officials necessary to resolve the matter. If you would like to speak in confidence, resources available to students include Confidential Advisors with the Shafer Center for Crisis Intervention, the Counseling Center, and Student Health Services. More information on these resources and University Policies is available at https://www.usm.edu/sexual-misconduct.

## Academic Integrity

All students at the University of Southern Mississippi are expected to demonstrate the highest levels of academic integrity. Forms of academic dishonesty include cheating (including copying from others work), plagiarism (representing another persons words or ideas as your own; failure to properly cite the source of your information, argument, or concepts), falsification of documents, disclosure of or use of test material or other assignment content to another student, submission of the same paper or other assignment to more than one class without the explicit approval of all faculty members involved, unauthorized academic collaboration with others, conspiracy to engage in academic misconduct.