SYLLABUS: STAT 2480
STATISTICS FOR THE LIFE SCIENCES
AUTUMN 2021

Course overview:

An introduction to statistical methods commonly used in the life sciences

Instructor

Name: Justin Long
Email: long.1787@osu.edu
Office hours:

- Monday: 10:00 am – 11:00 am
- Wednesday: 10:00 am – 11:00 am
- Thursday: 4:30 pm – 5:30 pm

Online Office Hours Link: See Carmen page.

Teaching Assistants

Name: Yingyu Cheng
Email: cheng.1753@osu.edu
Tutoring hours: TBD

Name: Nikki Schnitzler
Email: schnitzler.6@osu.edu

Class Time and Location

- Monday, Wednesday, Friday: 1:50 pm – 2:45 pm
- Lazenby Hall - Room: 021
- Lectures and Labs will be held in the same room.

Course description

Statistical methods play an important role in the analysis of data collected in the biological sciences. This course will provide an introduction to the analysis of biological data in a statistical framework. The topics covered include the definition of probability and manipulation of probabilistic quantities; the common discrete and continuous distributions used in modeling biological phenomena; experimental design; and statistical methods for testing hypotheses.

Course learning outcomes

By the end of this course, students should successfully be able to:

- Understand and discuss methods of collecting data

  – By providing examples of methods of random sampling
  – By explaining correct procedures for designing experiments and observational studies
  – By explaining uses and misuses of sample surveys

- Use statistical tools for presentation of data and to understand presentations of data

  – By discussing when different types of graphical displays are appropriate and explaining proper methods of constructing graphical displays
  – By using appropriate summary statistics to describe the distribution of data
  – By introducing statistical terminology used to describe data and distributions

- Analyze data

  – By constructing and interpreting confidence intervals
  – By conducting and interpreting hypothesis tests
  – By using simple linear regression for bivariate data

- Understand basic probability and statistical concepts

  – By presenting and applying rules of probability
  – By study of the common discrete and continuous distribution used to model biological data
  – By discussing sampling distributions and the use of the Central Limit Theorem as the foundation of inference

- Evaluate statistical procedures and summaries

– By discussing assumptions and conditions for analysis procedures
– By identifying sources of bias in sampling, experiment, and survey methods
– By discussing appropriate nature and scope of conclusions for analysis procedures
– By discussing case studies in the life sciences

GE Course Information

- This course satisfies the GEC Data Analysis requirement
- The expected learning outcomes are:
  - ELO1: Students understand basic concepts of statistics and probability.
  - ELO2: Students comprehend methods needed to analyze and critically evaluate statistical arguments.
  - ELO3: Students recognize the importance of statistical ideas.
- These goals will be achieved by detailed study utilizing example data from the life sciences.

Course materials

Required

- Textbook: *The Analysis of Biological Data*, by M. C. Whitlock and D. Schluter, 3rd ed., ISBN: 9781319226299.

- The textbook and the accompanying homework management system, **Achieve,** are for this course is being provided via CarmenBooks. Through CarmenBooks, students obtain publisher materials electronically through CarmenCanvas, saving them up to 80% per title. The fee for this material is included as part of tuition and is listed as CarmenBooks fee on your Statement of Account. In addition to cost-savings, materials provided through CarmenBooks are available immediately on or before the first day of class. There is no need to wait for financial aid or scholarship money to purchase your textbook. Unless you choose to opt-out of the program, you do NOT need to purchase any materials for this course at the bookstore. For more information on the program or information on how to opt out, please visit the CarmenBooks website, https://affordablelearning.osu.edu/carmenbooks/students

- Need help with the textbook? The publisher's technical support team can be reached by phone, chat, or by email via the Student Support Community. To contact support please open a service request by filling out the webform at https://macmillan.force.com/macmillanlearning/s/contactsupport
(Privacy notice: https://store.macmillanlearning.com/us/privacy-notice)

Course technology

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at https://ocio.osu.edu/help/hours, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** http://ocio.osu.edu/selfservice
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu
- **TDD:** 614-688-8743

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Carmen; the following website may help you if you encounter difficulties with Carmen: https://resourcecenter.odee.osu.edu/canvas/ .

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 8+) with high-speed internet connection OR tablet with web-browser capabilities and high-speed internet connection
- CarmenZoom text, audio, and video chat. If you need technical assistance, either call 614-688-HELP, or refer to the online instructions: https://resourcecenter.odee.osu.edu/carmenzoom

Necessary software

- No additional software is required beyond a web-browser; students will be given instructions for using the open-source R statistical software at the Ohio Supercomputer Center through their web browser. This software will be accessible on either a laptop or a tablet.

Grading and Assignments

Grades

Assignment or category	Percentage
Homework	25%
Lab assignments	20%
Discussion Assignments	5%
Exam #1	15%

Exam #2	15%
Final exam	20%
Total	100%

Assignment Information

Homework: Required homework problems will be assigned for each topic covered in the course, and solutions will be submitted and graded via Achieve or Carmen. Periodically, recommended problems will also be posted for additional practice, but will not be collected or graded. You need to work through homework problems on your own in a timely manner in order to perform well in the class. Homework is worth 25% of your overall grade.

Labs: Lab exercises using the R software will be carried out once per week in place of a formal lecture. These lab exercises will be submitted via Carmen quizzes and will together account for 20% of the overall grade.

Discussion Assignments: At two points during the semester, you will be required to create a discussion board post that shows an improper use of statistics. This could be a graph, statistical hypothesis test, discussion of data, etc., that you find in a news article, blog post, or twitter thread, for example. Each post should be accompanied by a couple of sentences describing what is incorrect. You will also be required to comment on at least two of the other students' posts, to either agree, point out an additional problem, or argue that the posted information is actually correct. A rubric and due dates will be provided on Carmen. Each post and set of comments are worth 2.5% of your grade.

Exams: There will be two in-class midterms exams and a final exam. Statistical tables will be provided as needed. Please note the dates of all exams as given on the syllabus (below).

Makeup exams: If you absolutely need a makeup exam and have a valid excuse, please see your instructor for the necessary arrangements. However, you must notify the instructor in advance in such a situation. A make-up exam should be taken within a week of the missed exam. Exceptions to this policy will be permitted on a case-by-case basis and only in extreme situations.

Late assignments

Late assignments **are not** accepted without **prior** permission from the instructor.

Grading scale

93–100: A
90–92.9999: A-
87–89.9999: B+
83–86.9999: B
80–82.9999: B-
77–79.9999: C+
73–76.9999: C
70 –72.9999: C-
67 –69.9999: D+
60 –66.9999: D
Below 60: E

Course Attendance Policy

You are expected to attend all lectures. Formal attendance records will not be kept on Mondays and Wednesdays; however, students are responsible for all material covered in class. Office hours should not be used for instruction on material that has already been covered in class. Attendance at labs will be required and Top Hat will be used to track attendance.

Communication

Class time and office/tutoring hours will be the primary mode of student to instructor communication in this class. Of course, there will be times that questions will arise will need to be addressed over email. In that case, please begin your email's subject with STAT 2480. Remember that all course email correspondence must be conducted using your valid OSU name.# email account.

At the beginning of each week's module, there will be a page with announcements. Other announcements and reminders will be made in class and/or via Carmen announcements.

Staff feedback and response time

We are providing the following list to give you an idea of our intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

Canvas Conversations/Email

A course instructor or teaching assistant will reply to messages sent via Canvas Conversations or email within **24 hours on school days (Monday – Friday, excluding university holidays; list of holidays at** http://registrar.osu.edu/staff/bigcal.asp**).**

Discussion board

We will check and reply to messages in the discussion boards as appropriate every **24 hours on school days**.

Office hours

Each week, there will be office hours. The dates and times of these will be communicated clearly and well in advance. An announcement will also be posted on the class website.

If you have questions about the Mastery Assessments (Homework, Exams, etc.) or notice any typos in the material, please message us directly via Canvas Conversations.

Communication guidelines

The following are our expectations for how we should communicate. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to communicate as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. Informality (including an occasional emoticon) is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Other course policies

Student academic services

Student academic services offered on the OSU main campus
http://advising.osu.edu/welcome.shtml.

Student support services

Student support services offered on the OSU main campus http://ssc.osu.edu.

Academic integrity policy

Policies for this online course

- **Homework**: Homework may be discussed with classmates or TAs but submitted homework assignments should represent your own efforts.

- **Lab activities**: can be completed in a "group setting" by collaborating with other students in the class. Help from sources outside of this class is not allowed.
- **Exams**: You must complete the exams yourself, without any external help or communication.

Ohio State's Academic Integrity Policy

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at titleix@osu.edu

Accessibility accommodations for students with disabilities

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process (https://slds.osu.edu/covid-19-info/covid-related-accommodation-requests/), managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Carmen (Canvas) accessibility
- Streaming audio and video
- Synchronous course tools

Your mental health!

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614- 292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273- TALK or at suicidepreventionlifeline.org

Course Schedule (tentative)

Week	Class No.	Date	Day	Topics	Reading
1	No Class	8/24/21	T	Semester Begins	-
	1	8/25/21	W	Introduction, methods for summarizing data	Ch. 1 - 3
	2	8/27/21	F	Lab 1: Intro to the R software	-
2	3	8/30/21	M	Probability	5.1 - 5.3
	4	9/1/21	W	Probability	5.5 - 5.6
	5	9/3/21	F	Lab 2: Exploratory data analysis in R	-
3	No Class	9/6/21	M	Labor Day	-
	6	9/8/21	W	Conditional probability, Law of total probability	5.7 - 5.9
	7	9/10/21	F	Lab 3: Random sampling activity	-

	8	9/13/21	M	Bayes Theorem, Random Variables	5.4, 5.9
4	9	9/15/21	W	Random variables	5.4, 7.1, 7.4
	10	9/17/21	F	Lab 4: Statistical distributions in R	-
	11	9/20/21	M	Hypothesis testing, Binomial test	Ch. 6, 7.2
5	12	9/22/21	W	Goodness-of-fit tests	8.1 - 8.3
	13	9/24/21	F	Lab 5: Hypothesis tests in R	-
	14	9/27/21	M	Poisson distribution	8.4
6	15	9/29/21	W	Analyzing proportions, odds ratios	9.1 - 9.3
	16	10/1/21	F	Exam #1	Ch. 1-8
	17	10/4/21	M	Contingency tables, Normal distribution	9.4, 10.1 - 10.4
7	18	10/6/21	W	Normal Distribution	10.1-10.4
	19	10/8/21	F	Lab 6: Contingency tables in R	-
	20	10/11/21	M	Central Limit Theorem	10.5 - 10.6
8	21	10/13/21	W	Central Limit Theorem, t-distribution and confidence intervals	10.5 - 10.6, 11.1-11.2
	No Class	10/15/21	F	Fall Break	-
	22	10/18/21	M	t distribution and confidence intervals	11.1 - 11.2
9	23	10/20/21	W	One-sample t-test	11.3 - 11.4
	24	10/22/21	F	Lab 7: Normal probability plots, t distribution	13.1, 13.3
	25	10/25/21	M	Comparing two means, unpaired test	12.1, 12.3
10	26	10/27/21	W	Comparing two means, paired test & sign test	12: 2,4 -7; 13.4
	27	10/29/21	F	Lab 8: Inference for the population mean in R	-
	28	11/1/21	M	Experimental and observational studies	Ch. 14
11	29	11/3/21	W	Experimental and observational studies	Ch. 14
	30	11/5/21	F	Exam #2	Ch. 9 - 13
	31	11/8/21	M	Case Study	-
12	32	11/10/21	W	ANOVA	15.1 - 15.2
	33	11/12/21	F	Lab 9: Power of hypothesis tests, NP tests	-
	34	11/15/21	M	ANOVA	15.3 - 15.4
13	35	11/17/21	W	Correlation	Ch 16

	36	11/19/21	F	Lab 10: ANOVA in R	-
14	37	11/22/21	M	Regression	17.1 - 17.5
	No Class	11/24/21	W	Thanksgiving Break	-
	No Class	11/26/21	F	Thanksgiving Break	-
15	38	11/29/21	M	Regression	17.1 - 17.5
	39	12/1/21	W	Regression	17.1 - 17.5
	40	12/3/21	F	Lab 11: Regression in R	-
16	41	12/6/21	M	Logistic Regression	17.6 - 17.9
	42	12/8/21	W	Review Day	-
	-	-	-	-	-

Final Exam: Wednesday, December 15th, 2-3:45pm