THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

SYLLABUS: STAT 2480.02
STATISTICS FOR THE LIFE SCIENCES
SPRING 2025

Course overview:

An introduction to statistical methods commonly used in the life sciences.

Instructor

Name: Dr. Nicole Kelbick
Email: kelbick.1@osu.edu
In-Person Office Location: 304-A Cockins Hall
Office hours:

Day/Time: Mondays from 4:00pm – 5:00pm
Wednesdays from 11:30am – 12:30pm
Tuesdays/Thursdays from 9:30am – 10:30am

Zoom: Check Syllabus tab on Carmen's navigation pane for zoom links and locations.
Other: Arrange an appointment with instructor via email.

Teaching Assistants

Name: Yuanheng Zhang
Email: zhang.15336@buckeyemail.osu.edu
Tutoring hours:

Days/Times: Tuesdays/Thursdays from 11am – 12pm (zoom only)
Zoom: Check Syllabus tab on Carmen's navigation pane for zoom links.

Math/Stat Learning Center (MSLC)

Tutoring is available starting the second week of school in room 132 in Cockins Hall (CH132) and via zoom at various days and times throughout the week. Use the Office Hours link on the Syllabus page on Carmen to see a list of the days, times and relevant zoom links.

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 studying common discrete and continuous distributions 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

The following goals will be achieved by detailed study utilizing example data from the life sciences.

This course satisfies the General Education foundation requirement in *Mathematical and Quantitative Reasoning or Data Analysis* which has the following goals and expected learning outcomes:

Goals: Successful students will be able to apply quantitative or logical reasoning and/or mathematical/ statistical methods to understand and solve problems and will be able to communicate their results.

Expected Learning Outcomes (ELOs): Successful students are able to:

1.1 Use logical, mathematical and/or statistical concepts and methods to represent real-world situations.

1.2 Use diverse logical, mathematical and/or statistical approaches, technologies and tools to communicate about data symbolically, visually, numerically and verbally.

1.3 Draw appropriate inferences from data based on quantitative analysis and/or logical reasoning.

1.4 Make and evaluate important assumptions in estimation, modeling, logical argumentation and/or data analysis.

1.5 Evaluate social and ethical implications in mathematical and quantitative reasoning.

This course also satisfies the Legacy General Education requirement in *Data Analysis* which has the following goals and expected learning outcomes:

Goals: Students develop skills in drawing conclusions and critically evaluating results based on data.

Expected Learning Outcomes (ELOs):

1. Students understand basic concepts of statistics and probability.

2. Students comprehend methods needed to analyze and critically evaluate statistical arguments.

3. Students recognize the importance of statistical ideas.

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,** 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://www.macmillanlearning.com/college/us/contact-us.
  (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 via either a laptop or a tablet.
- This software package is also available as Free Software if a student chooses to download it to a personal computer instead of accessing it through OSC.
    - You can download R for Windows, Mac, and Linux, from the CRAN archive at https://cran.r-project.org.
    - A more user-friendly interface to R is available in the software package **RStudio.** This package is available for Windows, Mac, and Linux and can be downloaded for free from http://rstudio.org. **Note that RStudio requires R to be installed first!**
- **All Ohio State students are eligible for free Microsoft Office 365 ProPlus** through Microsoft's Student Advantage program. Each student can install Office on five PCs or Macs, five tablets (Windows, iPad® and Android™) and five phones.
    - Students are able to access Word, Excel, PowerPoint, Outlook and other programs, depending on platform. Users will also receive 1 TB of OneDrive for Business storage.
    - Office 365 is installed within your BuckeyeMail account. Full instructions for downloading and installation can be found https://ocio.osu.edu/kb04733.

Course delivery

The course will be delivered as a mixture of synchronous and asynchronous formats. **The scheduled course hours will be used for synchronous exams and, possibly, office hours.** Otherwise, the course is primarily self-paced. Each week several lecture videos will be posted on the course website. You are responsible for

- watching the lecture videos
- studying the course material that is assigned each week.
- homework assignments via Achieve (See section on Course Materials)
- laboratory activity using the R statistical software (See section on Course Technology)

Ample time will be given to complete course assignments.

The instructor and teaching assistant will hold weekly office hours via CarmenZoom. Refer to the Syllabus page on Carmen for more detailed info including days, times and a Zoom link. In addition, they will initiate and manage active discussion boards via Carmen. Lastly, information about how and when students can access free tutoring from the Mathematics and Statistics Learning Center (MSLC) will also be provided.

Grading and Assignments

Grades

Category	Percentage
Homework	**25%**
Lab Assignments	**20%**
Exam #1	**17.5%**
Exam #2	**17.5%**
Final Exam	**20%**
Extra Credit	**1%**
Total	**101%**

Keep track of your final score by using the following formula:

Final Grade = 0.25*(100*Your HW Total Points/375) + 0.20 *(100*Your Lab quiz Total Points/210) + 0.175*Exam 1 Percentage + 0.175*Exam 2 Percentage + 0.20*Final Exam Percentage + 0.01*Extra Credit Percentage

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. Work through homework problems on your own in a timely manner in order to perform well in the class.

Labs: Lab exercises using the R software will be carried out approximately once per week. These lab exercises and quizzes will be submitted via Carmen.

Exams: There will be two midterms exams and a final exam. Statistical tables and formula sheets will be provided as needed. Please note the dates of all exams as given in the course schedule located at the end of the syllabus.

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 as soon as possible about 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

Lab assignments will have a 20% reduction in possible points for each day late. Homework assignments will have a similar reduction in points for every day past due. If you know of a conflict ahead of time, please reach out to your instructor to make arrangements regarding a modified due date. Sickness requires a doctor's note. It is worth getting some points if you can!

Grading scale

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

Course Attendance Policy

This course is asynchronous. Exceptions include both midterms and the final exam as well as the Friday of the first week. The latter will be an opportunity to review Lab 1 together since using R will be a new experience for most students.

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 **48 hours on school days (Monday – Friday, excluding university holidays; list of holidays at** https://registrar.osu.edu/academic-calendar/ **.**

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://ccs.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 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

Religious Accommodations

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course

requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

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

See the (tentative) schedules of Topics and Assignments on the following pages.

Course Schedule (tentative)

Week	Date	Day	Topic	Reading
1	Jan 6	M	Methods for Summarizing Data	Ch. 1 - 3
			LAB 1: INTRO TO R SOFTWARE	-
2	Jan 13	M	Probability: Definition and Rules	5.1-5.3, 5.5
			Conditional Probability	5.6 - 5.9
			Law of Total Probability; Bayes Theorem	5.6 - 5.9
			LAB 2: EXPLORATORY DATA ANALYSIS IN R	-
3	Jan 20	M	Martin Luther King Jr. Day	
			Random Variables	5.4
			LAB 3: RANDOM SAMPLING ACTIVITY	-
4	Jan 27	M	Hypothesis Testing	Ch 6
			Binomial Test	Ch 7
			LAB 4: STATISTICAL DISTRIBUTIONS IN R	-
5	Feb 3	M	Goodness-of-Fit Tests	8.1-8.3
			Poisson Distribution	8.4
			LAB 5: HYPOTHESIS TESTS IN R	-
6	Feb 10	M	Analyzing Proportions; Odds Ratios	9.1-9.3
			Contingency Tables	9.4
			Normal Distribution	10.1-10.4
7	Feb 17	M	Central Limit Theorem	10.5-10.6, Ch 4
	Feb 19	W	Exam #1	Ch. 1 - 8
			LAB 6: CONTINGENCY TABLES IN R	-
8	Feb 24	M	t-Distribution and Confidence Intervals	10.5-10.6, 11.1-11.2
			t-Distribution and Confidence Intervals	Ch 4, 11.1-11.2
			LAB 7: PROBABILITY PLOTS and *t*-DISTRIBUTIONS	-

9	Mar 3	M	One-sample t-test	11.3-11.4
			Comparing Two Means: Unpaired test	12.1, 12.3
			LAB 8: INFERENCE FOR THE POPULATION MEAN	-
10	Mar 10	M	Spring Break	-
	Mar 12	W	Spring Break	-
	Mar 14	F	Spring Break	-
11	Mar 17	M	Comparing Two Means: Paired t-test & Sign Test	12.2, 13.1-13.4
			Comparing Two Means; ANOVA	15.1-15.2
			LAB 9: POWER OF HYPOTHESIS TESTS	-
12	Mar 24	M	ANOVA	15.1-15.2
			ANOVA: Multiple Comparisons	15.1-15.4
			LAB 10: ANOVA IN R	15.1-15.4
13	Mar 31	M	Exam Review; Correlation	15.3-15.4
	Apr 2	W	Exam 2	Ch. 9-13
			Correlation	Ch 16
14	Apr 7	M	Regression	17.1-17.6
			Regression	17.1-17.6
			LAB 11: REGRESSION IN R	-
15	Apr 14	M	Logistic Regression	17.9
			Designing Experiments; Case Study	Ch 14
			Designing Experiments; Case Study	Ch 14
16	Apr 21	M	Last day of classes: Review/Catch-Up Day	-
	Apr 23	W	First day of exams	-
	Apr 25	F	Final Exam (2:00pm – 1:45 pm)	

See Schedule of Assignments on next page.

Schedule of Assignments (tentative)

Week	Due Date	Day	Assignment (Due by 11:59pm)
2	Jan 15	Wed	LAB 1 QUIZ (Intro to R)
	Jan 17	Fri	HW: Chapters 1 – 3 (Summarizing Data)
3	Jan 22	Wed	LAB 2 QUIZ (Exploratory Data Analysis)
4	Jan 29	Wed	LAB 3 QUIZ (Random Samples)
	Jan 31	Fri	HW: Chapter 5 (Probability)
5	Feb 5	Wed	LAB 4 QUIZ (Statistical Distributions)
	Feb 7	Fri	HW: Chps 6 & 7 (Hyp. Testing/Binomial Test)
6	Feb 12	Wed	LAB 5 QUIZ (Hypothesis Tests)
	Feb 14	Fri	HW: Chapter 8 (Goodness-of-Fit Tests)
7	Feb 19	Wed	Exam #1: Chapters 1 - 8
8	Feb 26	Wed	LAB 6 QUIZ (Contingency Tables)
	Feb 28	Fri	HW: Chapter 9 (χ^2 Contingency Test)
9	Mar 5	Wed	LAB 7 QUIZ (Probability Plots & t-Distribution)
	Mar 7	Fri	HW: Chapters 4 and 10 (Normal Distribution)
10	Mar 10-14	M/W/F	SPRING BREAK
11	Mar 19	Wed	LAB 8 QUIZ (Inference for Population Mean)
	Mar 21	Fri	HW: Chapter 11 (One-Sample t-tests)
12	Mar 26	Wed	LAB 9 QUIZ (Power of Hypothesis Tests)
	Mar 28	Fri	HW: Chapters 12 and 13 (Two-Sample t-tests)
13	Apr 2	Wed	Exam #2: Chapters 9 - 13
	Apr 6	Sun	HW: Chapter 15 (Anova)
14	Apr 9	Wed	LAB 10 QUIZ (Anova)
	Apr 11	Fri	HW: Chapter 16 (Correlation)
15	Apr 16	Wed	LAB 11 QUIZ (Regression)
	Apr 18	Fri	HW: Chapter 17 (Regression)
16	Apr 21	Mon	Extra Credit HW
	Apr 25	Fri	Final Exam (12:00pm – 1:45pm)