THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

SYLLABUS: STAT 2480
STATISTICS FOR THE LIFE SCIENCES
FALL 2020

Course overview:

An introduction to statistical methods commonly used in the life sciences

Instructor

Name: Nikki Schnitzler
Email address: schnitzler.6@osu.edu
Office hours: Wednesday (12 pm - 2 pm), Friday (10 am - 12 pm)
Office Location: All office hours, and any other needed meetings, will be conducted on Zoom. Links can be found on the course homepage.

Teaching Assistant

Name: Xiaohan Fu
Email address: fu.688@osu.edu
Tutoring hours: Monday (1:50 pm - 2:50 pm, 5:20 pm - 6:20 pm), Thursday (1:50 pm - 2:50 pm)

Graders

Name: Olivia Cleymaet
Email address: cleymaet.2@osu.edu
Tutoring hours: Tuesday (12:40 pm - 1:40 pm, 1:50 pm - 2:50 pm, 3:00 pm - 4:00 pm)

Name: Ruochen Zhao
Email address: zhao.3005@osu.edu
Tutoring hours: Monday (10:20 am - 11:20 am), Tuesday (11:30 am - 12:30 pm, 12:40 pm - 1:40 pm), Thursday (11:30 am - 12:30 pm)

Tutors

Name: John Yannotty
Tutoring hours: Wednesday (3 pm - 4 pm), Thursday (12:40 pm - 1:40 pm, 1:50 pm - 2:50 pm)

Name: Juan Xie
Tutoring hours: Tuesday (4:10 pm - 5:10 pm, 5:20 pm - 6:20 pm), Thursday (4:10 pm - 5:10 pm, 5:20 - 6:20 pm)

Course Coordinator

Name: Dr. Kubatko

Email address: kubatko.2@osu.edu

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 the accompanying homework management system, **Sapling,** 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.

Online Course Delivery

The vast majority of the course will be completed **asynchronously,** meaning that you will be able to study materials and work on assessments according to your own schedule. Each week

several lecture videos, totaling approximately 1.5 hours of lecture, will be posted on the course website. You are responsible for watching the videos and studying the material that is assigned each week. In addition to the lecture videos, weekly assignments, including a laboratory activity using the R statistical software, will be posted on the class website. You will be given ample time to complete the assignments.

The instructor will hold weekly office hours via Zoom. The dates and times will be announced later and posted on the Carmen website. The instructor and teaching assistants will initiate and manage active discussion boards, also via Carmen. Additionally, information about how and when students can access free tutoring from the Mathematics and Statistics Learning Center (MSLC) will be provided.

Grading and faculty response

Grades

Assignment or category	Percentage
Homework	15%
Lab assignments	10%
Discussion board posts	10%
Exam #1	20%
Exam #2	20%
Final exam	25%
Total	100%

See course schedule, below, for due dates

Assignment information

Homework: Required homework problems will be assigned for each topic covered in the course, and solutions will be submitted and graded via carmen. 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 15% 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 10% of the overall grade.

Discussion board posts: At two points during the semester, you will be required to post something on the class discussion board 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. Your first post and set of comments should be completed before the first exam, and your second should be completed before the end of the semester. Each post and set of comments is worth 5% of your grade.

Exams: There will be two 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). All exams will be administered remotely through the carmen course management system.

Formulas for use on the exams: Formula sheets will be provided for all exams. The formulas sheets will be made available prior to the exams to assist in exam preparation.

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.

Full credit on short answer exam problems: You need to show justification for your work on each short answer exam problem. Answers without work will not receive full credit.

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

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

A course instructor or teaching assistant will reply to messages sent via Canvas Conversations 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**.

Live Zoom office hours

Each week, there will be live Zoom 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 (Quizzes, Exams, etc.) or notice any typos in the material, please message us directly via Canvas Conversations – please do not use the Discussion board.

Attendance, participation, and discussions

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

- **Assessments**: You must complete the exams yourself, without any external help or communication. 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.

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. **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)

Class No.	Date	Topics	Reading
1	8/26/20	Introduction, methods for summarizing data	Ch. 1 - 3
2	8/28/20	Lab: Intro to the R software	-
3	8/31/20	Probability	5.1 - 5.3
4	9/2/20	Probability	5.5 - 5.6
5	9/4/20	Lab: Exploratory data analysis in R	-
No class	9/7/20	Labor Day Holiday	-
6	9/9/20	Conditional probability, Law of total probability	5.7 - 5.9
7	9/11/20	Lab: Random sampling activity	-
8	9/14/20	Bayes Theorem, Random Variables	5.4, 5.9
9	9/16/20	Random variables	5.4, 7.1, 7.4
10	9/18/20	Lab: Statistical distributions in R	-
11	9/21/20	Hypothesis testing, Binomial test	Ch. 6, 7.2
12	9/23/20	Goodness-of-fit tests	8.1 - 8.3
13	9/25/20	Lab: Hypothesis tests in R -- part 1	-
14	9/28/20	Poisson distribution	8.4
15	9/30/20	Analyzing proportions, odds ratios	9.1 - 9.3
16	10/2/20	Lab: Hypothesis tests in R -- part 2	-
17	10/5/20	**Exam #1**	Ch. 1-8
18	10/7/20	Contingency tables, Normal distribution	9.4, 10.1 - 10.4
19	10/9/20	Lab: Contingency tables in R	-
20	10/12/20	Normal distribution	10.1 - 10.4
21	10/14/20	Central limit theorem	10.5 - 10.6

22	10/16/20	t distribution and confidence intervals	11.1 - 11.2
23	10/19/20	One-sample t-test	11.3 - 11.4
24	10/21/20	Comparing two means, unpaired test	12.1 - 12.2
25	10/23/20	Lab: Normal probability plots, t distribution	Chapter 13
26	10/26/20	Comparing two means, paired test	12.3 - 12.7
27	10/28/20	Experimental and observational studies	Ch. 14
28	10/30/20	Lab: Inference for the population mean in R	-
29	11/2/20	**Exam #2**	Ch. 9 - 12
30	11/4/20	ANOVA	15.1 - 15.2
31	11/6/20	Lab: Power of hypothesis tests, NP tests	-
32	11/9/20	ANOVA	15.3 - 15.4
No class	11/11/20	Veteran's Day	-
33	11/13/20	Lab: ANOVA in R -- part 1	-
34	11/16/20	Case Study	-
35	11/18/20	Correlation	Ch. 16
36	11/20/20	Lab: ANOVA in R -- part 2	-
37	11/23/20	Regression	17.1 - 17.2
No class	11/25/20	Thanksgiving Break	-
No class	11/27/20	Thanksgiving Break	-
38	11/30/20	Regression	17.3 - 17.5
39	12/2/20	Logisitc Regression	17.6 - 17.9
40	12/4/20	Lab: Regression in R	-

Final Exam: TBD