

STATISTICS FOR THE LIFE SCIENCES

Spring 2019

Instructor:	Andrew Richards	Lecture Time:	WF 10:20-11:15
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Office Hours: T 1020-1120, W 150-250 in Cockins Hall 132; R 900-1000 in Cockins 217.

Required Textbook The Analysis of Biological Data, by M. C. Whitlock and D. Schluter, 2nd edition, customized for OSU, published by Bedford/Freeman/Worth. The online text can be purchased here: <https://www.vitalsource.com/custom/9781319147785>.

Website: Please visit <http://www.carmen.osu.edu/> Check periodically for announcements about the class and other class material.

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 goals: This course satisfies the learning goals of the GEC Data Analysis requirement. In particular, in Statistics 2480 students are expected to understand statistics and probability, comprehend mathematical methods needed to analyze statistical arguments, and recognize the importance of statistical ideas. These goals will be achieved by detailed study utilizing example data from the life sciences.

Course objectives:

- To introduce you to 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
- To enable you to 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
- To enable you to analyze data
 - By constructing and interpreting confidence intervals
 - By constructing and interpreting hypothesis tests
 - By using simple linear regression for bivariate data
- To enable you to understand basic statistical concepts
 - By presenting and applying rules of probability

- By study of the 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
- To enable you to evaluate statistical procedures and summaries
 - By discussing assumptions and conditions for analysis procedures
 - By identifying sources of bias in sampling, experiments, and survey methods
 - By discussing appropriate nature and scope of conclusions for analysis procedures
 - By discussing case studies in the life sciences

Homework: Required homework problems will be assigned for each topic covered in the course, and solutions will be submitted at the start of recitation on the date due. 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.

Quizzes and exams: Short quizzes will be given in approximately half the recitation periods. There will be two in-class exams and a final exam. Statistical tables will be provided as needed. Calculators may be used on the exams and quizzes, but the calculators on cell phones, PDAs, or any other communication device are NOT allowed. Formula sheets will be provided for all exams. The formula sheets will be made available prior to the exams to assist in exam preparation. No formula sheets will be provided for quizzes.

Makeup exams: If you absolutely need a makeup exam and have a valid excuse, please see me *in advance* for the necessary arrangements. A make-up exam must be taken within a week of the missed exam. Exceptions to this policy will be permitted only in extreme situations such as serious injury immediately prior to an exam or severe illness requiring hospitalization.

Full credit on exams, quizzes, and homework: You need to show your justification for your work on each lab, quiz, or exam problem. Answers without work will not receive full credit.

Course attendance policy: You are expected to attend all lectures and recitations. Office hours should not be used for basic instruction of material that has already been covered in class.

Grading Policy: Your final course grade will be based on the following weighting of assessment components: Homework, quizzes, and lab (10% each), Each midterm (20%), Final (30%).

Grading Scale: The minimum course score required to earn each grade, based on the weightings above, is as follows:

A	.....93
A-	.....90
B+	.....87
B	.....83
B-	.....80
C+	.....77
C	.....73
C-	.....70
D+	.....67
D	.....60

Email Correspondence: In order to protect your privacy, all course e-mail correspondence must be done through a valid OSU name.nn account. If you have not activated your OSU email account, you can activate your account at <https://acctmgt.service.ohio-state.edu/cgi-bin/KRB1EntryAdd>.

Academic misconduct: 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 (<https://trustees.osu.edu/rules/code-of-student-conduct/>)

In particular, please note that although students are encouraged to work together on lab assignments and homework, all students must submit their own written work **IN THEIR OWN WORDS**.

Special accommodations: Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 98 Baker Hall, 113 W 12th Ave; telephone 292-3307, TDD 292-0901; <https://slds.osu.edu>.

Tentative Schedule:

Lecture/lab no.	Date	Topic	Textbook Readings
Lab 1	1/7/19	Intro, Pre-test, Random Sampling	
1	1/9/19	Intro	
2	1/11/19	Generating data	Ch 1, 14
Lab 2	1/14/19	Means and Medians	
3	1/16/19	Displaying data	Ch 2
4	1/18/19	Describing data	Ch 3
	1/21/19	MLK Day	
5	1/23/19	Probability basics	Ch 5
6	1/25/19	Conditional probability	Ch 5
Lab 3	1/28/19	Probability, HW1	
7	1/30/19	Total probability and Bayes’s Theorem	Ch 5
8	2/1/19	Distributions, expectations, and variance	Ch 5
Lab 4	2/4/19	Bayes’s Theorem, HW2, Quiz 1	
9	2/6/19	The normal distribution	Ch 10
10	2/8/19	Central Limit Theorem	Ch 10
Lab 5	2/11/19	Exam review, HW3	
	2/13/19	Exam #1	
11	2/15/19	Tests and confidence intervals	Ch 4, 6

Lab 6	2/18/19	Normal distribution, HW4, Quiz 2	
12	2/20/19	T-distribution, CI of one mean	Ch 11
13	2/22/19	Testing one mean	Ch 11
Lab 7	2/25/19	Testing, HW5	
14	2/27/19	Binomial distribution	Ch 7
15	3/1/19	Binomial testing	Ch 7
Lab 8	3/4/19	Binomial distribution, HW6, Quiz 3	
16	3/6/19	Goodness of fit	Ch 8
17	3/8/19	Poisson distribution	Ch 8
	3/11/19	Spring Break	
	3/13/19	Spring Break	
	3/15/19	Spring Break	
Lab 9	3/18/19	Poisson distribution	
18	3/20/19	Odds ratios	Ch 9
19	3/22/19	Contingency tables	Ch 9
Lab 10	3/25/19	Exam review, HW7	
	3/27/19	Exam #2	
20	3/29/19	Paired t-test	Ch 12
Lab 11	4/1/19	Contingency tables, HW8, Quiz 4	
21	4/3/19	Comparing two means, pt. 1	Ch 12
22	4/5/19	Comparing two means, pt. 2	Ch 12
Lab 12	4/8/19	T-tests, HW9	
23	4/10/19	ANOVA	Ch 15
24	4/12/19	Correlation	Ch 16
Lab 13	4/15/19	ANOVA, HW10, Quiz 5	
25	4/17/19	Regression, pt. 1	Ch 17
26	4/19/19	Regression, pt. 2	Ch 17
Lab 14	4/22/19	Post-test and Exam review	

Final Exam: Wednesday, April 24, 10:00-11:45