

Syllabus for Stat 2480: Statistics for the Life Sciences

Instructor: Dr. Kubatko (“Dr. K”)

Office: 219 Cockins Hall

Office Hours: MWF 10:00-11:00am, other times by appointment

Office Phone: 614-247-8846

E-mail: kubatko.2@osu.edu

Course meeting times and locations: Lecture WF 1:50-2:45pm, 180 Hagerty Hall; Recitations M, times vary (3 contact hours per week)

Required Text: 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>.

Software: We will use the R Statistical Software environment for this course. This software is installed in the lab classroom, as well as in most computer labs on campus. It is free software that you can download and install on your personal machines as well (<http://www.r-project.org/>). Your TA will help you learn to use R for statistical analysis during lab, but **you should also expect to put in time outside of lab doing data analysis with R.**

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 conducting and interpreting hypothesis tests
 - By using simple linear regression for bivariate data
- To enable you to 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
- To enable you to 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

Homework: Required homework problems will be assigned for each topic covered in the course, and solutions will be submitted via carmen and graded. 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.

Labs: Lab exercises using the R software will be carried out in approximately half of the scheduled recitation sessions. These lab exercises will be turned in, and will together account for 10% of the overall grade.

Quizzes: Short quizzes (three in total) will be given in recitation. Each quiz will account for 5% of your overall grade.

Exams: 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, but the calculators on cell phones, PDAs, or any other communication device are NOT allowed.

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. 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 (not your lab instructor) for the necessary arrangements. However, you must notify me in advance in such a situation. 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 labs, quizzes, and exam problems: You need to show your justification for or 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. Formal attendance records will not be kept, 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.

Final Grade: Your final course grade will be based on the following weighting of assessment components:

Quizzes 1, 2, and 3 – 5% each	Exams 1 and 2 – 20% each
Lab – 10%	Final Exam – 25%
Homework – 10%	

Grading Scale:

Grades will be assigned according to the scale below, with course components weighted as listed above.

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
< 60 = E

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 (http://studentaffairs.osu.edu/info_for_students/csc.asp).

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.

E-mail 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>.

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 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.

Tentative Lecture and Lab Schedule

Lecture No./Lab	Date	Topic	Textbook Readings
1	8/22/18	Introduction, methods for displaying data	Ch. 1 and 2
2	8/24/18	Numerical summaries of data	Ch. 2 and 3
Lab 1	8/27/18	Lab Exercise 1: Intro to R	
3	8/29/18	Probability	5.1 - 5.3
4	8/31/18	Probability	5.5 - 5.6
No class	9/3/18	Labor Day Holiday	
5	9/5/18	Conditional probability	5.7
6	9/7/18	Law of total probability, Bayes Theorem	5.8 - 5.9
Lab 2	9/10/18	Lab Exercise 2: Sampling	
7	9/12/18	Random variables	5.4
8	9/14/18	RVs, Bernoulli & Binomial dists.	5.4, 7.1, 7.4
Lab 3	9/17/18	QUIZ #1	
9	9/19/18	Binomial test	6.1, 7.2
10	9/21/18	χ^2 goodness-of-fit test	8.2 - 8.5
Lab 4	9/24/18	Problem solving/exam review	
11	9/26/18	EXAM #1	Ch. 1 - 7
12	9/28/18	Poisson distribution	8.6
Lab 5	10/1/18	Lab exercise 3: Categorical data in R	
13	10/3/18	Proportions, Odds Ratios	9.1 - 9.3
14	10/5/18	Contingency Tables	9.4
Lab 6	10/8/18	QUIZ #2	
15	10/10/18	Normal distribution	10.1 - 10.4
No Class	10/12/18	Fall Break	
Lab 7	10/15/18	Lab exercise 4: Normal probability plots	
16	10/17/18	Central Limit Theorem	10.5 - 10.7
17	10/19/18	Confidence intervals for proportions	10.7, 7.3
Lab 8	10/22/18	Lab exercise 5: Central Limit Theorem	
18	10/24/18	Confidence intervals for a single mean, t-distribution	11.1 - 11.2
19	10/26/18	EXAM #2	Ch. 8 - 10
Lab 9	10/29/18	Lab exercise 5 (continued)	
20	11/2/18	Hypothesis tests for a single mean	11.3 - 11.4
21	11/4/18	Confidence intervals for the population variance	11.5

Lab 10	11/5/18	Lab exercise 6: Hypothesis tests in R	
22	11/7/18	Comparing two population means	12.1 - 12.3
23	11/9/18	Experimental Design & ANOVA	Ch. 14, 15.1
No class	11/12/18	Veteran's Day	
24	11/14/18	One-way ANOVA	15.1 - 15.2
25	11/16/18	Correlation	16.1 - 16.3
Lab 11	11/19/18	Lab exercise 7: Fitting ANOVA models in R	
No class	11/21/18	Thanksgiving Break	
No class	11/23/18	Thanksgiving Break	
Lab 12	11/26/18	Problem solving	
26	11/28/18	Regression, R^2	17.1
27	11/30/18	Regression, CI and tests for β	17.3
Lab 13	12/3/18	Regression models in R, QUIZ #3	
28	12/5/18	Course summary & review	All material

FINAL EXAM: Wednesday, December 12, 12:00 - 1:45pm