

Biostatistics I

BIOL 29, BIOL 127, EEES 127

Meeting period: 12

MWF 1010-1115 hr; X-hour: Th 1215-1305 hr

Lecture and X-Hour in 205 LSC

Instructor: Mark McPeck, 022 LSC, office hours; by arrangement – just e-mail me! We can meet in person or on Zoom

This is the first course in Biostatistics. The goal of the course is to educate students on the basics of statistics, including observational data analyses, correlation, regression, comparisons of means, basic analyses of variance, and observational and experimental study design. Modern statistics used by all scientific disciplines today was invented by a group of researchers in the 19th and early 20th centuries to solve biological problems. Therefore, this course will simultaneously teach you everything as though you were living in 1918 when Sir Ronald Fisher invented Analysis of Variance in a paper entitled “The Correlation between Relatives on the Supposition of Mendelian Inheritance” and teach you how to utilize state-of-the-art 21st century statistical software to quicken your analyses of large datasets.

Textbook

Baldi, B., and D. S. Moore. 2022. Practice of Statistics in the Life Sciences. MacMillan Learning.

You can purchase a hardbound version, or you can purchase or rent an eBook version from MacMillan publishing at https://store.macmillanlearning.com/us/product/Practice-of-Statistics-in-the-Life-Sciences-Digital-Update/p/1319244424?_ga=2.196531692.1752202090.1733147130-1692163820.1731944399.

If you would like to purchase a hardbound version but the 2022 version is too steep in price for you, you may be able to find earlier editions at a lower price somewhere online. Earlier versions are certainly acceptable (statistics has not changed since Andre-Marie Legendre and Carl Friedrich Gauss independently invented least squares regression in 1805 and 1809, respectively, and Fisher invented analysis of variance in 1918), but some of the chapters may be out of order to what I list here on the syllabus. If so, go by topic.

Topics and Weekly Schedule

	Topic	Textbook Chapter
Monday, January 6, 2025	No Class	
Wednesday, January 8, 2025	No Class	
Thursday, January 9, 2025	No Class	

Friday, January 10, 2025	Graphing Data	1
Monday, January 13, 2025	Basic Descriptive Statistics of Distributions	2
Wednesday, January 15, 2025	Correlation	3
Thursday, January 16, 2025	Regression	4
Friday, January 17, 2025	Frequency Tables	5
Monday, January 20, 2025	Martin Luther King Jr. Commemoration	
Wednesday, January 22, 2025	Observational and Experimental Studies	6, 7, & 8
Thursday, January 23, 2025	X-Hour	
Friday, January 24, 2025	The Basics of Probability	9
Monday, January 27, 2025	Independence, Conditional Probability & Bayes Theorem	10
Wednesday, January 29, 2025	Normal Probability Distribution	11
Thursday, January 30, 2025	X-Hour	
Friday, January 31, 2025	Binomial and Poisson Distributions	12
Monday, February 3, 2025	Sampling Distributions	13
Wednesday, February 5, 2025	Introduction to Inference	14
Thursday, February 6, 2025	X-Hour	
Friday, February 7, 2025	Inference	15 & 16
Monday, February 10, 2025	Inference About One or Two Population Means	17
Wednesday, February 12, 2025	Inference About Population Variances	
Thursday, February 13, 2025	X-Hour	
Friday, February 14, 2025	Inference about a Population Proportion or Count	18 & 19
Monday, February 17, 2025	Comparing Proportions or Counts From Two Populations	20
Wednesday, February 19, 2025	Chi-Square Goodness of Fit For Contingency Tables	21 & 22
Thursday, February 20, 2025	X-Hour	
Friday, February 21, 2025	Inferences about Regressions	23

Monday, February 24, 2025	Inference for Regression (continued)	
Wednesday, February 26, 2025	Inference for More Than Two Population Means (1-Way Analysis of Variance)	24
Thursday, February 27, 2025	X-Hour	
Friday, February 28, 2025	Multiple Comparisons & Linear Contrasts	
Monday, March 3, 2025	Two-Way ANOVA	26
Wednesday, March 5, 2025	Inference for Comparing Two or More Regressions	28
Thursday, March 6, 2025	X-hour	
Friday, March 7, 2025	TBD	

Data

All the Data used for analyses in this course are in the Files section on the Course Canvas site. All the data sets in the textbook are in the file TextbookDataSets.zip. Download this file to your computer and unzip it. My strong advice to you is to make an organized directory structure for this course on your computer so that you can easily find files. We will be using lots of different datasets, and you will be producing lots of different analysis files, so organization and good file naming habits are also skills you should learn and exercise in this class. New datasets will be posted there as needed.

Software

In this course, you will be doing statistics from scratch using paper/pencil/calculator and using three different software platforms.

For the pencil/paper/calculator analyses, you will need a standard issue calculator. The calculator **cannot** be programmable. Get one that has *ln* and *exp* functions, all the standard arithmetic stuff (i.e., adding, subtracting, multiplying, dividing, negating, etc.), and can store a few numbers at a time. You **cannot** use the calculator app on your phone or computer. You need a real calculator. All exams in this class will be pencil/paper/calculator-only endeavors, and so you need one that you know how to use and fits the above specifications. We do this so that you actually know what computer software is trying to accomplish, and so you can check whether computers in the future are giving you the right answer – i.e., did you tell the computer to do the right thing, and did the person who wrote the code do it correctly.

During the term, you will also use three different software platforms for performing calculations: Microsoft Excel, R, and SAS JMP. Homework assignments will require you to use the software, and after you are done with this class, you will probably primarily use software for statistical calculations. So this class will expose you to the three most popular platforms that biologists use, and after the class is done, you can choose whichever one you want to continue using. In

most periods of this class, students will use their computers for analyses, so please bring your computers charged and ready to go to every class.

I have posted instructions for how to install these three software platforms on your computer in the first Assignment. Please have them installed and ready to work for the first day of class. That Assignment also has links to software guides if you would like to learn more about using R and JMP.

Assessment

Assessment of student performance for the material covered in this course will be done in two mid-term examinations, a final examination, and a weekly group homework assignment.

The mid-terms and final examinations will be written examinations with no computers – just pencil, paper, and a calculator. If you do not know what the computer is doing under the hood, you are not doing statistics. Because the material builds on itself, the exams are all cumulative.

The group homework assignments will be computer and short writing assignments that will assess how students are developing analytical statistical skills and thinking skills for applying various statistical techniques and interpreting the outcomes of analyses. Students will complete each homework in assigned groups. We want you to do homework assignments in groups so that you can help one another in the learning process and develop skills that you will use throughout your scientific career. By submitting a homework assignment, all members of the group are attesting that all members of the group contributed equally to the work in producing the assignment. All members of a group will receive the same grade for a homework assignment.

The two mid-term exams will each constitute 25% of a student's grade, the final will constitute 30%, and the group homeworks will constitute 20%.

Student Needs

Students with disabilities enrolled in this course and who may need disability-related classroom accommodations are encouraged to make an appointment to see me before the end of the second week of the term. All discussions will remain confidential, although the Student Accessibility Services office may be consulted to discuss appropriate implementation of any accommodation requested.

Religious Observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

Academic Honor Principle

As in all of your work at Dartmouth, you are expected to adhere to the highest standards of the [Academic Honor Principle](#).