

# STAT 145: Biostatistics

## Syllabus, Fall 2023

### Course Information.

- 4 semester hours
- Professor: Thomas Scofield
- Text: *Statistics: Unlocking the Power of Data*, 1st Ed., by Lock, Lock, Lock, Lock, and Lock  
*How Not to Be Wrong—the Power of Mathematical Thinking*, by Jordan Ellenberg
- Class meetings: MWF, 9:15–10:20 am, NH 259

### Catalog Description.

An introduction to the concepts and methods of probability and statistics for students in life science programs. Topics include descriptive statistics, probability theory, random variables and probability distributions, experimental design, sampling distributions, confidence intervals and hypothesis tests, analysis of variance, and correlation and regression. This course is an alternative to STAT 143 for students in certain life science programs. It is a required course for biology and public health majors and is open to others. No student may receive credit for both STAT 143 and STAT 145.

The course meets the Mathematical Sciences Core requirement.

**Student Learning Outcomes.** Upon completion of this course, students will be able to

- Explain basic principles of study design, describing their role in answering research questions.
- Produce appropriate graphical and numerical summaries of one or two variables (categorical and/or quantitative).
- Use confidence intervals and hypothesis tests to make inferences about a population based on a sample drawn from the population.
- Choose an appropriate statistical model to analyze data in certain common situations.
- Verify whether underlying assumptions justifying the use of a statistical model are met.
- Critically evaluate presentations of statistical results (for example, in journal articles, media pieces, case studies, etc.)
- Use statistical software in the pursuit of the outcomes listed above.

As this is a core course, we formally expect students to

- Demonstrate understanding of formal mathematical structures and their applications.
- Use mathematical reasoning to solve problems and draw conclusions.
- Identify ways that mathematics and the mathematical sciences shape human perspectives.

**Topics include**

1. Structure and organization of data
2. Sampling and study/experimental design
3. Graphical and numerical summaries of data
4. Basic probability theory
5. Probability distributions, and methods for simulating them; Central Limit Theorem
6. Statistical inference via resampling methods
7. Parameter estimation/confidence intervals, taken from settings such as 1-proportion, 2-proportion, single mean, difference of means, correlation/slope
8. Null-hypothesis significance testing, taken from settings such as univariate (goodness-of-fit, 1-sample  $t$ ) and bivariate data (2-sample  $t$ , chi-square, 1-way ANOVA, model utility)
9. Simple linear regression
10. Multiple regression (if time allows)

<b>Methods of Evaluation.</b>	<u>Assessment</u>	<u>Pct</u>
	Homework assignments	20%
	Quizzes (Sept. 8, Sept. 22, Oct. 11, Nov. 1, and Nov. 15)	50%
	Final (Dec. 11, at 1:30 pm)	30%

**Policies.**

- You are expected to attend class faithfully, in person, ready to go as class begins. When you cannot, regardless of reason, you are responsible for catching yourself up.
- Written work should be neat and well-organized, legibly written (if not typeset using Quarto) in complete sentences, and providing justification in the form of reasoning and mathematical or computational work/plots with shared code. You are expected to be aware of assignments and their due dates. If you are unable to submit work by the due date, you may use one of your allotted late passes in MyOpenMath, adhering to the extra time it provides, until such time that you have used up your passes.
- Unless directed otherwise on specific assignments, you may freely collaborate with classmates as you explore problems. Your write-ups are to be your own, however. Sections grafted from another student's work shall be considered *cheating*, and shall result in a score of zero. Repeated instances shall result in a course grade of "F".
- You are expected to take exams on the dates specified, or provide sufficient cause why you cannot. Family trips, pre-arranged flights, etc. are *not* sufficient.

**Accommodations.** Calvin University is committed to providing reasonable accommodations for students with documented disabilities. Students with disabilities requiring special assistance to facilitate participation in this class are urged to contact Disability Services in the Center for Student Success ([disabilityservices@calvin.edu](mailto:disabilityservices@calvin.edu)) as soon as possible to explore arrangements.

**Exceptions.** I reserve the right to make changes or exceptions to course policies, including those described in this document, either for the entire class or for individuals. The ultimate goal in this course is **learning**, and formal requirements should not unnecessarily stand in the way of that. Thus, if you think that any of the conditions of the course are interfering with learning, please speak with me about this, and we will consider what can be done.