

STAT 145: Biostatistics

Syllabus, Fall 2024

Course Information.

- 4 semester hours
- Instructor: Thomas Scofield
- Texts:
 - *Statistics: Unlocking the Power of Data*, 1st Ed., by Lock, Lock, Lock, Lock and Lock
 - *Social Justice Fallacies*, by Thomas Sowell
- 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, RStudio particularly, in the pursuit of the outcomes listed above.

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

- Apply algorithmic, statistical, and/or mathematical methods to solve problems, broadly defined to find the answers to questions in various domains (as appropriate).

- Articulate limiting assumptions or limitations to the conclusions that can be drawn from the use of these methods and identify appropriate and inappropriate uses of such methods, as informed by a Reformed Christian perspective.
- Identify and use appropriate mathematical and statistical tools for solving a given problem; implementing solutions using RStudio software, but with an ability to explain the algorithms used.
- Represent, interpret, and process information in graphical, numeric, and/or symbolic forms.

Student achievement with regard to these outcomes will be assessed via homework and test questions.

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)

Methods of Evaluation.	<u>Assessment</u>	<u>Pct</u>
	Homework assignments (generally 1-3 per week)	20%
	Midterms (Oct. 2, Nov. 6, and Dec. 6)	54%
	Final (Dec. 16, at 1:30 pm)	26%

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 R Markdown) 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, whether in homework or on a test, shall be considered *cheating*, and shall result in an "F" on that assignment or test. The same goes for unauthorized use of aids, and "work" that you cannot explain (answers produced by Wolfram Alpha or some AI engine, for instance). A second instance 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.
- You are allowed the use of a calculator (not any "smart devices") while taking exams, though you are to limit yourself to the basic calculations of addition, subtraction, multiplication, division, powers and roots. To be clear, if you know how to use statistics-specific features on your calculator, **you are not allowed to use them** to avoid calculations others would need to do by different means.

Statistics and R Study Sessions. This class has a Study Session as part of your formula for success. Adding strategies:

$$\begin{array}{r}
 \text{Attend class} \\
 \text{Utilize Professor Office Hours} \\
 \text{Use the MOM Student Forum} \\
 + \quad \text{Attend Study Sessions} \\
 \hline
 \text{Maximal Grade}
 \end{array}$$



I recommend you attend the Study Sessions for this course early in the semester to prevent falling behind. It is up to you to advocate for yourself. Don't wait until after you get the results from your first test—make sure you are going into that first test with confidence! Sessions are held 7–9 pm on Tuesday and Thursday in NH 261, beginning on Sept. 9, 2024, and offer you 4 hours of help each week. In the Study Sessions, you can do your homework surrounded by others in your class, work together with classmates, and ask questions of the Peer Tutors provided to help you. Ask clear questions, and follow-up as needed; and plan to need to do so when the concepts are most challenging, as tutors aren't there to give you the answers, but to help you learn how to find them! Study Sessions are drop-in, so you can come for 10 minutes or 2 hours, depending on what you need on any given day. Further questions about this, and other, Support Services may be directed to Emily Bosscher (emily.bosscher@calvin.edu) or scan the QR code.

Accommodations. Calvin University is committed to providing reasonable accommodations for students with disabilities. Students with a documented disability should notify a Disability Coordinator in the Student Success Office (HH 227) to discuss appropriate accommodations. If you have an accommodation memo, talk with me early about arrangements, preferably within the first 2 weeks of the semester.

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.