

# STAT 145: Biostatistics

## Syllabus, Fall 2025

### 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.
- Employ data-driven, mathematical, statistical, and/or software models, analyzing their results to answer questions, solve problems, support arguments, draw conclusions, make predictions, and/or identify possible causal relationships.
- 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)

<b>Methods of Evaluation.</b>	<u>Assessment</u>	<u>Pct</u>
	Homework and quizzes	20%
	Midterms (Feb. 19, Mar. 28, and Apr. 28)	54%
	Final (May 5, at 1:30 pm)	26%

**Policies.**

- You are expected to attend class faithfully, in person. When you cannot, regardless of reason, you are responsible for catching yourself up.
- Before class begins, visit the restroom, and prepare yourself for a prompt beginning. Except on specified days, this includes parking your electronic devices.
- If written work is assigned, you are to submit only work composed by you. It should contain not only final answers, but a description of the core calculations or rationale leading

to them. When a question in MyOpenMath calls for a file submission, it should be a single .pdf file (no image files, please), either comprised of scans of written pages (neat, legible, well-organized), or a document produced using Quarto. You **may** collaborate with other students, but after you have hashed out ideas, those must be written up in isolation using your words. **You are not to use AI tools to produce (any) evaluated work attributed to you.** Violations of this policy shall result in a score of zero. Repeated instances shall result in a course grade of "F".

- Course administration (communication, assignments, scores, etc.) is conducted in MyOpenMath (MOM). Check the MOM calendar regularly for assignments, daily readings and learning objectives, and anything else deemed useful. Stay on top of assignments and their due dates. If you should miss a deadline, you have a bank of 12 late passes that, when used, extend a deadline (usually) 72 hours. **You may not use more than one late pass per assignment.** Be a good steward of your late passes as, almost certainly, there will be times when circumstances beyond your control are the cause of lateness.
- 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.
- Basic calculators with only a few functions are supplied by the instructor, serving as the lone computing device allowable during evaluations.

**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.