BMED 2400 – Introduction to Bioengineering Statistics
Fall 2026
Lectures: TBD

Instructional team contact information:

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Office hours: TBD

Course Teaching Assistants:

Office hours: TBD

TBD

Course structure:
Course webpage: We will use Canvas® for communication and posting information. Please check canvas regularly, we will post EVERYTHING course related there.

Table of Contents

Schedule

Note: All assignments must be submitted via Canvas unless otherwise noted.

Wk	Day	Date	Topic	Reading	Assignment due (topics)
1			Syllabus, Course Intro	chapter 1-2	
1			Types of data & sampling	N/A	
2			Descriptive statistics	chapter 5 and chapter 7.1-7.4	Homework 1 (Types of data & sampling, data management)
2			Probability	chapter 3	
3			Bayes formula, theorem, and implications	chapter 3.7-3.9	Homework 2 (Probability, Descriptive statistics)
3			PSS: Bayes formula, theorem, and implications		
4			Sensitivity and Specificity	Chapter 4	Homework 3 (Bayes formula, theorem, and implications)
4			PSS: sensitivity/Specificity	Chapter 4	
5			1st Exam Review		Homework 4 (Sensitivity and Specificity)
5			First mid-term		Exam 1 (HWs 1 - 4)
6			Statistical distributions	section 5.5 & chapter 6	
6			Hypothesis testing, degrees of freedom	chapter 9	
7			The t-Test, research questions, variations	chapter 10	Homework 5 (hypothesis testing, statistical distributions)

7			The t-Test, research questions, variations	chapter 10	
8			Z-tests		Homework 6 (t-test)
8			PSS: Z-tests	chapter 11	
9			ANOVA	chapter 11	Homework 7 (Z-tests)
9			ANOVA	chapter 11	
10			2nd Exam Review		Homework 8 (ANOVA)
10			Second mid-term		Exam 2 (HWs 5 - 8)
11					
11					
12			Non-parametric tests	chapter 17 and 18	
12			Goodness of fit tests	chapter 12	
13			Correlation and Regression	chapter 13 and 14	Homework 9 (Goodness of fit and nonparametric tests)
13			Correlation and Regression	chapter 13 and 14	
14			Logistic and/or multiple regression	chapter 15 and *section* 14.6	Homework 10 (Correlation and Regression)
14			Logistic and/or multiple regression		
15			Sample Size, effect size, and Power		Homework 11 (Logistic and multi regression)
15			Confidence and prediction intervals		
16			Presentation Day		Homework 12 (Sample Size, effect size, and Power)
Exam			Final Exam (2:40 – 5:30 pm)		Exam 3 (HW 9-12)

Technology and platforms:
The use of following technologies and platforms are **required** during our class:
Canvas: We will use canvas for official announcements, direct communication, sharing assignment files, test files, sharing supplementary materials, posting and submission of all graded assignments, grade reporting, and sharing of links to instructional videos and demo session recordings. Please make sure you check the Canvas website and familiarize yourself with all of its features.

Point Solution: You are expected to participate all during-class activities. Often this will include participating in a "Point Solution" quiz or survey. You can access Point Solution both from your canvas website and the application. You should create an account or activate your existing account in this application, before the first day of classes. When the instructors ask you to participate in a class activity, you should enter the session code in your application and then participate in the class activities.

Microsoft Teams: MS Teams is the platform that we are using for our office hours. And in case if we want to have an online synchronous session.

Browsers and internet connection: You need to make sure you have internet connection during demo sessions and PSS sessions. Since some of the activities require your fast response, make sure you contact your TAs the moment you face any difficulties. You must use Chrome when using HonorLock, and you must install the HonorLock Chrome extension. In addition, we've found Chrome as the most reliable browser when it comes to work with the technologies described here.

Textbooks:
Required: Engineering Biostatistics: An Introduction using MATLAB
URL for a FREE PDF copy: http://statbook.gatech.edu/statb4.pdf

Software support:
The course will require the use of Microsoft Excel or another spreadsheet tool that allows iterative solutions (PRIMARY) and MATLAB (SECONDARY).

Prerequisites: (Undergraduate Semester level MATH 1501 Minimum Grade of C or Undergraduate Semester level MATH 1511 Minimum Grade of C or Undergraduate Semester level MATH 1552 Minimum Grade of C) and Undergraduate Semester level CS 1371 Minimum Grade of D

Course description:
This course is a biomedical engineering specific introduction to statistics, probability, and inference. It is also an introduction to the related skills that are needed to employ statistics, probability, and inference in biomedical engineering contexts. It is primarily concerned with the use of statistical tools for modeling, analysis, and (MOST IMPORTANTLY) making sense of data in biomedical engineering research. The primary focus is practical and applied rather than theoretical but will be theoretical when such understanding is necessary to properly understand the methods covered. Basically, it is an engineering course. Closer to 2110 and 2250 than to whatever flavor of calculus you took.

Concepts list

1. Types of data and Sampling
2. Descriptive statistics
3. Probability and distributions
4. Bayes theorem and formula
5. Sensitivity, specificity, and test optimization
6. Fundamentals of hypothesis testing and degrees of freedom
7. T-tests
8. Z-tests
9. ANOVAs
10. Non-parametric tests
11. Goodness of fit tests
12. Correlation and Regression
13. Logistic regression
14. Sample size, effect sizes, and power
15. Confidence and prediction intervals

Course learning objectives:
Core
- Translate real life inferential problems to proper statistical models.
- Use Bayes theorem in the context of medical testing: sensitivity, specificity, positive predicted value, and ROC curves.
- Identify and employ basic probability tools to assess frequencies or likelihood of occurrence of independent and dependent events.

- Perform the following statistical test: T-test, ANOVA, Z-Test, Regression, Correlation, Multiple Regression, Non-parametric tests, Chi-square tests
- Formulate, formally state, and identify appropriate tests to serve research goals
- Summarize and describe data, identify parameters and calculate their point and interval estimates.
- Make meaning from statistical tests

Complementary
In addition to the core learning objectives, we have a set of 'complimentary' learning objectives that round out the core learning objectives to ensure comprehensive preparedness of young engineering-statisticians. These include:

- Read, interpret, and validate statistical analysis in BME papers and media
- Prepare professionally appropriate reports on data analysis
- Make and execute data collection and analysis plans
- Work effectively in teams

Policies and expectations for our learning environment:
This section details the overarching policies, expectations, and guidelines we ask all members of the course community to participate in. They apply equally to the every member of the instructional team and all of the students.

Disability and accommodations
We all need some accommodations in education because we each learn differently. If you are a person with circumstances that you believe may affect your learning experience (e.g., visual, hearing, learning disabilities) please let me know as soon as possible so that we can collaborate on appropriate accommodations. You should also contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your needs and to obtain an accommodation letter.

Collaboration and group work policy
Each assignment is explicitly indicated as either collaborative or individual work. If you are unclear about the definitions or boundaries of academic misconduct in regards to individual or academic work, it is explicitly your responsibility to seek clarification in advance.
Individual assignments should be your own work. What that means is that the intellectual output should be yours and yours alone, in your words, completed by you and you alone. On individual assignments, learning or getting help from peers is acceptable – submitting others' (in or out of this class) work, in part or whole, as yours is not. If, under this policy, you have questions on or need help with appropriate citation of others' work, just ask.
For collaborative assignments, we expect all group members to participate in the intellectual labor of assignments. Students choosing not to effectively and meaningfully collaborate on such assignments should not expect to receive credit for the work of their teammates.

Academic integrity
Academic misconduct, including plagiarism and completing others' work for them, hurt you and your classmates and will not be tolerated in this course. Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards and Tech's Academic Honor Code (http://www.catalog.gatech.edu/policies/honor-code/).
As a member of the Georgia Tech community, we assume that you have read and understood the Academic Honor Code. By rule, we am required to report any student suspected of cheating or plagiarizing on a quiz, exam, or assignment to the Office of Student Integrity, who will investigate the

incident and identify the appropriate penalty for violations. Specifically, we will submit any cases where there is significant evidence of academic misconduct and am then constrained to the results of that process.

Examples of honor code violations:

- Using unauthorized notes or "cheat sheets" during an exam.
- Looking at another individual's exam while the test is in progress.
- Communicating electronically (e.g., texting or surfing the web) during any exam.
- Uploading to, or using course material from, content sharing websites such as coursehero.com
- Completing a problem (HW or any other kind of problem) using a solution key prepared by someone else, regardless of where the solution key is acquired: from the publisher's website, from the course's CANVAS website, from a previous student, from content sharing websites, or from a textbook. Homework should be your original work.

Attendance Policy

Attendance and participation in class is expected. While we will post slides, they will not include any work on the board or the performance of any examples in class. Further, your presence in class not only supports your own learning and growth, it supports the learning and growth of your course peers and instructor as well. Every study that we are aware of shows a strong correlation between course attendance and final grade. You will learn in this course that correlation is not causation, but it does point a flashing red arrow towards what may be the cause.

However, we also believe in treating you as professionals – because you are. That being said, we will use multiple factors, including daily clicker questions and engagement in in class activities, to assign a grade for class participation. Part of your role in the course is helping your peers learn – both as a part of our community and because it helps you learn as well. That necessitates active engagement.

Finally, out of fairness to your classmates, we are hesitant to reschedule in class assignments such as tests. However, we are also empathic about the things that happen in your life. If you must miss an assignment please let me know as soon as possible so we can jointly work out a plan. It is helpful if you tell us in advance, and even more helpful if you propose a plan on how you want to make up the assignment. In the end, unless overridden by university policy, the decision is mine on how to address missed assignments. However, we are sympathetic.

Emergency Procedures

In the event of a fire alarm, everyone must immediately evacuate the building until given the all clear by the fire department. In the event of an all hazards siren, everyone should immediately seek shelter in a safe location. In both cases, you should solicit additional clarifying information by all possible means: Georgia Tech Homepage, TV, radio, email, etc. Additional information about campus preparedness is available at http://www.gatech.edu/emergency/

In the event of a major campus emergency, including severe weather, course requirements, deadlines, and grading totals we may need to revise the course. If that happens, we will work together to balance our learning objectives, constraints, and students' needs. Information about course changes related to campus emergencies will be made available via Canvas and will also be distributed via email as soon as is practical.

How to succeed in this course

The creation of the learning environment that we hope to have requires a set of expectations for how both the instructors and students will act. Therefore, we hope that you, and we, will do the following 5 shared things:

1. Attend and fully engage in all classes

2. Come prepared for class
3. Be honest about what you understand, what you do not, and what you need help with
4. Provide a supportive environment that fosters mutual success of everyone in our classroom
5. Honor and respect each other and each other's interests

Based on my prior experience as an engineering student, engineer, and professor, I feel it useful to list some techniques that you may find helpful to succeed in the course I have found that the most successful students:

- Engage with the wide range of resources available to you on campus, including the Writing Center, Tutoring Center, and Academic Advising Center. (i.e., get help when you need it)
- Carefully document your work, thinking, and activities so that they become a resource when creating the deliverables for your assignments (i.e., keep detailed notes as you work)
- Start all deliverables early and create drafts that are thoughtful and intentional to structure your work and documentation (i.e., keep the goal in mind). This will allow you to step away from and come back to assignments to ensure they are complete and high quality.
- Think deeply about their intended learning outcomes of the course and their relation to your activities (i.e., remember why we are here)
- Be open to new ways of thinking about learning and thinking.

Office hours

It is important to us that you have a positive learning experience in this course. Your regular and active participation in office hours is a great way to help make sure this happens. Office hours are a scheduled opportunity for you to meet with your professor or teaching assistants one-on-one, or in a small group setting, to discuss course topics and concepts. In fact, feel free to chat with us about *anything* that interests you or concerns you. We want to help you have a good experience in this course and as a student at Tech – please give us the opportunity to do so by attending office hours!

Miscellaneous

- Parental inquiries. Based on the Family Educational Rights and Privacy Act (FERPA) (http://www.ed.gov/policy/gen/guid/fpco/ferpa/index.html), the performance of students in class and their grades cannot be legally discussed with the parents of undergraduate students.
- Email etiquette. Please only use your official Georgia Tech e-mail account. To help ensure a speedy response to your email, please use a subject line with the below format: BMED2400- *your name - reason why you are writing*.
- If any class meetings conflict with a religious event, please let us know during the first week of classes

Assessments in this course

In an attempt to reduce the impact of any one assignment on your grade, we have spread out your grade over multiple assignments. This has its positives and negatives – e.g., we are conscious of keeping the workload of each individual assignment reasonable. The course assignments are as follows:

Assignment	Count	% Total	Notes
Homework	12	10%	Homework will typically be assigned on a Tuesday and due the following Tuesday. Will usually require Excel and/or MATLAB. They will each be scored out of 10 points.
Tests	3	75% (25% each)	Midterms will cover content from the previous module (see colors in the schedule). Tests are open books, open notes, and open internet, but not open classmates. They will each be scored out of 100 pts.
Project	1	10%	The project will consist of two parts. Both are team assignments.

Course participation	N/A	5%	During the synchronous sessions, you will be asked to participate in some point solution surveys or Qualtrics surveys.

Grading

Homework grading scale

Every worked homework problem will be graded on a 3-point scale as detailed below. The scale is meant to highlight the three key components of working with statistical data. This section outlines the grading scheme and describes the components.

Setup – The first part of any statistical work is preparing yourself to do the math. In my experience, this is the area where most mistakes are made. During the setup you need to figure out precisely what question you are asking, what data you have or need, what analyses you need to run, what your dependent and independent variables are, and what assumptions you are making implicitly and explicitly.

Calculation – With the setup complete, you need to actually run your analyses properly. That includes identifying correctly the formulas, selecting the right options for any formulas, calculating the results, and reporting the results. That includes things like arithmetic but also includes things like reporting the correct number of significant digits.

Interpretation – With the setup and the calculation in hand, you need to make sense of what you have found out. That includes synthesizing the results and communicating them to whoever is reading your assignment – e.g., stating whether a hypothesis was accepted or rejected or suggesting a decision based on your results. Just getting the calculation right isn't the end of the problem, you have to articulate what the answer means. Most importantly, you must draw the conclusions from your calculations and your setup.

Pts.	**Setup**	**Calculation**	**Interpretation**	**Notes**
3	Correct	Correct	Correct	To get 3/3, you really need to get all three components correct. Whether your calculation is by hand, in excel, or in Matlab you have to set the problem up right, do the correct math correctly, *and* then properly interpret your results. Mistakes at any of these phases can, and has, created major problems in the use of statistics.
2	Correct	Correct	Incorrect	Option A for a 2/3 involves getting the setup and answer closely approximate to our answer (e.g., 4.24 instead of 4.22) but interpreting it incorrectly.
		Incorrect	Correct	Option B for a 2/3 involves getting the setup right but the calculation wrong. However, if you provide a correct interpretation of <u>your calculated results</u>, you still get 2 points.
1	Correct	Incorrect	Incorrect	If you get the setup right you are on the way to getting the whole problem right. You get a point

				for that, but need to get at least one of the other two pieces right to get more points.

A final note on homework. You should expect most homework to include a small thing – such as a formula – that was not covered in class. That is intentional and by design. That content will not be on the test, but the process is designed to help you practice your research skills.

Final Grade Scale

Your final grade will be converted to a letter grade using the following formula and table. Grades are individual and based on mastery – rather than relative or a 'bell curve'. In plain English, that means that there are no limits on how many people can earn a specific grade. Theoretically, and hopefully, everyone can get an A in the course.

Grade	**Minimum Final**
A	90 %
B	80 %
C	70 %
D	60 %

Calculated final averages will be rounded at the first decimal place to the nearest integer value. Because portions of your grade are based purely on submitting work on time, because there is the opportunity to earn up to extra credit, and because of the test revisions, we will not entertain requests to further roll up grades.

Grading detritus: Late assignments, re-grading, etc.

- Each homework will have 1 point out of 10 points that are awarded for turning the assignment in on time and making a sincere attempt at each problem.
- The only assignments that will be accepted 'late' are homework. Late homework will be accepted up to 24 hours later than it is due. If turned in late, you will lose 1 point out of 10 points.
- **Regrades:** The number of points awarded for each part of an assignment is decided by the instructors. However, if you believe, using the grading rubric designed by the instructors, that you should have been awarded more points than you were, please submit a typed regrade request to the person who graded the assignment within one week after receiving the graded assignment. Please do not discuss regrade requests orally with your TA or instructor. Instead, take the time to carefully compare your graded work to the published solutions and grading rubric. Then, if you find a mistake has been made and your overall grade is lower than it should be, please by all means write up your observations and submit the typed written request. Please know that whenever an assignment is regraded, the entire assignment is regraded. These processes are to help ensure the regrade process results in a fair grade.