STA 310 Mathematical Statistics I (3 units)
Tuesdays and Thursdays, 12:15 - 1:45 pm

Dr. Esther Lee
Email: elee@calbaptist.edu
Office Location: James 479
Office Hours: TBA

"Not that I have already obtained all this, or have already arrived at my goal, but I press on to take hold of that for which Christ Jesus took hold of me." (Philippians 3:12, NIV)

Course Description: The first course of a two-semester sequence (Mathematical Statistics I and II) systematically develops the theories of probability and statistics. This course presents an introduction to probability and mathematical statistics for students who already have some mathematical and statistical background. It is intended for a one-year sophomore or junior-level undergraduate probability theory and mathematical statistics course. The first semester is required for BA and BS statistics majors of all concentrations.

Prerequisite(s): MAT 245 & EGR 120, 121, or STA 144 (Note: a minimum grade of C is required to progress to COURSE).

Course Objectives: The primary goal of this course is to provide a calculus-based theoretical foundation for descriptive statistics, probability models, and their applications, with an emphasis on integrating computer programming. Specifically, students will learn and apply fundamental concepts of probability models, random variables, and their distributions through both theoretical analysis and practical implementation using programming tools.

Computer software: We will use the free, open-source package R/RStudio for all statistical analysis and programming in this course. All instruction, examples, and assignments will be based on R. However, students who are already proficient in Python may use it for their individual projects or assignments, provided they can meet the same learning objectives. In addition, we will incorporate ChatGPT as a support tool to assist with debugging, refining code, and exploring programming solutions.

Textbooks:

- **PennState Online Course (PS)**, STAT 414 Mathematical Statistics
- **Probability, Statistics, and Data: A Fresh Approach Using R (PSD)** written by Darrin Speegle and Bryan Clair
- (Extra) OpenStax Introductory Statistics by Barbara Illowsky *et al.*

Optional textbooks:

- "Probability and Statistical Inference" By *Hogg, Tanis, and Zimmerman*, 9th Edition, Pearson; **ISBN-13:** 978-0321923271 (**Strongly recommended**)
- "Introduction to Mathematical Statistics" By *Hogg, McKean, and Craig*, 7th Edition, Pearson
- "Mathematical Statistics with Applications" By *Wackerly, D., Mendenhall, W., and Scheaffer, R.*, 7th edition, Duxbury; **ISBN-13:** 978-0495110811

Tentative Course Outline

Week	Contents	Readings	Homework	Due
1	Data in R	PSD 1.1 – 1.10		
2	Sample spaces; events; probability; simulations	PS 1-2; PSD 2.2	PS 2.1 – 2.11; PSD 2.9 – 2.14	
3	Conditional probability; Independence; Bayes rule	PS 4-6; PSD 2.3	PS 4.1 – 5.9; PSD 2.26, 2.27	
4	Review on Tue; **Test 1** on Thu			HW 1
5 - 6	Random variables (RV); E(X) and Var(X); Moment generating functions	PS 7-9; PSD 3.1 – 3.2	PS 7.1 – 7.6, 8.1 – 8.20; PSD 3.4 – 3.7, 3.11 – 3.13	
7	Bernoulli; Binomial	PS 10-11; PSD 3.3	PS 10.1 - 10.7; PSD 3.19 – 3.20, 3.26 – 3.33	
8	Geometric; Negative Binomial; Poisson	PS 11-12	PS 11.2, 12.1 - 12.3; PSD 3.37, 3.38, 3.40	
9	Review on Tue; **Test 2** on Thu			HW 2
10	Continuous RV; Uniform	PS 13 – 14	PS 14.2 (+ revisited), 14.3 (+ revisited), 14.4	
11	Normal	PS 16.1 – 16.6	PS 16.2 (+ revisited), 16.3	
12	Random Functions associated with Normal	PS 26.1 – 26.3	PS 26.1 – 26.6, 27. 1 – 27.4; PSD 4.20 – 4.25, 5.21 – 5.23	
13	Thanksgiving			
14	Review on Tuesday; no class on Thu			HW 3
15	no class on Tue; **Final** on 12/9 (Tue), 9:30 - 11:30 am			

Course Policies:

General

- Lecture slides/notes will be available to you on the Blackboard as PDF documents. However, students are responsible for taking notes.
- Study groups are strongly recommended. I do not believe that anyone can be successful in the course if s/he studies independently.

Class Etiquette

- Although situations arise making it impossible for you to arrive on time and/or requiring you to leave early, please remember that late arrivals and early departures can be quite disruptive to your classmates.

- I have no objections to students eating during class.
- I do not allow audio/visual recording of lectures and presentations in class.
- Questions during class are welcomed and encouraged.

Netiquette
"Netiquette" is network etiquettethat is, the etiquette of cyberspace. And "etiquette" means the forms required by good breeding or prescribed by authority to be required in social or official life. In other words, netiquette is a set of rules for behaving properly online. Virginia Shea has defined the issues and discussed them at length in her book **Netiquette**. You may want to review a brief summary of her "Core Rules of Netiquette". This resource won't answer all netiquette questions, but it will provide some basic principles to use in solving many netiquette dilemmas.

AI Policy and Acknowledgement Requirement: Part of a college education is learning content, but an equally important part is developing skills. The proper use of artificial intelligence (AI) tools is a valuable skill in today's rapidly changing worlda world where you may even wonder, "Will AI take my job?" The truth is, there will always be a need for people who can think critically and use digital tools to support, extend, and enhance their thinking. There will not always be a need for people who simply duplicate or regurgitate what a tool produces without understanding it. In this class, you are welcome to explore and use digital tools, including AI, to assist with your learning. However, the following rules apply:

- **Transparency:** If you use AI in any assignment, you must clearly state how and where it was used.
- **Original Understanding:** All work submitted must demonstrate your own comprehension. You are responsible for explaining or reproducing any results without AI assistance if asked.
- **Appropriate Use:** AI tools may be used to help with idea generation, formatting, coding assistance, or practice problems, but not to bypass the learning process. Using AI to submit unverified, copied responses will be considered academic dishonesty.
- **Accountability:** You are fully responsible for the accuracy, quality, and integrity of all work submitted, regardless of whether AI was used.

Grade Distribution:

	Points
Attendance	100
Homework ($\times$ 3)	60
Test 1	100
Test 2	100
Final	150
Total	510

Grade	Percentage (%)	Interpretation of Grade
A	93-100	Outstanding
A-	90-92.99	Exemplary
B+	87-89.99	Superior
B	83-86.99	Above Average
B-	80-82.99	Somewhat above average
C+	77-79.99	Average, but well done
C	73-76.99	Meets minimum requirements
C-	70-72.99	Requirements barely met

- **Attendance:** Attendance is expected and will be taken in each class.
  - Class participation and active learning are important aspects of this class, so your engagement is critical to your success regardless of modality/delivery.
  - Please check your attendance on InsideCBU on Fridays.

- **Attendance Policy:**
  - If a student misses more than **30% of class sessions** (i.e., more than 9 out of 30 total meetings based on a 15-week schedule with 2 classes per week), the final course grade will be recorded as an **F** automatically, regardless of performance on assignments or projects.
  - If a student misses more than **20% of class sessions** (i.e., 6 – 8 classes), a **penalty of 20 points** will be deducted from the total course points.
  - If a student misses more than **10% of class sessions** (i.e., 3 – 5 classes), a **penalty of 10 points** will be deducted from the total course points.
- **Health-related Absences:** In the event of having a contagious illness, email me about your absence as soon as you are able so that appropriate accommodations can be explored. Please note that **documentation** for "medical" absences **is required**.
- Please note that absences for reasons other than medical **will not** be excused, and there will be a penalty for such absences.
- Students are responsible for all missed work, regardless of the reason for absence. It is also the absentee's responsibility to get all missing notes or materials.
- **Bonus Quiz:** There will be pop-up bonus quizzes given only during class. No make-up opportunities or late submissions will be accepted. Please arrive on time.
  - If you arrive late to class, you will not be allowed to take the bonus quiz.
  - If you are absent, including for excused reasons, you will not receive bonus points..

- **Homework:** The purpose of these assignments is to help students realize instantly what parts of the current statistical programming they have mastered and what parts are unclear.
  - There will be a total of **three homework assignments**, each worth **20 points**, for a total of 60 points across the semester.
  - Please make sure to complete **all assigned problems exactly as specified**.
  - Homework will be **due on Sundays 6 PM** and must be submitted as a **handwritten copy**, unless otherwise specified.
  - Each homework will be graded on a qualitative scale: **Excellent (20-18)**, **Good (17-15)**, **Satisfactory (14-11)**, **Needs Improvement (10-8)**, and **Incomplete (7-0)**.
  - Late or partial submissions may receive reduced credit (**-2 per day**).

- **Tests:** There will be two midterm exams and a comprehensive final exam.
  - Bring a calculator if needed. **No Internet-enabled devices (including your phone)** will be permitted to perform calculations.
  - **2-pager crib sheet:** Tests will be closed book, but the two-page (e.g., front-back or front-front) crib sheets will be allowed.
  - **Midterm Retake Policy:** A retake of the midterm exam may be considered **only at the discretion of the instructor** in special circumstances (e.g., technical issues, exceptional hardship). If approved, the retake score may be capped.
  - **No Makeup/Retake Final:** There will be **no makeup opportunity for the final exam**. Students must plan to take the final at the scheduled time (i.e., 12/9 Tue, 9:30 - 11:30 AM).

Notes:

1. The instructor reserves the right to adjust the grading procedure.

2. The cutoff points may vary depending on the difficulty of the exams. Also, borderline cases may receive a + or −, and grades may be lowered due to attendance and/or class participation.
3. Grades may be posted throughout the course on Blackboard or via email. It is the student's responsibility to check that all grades posted are correct.
4. Any point discrepancies or questions must be addressed before the next exam and as of the last day of instruction.

Academic Honesty Policy: In addition to skills and knowledge, CBU aims to teach students appropriate Ethical and Professional Standards of Conduct. The Academic Honesty Policy exists to inform students and Faculty of their obligations to uphold the highest standards of professional and ethical integrity. All student work is subject to the Academic Honesty Policy. Professional and Academic practice provides guidance about how to properly cite, reference, and attribute the intellectual property of others. Any attempt to deceive a faculty member or to help another student do so will be considered a violation of this standard.

- Instructor's Intended Purpose: The student's work must match the instructor's intended purpose for an assignment. While the instructor will establish the intent of an assignment, each student must clarify outstanding questions of that intent for a given assignment.
- Unauthorized/Excessive Assistance: The student may not give or get any unauthorized or excessive assistance in the preparation of any work.
- Authorship: The student must clearly establish authorship of a work. Referenced work must be clearly documented, cited, and attributed, regardless of media or distribution. Even in the case of work licensed as public domain or Copyleft, (See: http://creativecommons.org/) the student must provide attribution of that work in order to uphold the standards of intent and authorship.
- Declaration: Online submission of, or placing one's name on an exam, assignment, or any course document is a statement of academic honor that the student has not received or given inappropriate assistance in completing it and that the student has complied with the Academic Honesty Policy in that work.
- Consequences: An instructor may impose a sanction on the student that varies depending upon the instructor's evaluation of the nature and gravity of the offense. Possible sanctions include but are not limited to, the following: (1) Require the student to redo the assignment; (2) Require the student to complete another assignment; (3) Assign a grade of zero to the assignment; (4) Assign a final grade of "F" for the course. A student may appeal these decisions according to the Academic Grievance Procedure. (See the relevant section in the Student Handbook.) Multiple violations of this policy will result in a referral to the Conduct Review Board for possible additional sanctions.

Conduct: All students will be expected to abide by the CBU Title IX policy. If you fail to abide by these rules, you will be asked to leave the classroom or be removed completely from the class. A further list of policies can be found on the InsideCBU website at https://calbaptist.edu/about/title-ix/.

Students with Disabilities: Students who have qualified disabilities and wish to arrange the appropriate accommodations, in addition to the general academic support services coordinated by the Academic Resources Center, must identify themselves to the Director of Disability Services. Disabled students who wish to arrange appropriate accommodations must complete and submit a Request for Accommodations form and provide recent (not older than 3 years) diagnostic test results.