STA 505: Mathematical Statistics I

STA 505	**SYLLABUS AND COURSE POLICIES**	Fall 2021

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Office Hours: Tuesday noon-2pm
Wednesday 3-5pm
Thursday 3:30-4:30pm

Course Web Page: This course has a D2L website. I will be using it quite heavily
so please make sure to check it often!

Lectures: Section 01 - Th 5:45-8:30, 25 University Ave. 120
Section 91 - Online

Text: *Mathematical Statistics with Applications*, **7th edition**
Wackerly, Mendenhall and Scheaffer (required but free pdf on D2L)

OVERVIEW & COURSE DESCRIPTION

In recent years, the growth of statistics has made itself felt in almost every phase of human activity. Statistics no longer consists merely of the collection of data and their presentation in charts and tables (descriptive statistics) - it is now considered to encompass the science of basing inferences on observed data and the entire problem of *making decisions in the face of uncertainty* (inferential statistics). This covers considerable ground since uncertainties are met when we flip a coin, when a drug company evaluates the efficacy of a new drug, when an actuary determines life expectancy, when a quality control engineer accepts or rejects manufactured products, when a teacher compares the abilities of students, when an economist forecasts market trends, when a newspaper predicts an election, and so forth.

The purpose of this course is to give you an introduction to probability theory and probability distributions. The material presented will not only serve as a basis for the following course (STA 506), Mathematical Statistics II, but is extremely useful and fascinating on its own.

COVID-19 CLASSROOM PROTECTION REQUIREMENTS

We, as a community of educators and learners, should work together to create a culture that protects our most precious resource: each other. As such, it is the expectation of all members of the University community to continue to do their part to protect the health and safety of others. In our classrooms where the universitys primary function is carried out, the following protocols are being implemented:

- Unless otherwise directed by the faculty member, students must wear a cloth or disposable face mask that covers both the nose and mouth the entire time they are in class.

- Face shields and gaiters do not meet the universitys mask requirement.

- Eating and drinking in the classroom are only permitted if they are medically necessary.

- Please work with the Office of Services for Students with Disabilities to notify the university and your professors of this necessity.

We want you to succeed in this class, but we will have to ask you to leave if you do not follow these guidelines, so please make the most of this opportunity and help keep our campus safe.

Student Learning Outcomes for the Masters of Science in Applied Statistics:

1. Demonstrate an understanding of probability and statistical inference, including the fundamental laws of classical probability, discrete and continuous random variables, expectation theory, maximum likelihood methods, hypothesis testing, power, and bivariate and multivariate distribution theory.

2. Demonstrated the ability to apply the elementary methods of statistical analysis, namely those based on classical linear models, categorical methods, and non-parametric ideas to perform data analysis for the purposes of statistical inference.

3. Demonstrate proficiency in the effective use of computers for research data management and for analysis of data with standard statistical software packages, particularly SAS.

4. Learn to develop and critically assess design of experimental studies and the collection of data.

5. Apply one or more methods of statistical inference to a particular area of interest, particularly the program in the elective concentration.

6. Gain practical experience in statistical consulting and communicating with non- statisticians, culminating with interaction with research workers at a local company as part of the internship practicum.

COURSE OBJECTIVES

1. To introduce the basic ideas and methods of probability theory [SLO 1].

2. To illustrate the rich diversity of applications of probability theory in the sciences [SLO 2].

3. To develop the probabilistic foundations for the study of mathematical statistics [SLO 2].

4. To learn the statistical programming language R [SLO 3].

All course objectives will be assessed through homework assignments and exams.

LECTURES

Lectures will consist mainly of notes that I will post on the course website the night before class. However, there will be plenty of time for discussion. Statistics is very conducive to collaboration so it is important that you contribute to the process. I expect everyone to participate in discussion when the situation arises.

This class is also being offered remotely. I will be posting annotated slides, R code, R Markdown files, and videos to the D2L website. Please check this site regularly.

CLASS CANCELLATION POLICY

In the event that I am unable to meet a class, I will: (a) notify you in person at a prior meeting to that effect or (b) an official class cancellation notification on the *stationary of the Department of Mathematics and signed and date stamped by the Department's Secretary Sally Malarney* will be posted on the classroom door. All other postings announcing the cancellation of this class are to be considered unofficial and are to be ignored.

HOMEWORK

• There will be regular homework assignments for this class. Homework will be assigned at the beginning of each week and are (usually) be **due the following week**.

• You can either submit homework assignments at the beginning of class or by midnight via the assignment folder on D2L.

• Extra credit will be given to those who use Latex(ish) code to type up your assignments. I will provide plenty of examples on how to do this.

Academic and Personal Integrity

It is the responsibility of each student to adhere to the universitys standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of anothers work and/or using ideas of another and presenting them as ones own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and

removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the Rams Eye View, and the University website at www.wcupa.edu.

EXAMS

• Your first midterm exam is scheduled for Thursday, October 14th. You will have two hours to complete the exam. For those that are taking the course remotely, you will have a 24 hour window to complete the exam. However, once you start, you will have two hours to complete. Your second midterm exam is scheduled for Thursday, November 18th.

• **Final Exam:** Please refer to the University Final Exam schedule. Again, those taking the course remotely will have a 24 hour window to complete the final exam.

• **No makeup examinations** will be given. A student who misses an examination because of a medical reason must provide **documented** evidence of serious medical incapacitation. Other reasons for missing an examination must be discussed with me **before** the day of the examination. Each case will be considered on an individual basis. The overall course grade for a student who misses an examination with a valid reason will be based on that student's remaining course work. A student who misses an examination without a valid excuse will receive a grade of zero on that examination. Sleeping through an exam is not a valid excuse and will result in a grade of zero.

COURSE GRADE

Your course grade consists of:

Midterm 1	25%
Midterm 2	25%
Homework	20%
Final	30%

ATTENDANCE POLICY:

• **I will not be taking attendance**. However, I highly recommend that you attend class. If you do have to miss class, for whatever reason (or if you're taking the course remotely), there will be videos posted on the D2L website.

STUDENTS WITH DISABILITIES

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester Universitys Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is ossd@wcupa.edu , and their website is at https://www.wcupa.edu/universityCollege/ossd/. In an effort to assist students who either receive or may believe they are entitled to receive accommodations under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, the University has appointed a student advocate to be a contact for students who have questions regarding the provision of their accommodations or their right to accommodations. The advocate will assist any student who may have questions regarding these rights. The Director for Equity and Compliance/Title IX Coordinator has been designated in this role. Students who need assistance with their rights to accommodations should contact them at 610-436-2433.

COMPUTING

- We will use *R* and *RStudio* software throughout the semester. However, no programming background is required! Refer to the R/RStudio Installation slides found on the D2L Announcements page to install both. Neither are required. However, they will help illustrate certain concepts and can make many calculations easier. Also, you will have the opportunity to get extra credit using them.

OFFICE HOURS

My office hours will be held both in-person AND remotely via Zoom. The link to my personal meeting room can be found in the announcements on D2L.

REPORTING INCIDENTS OF SEXUAL VIOLENCE

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the Universitys commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University Protection of Minors Policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: https://www.wcupa.edu/_admin/diversityEquityInclusion/sexualMisconduct/default.aspx

EMAIL POLICY

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.

CAMPUS EMERGENCIES

All students are encouraged to sign up for the Universitys free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

INCLUSIVE LEARNING ENVIRONMENT AND ANTI-RACIST STATEMENT

Diversity, equity, and inclusion are central to West Chester Universitys mission as reflected in our Mission Statement, Values Statement, Vision Statement and Strategic Plan: Pathways to Student Success. We disavow racism and all actions that silence, threaten, or degrade historically marginalized groups in the U.S. We acknowledge that all members of this learning community may experience harm stemming from forms of oppression including but not limited to classism, ableism, heterosexism, sexism, Islamophobia, anti-Semitism, and xenophobia, and recognize that these forms of oppression are compounded by racism.

Our core commitment as an institution of higher education shapes our expectation for behavior within this learning community, which represents diverse individual beliefs, backgrounds, and experiences. Courteous and respectful behavior, interactions, and responses are expected from all members of the University. We must work together to make this a safe and productive learning environment for everyone. Part of this work is recognizing how race and other aspects of who we are shape our beliefs and our experiences as individuals. It is not enough to condemn acts of racism. For real, sustainable change, we must stand together as a diverse coalition against racism and oppression of any form, anywhere, at any time.

Resources for education and action are available through WCUs Office for Diversity, Equity, and Inclusion (ODEI), DEI committees within departments or colleges, the student ombudsperson, and centers on campus committed to doing this work (e.g., Dowdy Multicultural Center, Center for Women and Gender Equity, and the Center for Trans and Queer Advocacy).

Guidance on how to report incidents of discrimination and harassment is available at the Universitys Office of Diversity, Equity and Inclusion.

TENTATIVE LIST OF COVERED TOPICS

- Basic Probability Theory [CO 1] (Chapters 2.1 - 2.11)

- Discrete Random Variables [CO 1,2] (Chapters 3.1 - 3.8)

- Continuous Random Variables [CO 1,2] (Chapters 4.1 - 4.8)

- Moment Generating Functions [CO 3] (Chapters 3.9, 4.9)

- Joint Probability Distributions [CO 1,2] (Chapters 5.1 - 5.2)

- Marginal Probability Distributions [CO 1,2] (Chapters 5.3)

- Conditional Probability Distributions [CO 1,2] (Chapters 5.4 - 5.6)

- Functions of Random Variables [CO 3] (Chapters 6.1 - 6.5)

- Order Statistics [CO 3] (Chapters 6.7)

I am looking forward to teaching this class as I hope you are looking forward to taking it. Please do not hesitate to contact me if you have any questions or concerns whatsoever.

Welcome, and Good Luck!