STA 506 Mathematical Statistics II

Spring 2020

Instructor: Cheng Peng, PhD
Office: 25 University Ave. 111
Phone: 610-436-2369
Email: cpeng@wcupa.edu

Office Hours: Monday: 1:00 PM-4:00 PM
Tuesday: 8:00 AM – 9:30 AM
Thursday: 8:00 AM - 9:30 AM

Course Web Page: D2L.

Lectures: Day: T/R
Time: 4:25 PM - 7:10 PM (Session 1)
7:15 PM - 10:00 PM (Session 2)
Location: UNA 158 / 103

Required Text: *Mathematical Statistics with Applications*, 7th edition Wackerly, Mendenhall, and Scheaffer.

COURSE DESCRIPTION

Continuation of STA 505. Correlation, sampling, tests of significance, analysis of variance, and other topics. Pre / Co requisites: STA 506 requires a prerequisite of STA 505 or STA 504.

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

4. Learn to develop and critically assess the 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 systematically discuss sampling distributions and the Central Limit Theorem. [SLO 1]
2. To introduce the basic ideas of both point and interval estimators. [SLO 1, 2, 4]
3. To discuss the methods of moment and likelihood estimators in detail. [SLO 1, 2, 4]
4. To illustrate logic and methods of testing hypotheses. [SLO 1, 2, 4]
5. To discuss the linear regression models and relevant inferences. [SLO 1, 2]
6. To use R to implement some inferential problems [SLO 1, 2, 3, 5]

POLICIES ON HOMEWORK

There will be regular homework assignments for this class. The assigned problems reflect the contents covered in the class. Also, I will assign some computational problems whose answers can be obtained using a statistical software package. Note that prior programming experience is NOT required for this course. Following policies apply to the homework of this class

1. No later homework will be accepted.
2. You are assumed to complete all the problems assigned each time. I may randomly pick a few of them to grade. Your HW grade will be based on the randomly selected ones. I will post the detailed solutions to each of the assigned problems on D2L.
3. ***Collaboration***: you are encouraged to work together on homework problems. However, the write-up MUST be your own (be aware of the University's policies on academic integrity).
4. Please submit organized, neat, and stapled paper copies of homework. If possible, prepare your homework using a word processor or a typesetting system.
5. For computational problems, please submit your code (script) via email on the due date and put the "STA 506 HW Code" in the subject line. I will copy and paste your code and run it on my computer.

EVALUATION & GRADING

The course grade will be based on

(1). Homework (30%)

(2). Two Midterm Exams (20% each)

(3). Final Comprehensive Exam (30%).

A letter grade will be assigned based on performance in the course, according to the following scale:

Grade	Quality Points	Percentage Equivalents	Interpretation
A	4.00	[93%, 100%]	Superior graduate attainment
A-	3.67	[90%, 93%)	
B+	3.33	[86%, 90%)	Satisfactory graduate attainment
B	3.00	[83%, 86%)	
B-	2.67	[80%, 83%)	
C+	2.33	[76%, 80%)	Attainment below graduate expectations
C	2.00	[73%, 76%)	
C-	1.67	[70%, 73%)	
F	0	< 70%	Failure

D grades are not used. Refer to the Graduate Catalog for the description of NG (No Grade), W, & other grades.

TENTATIVE TOPICS

Following is the list of tentative topics to be covered in the semester. I may modify and list as we move forward during the semester.

1. Sampling Distributions and CLT
    - 1.1. Sampling Distributions of Commonly Used Statistics from Normal Population
        - 1.1.1. Normal Distribution
        - 1.1.2. t-distribution
        - 1.1.3. Chi-squared Distribution
        - 1.1.4. F Distribution
    - 1.2. Central Limit Theorem and Applications
    - 1.3. Simulating CLT Using R

2. Concepts of Parameter Estimation
    2.1. Point Estimators and Performance Metrics
        2.1.1. Bias and MSE
        2.1.2. Common Unbiased Estimators
        2.1.3. Goodness-of-Estimator
    2.2. Confidence Intervals – One-Sided and Two-sided Confidence Intervals
    2.3. Large Sample Asymptotic Confidence Intervals
    2.4. Sample Size Determination
    2.5. Small Sample Confidence Intervals Based on Normal Population
    2.6. Confidence Intervals of Variance of Normal Population
    2.7. Constructing Confidence Intervals with R

3. Properties of Point Estimators and Methods of Estimation
    3.1. Relative Efficiency
    3.2. Consistency
    3.3. Sufficiency
    3.4. Methods of Moments and Maximum Likelihood Estimation
    3.5. Numerical Methods for Finding Estimate Using R

4. Hypothesis
    4.1. Logic and Components of Hypothesis
    4.2. Common Large Sample Tests
    4.3. Type I and II Errors and Power of Test
    4.4. Relationship between Testing Hypothesis Procedures and Confidence Intervals
    4.5. Small Sample Testing Hypothesis Testing
    4.6. Testing Hypothesis About Population Variance
    4.7. Likelihood Ratio Tests

5. Introduction to Linear Regression Models
    5.1. Parameter Estimation with Least Squares
    5.2. Inference about regression coefficients
    5.3. Prediction with Linear Regression Model
    5.4. Matrix Version of Simple Linear Regression Models
    5.5. Inference of Coefficients
    5.6. Regression Models Using R

6. Analysis of Variance

6.1. Introduction to One-way Layout
6.2. Models for Ona-way ANOVA
6.3. ANOVA for Randomized Design
6.4. ANOVA Using Linear Models
6.5. ANOVA Using R

ACADEMIC & PERSONAL INTEGRITY

It is the responsibility of each student to adhere to the university's 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 another's work and/or using ideas of another and presenting them as one's 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 Graduate Handbook, the Graduate Catalog, the *Ram's Eye View*, and the University website at www.wcupa.edu.

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 University's Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. The OSSD hours of Operation are Monday – Friday, 8:30 a.m. – 4:30 p.m. 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 www.wcupa.edu/ussss/ossd.

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 meet this commitment and to comply

with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator, Ms. Lynn Klingensmith. 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 minor's policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at the webpage for the Office of Social Equity at http://www.wcupa.edu/_admin/social.equity/.

EXCUSED ABSENCES POLICY

Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Graduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

EMERGENCY PREPAREDNESS

All students are encouraged to sign up for the University's 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.

ELECTRONIC MAIL 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.