

# MAT 125 – Introduction to Probability and Statistics

Fall 2019

## Section 03

### CONTACT INFORMATION

**Professor:** Cheng Peng, Ph.D.

**Email:** cpeng@wcupa.edu

**Office Hours:** Monday: 10:00 AM -11:00 AM

Tuesday: 1:00 PM -5:00 PM

Wednesday: 10:00 AM -11:00 AM

**Phone:** 610-436-2369

**Office:** 25 University Avenue 111

**Class Meeting Days:** M/W/F

**Time:** 1:00 PM – 1:50 PM

**Room:** UNA 162

### COURSE SYLLABUS

**Required Materials:** Elementary Statistics, the third edition by Navidi and Monk (ebook or textbook)

**Course Description:** Introduction to probability, statistics, and statistical inference. Concepts include descriptive statistics, probability, probability distributions, sampling distributions, confidence intervals, hypothesis testing, along with a formal introduction to linear regression and categorical data analysis. Statistical software, including but not limited to SPSS and Excel, will be used to facilitate the understanding of important statistical ideas and for the implementation of data analysis in many areas of application.

**Course Student Learning Outcomes:** after finishing this class, a student will be able to

1. Describe a data set by producing appropriate graphs and calculating descriptive statistics.
2. Compute basic probabilities and conditional probabilities.
3. Understand and apply commonly used random variables and their distributions to solve real world problems.
4. Understand and apply the Central Limit Theorem.
5. Compute and correctly interpret confidence intervals for population means, proportions and differences in means and proportions.
6. Perform and interpret test of hypotheses test for means, proportions, difference in means (independent and dependent samples) and proportions.
7. Perform a linear regression to determine the relationship between two quantitative variables and make predictions using the linear regression equation.
8. proficiently utilize technology to conduct data analysis using statistical methods covered in the semester.

**Meeting & Assessing Student Learning Outcomes:** Following methods will be used to assess students' learning outcomes

1. Midterm exams will test students understanding of individual topics.
2. Lab reports will assess students' understanding of individual topics and the proficiency of using technology.
3. Final exam will assess students' comprehensive understanding of all topics covered in the entire semester.
4. Final project assesses students

**Attendance Policy:** Attendance to this class is mandatory. I will take random attendance. Your overall attendance rate will be based on the random attendance that I will take in the semester.

**Important Dates:**

Last day to add/drop: Friday, Sept 4, 2019  
 Last day to withdraw: Tuesday, Oct 22, 2019  
 Reading/Writing Days (no classes): Monday, Nov 25 – Tue, Nov 26, 2019  
 Fall/Thanksgiving Break (no classes): Wednesday, Nov 27 – Sunday, Dec 1, 2019

**Assignments:** There will be different assignments for this class.

- (1). Homework – I will select some exercises from the textbook and assume that you will do all these problems either independently or collaborate your peers or tutors (will send you tutoring schedule when it is available). In the end, you need to understand all the assigned problems. Note that homework will NOT be graded.
- (2). Lab Reports – there will be several sets of lab assignments mainly focusing on using technology to solve problems similar to the problems in homework. Note that these reports will be collected and graded.
- (3). There will be a mini term project on data analysis. The idea is ask apply as many methods as possible to address a real-world data analysis problem. You will choose any a problem and data set at your preference and analyze it and write a report to summarize your results. The project report will be collected and graded.

**Evaluation & Grading:** Course grade will be determined by following components:

- (1). Three midterm exams (15% each)
  - Exam 1: Friday, Sept 20, 2019
  - Exam 2: Friday, Oct 18, 2019
  - Exam 3: Friday, Nov 22, 2019
- (2). Final Exam (30%)
  - Wednesday Dec 11, 1:00PM-3:00PM
- (3). Lab reports (10%)
- (4). Project Report (10%)
- (5). Attendance (5%)

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	Excellent
A-	3.67	90-92	
B+	3.33	87-89	Superior
B	3.00	83-86	
B-	2.67	80-82	
C+	2.33	77-79	Average
C	2.00	73-76	
C-	1.67	70-72	
D+	1.33	67-69	Below Average
D	1.00	63-66	
D-	0.67	60-62	
F	0	< 60%	Failure

Refer to the Undergraduate Catalog for description of NG (No Grade), W, Z, and other grades.

**Exam Make-up Policy:** There will be NO make-up exams for this class. If you must miss an exam under an unusual circumstance, I will replace your missing midterm exam grade with your final exam grade.

**Tentative Course Outline:** Following is the list of tentative topics to be covered in this class. The actual delivery order may be slightly different from the topic list. I also reserve the right to adjust the topics as we move forward during the semester to ensure that you will accomplish your goal and be challenged in the class.

## Part I: Summarize Data Sets

### Topic 1. Frequency Tables and Charts

1. Data Types
2. Frequency tables and charts for categorical data: four types frequency tables, bar-chart, pie chart, frequency polygon.
3. Frequency tables for numerical data: steps for constructing a frequency table, Histograms and frequency tables.

### Topic 2. Numerical Measures

1. Measures of central tendency: mean, median, mode, mid-range.
2. Measures of variation: variance, standard deviation, mean absolute deviation, range.
3. Measures of location: z-score transformation, percentiles-deciles-quartiles, general steps for finding the k-th percentile.
4. Five number summary and box-plot,
5. Empirical rules Association between two numerical variable using scatter plots.

## Part II. Probability and Distributions

### Topic 3. Probability: Definitions and Rules

1. Definition of experiment, event, and probability.
2. Operations between events and Venn Diagram
3. Additive and multiplicative rules, conditional probability
4. Bayes Rule

### Topic 4. Discrete Random Variables

1. Definition of a random variable, types of random variables
2. Characterization of a random variable: a three-step procedure (1). definition of the random variable; (2). probability distribution; (3). Expectation and variance.
3. Binomial distribution: three-step characterization and applications
4. Poisson distribution: three-step characterization and applications

### Topic 5: Continuous Random Variable

1. General description of a continuous random variable: density, definition of an event based on a continuous random variable.
2. Uniform distribution: events are associate with a rectangle and the area associated with a probability
3. Standard normal distribution: Use of the normal table, two basic types of problems in normal distribution.
4. General normal distribution: z-score transformation before using the normal table, applications

### Topic 6. Sampling Distributions

1. Sampling plans: the way of obtaining statistically valid data
2. Central Limit Theorem: pay a serious attention to the conditions and the conclusions in the theorem.
3. Sampling distribution for sample mean: large sample case and the case of small normal sample.

4. Sampling distribution of sample proportion: always large sample size!
5. Approximation a binomial distribution by a normal distribution: continuity correction.

### Part III. Inferential Statistics

#### Topic 7. Confidence Intervals

1. Concepts of confidence interval: a four-step procedure for mean and proportion -- (1). identifying the underlying table and find the appropriate critical value CV; (2). Find the margin of error; (3) write out the confidence interval; (4) interpretation of the confidence interval.
2. Confidence interval of the mean based on a large sample
3. Confidence interval of the mean based on a small normal sample with a known pop. variance
4. Confidence interval of the mean based on a small normal sample with a unknown pop. variance
5. Confidence interval of the proportion (always large sample)
6. Sample size determination: the cases of mean and proportion.

#### Topic 8. Testing Hypotheses

1. Logic of testing a hypothesis.
2. Components of a hypothesis and types of hypotheses.
3. Testing the population mean based on large samples - normal test
4. Testing the population proportion based on large samples
5. Decision rule using a p-value
6. Testing the population mean based on small samples - t test.
7. Testing population variance - chi-square test

#### Topic 9. Testing Hypotheses Based on Two Samples

1. Testing population means based on two large samples - normal test.
2. Testing population means based on two small normal samples:
  - case 1.* Both population variances are known - normal test;
  - case 2.* both population variances are unknown but equal - t-test using combined sample variance and  $df = n_1 + n_2 - 2$ ;
  - case 3:* both population variances are unknown and unequal. t-test using the separate sample variances with  $df = \min\{n_1, n_2\}$
3. Testing two population proportions
4. Testing two population variances.

#### Topic 10. A Brief Introduction to Linear Regression

1. Formulation of the regression problems
2. Assumptions
3. Simple linear regression (SLR) model: find regression coefficient from data
4. SLR: interpretation of regression coefficients
5. Prediction using SLR

### FREE TUTORING SERVICES

The Mathematics Department provide free tutoring services to students enrolled in statistics class at all levels. The university learning center also provide similar services. The schedules will be provided to you when they are available.

## 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](http://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](mailto:ossd@wcupa.edu), and their website is at [www.wcupa.edu/ussss/ossd](http://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](http://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.