Statistics and Applications

Instructor: Ruizhi Zhang

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Lecture Video: The lecture video will be posted on Canvas at 12:30 PM on Tuesdays and Thursdays

Office Hours: 2:00 PM - 3:00 PM Tuesdays online via Zoom, or By appointment

TA: Rachel Rogers
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Office Hours: 3:00 PM - 4:00 PM Monday, and 4:00 PM-5:00 PM Thursday online via Zoom, or By appointment

TA: Liangrui Sun
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Office Hours: 3:00 PM - 4:00 PM Wednesday, and 3:00 PM - 4:00 PM Friday online via Zoom, or By appointment

Textbook: *PROBABILITY AND STATISTICS FOR ENGINEERS AND SCIENTISTS*, 9th edition; Walpole, Myers, Myers and Ye.

Prerequisites: MATH 107 (MATH 107H): Analytic Geometry and Calculus II

Course Description: The STAT/MATH 380: Introduction to Probability and Statistics Concepts is the second-level course in "undergraduate statistics and mathematics" sequence. The course provides an introduction to probability concepts, i.e., random variables, probability distributions, expectation, variance, covariance, correlation; and statistical concepts, i.e., fundamental sampling distributions and data descriptions, one- and two-sample estimation and testing problems, and simple linear regression. This course lays the foundation for many 400-level courses in Engineering, Mathematics and Statistics, and is also offered for Honors credit.

ACE Outcome 3: The STAT/MATH 380 course is accredited as Achievement Centered Education (ACE) course and satisfies ACE outcome 3: to use mathematical, computational, statistical, or formal reasoning (including reasoning based on principles of logic) to solve problems, draw inferences, and determine reasonableness. Therefore, the reinforced skill for STAT/MATH 380 is Critical Thinking.

Course Goals: This course will help you learn to think and reason statistically, and to construct arguments based on numerical evidence. My role as the instructor is to facilitate this type of learning by providing you with a variety of meaningful activities and opportunities to learn, as well as creating an environment conducive to learning. This will manifest in a variety of ways: direct instruction, individual practice, exploration and discovery activities, writing, discussions panel. Ultimately, **you are responsible for your own learning**, so please put into the class what you hope to get out of it.

- Students will understand essential theoretical concepts (and logic behind them) including common discrete and continuous probability distributions, sampling distributions and data description techniques, hypothesis testing problems, and modeling approaches.
- Students will be able to recognize a classical distribution model when are presented with details of an experiment, translate a research question into a logical probability statement in terms of a mass/density or cumulative probability function, perform calculations, and comment on the result.
- Students will be able to state a hypothesis testing (or estimating) problem (out of the ones considered in the course) for a given research question, perform testing (construct the corresponding confidence interval) and draw statistical inferences.
- For a given data set, students will be able to fit a simple linear regression model (obtain regression coefficients), provide an equation of a fitted model, interpret the observed relationship in words, and use the model to make predictions.

Course Content: Introduction to Statistics and Data Analysis (sample, population, observational and experimental studies, measures of location and variability, basics of data cleaning, graphical methods and data description)

Probability

Random Variables, Probability Distributions and Expectation

Discrete and Continuous Probability Distributions

Fundamental Sampling Distributions and Data Descriptions (random sampling, key statistics, sampling distributions of a sample mean and sample variance)

One- and Two-Sample Estimation Problems (statistical inference, confidence intervals for the mean, difference between two means, proportion and the difference between two proportions: their derivations and applications)

One- and Two-Sample Testing Problems (statistical hypotheses and their testing, tests for a single mean and the difference between two means: cases with known and unknown variances; large sample tests for a single proportion and the difference between two proportions, applications)

Simple Linear Regression

Course Expectations: In this course, you are expected to have professional behavior. You are expected to listen to all lecture videos, be curious, ask questions, seek opportunities to learn, and be open and responsive to constructive feedback. You are also expected to exhibit a professional demeanor (language, attitude) toward others. Disagreement during discussions is welcome and often productive in developing a deeper understanding of the concepts being discussed. However, disagreement does not warrant yelling or disrespectful language or behavior. Unprofessional behavior will not be tolerated, and appropriate actions will be taken to prevent future occurrences.

Online Lectures: Lecture video and slides will be posted on Canvas at (or before) 12:30 pm on Tuesday and Thursday. Students are expected to make notes to supplement the slides. If a student plans to miss a lecture then he/she should notify the instructor in advance.

Grading:

Homework	15%	Exam 1	20%
Quizzes	15%	Exam 2	20%
		Final Exam	30%

Grading Scale:

Grade	Final Percentage Range
A	94.0-100
A-	90.0-93.99
B+	88.0-89.99
B	84.0-87.99
B-	80.0-83.99
C+	78.0-79.99
C	74.0-77.99
C-	70.0-73.99
D+	68.0-69.99
D	64.0-67.99
D-	60.0-63.99
F	<60.0

Homework: Each student should download/print out and complete each homework assignment, and also take an on-line homework test on Canvas. Answer keys are posted on Canvas after the due date. Students are expected to compare their solutions with the answer keys and discuss their questions and concerns with the instructor or TAs. Homework tests are equally weighted. All assignments should be submitted before the deadline. There is **no makeup possible** for any assignments unless prior arrangements with the instructor have been made.

Quizzes: All quizzes need to be done online on Canvas before the due date. Any missed quiz is given 0 points. All quizzes are equally weighted. There is **no makeup possible** for any quizzes unless prior arrangements with the instructor have been made.

Exams: Three exams will be given during the course: **EXAM1: 12:30pm -1:45pm, Sep. 17 (online); EXAM2: 12:30pm -1:45pm, Oct. 20 (online); FINAL: 7:30am -9:30am, Nov. 25(online)**.
Exams are open-book and open-notes. But **NO discussions are allowed.** You are not allowed to share the questions or your answers with anyone. You are expected to take exams at the scheduled times on Canvas. If this is impossible due to extreme circumstances (illness, death in the family, previously scheduled activities vital to academic program), please notify me. **No make-up exams will be given if I am not notified prior to the examination.** You will be required to obtain a note from your physician or adviser explaining the nature of the conflict.

Discussion and Bonus : We will open the discussion panel on Canvas. Each week, we will open a new discussion session. Students are welcomed to ask any questions related to the lecture taught in that week (but should not related to the homework, quiz, and exams). Students who know the answers are encouraged to answer the questions. In the end of this semester, active students in answering questions in the discussion panel can receive **additional one point** to their final grades.

Department Grade Appeal Policy: Students who believe their academic evaluation has been prejudiced or is capricious have recourse for appeals to, in order: their instructor; the Chair of the Statistics Department; the undergraduate academic grading appeals committee; and lastly, the college grading appeals committee.

Disabilities: Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 404-472-3787.

Academic Integrity: You are encouraged to work together on problems and exercises, but the work you turn in must be your own (unless the assignment specifically states otherwise) Work on exams must be your own (no discussion allowed). University policy will be followed in cases of academic dishonesty:

In cases where an instructor finds that a student has committed any act of academic dishonesty, the instructor may in the exercise of his or her professional judgment impose an academic sanction as severe as giving the student a failing grade in the course. Before imposing an academic sanction the instructor shall first attempt to discuss the matter with the student. If deemed necessary by either the instructor or the student, the matter may be brought to the attention of the student's major adviser, the instructor's department chairperson or head, or the dean of the college in which the student is enrolled.

For additional details see http://stuafs.unl.edu/ja/code/three.shtml.

Important Dates:

Class Begins	Aug. 18
Last day for late registrations and adds	Aug. 24
Last day to drop with 100% refund	Aug. 28
Last day to file a drop to remove course from student's record	Aug. 28
Exam 1 12:30 PM-1:45 PM	Sep. 17
Exam 2 12:30 PM-1:45 PM	Oct. 20
Last Class	Nov. 19
Final Exam 7:30 AM-9:30 AM	Nov. 25

Disclaimer: Information contained in this syllabus was, to the best knowledge of the instructor, considered correct and complete when distributed at the beginning of the term. However, the instructor reserves the right, acting within the policies and procedures of UNL, to make changes in course content or instructional technique without notice or obligation. However, any changes will be explained to the class as a whole including reasons for the change.

TENTATIVE COURSE OUTLINE

Due to the natural variation in the progress of lectures, the schedule is **tentative**.

Week	Day	Topic	Book Section(s)
August. 17	Tues	Syllabus, Introduction to Statistics	Chapter 1
Week 1	Thurs	Introduction to Data Analysis	Chapter 1
August. 24	Tues	Probability, counting techniques;	Chapter 2.1-2.4
Week 2	Thurs	Probability rules, Conditional probability	Chapter 2.5-2.6
August. 31	Tues	Random variables, Discrete distribution	Chapter 3.1-3.2
Week 3	Thurs	Continuous distribution, Joint distribution	Chapter 3.3-3.4
September. 7	Tues	Expectation, Variance	Chapter 4.1, 4.2
Week 4	Thurs	Linear Combinations of Random Variables, Chebyshev's Theorem	Chapter 4.3, 4.4
September. 14	Tues	Review	
Week 5	Thurs	EXAM 1 (Sep. 17)	
September. 21	Tues	Discrete distributions, Bernoulli distribution	Chapter 5.1, 5.2
Week 6	Thurs	Binomial distribution, Poisson distribution	Chapter 5.2, 5.5
September. 28	Tues	Continuous distributions, Uniform, Normal distributions	Chapter 6.1-6.4
Week 7	Thurs	Gamma and Exponential Distribution	Chapter 6.6
October. 5	Tues	Sampling Distributions, Sample mean, Sample variance	Chapter 8.1-8.2
Week 8	Thurs	Sampling Distributions of Means, Central Limit Theorem	Chapter 8.3-8.4
October. 12	Tues	Sampling Distributions of Sample Variances	Chapter 8.5
Week 9	Thurs	Review	
October. 19	Tues	EXAM 2 (Oct. 20)	
Week 10	Thurs	Statistical inference, Point estimator, Interval estimator	Chapter 9.1-9.3
October. 26	Tues	Confidence interval	Chapter 9.4-9.5, 9.10
Week 11	Thurs	Two-sample estimation	Chapter 9.8, 9.11
November. 2	Tues	Test of Hypotheses	Chapter 10.1-10.3
Week 12	Thurs	Test on single mean, single proportion	Chapter 10.4, 10.8
November. 9	Tues	Tests on two means	Chapter 10.5
Week 13	Thurs	Simple linear regression, least squares estimators	Chapter 11.1-11.3
November. 16	Tues	Properties and inference of least squares estimators	Chapter 11.4,11.5
Week 14	Thurs	Review	
November. 23	Wed	FINAL EXAM (Nov. 25)	
Week 15			