Master Course Syllabus

For additional course information, including prerequisites, corequisites, and course fees, please refer to the Catalog: https://catalog.uvu.edu/

Semester: Spring
Year: 2025
Course Prefix: STAT
Course and Section #: 2040-002
Course Title: Principles of Statistics
Credits: 4

Course Description

Includes summarizing data, measures of central location, measures of variation, probability, mathematical expectation, probability distributions, sampling and sampling distributions, estimation, hypothesis testing, analysis of variance, regression analysis, and correlation.

Course Attributes

This course has the following attributes:
☒ General Education Requirements
☐ Global/Intercultural Graduation Requirements
☐ Writing Enriched Graduation Requirements
☐ Discipline Core Requirements in Program
☐ Elective Core Requirements in Program
☐ Open Elective
Other: *Click here to enter text.*

Instructor Information

Instructor Name: Dr. Ji Xiaoyi

Student Learning Outcomes

At the end of the course, the student will have a good understanding of some statistical methods used in biological research. They will also be able to identify the appropriate statistical methods for analyzing data in their fields, be able to analyze them using R, and be able to interpret the results. More specifically, they will be able to

- Demonstrate understanding of the difference between controlled experiments and observational experiments.
- Summarize data numerically and graphically.
- use the sampling distributions of statistic to find the p-value for a test statistic
- Compute confidence intervals for different parameters of interest
- Conduct significance tests for one, two, and more than two sample cases
- Use statistical methods - linear regression, chi-square tests, and ANOVAs

Course Materials and Texts

- Statistics Unlocking the Power of Data, by Robin H. Lock, Patti Frazer Lock, Kari Lock Morgan, Eric F. Lock, Dennis F. Lock, 3rd edition
- Laptop with R and Studio

Course Requirements

Course Assignments, Assessments, and Grading Policy

Homework: Homework problems will be assigned in each section. An assignment is considered late if it is not submitted on time due and no late homework will be accepted. We will use the computers periodically to do examples of statistical analysis in R, and statistical analysis using a computer will be required on select assignments. Homework is intended to be practice, and we will spend a few minutes each class period answering questions from the homework. The number one reason why so many students do not succeed in this class is because they ignore, or routinely postpone the daily homework assignments.

Class Activity: At the end of each unit, a Class Activity will be assigned. These Class Activity will include the material covered that week(s). The class activity on the selected chapters or topics along with datasets will be given. To complete the activity, students will need to use statistical software R. Some activities require analyzing the real datasets and writing a report.

Tests: There will be three tests and Final Exam. Problems in the tests will be similar to examples done in class and to problems in your projects. The final will be comprehensive. A student must provide the written documentation supporting the need for a make-up test.

Course evaluation:

Homework Assignments:	15%
Class Activities:	15%
Midterm:	50%
Final exam:	20% (80% of questions in class, 20% of questions in take home using R)

A = 93-100	B - = 80-82.9	D+ = 67-69.9
A - = 90-92.9	C+ = 77-79.9	D = 63-66.9
B+ = 87-89.9	C = 73-76.9	D - = 60-62.9
B = 83-86.9	C - = 70-72.9	F = 0-59.9

Required or Recommended Reading Assignments

All required readings use chapters from the course text that align with the lectures below

General Description of the Subject Matter of Each Lecture or Discussion

- **Data Collection (Ch. 1)**
  - Simple Random Sampling
  - Observational Experiments vs Designed Experiments
  - Design of Experiments
    - Completely Randomized Design
    - Match-Pairs Design
    - Randomized Block Design

- **Graphs and Summary Statistics (Ch. 2)**
  - Organizing and displaying qualitative data with Bar chart, Pie chart, and creating contingency table for two or more categorical variables
  - Organizing and visualizing quantitative data with Stem-plot, Dot plot, Frequency distribution, Histogram
  - Measures of central tendency – Mean, Median, Mode
  - Measures of Dispersions- Range, Variance, Standard Deviation, Interquartile range (IQR)
  - Finding outliers and measures of positions – Percentile, Quartile, Boxplot for five- number summary
- **Normal Distribution (Ch. 5)**
  - The rules of Normal Distribution in statistical inference and its applications
  - Assessing normality

- **Sampling Distribution (Ch. 5, 8)**
  - Concept of sampling distribution and Central Limit theorem (CLT)
  - Distribution of the sample mean– t-distribution
  - Distribution of sample proportion – normal distribution
  - Distribution of the ratio of two independent sample variances– F-distribution
  - Use of the sampling distribution to find the p-value for a test statistic

- **Confidence interval (Ch. 3)**
  - Understanding and interpreting confidence interval
  - Constructing confidence interval for a population mean, a population proportion, and a difference in two population means and proportions
  - Bootstrap confidence intervals

- **Hypothesis Testing (Ch. 4,5, 6, 7)**
  - Measuring evidence with p-values
  - Determining statistical significance
  - Hypothesis Tests for a population mean, and a population proportion, the equality of two population proportion, the equality of two population means when samples are independent, the equality of two population means when samples are dependent
  - Hypothesis testing for categorical data
    - Goodness of fit with chi-square test
    - Tests for independence and the homogeneity of proportions with chi-square test

- **Analysis of Variance (ANOVA) (Ch. 8)**
  - Sample size estimation for different statistical designs
  - Power of the test and its application to estimate sample size
  - Comparing three or more Means (One-way Analysis of Variance)
  - Post Hoc Tests on One-Way Analysis of Variance – Tukey Test
  - Randomized Complete Block Design, and Two -Way Analysis of Variance

- **Correlation and Regression (Ch 2, 9, 10)**
  - Concept of correlation and causation and finding the correlation and testing the significance of the correlation
  - Least -Squares Regression for single, and multiple explanatory variables

- Testing the significance of the least -square regression model

Required Course Syllabus Statements

Generative AI

This course requires you to complete assignments that assess your understanding and application of the material. You are expected to do your own work, and the use of artificial intelligence (AI) tools, such as chatbots, text generators, paraphrasers, summarizers, or solvers, is strictly prohibited for any part of your assignments. Using these tools will be considered academic dishonesty and will be handled according to the university's policy. If you have questions about acceptable use of AI tools, please consult the instructor before submitting your work.

Using Remote Testing Software

☒ This course does not use remote testing software.

☐ This course uses remote testing software. Remote test-takers may choose their remote testing locations. Please note, however, that the testing software used for this may conduct a brief scan of remote test-takers' immediate surroundings, may require use of a webcam while taking an exam, may require the microphone be on while taking an exam, or may require other practices to confirm academic honesty. Test-takers therefore shall have no expectation of privacy in their test-taking location during, or immediately preceding, remote testing. If a student strongly objects to using test-taking software, the student should contact the instructor at the beginning of the semester to determine whether alternative testing arrangements are feasible. Alternatives are not guaranteed.

Required University Syllabus Statements

Accommodations/Students with Disabilities

Students needing accommodations due to a permanent or temporary disability, pregnancy or pregnancy-related conditions may contact UVU Accessibility Services at accessibilityservices@uvu.edu or 801-863-8747.

Accessibility Services is located on the Orem Campus in BA 110.

Deaf/Hard of Hearing students requesting ASL interpreters or transcribers can contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at DHHservices@uvu.edu

DHH is located on the Orem Campus in BA 112.

Academic Integrity

At Utah Valley University, faculty and students operate in an atmosphere of mutual trust. Maintaining an atmosphere of academic integrity allows for free exchange of ideas and enables all members of the community to achieve their highest potential. Our goal is to foster an intellectual atmosphere that produces scholars of integrity and imaginative thought. In all academic work, the ideas and contributions of others must be appropriately acknowledged and UVU students are expected to produce their own original academic work.

Faculty and students share the responsibility of ensuring the honesty and fairness of the intellectual environment at UVU. Students have a responsibility to promote academic integrity at the university by not participating in or facilitating others' participation in any act of academic dishonesty. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, assessments, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Likewise, instructors are responsible to clearly state expectations and model best practices.

Further information on what constitutes academic dishonesty is detailed in UVU Policy 541: *Student Code of Conduct*.

Equity and Title IX

Utah Valley University does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, age (40 and over), disability, veteran status, pregnancy, childbirth, or pregnancy-related conditions, citizenship, genetic information, or other basis protected by applicable law, including Title IX and 34 C.F.R. Part 106, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Inquiries about nondiscrimination at UVU may be directed to the U.S. Department of Education's Office for Civil Rights or UVU's Title IX Coordinator at 801-863-7999 – TitleIX@uvu.edu – 800 W University Pkwy, Orem, 84058, Suite BA 203.

Religious Accommodation

UVU values and acknowledges the array of worldviews, faiths, and religions represented in our student body, and as such provides supportive accommodations for students. Religious belief or conscience broadly includes religious, non-religious, theistic, or non-theistic moral or ethical beliefs as well as participation in religious holidays, observances, or activities. Accommodations may include scheduling or due-date modifications or make-up assignments for missed class work.

To seek a religious accommodation, a student must provide written notice to the instructor and the Director of Accessibility Services at accessibilityservices@uvu.edu. If the accommodation relates to a scheduling conflict, the notice should include the date, time, and brief description of the difficulty posed by the conflict. Such requests should be made as soon as the student is aware of the prospective scheduling conflict.

While religious expression is welcome throughout campus, UVU also has a specially dedicated space for meditation, prayer, reflection, or other forms of religious expression.