Statistical Methods Syllabus
SOUTH PLAINS COLLEGE
MATH 1342 Spring 2024
Mr. Reeves

Course Description: This course is a study of the methods of analyzing data, statistical concepts and models, estimation, tests of significance, introduction to analysis of variance, linear regression, and correlation.

Course Purpose/Rational/Goal: The purpose of the course is to provide a fundamental background in statistics that can be used as a basis for studies in many fields. This course will meet the requirement for mathematics in the core curriculum and for any major that requires an elementary statistics course.

Textbook: Starnes, Tabor, Yates, Moore, *The Practice of Statistics*, fifth edition. Houndmills, Basingstoke, England: W.H. Freeman and Company, 2014.

Student Learning Outcomes/Competencies:

Upon completion of this course and receiving a passing grade, the student will be able to:

1. Represent raw data using various tables and graphs.
2. Calculate measures of central tendency, variation, and position for both grouped and ungrouped data and interpret in writing the significance and meaning of calculations.
3. Calculate coefficients of variation and skewness and interpret in writing the significance of the calculations.
4. Calculate classical and empirical probabilities.
5. Apply binomial and normal distribution properties to calculate probabilities and interpret in writing the significance of the calculations.
6. Calculate mean, variation, and standard deviations of probability distributions and interpret in writing the significance of the calculations.
7. Evaluate a hypothesis-testing situation to determine the appropriate test to be used.
8. Use parametric and non-parametric tests for hypothesis testing and interpret in writing the significance of test results.
9. Calculate coefficients of correlation, determination, and non-determination and interpret in writing the significance of the calculations.
10. Calculate linear regression equations and standard error and use equations to make predictions.
11. Use various statistical packages and/or a calculator with statistical capabilities to help with computation.

There are five necessary components for an elementary statistics class.

1. Descriptive Statistics
2. Probability
3. Estimation
4. Statistical Inference (Hypothesis Testing)
5. Correlation & Regression

Each of these areas of Statistics are listed below with its detailed components:

1. <u>Descriptive Statistics</u>

a. Identify a population, sample, and variables for a study
b. Identify the variables as qualitative or quantitative
c. Identify the variables as discrete or continuous
d. Classify data as nominal, ordinal, interval, or ratio level of measurement
e. Discuss the difference between a census and a sample
f. Discuss various sampling designs and the importance of a "good" sample
g. Discuss the difference between a parameter and a sample
h. Summarize data with frequency and relative frequency tables
i. Display data with charts and graphs including pie charts, bar charts, histograms, frequency polygons, ogives, and stem-and-leaf plots
j. Compute the 4 measures of center (mean, median, mode, and midpoint)
k. Compute the 3 measures of variation (range, variance, and standard deviation)
l. Discuss distributions of a data set (skewed vs. symmetric) and relate these distributions to the mean, median, and mode
m. Discuss the Empirical Rule and Chebyshev's Theorem
n. Compute percentiles
o. Find the 5-number summary and construct box-plots

2. <u>Probability</u>

a. Fundamentals of probability
b. Apply various rules of probability including complement rule, addition rule, multiplication rule, conditional rule, and *Bayes' theorem
c. Compute mean, variance, and standard deviation for a discrete probability distribution
d. Finding probabilities utilizing the binomial formula
e. Compute mean, variance, and standard deviation for a binomial experiment
f. Standard normal distribution
g. Applications of the standard normal distribution (finding values and probabilities)
h. Applications and discussion of the central limit theorem
i. Normal distribution as approximation to binomial distribution

3. <u>Estimation</u>

a. Discussion of point estimators vs. interval estimators
b. Finding the sample mean and standard deviation on a scientific calculator
c. Discuss the significance of margin of error for confidence intervals
d. Find the confidence interval for population mean: large and small samples

e. Apply the t-distribution when applicable
f. Find the confidence interval for population proportion
g. *Find the confidence interval for population standard deviation
h. Determine sample size required to estimate a population parameter

4. <u>Statistical Inference (Hypothesis Testing)</u>

a. Fundamentals of hypothesis testing
b. Discuss components of a complete hypothesis test including null/alternative hypotheses, level of significance, critical values/regions, collecting data and computing test statistics, and making conclusions
c. Test a claim about a population mean: large and small samples
d. Test a claim about a population proportion
e. Test a claim about a population standard deviation
f. Compute and understand significance of p-values
g. Inferences about two means: independent and large samples
h. Inferences about two means: independent and small samples
i. Inferences about two means: matched pairs
j. Inferences about two proportions
k. *Comparing variation in two samples
l. *Multinomial experiments: goodness-of-fit test
m. *Contingency tables: independence and homogeneity
n. *Analysis of variance (ANOVA): one-way and two-way
o. *Nonparametric statistics

5. <u>Correlation and Regression</u>

a. Construct scatterplots
b. Compute and interpret correlation coefficients
c. Compute and interpret regression equations
d. Apply regression equation and examine shortcomings of the regression model
e. Discuss the role of outliers and influential observations with regression
f. *Multiple regression and modeling
g. Find correlation coefficients and regression equations using a calculator or computer software

* Indicates the topic is optional

DIVERSITY STATEMENT:
In this class, the teacher will establish and support an environment that values and nurtures individual and group differences and encourages engagement and interaction. Understanding and respecting multiple experiences and perspectives will serve to challenge and stimulate all of us to learn about others, about the larger world and about ourselves. By promoting diversity and intellectual exchange, we will not only mirror society as it is, but also model society as it should and can be. (Copied from current South Plains College Faculty Handbook)

SPECIFIC GRADING POLICIES:
1. 70%: Tests
2. 30% Homework

CORE OBJECTIVES:

Communication Skills:

Effective development, interpretation, and expression of ideas through written, oral, and visual communication.

- Develop, interpret, and express ideas through written communication
- Develop, interpret, and express ideas through oral communication
- Develop, interpret, and express ideas through visual communication

Critical Thinking:

Creative thinking, innovation, inquiry, analysis, evaluation, and synthesis of information.

- Generate and communicate ideas by combining, changing, and reapplying existing information
- Gather and assess information relevant to a question
- Analyze, evaluate, and synthesize information

Empirical and Quantitative Competency Skills:

The manipulation and analysis of numerical data or observable facts resulting in informed conclusions.

- Manipulate and analyze numerical data and arrive at an informed conclusion
- Manipulate and analyze observable facts and arrive at an informed conclusion

DISABILITY STATEMENT:

Students with disabilities, including but not limited to physical, psychiatric, or learning disabilities, who wish to request accommodations in this class should notify the Special Services Office early in the semester so that the appropriate arrangements may be made. In accordance with federal law, a student requesting accommodations must provide acceptable documentation of his/her disability to the Special Services Coordinator. For more information, call or visit the Disability Services Office through the Guidance and Counseling Centers at Reese Center (Building 8) 806-716-4606, or Levelland (Student Services Building) 806-716-2577.
(Copied from current South Plains College Faculty Handbook)

ACADEMIC HONESTY, EQUAL OPPORTUNITY:

You are expected to uphold the ideas of academic honesty. All work that is graded must be your own. This policy applies to all work attempted in this course. If this policy is violated the student will receive an F for the assignment and will be dropped with an F. For more details on what is considered cheating, see the South Plains College catalog.
South Plains College strives to accommodate the individual needs of all students in order to enhance their opportunities for success in the context of a comprehensive community college setting. It is the policy of South Plains College to offer all educational and employment opportunities without regard to race, color, national origin, religion, gender, disability, or age.