MISSOURI WESTERN STATE UNIVERSITY

COLLEGE OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS

COURSE NUMBER: MAT 331

COURSE NAME: Applied Statistics

COURSE DESCRIPTION:

> Fundamental principles and techniques of statistical investigations and data analysis from a calculus-based perspective including discrete and continuous random variables, estimation and hypothesis testing. Offered Spring semester.

PREREQUISITE:

> A grade of C or better in MAT 137, MAT 147, or MAT 167

TEXT:

> *This course does not require any textbooks.*

TECHNOLOGY:

> Use of graphing calculators will be required throughout the course and each student must have access to a suitable graphing calculator. The graphing calculator must have at least the capacity of the TI-83/84 (the recommended calculator). Graphing calculators other than Texas Instruments calculators may be used but classroom instruction on calculators will be given for TI equipment only. Also, *Minitab* statistical software will be used for data analysis and exploration.

COURSE OBJECTIVES:

> The major goal of this course is to provide students with knowledge and understanding of the mathematical foundations of statistics and the ability to apply that knowledge to analyze and solve problems using statistical techniques. In order to meet this major goal, students will learn how to:

1. Explore and describe data distributions using graphical methods.
2. Describe data distributions using numerical measures.
3. Compute probabilities of discrete and continuous random variables.
4. Recognize the probability distributions for discrete and continuous random variables frequently used in statistical analysis.
5. Apply basic probability principles.
6. Find confidence intervals for population parameters.

7. Perform hypothesis tests using parametric methods.
8. Perform hypothesis tests using non-parametric methods.
9. Analyze two-way tables using a Chi-square test statistic.
10. Understand and perform an analysis of variance (ANOVA).
11. Analyze data trends using regression and correlation.
12. Use appropriate software to analyze data and generate reports.

STUDENT COMPETENCIES:

1. Create barcharts, histograms, boxplots, and stem-and-leaf plots.

2. Compute the mean, median, variance, and standard deviation of a set of data.

3. Compute probabilities of events using results of enumeration methods.

4. Compute probabilities using the probability density function.

5. Distinguish between discrete and continuous random variables and apply the appropriate techniques to each situation.

6. Determine the probability function, the expected value, the variance, and the standard deviation of a discrete random variable.

7. Determine the expected value, variance, and standard deviation of a binomial distribution.

8. Determine the probability of a continuous random variable.

9. Determine the mean, variance, and standard deviation of the sample mean and of the distribution of the sample mean.

10. Determine the mean, variance, and standard deviation of the sample mean and of the distribution of the sample proportion.

11. Determine a confidence interval for a single population parameter.

12. Determine a confidence interval for the difference of two population parameters.

13. State the null and alternative hypotheses of a hypothesis test

14. Distinguish between Type I and Type II errors in a hypothesis test.

15. Compute the p-value associated with a test statistic.

16. Determine the critical value associated with a level of significance.

17. Compute the power of the test.

18. Perform a test of hypotheses on a single population parameter.

19. Perform a test of hypotheses on the difference of two population parameters.

20. Perform non-parametric statistical tests.

21. Create and analyze two-way tables.

22. Perform a Chi-square goodness of fit test.

23. Perform a Chi-square test to compare multiple proportions.

24. Perform a one-way ANOVA to compare multiple means.

25. Construct an ANOVA table by computing the appropriate sums-of-squares.

26. Compute the slope and y-intercept of the least squares regression line.

27. Use the regression line to compute predicted values.

28. Determine residual values associated with the regression line.

29. Perform a hypothesis test on the linear regression slope parameter.

30. Construct confidence intervals for the mean response, $E(Y \mid X = x)$

31. Construct prediction intervals for a future observation of the response variable.

COURSE OUTLINE:

I.   Looking at Data—Distributions

II. Looking at Data—Relationships

III. Producing Data

IV. Probability: The Study of Randomness

V.   Sampling Distributions

VI. Introduction to Inference

VII. Inference for Distributions

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