MATH 361 : Statistical Methods I   **(4-0-4)**   10-05-2017

Catalog Description: Graphical representation of statistical data, measures of central tendency and variability, and elementary probability. Applications of binomial, normal, t, F, and chi-square distributions; tests of hypothesis; regression and correlation analysis. Multiple regression, analysis of variance and design and analysis of experiments.

Course Objectives: After completing this course, students will be able to

1. Describe patterns and departures from patterns in data.

2. Use probability rules and distributions, including the binomial and normal distributions, to solve problems.

3. Perform statistical inference.

Learning Outcomes and Performance Criteria

1. Organize and describe data with numerical measures.
   Core Criteria:

   (a) Calculate the mean.
   (b) Compare and contrast two data sets in terms of their means, variances, and standard deviations.
   (c) Calculate the five number summary.
   (d) Answer questions about a data set based on the five number summary.
   (e) Calculate the linear correlation coefficient.
   (f) Calculate the least squares regression line.
   (g) Compare and contrast the correlation coefficient for two data sets (strength and direction).
   (h) Interpret the slope of a least squares regression line in terms of the variables.
   (i) Interpret the coefficient of determination as the percentage of variation in the response variable explained by the linear model.

   Additional Criteria:

   (a) Calculate the coefficient of determination.
   (b) Calculate the mode.
   (c) Interpret the y-intercept of a least squares regression line.

2. Organize and describe data graphically.
   Core Criteria:

   (a) Create and interpret a box-plot.
   (b) Create and interpret a histogram.
   (c) Create and interpret a scatter-plot.

(d) Compare multiple graphs for different data sets.

Additional Criteria:

(a) Create and interpret a dot-plot.
(b) Create and interpret a steam and leaf diagram.
(c) Create and interpret a pie chart.
(d) Create and interpret a cumulative frequency plot.

3. Describe data with appropriate vocabulary.
   Core Criteria:

   (a) Determine if data is qualitative or quantitative.
   (b) Determine if data is discrete or continuous.
   (c) Distinguish between the explanatory and response variables.
   (d) Determine if data is skewed or symmetric.

4. Calculate and interpret probabilities with discrete distributions using one or more of the following:
   Core Criteria:

   (a) Addition rule.
   (b) Multiplication rule.
   (c) Conditional probability.
   (d) Marginal probability.
   (e) Independent events.
   (f) Dependent events
   (g) Compliment.
   (h) Combination.
   (i) Permutation.
   (j) Multiplication law.
   (k) Binomial distribution.
   (l) Mean and standard deviation of the binomial distribution.
   (m) Tree diagram.
   (n) Expected Value

   Additional Criteria:

   (a) Probability distribution.
   (b) Law of large numbers.
   (c) Standard deviation of a probability distribution.

5. Calculate and interpret probabilities with continuous distributions using one or more of the following distributions or concepts:

Core Criteria:

(a) Normal Distribution.

(b) Sampling Distribution of the mean.

(c) Central limit theorem.

(d) T-Distribution.

Additional Criteria:

(a) Proportions.

6. Make inferences about population mean(s) using a confidence interval:

Core Criteria:

(a) Compute confidence intervals for the mean of a large sample (z-value).

(b) Compute confidence intervals for the mean of a small sample (t-value).

(c) Compute confidence intervals for the difference of two means. (dependant and independent)

(d) Interpret a confidence interval.

Additional Criteria:

(a) Compute confidence intervals for the mean for a proportion.

(b) Test hypothesis for one or two proportion(s).

7. Make inferences about population mean(s) by hypothesis testing:

Core Criteria:

(a) Test hypothesis for one or two mean(s).

(b) Conduct a one-sample, two-sample or paired t-test:
   - Write the null and alternative hypotheses.
   - Determine the test statistic t and the degrees of freedom df.
   - Determine the P-value using technology or give an appropriate interval that includes the P-value.
   - Decide whether or not to reject the null hypothesis and write a conclusion.

(c) Determine whether a t-test is one or two-tailed.

(d) Determine when a paired t-test should be used.

(e) Quantitative evidence from a hypothesis test is conveyed, and explained in such a way that a competent non-expert reader can follow along.