Math 243: INTRODUCTORY STATISTICS   **(4-0-4)**
10/05/2017

Catalog Description: Descriptive statistics, numerical and graphical representation of data, estimation and margin of error, hypothesis testing, correlation; interpretation of statistical results. Cannot be taken for graduation credit by students who have taken MATH 361.

Prerequisite: MATH 100 or instructor's consent.

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

1. Identify types of data, organize and display data.

2. Calculate and interpret numerical measures of data.

3. Determine probabilities.

4. Use statistical methods to make inferences about population parameters.

5. Determine and apply hypothesis tests.

6. Identify regression, methods of sampling and design of experiment.

Learning Outcomes and Performance Criteria

1. Identify types of data, organize and display data.
   Core Criteria:

   (a) Identify the experimental units in a study.
   (b) Identify variables, types of variable and their values (and units).
   (c) Create frequency tables, percent frequency tables, two-way tables.
   (d) Determine appropriate graphical displays for data.
   (e) Interpret graphical displays including histograms, bar charts and scatter plots.
   (f) Describe distributions of data with regard to modality, skewness, (approximate) center and spread.

   Additional Criteria:

   (a) Create a stem-leaf plot for appropriate data set.

2. Calculate and interpret numerical measures of data.
   Core Criteria:

   (a) Compute measures of center and spread (mean, median, mode, standard deviation, variance, interquartile range, range) with or without technology.
   (b) Create and interpret a five number summary and a box-plot.
   (c) Compute and interpret proportions, Z-scores, percentiles and quartiles.
   (d) Interpret coefficient of determination and correlation coefficient.

   Additional Criteria:

   (a) Identify outliers using the Tukey's rule or using the modified box plot.

(b) Interpret the coefficient of variation.

3. Determine probabilities.

   Core Criteria:

   (a) Determine probabilities for normally distributed data using the Empirical Rule.
   (b) Determine probabilities for normally distributed data using Z-scores.
   (c) Determine data value(s) from a given percentage, for normally distributed data.
   (d) Determine probabilities from a two-way table.

   Additional Criteria:

   (a) Calculate binomial probabilities.

4. Use statistical methods to make inferences about population parameters.

   Core Criteria:

   (a) Identify statistical inference technique used in a study.
   (b) Determine whether a value is a parameter or a statistic.
   (c) Determine whether a parameter is a mean or a proportion.
   (d) Determine a point estimate, margin of error, confidence interval estimate and level of confidence.
   (e) Describe relationships between the point estimate, margin of error, confidence level and sample size.
   (f) Identify or give the statistical null and alternative hypotheses for a study.
   (g) Interpret a P-value in terms of the alternative hypothesis.
   (h) Given a P-value and a level of significance α, determine whether to reject the null hypothesis.
   (i) Write a conclusion based on whether or not a null hypothesis was rejected.
   (j) Interpret your statistical conclusions in the context of the study given.

   Additional Criteria:

   (a) Apply the rejection region method to determine whether to reject the null hypothesis.

5. Determine and apply hypothesis tests.

   Core Criteria:

   (a) Determine the correct test for a given situation
   (b) Conduct a one-sample, two-sample or matched pair 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 matched-pairs 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.

Additional Criteria:

(a) Apply a goodness-of-fit chi-square test.

(b) Determine whether the data meets the assumptions for a given test.

6. Identify regression, methods of sampling and design of experiment.

Core Criteria:

(a) Determine the sampling methods used for a study (simple random, stratified, convenience).

(b) Determine whether a study is observational or experimental.

(c) Discuss the need for controls such as placebo and blinding.

(d) Discuss the need of randomization in the design of an experiment.

(e) Interpret the slope of a simple regression line.

(f) Interpret linear (Pearson's) correlation coefficient.

Additional Criteria:

(a) Determine sampling methods including systematic and cluster sampling.

(b) Identify potential sources of bias.

(c) Identify potential confounding variables (lurking variable).

(d) Discriminate between causation and association.

(e) Using technology, develop a simple linear regression for a given scatter data.

(f) Use a linear regression line to make predictions.