J. Sargeant Reynolds Community College
Course Content Summary

Course Prefix and Number: MTH 245 **Credits:** 3

Course Title: Statistics I

Course Description: Presents an overview of statistics, including descriptive statistics, elementary probability, probability distributions, estimation, hypothesis testing, correlation, and linear regression. Credit will not be awarded for both MTH 155 - Statistical Reasoning and MTH 245 - Statistics I or equivalent. Prerequisite: Completion of MTH 154 or MTH 161 or equivalent with a grade of C or better. Lecture 3 hours.

General Course Purpose: To serve as a first course in data collection and analysis, applied probability, and statistical inference for students needing greater depth in preparation for application of content to workforce tasks or further study in statistical research methods. Designed for students whose intended transfer program requires a comprehensive introduction to a statistics course typical of students whose academic requirements require a research methods course, such as psychology majors.

Course Prerequisites and Co-requisites:
Prerequisite: Completion of MTH 154 or MTH 161 or equivalent with a grade of C or better.

Student Learning Outcomes:
Upon completing the course, the student will be able to

1. (Graphical and Numerical Data Analysis)
   - Identify the difference between qualitative, discrete quantitative, and continuous quantitative data;
   - Construct and interpret graphical displays of data, including (but not limited to) frequency tables, box plots, line charts, histograms, and bar charts;
   - Compute measures of center (mean, weighted mean, median, mode), measures of variation (range, interquartile range, standard deviation, variance), and measures of position (percentiles, quartiles, standard scores);
   - Apply the Empirical Rule;

2. (Sampling/Experimental Design)
   - Recognize a representative sample and describe its importance;
   - Identify methods of sampling;
   - Explain the differences between observational studies and experiments;
   - Recognize and explain the key concepts in experiments;

3. (Probability Concepts)
   - Describe the difference between relative frequency and theoretical probabilities, and use each method to calculate probabilities of events;
   - Determine whether two events are mutually exclusive or independent;
   - Determine probabilities of composite events using the complement rule, the addition rule, and the multiplication rule;
   - Apply the Law of Large Numbers;
   - Distinguish between discrete and continuous random variables;

- Use the binomial, normal, and t distributions to calculate probabilities;
- Recognize or restate the Central Limit Theorem and use it as appropriate;
- Identify when the use of the normal distribution is appropriate;
- Identify when the t distribution is preferable to the normal distribution in statistical inference;
- Distinguish between the distribution of a random variable and the sampling distributions of its associated sample statistics;
- Identify the sampling distributions of the sample mean and the sample proportion and use them to make statistical inferences;

4. (Univariate Statistical Inference)
   - Explain the difference between point and interval estimates;
   - Describe the concepts of best estimate and margin of error;
   - Construct confidence intervals for population means and proportions;
   - Interpret the confidence level associated with an interval estimate;
   - Distinguish between a two-tailed, left-tailed, and right-tailed hypothesis test;
   - Conduct hypothesis tests for population means and proportions;
   - Interpret the meaning of both rejecting and failing to reject the null hypothesis;
   - Describe Type I and Type II errors in the context of specific hypothesis tests;
   - Use a p-value to reach a conclusion in a hypothesis test;
   - Identify the interrelationship between hypothesis tests and confidence intervals;

5. (Two-Sample Statistical Inference)
   - Construct and interpret a confidence interval for the difference between two population means where the samples are independent and the population variances are assumed unequal;
   - Construct and interpret a confidence interval for the difference between two population means where the data consists of matched pairs;
   - Conduct a hypothesis test for the equality of two population means where the samples are independent and the population variances are assumed unequal;
   - Conduct a hypothesis test for the equality of two population means where the data consists of matched pairs;

6. (Correlation and Regression)
   - Analyze scatterplots for patterns, linearity, and influential points;
   - Determine the equation of a least-squares regression line and interpret its slope and intercept;
   - Calculate and interpret the correlation coefficient and the coefficient of determination;
   - Conduct a hypothesis test for the presence of correlation;

7. (Technology Application)
   - Construct statistical tables, charts, and graphs using appropriate technology;
   - Calculate descriptive and inferential statistics using an appropriate statistical software package; and
   - Complete statistical project.

Major Topics to Be Included:

1. Graphical and Numerical Data Analysis
2. Sampling/Experimental Design
3. Probability Concepts
4. Univariate Statistical Inference
5. Two-Sample Statistical Inference
6. Correlation and Regression
7. Technology Application

Date Created/Updated (Month, Day, and Year)**:** December 13, 2018