



## MTH 163 Statistics I Extended Topics – Course Objectives

(approved 4/2021)

The purpose of this course is to bridge the gap between MTH160 Statistics and MTH 162 Statistics for the Social Sciences. Its purpose is to allow for a more direct pathway for transfer students, students who have changed their major, etc., who have earned MTH 160 credit and now find themselves needing credit for MTH 162.

Instructors will incorporate the use of technology and real data to perform calculations and to construct graphs. This course will focus on interpretation of results obtained from statistical software with minimal emphasis on manual computation.

1. Statistical Inference - Estimation and Hypothesis Testing
  - 1.1 Review the relationship between a sample statistic and its corresponding population parameter.
  - 1.2 Review how to estimate a parameter and define the following terms: point estimate, level of confidence, maximum error of estimate, and confidence interval.
  - 1.3 Review how to perform a hypothesis test and define the following terms: null hypothesis, alternative hypothesis, level of significance, Type I and Type II errors and their associated probabilities, test statistic,  $p$ -value, decision, and conclusion.
  - 1.4 Review the Student's  $t$ -distribution and compare it with the normal distribution.
  - 1.5 Review formulas and statistical software to determine and interpret confidence intervals that estimate  $\mu$  and  $p$  for any level of confidence. Recognize the limitations of the methods used to construct these estimates.
  - 1.6 Generate the following hypothesis tests and interpret the decisions with appropriate conclusions that incorporate the limits of these tests.
    - a. Review one population
      - I. test  $\mu$  using both the  $z$  and  $t$  statistic
      - II. test  $p$
    - b. Two populations
      - I. test two independent means
      - II. test two dependent means
      - III. test two proportions
    - c.  $\rho$  (rho), the population value of linear correlation.
  - 1.7 Perform the calculations for effect size (standardizing the mean differences). Describe, interpret, and compare the values of effect size for different samples.
  - 1.8 Use Chi-Square to complete hypothesis tests for independence using data in a contingency table and interpret the results as it relates to the data set.
2. Analysis of Variance
  - 2.1 Articulate the basic concepts of Analysis of Variance.
  - 2.2 Recognize when to apply ANOVA technique.
  - 2.3 Complete one-factor ANOVA (hypothesis test for the factor)

3. Statistical Software
  - 3.1 Use statistical software to generate output corresponding to the following topics.
    - a. Confidence intervals.
    - b. Hypothesis tests and ANOVA.
  - 3.2 Analyze and interpret software-generated output

### **Optional Topics:**

4. Power Calculations
  - 4.1 Calculate the power of a statistical test
  - 4.2 Articulate the basic concept of the power of a statistical test with relationship to  $\beta$ , the probability of committing a Type II error.
5. Complete an ANOVA solution for problems involving:
  - 5.1 two-factors without replication (hypothesis test for each factor)
  - 5.2 two-factors with replication (hypothesis test for interaction and each factor)