The individual instructor is responsible for his/her own final exam.

The main purpose of this course is the continuation and extension of the study of the techniques of inferential statistics studied in MTH 160. There is an emphasis on the problems and procedures of statistical experimentation, where each student is directly involved with the following tasks:

a. Obtain real data from a web site, publication, survey, experiment, or class collected data.
b. Collect, organize, analyze, interpret, and represent numerical data for at least one project, taking advantage of computer software to facilitate calculations and graphing while minimizing labor-intensive work done manually.

The use of a statistical software is strongly encouraged throughout the course.

Unless stated otherwise in the objectives, work may be done by hand and/or technology. Regardless of the approach, the focus is on the interpretation of the results.

1. Statistical Inference – Estimation and Hypothesis Testing
   - 1.1 Generate the following hypothesis tests and interpret the decision with appropriate conclusions that incorporate the limits of these tests
     - a. One population
       - i. Test μ using the t statistic (review)
       - ii. Test p (review)
       - iii. Test σ or $\sigma 2$
     - b. Two populations
       - i. Test two dependent means
       - ii. Test two independent means
       - iii. Test two proportions
       - iv. Test two variances and/or standard deviations
   - 1.2 Construct confidence interval estimates for
     - c. One population
       - i. μ using the t statistic (review)
       - ii. p (review)
     - d. Two populations
       - i. Mean value of paired differences
       - ii. Difference of means
       - iii. Difference of two proportions
2. Sampling Techniques, Errors, and Sample Size
   - 2.1 Describe and understand the differences among various random sampling techniques. Understand the various errors that can occur in sampling
   - 2.2 State the Type I and Type II errors for given null hypotheses. Determine which error is more serious and discuss appropriate values for α and β
   - 2.3 Articulate the meaning of the Type II error and be able to calculate the Type II error for proportions.

2.4 Calculate the sample size necessary to meet the specified restrictions of an inference problem dealing with proportions.

2.5 Know and understand the relationship between α, β and n.

2.6 Perform appropriate analyses for detecting extreme values (outliers)

3. Use of Chi Square

3.1 Distinguish between problems that can be solved using chi-square and those that cannot

3.2 Distinguish between types of chi-square tests:

a. Multinomial experiments

i. Goodness-of-fit

b. Contingency tables

i. Independence

ii. Homogeneity

3.3 Complete hypothesis tests using all three types of chi-square tests

4. Analysis of Variance

4.1 Articulate the basic concepts of analysis of variance

4.2 Recognize when (and when not) to apply ANOVA techniques

4.3 Complete an ANOVA solution for problems involving

a. One-factor

b. Two-factor with replication

5. Correlation and Regression Analysis

5.1 Determine and interpret the linear correlation coefficient r and the equation of the least- squares regression line (Review)

5.2 Produce and interpret the graph of the least-squares regression line and interpret a predicted value of y (Review)

5.3 Complete inferences about ρ (rho), the population value of linear correlation

5.4 Understand the limitations of correlation

5.5 Test the calculated line of regression for lack of fit and usefulness for predictions

5.6 Construct confidence interval estimates for the mean value of y at a given value of x, and prediction interval estimates for the value of y at a given value of x

5.7 Articulate the relationship and the difference between correlation and regression analysis

5.8 Produce and interpret a multiple regression model and calculate a predicted value of y

5.9 Determine the appropriate non-linear regression model to use when applicable

6. Non-Parametric Statistics

6.1 Demonstrate the awareness of the existence of a multitude of non-parametric tests, include the idea of "distribution free" statistics in reference to the lessening of restrictions and understand the comparison between the non-parametric and parametric methods

6.2 Conduct hypothesis tests for normality as a means of choosing between non-parametric and parametric methods

6.3 Demonstrate familiarity with and be able to complete:

a. Sign Test

b. Wilcoxon Rank-Sum and/or Mann-Whitney U test

c. Runs Test

d. Spearman's Rank Correlation Test

6.4 Determine when specific non-parametric procedures may be applied and be able to determine when a parametric method could be used

7. Statistical Experimentation

7.1 Demonstrate an awareness of the realities of statistical applications to the real world by carrying out at least one independent research project. The project(s) shall include the use of statistical software and the following:

a. Development of objectives

b. Obtaining real data from a website, publication, survey, experiment, or class collected data.

c. Selection of statistical techniques

d. Collection of a sample

e. Calculations and descriptions

f. Completion of statistical inferences

g. Conclusions