WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline – STAT 460**

**Title:** Mathematical Statistics II

**Number of Credits:** 3

**Catalog Description:** A mathematical approach to probability and statistics. Prerequisites: MATH 312, completion of or concurrent enrollment in MATH 337, and ENG 111.

**Possible Textbooks:**

* Wackerly, Mendenhall, & Scheaffer. *Mathematical Statistics with* Applications. 7th edition.
* Casella & Berger. *Statistical Inference*. 2nd Edition

**Topics Covered:**

1. Point Estimation
   1. Methods for finding estimators
      1. Method of moments
      2. Maximum likelihood
      3. Minimum distance methods
   2. Properties of estimators
   3. Sufficiency and completeness
      1. Definitions
      2. Factorization criterion
      3. Minimal sufficient statistics
      4. Lehman-Scheffe theorem
      5. Exponential family of distributions
   4. Unbiased estimation
      1. Cramer-Rao lower bound for variance
      2. Rao-Blackwell theorem
      3. Sufficiency and completeness
   5. Baye’s estimation
2. Interval Estimation
   1. Definitions of a confidence interval
   2. Methods for finding a confidence interval
      1. Pivotal quantity method
      2. Statistical method
      3. Large sample methods
   3. Examples based on the normal distribution
   4. Bayesian credible intervals
3. Test of Hypothesis
   1. Introduction
   2. Simple versus simple and Neyman-Pearson Lemma
   3. Composite alternative and composite hypothesis
      1. Uniformly most powerful tests
      2. Methods for finding tests
      3. Baye’s tests
   4. Generalized likelihood ratio test (GLRT)
      1. ANOVA
      2. Regression
      3. Chi-square
4. Nonparametric tests (time permitting)



**Listing of Sections to be Covered:** Not applicable to this course, since there is no standard textbook. Chosen sections of any text should correspond to the topics outlined above.

**Remarks:** None.

**Approximate Pace of Coverage:** Not Applicable.

**Method of Instruction:** Methods may include lecture, group work, and presentations.

**Evaluation Procedure:** Assessments will vary in style and may include written exams, quizzes, and homework assignments.

**Minnesota Transfer Curriculum:** Writing Intensive

* Practice the processes and procedures for creating and completing successful writing in their fields.
* Understand the main features and uses of writing in their fields.
* Adapt their writing to the general expectations of readers in their field.
* Make use of technologies commonly used for research and writing in their fields.
* Learn the conventions of evidence, format, usage, and documentation in their fields.

**MnSCU Learning Outcomes:**

* This course will promote a student’s ability to understand the concepts of parameter estimation and various criteria to gauge the estimators.
* This course will promote a student’s ability to be able to derive the estimates for the parameters of various distributions.
* This course will promote a student’s ability to be able to construct confidence intervals for the parameters of various distributions.
* This course will promote a student’s ability to understand the concept of statistical hypothesis testing.
* This course will promote a student’s ability to be able to derive the likelihood ratio test statistics.
* This course will promote a student’s ability to be able to perform various statistical tests concerning means, proportions, variances and correlations.
* This course will promote a student’s ability to be able to perform statistical tests involving contingency tables and goodness-of-fit.

**Possible Computer Software:** None

**Last Revised:** Fall 2012 by the Statistics Subgroup.