WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline – STAT 450**

**Title:** Mathematical Statistics I

**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. Review of probability
2. Discrete random variables
3. Distribution functions
4. Expectation
5. Discrete random vectors
6. Joint distribution function
7. Independent random variables
8. Conditional distributions
9. Distribution of a function of a random variable
10. Expectation
11. Properties
12. Expectation of a function of a random variable
13. Conditional expectation
14. Computing expectations by conditioning
15. Computing variances by conditioning
16. Moment generating functions
17. Other probability topics (as time permits)
18. Review of probability
19. Discrete random variables
20. Distribution functions
21. Expectation
22. Discrete random vectors
23. Joint distribution function
24. Independent random variables
25. Conditional distributions
26. Distribution of a function of a random variable
27. Expectation
28. Properties
29. Expectation of a function of a random variable
30. Conditional expectation
31. Computing expectations by conditioning
32. Computing variances by conditioning
33. Moment generating functions
34. Other probability topics (as time permits)
35. Distribution theory
36. Uniform, normal, gamma, beta, and other continuous distribution functions
37. Joint and conditional distribution functions, stochastic independence
38. Expectations of random variables
39. Definition
40. Conditional expectation
41. Generating functions and moments
42. Independence and expectation
43. Moment inequalities
44. Expectations of functions of random variables
45. Distributions of functions of random variables
46. Cumulative distribution function technique
47. Generating function technique
48. Jacobian technique
49. Sampling distributions
50. Sample mean
51. Law of large numbers
52. Central limit theorem
53. Sampling from the normal
54. Chi-Square distribution
55. T distribution
56. F distribution
57. Order statistics

**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 basic probability theory.
* This course will promote a student’s ability to understand the concepts of probability distributions and distribution functions.
* This course will promote a student’s ability to understand how the most commonly used discrete as well as continuous distributions arise in the real world.
* This course will promote a student’s ability to understand the random variables and their distributions.
* This course will promote a student’s ability to understand the concept of joint distributions.
* This course will promote a student’s ability to understand the mathematical expectations of random variables.
* This course will promote a student’s ability to understand the moments, joint moments and moment generating functions of the random variables.
* This course will promote a student’s ability to be able to apply the various techniques they learned in calculus to the field of Statistics.
* This course will promote a student’s ability to be able to derive the marginal and conditional distributions from the joint distributions.
* This course will promote a student’s ability to be able to derive the distributions of the functions of random variables by various different methods.
* This course will promote a student’s ability to understand the concept of sampling distributions.
* This course will promote a student’s ability to understand convergence in probability and distribution.
* This course will promote a student’s ability to be able to derive the basic distributions that come from sampling from a normal distribution.

**Possible Computer Software:** None

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