WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline – STAT 110**

**Title:** Fundamentals of Statistics

**Number of Credits:** 3

**Catalog Description:** Introductory statistics with an emphasis on applications. Meets: GOAL 4. Prerequisite: Qualifying mathematics placement score or STAT 100 – Numbers and Data in Society. **Note:** Students in certain majors should take STAT 210 instead of STAT 110.

**Possible Textbooks:**

* *Utts and Heckard, Mind on Statistics, latest edition*
* *McClave and Sincich, Statistics, latest edition*
* *Agresti and Franklin, Statistics the Art and Science of Learning from Data, latest edition*
* *De Veaux, Vellman and Bock, Intro Stats, latest edition*
* *Moore, The Basic Practice of Statistics, latest edition*

**Topics Covered:**

1. The Research Process
	1. The research question/hypothesis and the predictor, response, and population of interest
	2. The role of random samples; population vs. sample
	3. Types of studies
		1. Experiments and the role of randomization
		2. Observational studies and effects of confounding
		3. Surveys and possible biases
2. Data Displays and Summary Statistics
	1. For categorical variables
		1. Bar charts
		2. Frequency distributions
	2. For numeric variables
		1. Measure of central tendency: mean/average, median
		2. Measures of variation: variance, standard deviation, interquartile range
		3. Robustness
		4. Histograms and boxplots
	3. Contingency tables
		1. Row and column percentages
		2. Relative risk, difference between proportions, and odds ratios
		3. Relationships in r x c tables
	4. Scatterplots
		1. Measures of correlation
		2. Simple linear regression
3. Introduction to Sampling Distributions
	1. Statistics vs. parameters
	2. Sampling errors
	3. The importance of random samples
4. Confidence Interval Estimation
	1. One-sample confidence intervals
		1. Inference about a single proportion
		2. Inference about a single mean
	2. Two-sample confidence intervals
		1. Inference about a difference between two proportions
		2. Inference about relative risks
		3. Inference about a difference between means
	3. Paired-sample confidence interval, involving inference about a mean difference
5. Hypothesis Testing
	1. The logic of hypothesis tests
		1. Translating a research question into null and alternative hypotheses
		2. p-values; Type I and Type II errors
	2. Interpretation of statistical results
		1. Association vs. casual connection
		2. Description of a sample vs. inference about a population
		3. Statistical significance vs. practical significance
	3. Common two-sample tests
		1. For a difference between proportions
		2. For a difference between means
		3. Mann-Whitney-Wilcoxon Test
	4. Paired-sample tests
		1. Paired-sample t-test
		2. Wilcoxon signed-rank test
	5. Tests for contingency tables
		1. Fisher’s Exact Test for 2x2 tables
		2. Chi-square test

**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, case studies, discussion, group work, problem solving sessions, computer sessions, and discussion of computer output.

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

**Minnesota Transfer Curriculum:** Goal 4 – Mathematical/Logical Reasoning

* Illustrate historical and contemporary applications of mathematical/logical systems.
* Clearly express mathematical/logical ideas in writing.
* Explain what constitutes a valid mathematical/logical argument (proof).
* Apply higher-order problem-solving and/or modeling strategies.

**MnSCU Learning Outcomes:**

* This course will promote a student’s ability to use logical reasoning by studying mathematical patterns and relationships. A successful student will be able to investigate the different ways in which to determine patterns for variables and evaluate the relationship between them.
* This course will promote a student’s ability to use mathematical models to describe real-world phenomena and to solve real-world problems, as well as understand the limitations of models in making predictions and drawing conclusions. A successful student will be able to design and carry out a real-world experiment or observational study and properly state the findings and conclusions.
* This course will promote a student’s ability to organize data, communicate the essential features of the data, and interpret the data in a meaningful way. A successful student will be able to organize data, communicate essential features of the data both numerically and graphically and provide interpretations and conclusions.
* This course will promote a student’s ability to do a critical analysis of scientific and other research. A successful student will be able to answer a desired research question through hypothesis testing by providing implications, interpretations and conclusions.
* This course will promote a student’s ability to extract correct information from tables and common graphical displays. A successful student will be able to draw conclusions and express relationships (both orally and written) illustrated in graphical displays such as line graphs, scatterplots, histograms and frequency tables.
* This course will promote a student’s ability to use appropriate technology to describe and solve quantitative problems. A successful student will be able to use the statistical software package JMP to perform most analyses in this course. The students will also be able to interpret the results from the given output.

**Possible Computer Software:**

* JMP
* Excel
* SPSS

**Last Revised:** Fall 2011 by the Statistics Subgroup.