WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline – STAT 405**

**Title:** Biostatistics

**Number of Credits:** 3

**Catalog Description:** This course will give students an overview of Biostatistics. The topics to be covered include contingency tables analysis, relative risk, odds ratios, partial association, Cochran-Mantel-Haenszel methods, two-way ANOVA, interactions, repeated measures, logistic regression, Poisson regression, Kaplan-Meier methods, and Cox proportional hazards models. Parametric methods and various nonparametric alternatives will be discussed. Prerequisites: STAT 310. Offered Alternate Years.

**Possible Textbooks:**

* Rosner, Bernard. *Fundamentals of Biostatistics* (7th edition) - ebook
* Daniel, Wayne. Biostatistics *A Foundation for Analysis in the Health Sciences*. 9th Edition. Wiley

**Topics Covered:**

1. Introduction to Biostatistical Design of Medical Studies
   1. Randomized clinical trials
   2. Cross-sectional, case-control, and cohort studies
2. Methods for a Single Categorical Variable
   1. Review of descriptive summaries
   2. Hypothesis tests for a single proportion (including binomial exact tests)
   3. Confidence intervals for a single proportion (including binomial exact intervals)
   4. Power and sample size
   5. Inference using the Poisson distribution
3. Methods for Two Categorical Variables
   1. Conditional probability and Bayes rule for screening tests
   2. Relative risk and odds ratios
   3. Confidence intervals for relative risk and odds ratios
   4. Tests for comparing two independent proportions (including chi-square and Fisher’s exact test)
   5. Confidence intervals for the difference in proportions
   6. Number needed to treat and number needed to harm
   7. Inference for two dependent proportions (McNemar’s test)
   8. Power and sample size for chi-square, Fisher’s exact, and McNemar’s tests
   9. Chi-square tests for RxC tables (including test for trend)
4. Methods for Three Categorical Variables
   1. Cochran-Mantel-Haenszel (CMH) test
   2. CMH odds ratio
   3. Tests for common odds ratios
5. Brief overview of linear models
   1. Linear regression
   2. ANOVA for factorial experiments
6. Logistic Regression
   1. The simple logistic regression model
   2. Inference for the simple logistic regression model
   3. Interpretation of results (including discussion of odds ratios)
   4. The multiple linear regression model
   5. Inference for the multiple linear regression model
   6. Interpretation of results (including discussion of adjusted odds ratios)
   7. Model diagnostics
   8. Conditional logistic regression
7. Survival Analysis
   1. Censoring
   2. Estimation of survival curves – Kaplan-Meier method
   3. Inference for comparing survival curves
   4. The hazard function
   5. The Cox proportional-hazards (PH) regression model
   6. Inference for the Cox PH regression model
   7. Model Diagnostics for the Cox PH regression model

**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:** none

**MnSCU Learning Outcomes:**

* This course will promote a student’s ability to recognize the roles and responsibility of the practicing biostatistician.
* This course will promote a student’s ability to be a knowledgeable consumer of common statistical methods used in the field of biostatistics and should be able to properly obtain and use these methods.
* This course will promote a student’s ability to model and solve real-world problems in the field of biostatistics, as well as understand the limitations of models in making predictions and drawing conclusions.
* This course will promote a student’s ability to effectively communicating results to persons without any specialized statistical training.
* This course will promote a student’s ability to improve their ability to interpret and critique analyses done by others.
* This course will promote a student’s ability to use appropriate technology to describe and solve quantitative problems.

**Possible Computer Software:** None

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