Course Proposal for Introduction to Biostatistics
STAT 405 (3 s.h.)
Department of Mathematics and Statistics
Winona State University

A. COURSE DESCRIPTION

I. Catalog Description:

✓ This course will give students an overview of aspects in the field of Biostatistics. The topics to be covered are contingency tables, relative risk, odds ratios, partial association, Cochran-Mantel-Haenszel methods, logistic regression, Poisson regression, Kaplan-Meier methods, and Cox proportional hazards models.

✓ Two-way ANOVA, interactions, repeated measures, general linear models. Logistic regression for cohort and case-control studies. Loglinear models, contingency tables, Poisson regression, survival data, Kaplan-Meier methods, proportional hazards models.

✓ Nonparametric methods

✓ Prerequisites: an introductory statistics course (preferably STAT 210 or STAT 305).

✓ Offered alternative fall semesters.

1. Major focus and objectives:

✓ The focus of the course is to introduce students to many of the common analyses in the field of biostatistics.

✓ The course will emphasize the roles and responsibilities of the practicing biostatistician.

✓ The objectives of the course are to teach students the correctly analyze biological studies and communicate their results of their analyses in laymen terms.
2. **Course Outline:**

I. Introduction to Biostatistics

II. Biostatistical Design of Medical Studies

III. Statistical Preliminaries

IV. Nonparametric Methods
   a) Concept of Ranks
   b) Single Sample Procedures
   c) Comparative Methods
      i) Two-sample procedures
      ii) Procedures for three or more samples

V. Categorical Data
   a) Categorical Response Data
   b) Inferences for a Single Proportion
   c) Inferences for Two Independent Proportions
   d) Inferences for Multinomial Probabilities (Goodness-of-Fit)
   e) Inferences for Two Dependent Proportions (McNemar’s Test)

VI. Two-Way Contingency Tables
   a) Fisher’s Exact Test
   b) Relative Risk and Odds Ratios
   c) Measures of Association
   d) Chi-Square Test of Independence
   e) Chi-Square Test of Homogeneity
   f) Tests for Trend

VII. Three-Way Contingency Tables
   a) Partial Association
   b) Cochran-Mantel-Haenszel Methods

VIII. Brief Overview of Linear Models
   a) Linear Regression
   b) Factorial Experiments (ANOVA)
   c) Repeated Measures

IX. Generalized Linear Models
   a) Models for Binary Data – Logistic Regression
      i. Logistic Regression Model
      ii. Model Development and Inference
      iii. Interpretation of Results
      iv. Model Diagnostics
   b) Models for Count Data – Poisson Regression
      i. Poisson Regression Model
      ii. Model Development and Inference
      iii. Interpretation of Results
      iv. Model Diagnostics

X. Analysis of Person-Time Data
   a) Person-Time Data
   b) Analysis of Incidence Rates
XI. Survival Analysis
   a) Censoring
   b) Estimation of Survival Curves – Kaplan-Meier Method
   c) Comparing Two Survival Curves
   d) Comparing More than Two Groups
   e) The Hazard Function
   f) Proportional-Hazard Model
      i. Model Development and Inference
      ii. Interpretation of Results
      iii. Model Diagnostics

III. Basic Instructional Plan and Methods Utilized:

✓ The basic method of instruction will be lecture, discussion, and laboratory work.

IV. Course Requirements:

✓ Course requirements may include homework assignments that will include various analyses and write-ups, and exams. Students will be evaluated on their performance on these assignments.

VI. References

✓ Nonparametrics
   1. Applied Nonparametric Statistics (The Duxbury Advanced Series in Statistics) by Wayne Daniel

✓ Categorical
   1. An Introduction to Categorical Data Analysis by Alan Agresti
   2. A Course in Categorical Data Analysis by Thomas Leonard, Tom Leonard
   3. Applied Categorical Data Analysis by Chap T. Le

✓ Survival
   1. Survival Analysis: A Practical Approach by Mahesh K. B. Parmar, David MacHin
   2. Survival Analysis: A Self-Learning Text (Statistics in the Health Sciences) by David G. Kleinbaum
   3. Survival Analysis: Techniques for Censored and Truncated Data (Statistics for Biology and Health) by John P. Klein, Melvin L. Moeschberger
Logistic Regression/Generalized Linear Models

III.

✓ Journal articles as needed

B. **RATIONALE**
The area of Biostatistics is rapidly growing and the job outlook for biostatisticians is very good. Over the years we have seen an increase the number of students pursuing advanced degrees in biostatistics after graduation. Also several of our students have gained employment or held internships in the Division of Biostatistics at the Mayo Clinic. It is the opinion of the statistics faculty in the Department of Mathematics and Statistics that we should be offering a course in biostatistical methods for students majoring and minoring in statistics. A statistics major with a background in this material will be at a competitive advantage whether they plan to enter the work force directly or they plan to attend graduate school.

C. **NOTIFICATION**
There is no notification required because the course is not required in any major or minor. However, the Biology Department has been notified, as the course may be of potential interest to students in pre-professional tracks.

D. **“G” Course**
Not applicable

E. **GENERAL EDUCATION COURSE PROPOSALS**
Eventually the department would like to propose this course as a writing flag.