WINONA STATE UNIVERSITY
PROPOSAL FOR NEW COURSES

Department: Mathematics & Statistics

Date: February 28, 2005

Course No. Course Name Credits
405 Biostatistics 3

This proposal is for a(n) X Undergraduate Course ___ Graduate Course
Applies to: X Major ___ Minor ___ University Studies*
X Required ___ Required
Elective Elective

Prerequisites: Any introductory statistics course (preferably STAT 210 or STAT 305)

Grading method Grade only P/NC only X Grade and P/NC Option

Frequency of offering: Alternative Fall Semesters

*For University Studies Program course approval, the form Proposal for University Studies Courses must also be completed and submitted according to the instructions on that form.

Provide the following information (attach materials to this proposal):

A. Course Description
   1. Catalog description.
   2. Course outline of the major topics and subtopics (minimum of two-level outline).
   3. Basic instructional plan and methods.
   4. Course requirements (papers, lab work, projects, etc.) and means of evaluation.
   5. Course materials (textbook(s), articles, etc.).
   6. List of references.

B. Rationale
   1. Statement of the major focus and objectives of the course.
   2. Specify how this new course contributes to the departmental curriculum.
   3. Indicate any course(s) which may be dropped if this course is approved.

C. Impact of this Course on other Departments, Programs, Majors, or Minors
   1. Does this course increase or decrease the total credits required by a major or minor of any other department? If so, which department(s)?
   2. List the departments, if any, which have been consulted about this proposal.

D. University Studies Course Proposals
   The form Proposal for University Studies Course must also be completed and submitted according to the instructions on that form.

Attach a Financial and Staffing Data Sheet.

Attach an Approval Form.

Department Contact Person for this Proposal:

Christopher J. Malone 457-2989 cmalone@winona.edu
Name (please print) Phone e-mail address
Course Proposal for *Biostatistics*  
STAT 405 (3 s.h.)  
Department of Mathematics and Statistics  
Winona State University  

**A. COURSE DESCRIPTION**

1. **Catalog Description**

   This course will give students an overview of aspects in the field 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: An introductory statistics course (preferably STAT 210 or STAT 305). Offered alternate fall semesters.

2. **Major focus and objectives**

   The focus of the course is to introduce students to many of the common analyses in the field of biostatistics. This course will emphasize the roles and responsibilities of the practicing biostatistician. The objectives of the course are to teach students to correctly analyze biological studies and how to effectively communicate the results of their analyses.

3. **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

4. Basic Instructional Plan and Methods Utilized

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

5. Course Requirements

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

6. References
   • Nonparametric Statistics
     o Applied Nonparametric Statistics by Wayne Daniel
     o Practical Nonparametric Statistics by W.J. Conover.
• Categorical Data Analysis
  o An Introduction to Categorical Data Analysis by Alan Agresti
  o A Course in Categorical Data Analysis by Thomas Leonard and Tom Leonard
  o Applied Categorical Data Analysis by Chap T. Le

• Survival Analysis
  o Survival Analysis: A Practical Approach by Mahesh K. B. Parmar and David MacHin
  o Survival Analysis: A Self-Learning Text (Statistics in the Health Sciences) by David G. Kleinbaum
  o Survival Analysis: Techniques for Censored and Truncated Data (Statistics for Biology and Health) by John P. Klein and Melvin L. Moeschberger
  o Applied Survival Analysis by Chap T. Le

• Logistic Regression/Generalized Linear Models
  o Applied Logistic Regression by David Hosmer and Stanley Lemeshow
  o Generalized Linear Models by Peter McCullagh and J. A. Nelder

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 in the number of students pursuing advanced degrees in biostatistics after graduation. Also, several of the statistics majors have gained employment or held internships in the Division of Biostatistics at the Mayo Clinic. Further, medical schools (such as the University of Minnesota) are asking their applicants to have deeper backgrounds in statistics than in the past. Hence, there is a great need for a course in this area for students majoring or minoring in statistics and/or considering medical school. Students with a background in Biostatistics 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
WINONA STATE UNIVERSITY
FINANCIAL AND STAFFING DATA SHEET

Course or Program: STAT 405 Biostatistics

Include a Financial and Staffing Data Sheet with any proposal for a new course, new program, or revised program.

Please answer the following questions completely. Provide supporting data.

1. Would this course or program be taught with existing staff or with new or additional staff? If this course would be taught by adjunct faculty, include a rationale.

   The course was offered as a topics course last year. The enrollment was similar to other electives regularly offered by our Department. Last year this course was taught by existing staff and could be in the future; however, our Department is currently searching for a Biostatistician and anticipate that this individual will teach this course in the future.

2. What impact would approval of this course/program have on current course offerings? Please discuss number of sections of current offerings, dropping of courses, etc.

   Recently, several of our statistics majors and minors have gained employment or held internships in the Division of Biostatistics at the Mayo Clinic and have attended graduate programs in Biostatistics. There is a need for a course in this area for our students. As a result, this course is being developed to meet their needs.

   This course will serve as an elective for all statistics majors and statistics minors, but students interested in pursuing a career in biostatistics will be strongly encouraged to take this course. There will be one section of this course and this course is to be offered alternative fall semesters.

3. What effect would approval of this course/program have on the department supplies? Include data to support expenditures for staffing, equipment, supplies, instructional resources, etc.

   The impact on department supplies is minimal. Additional software will not be required to teach this course.
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Please forward to Registrar.

Registrar

Date entered