New Course Request **Indiana University** Indianapolis Campus

Check Appropriate Boxes: Undergraduate credit ☐ Graduate credit XX ☐ Professional credit ☐

1. School/Division Science, Biostatistics 2. Academic Subject Code BIOS
3. Course Number S636 (must be cleared with University Enrollment Services) 4. Instructor M. Yu
5. Course Title Advanced Survival Analysis

   Recommended Abbreviation (Optional) _____
   (Limited to 32 Characters including spaces)
6. First time this course is to be offered (Semester/Year): Fall 2009
7. Credit Hours: Fixed at 3.0 or Variable from _____ to _____
8. Is this course to be graded S-F (only)? Yes _____ No X
9. Is variable title approval being requested? Yes _____ No X
10. Course description (not to exceed 50 words) for Bulletin publication: P: STAT 53600, STAT 62800. Addresses the counting process approach to the analysis of censored failure time data. Standard statistical methods in survival analysis will be examined, such as the Nelson-Aalen estimator of the cumulative hazard function, the Kaplan-Meier estimator of the survivor function, the weighted logrank statistics, the Cox proportional hazards regression model, and the accelerated failure time model.
11. Lecture Contact Hours: Fixed at 3 or Variable from _____ to _____
12. Non-Lecture Contact Hours: Fixed at _____ or Variable from _____ to _____
13. Estimated enrollment: 5-10 / TBD of which 100 percent are expected to be graduate students.
14. Frequency of scheduling(new program) Will this course be required for majors? Yes
15. Justification for new course: Required course for new biostatistics Ph.D.program
16. Are the necessary reading materials currently available in the appropriate library? Yes
17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.
18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant.
19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by:

Bertin Barlow Date 3/17/09
Department Chairman/Division Director

_____ Date _____
Dean of Graduate School (when required)

Approved by:

Jean M. Murphy Date 4/17/2009
Dean

_____ Date _____
Chancellor/Vice-President

_____ Date _____
University Enrollment Services

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

UPS 724

University Enrollment Services Final—White; Chancellor/Vice-President—Blue; School/Division—Yellow; Department/Division—Pink; University Enrollment Services Advance—White

BIOS S636 (3 cr.)
ADVANCED SURVIVAL ANALYSIS

Syllabus

A. Instructors

Menggang Yu, Ph.D.
Wanzhu Tu, Ph.D.

Contact information:
Menggang Yu, Ph.D.
Indiana University School of Medicine
Department of Medicine/Biostatistics
535 Barnhill Drive, RT 380F
Indianapolis, IN46202
Tel.: 317-278-5471
Fax: 317-274-8022

Office hours: 3:00 - 5:00 pm Mon (or by appointment)

Lectures: Mon & Wed 10:00 - 11:30 am in TBA.

Teaching Style: Course notes will be handed out prior to each lecture. A combination of overheads and boardwork will be used in the presentation of the materials. A 5-10 minute break will be given about halfway through the lecture period.

Intended Audience
The course is designed for Biostatistics Ph.D. students in their second year or beyond. Exceptions made with permission of the instructor.

B. Course Description

This course will discuss the counting process approach to the analysis of censored failure time data. From this prospective, we will revisit many of the standard statistical methods in survival analysis, including the Nelson-Aalen estimator of the cumulative hazard function, the Kaplan-Meier estimator of the survivor function, the weighted logrank statistics, the Cox proportional hazards regression model, and the accelerated failure time model. All of the estimators and test statistics will be shown to be equal to or approximated by stochastic integrals with respect to martingales. This structure will then be exploited to establish their asymptotic properties. Data from a clinical trial for the treatment of liver disease will be used as a background theme throughout the entire course.

C. Prerequisites

Introductory Survival Analysis (STAT 53600), Advanced Statistical Inference (STAT 62800).

D. Course Description for Bulletin

P: STAT 53600, STAT 62800. Addresses the counting process approach to the analysis of censored failure time data. Standard statistical methods in survival analysis will be examined, such as the Nelson-Aalen estimator of the cumulative hazard function, the Kaplan-Meier estimator of the survivor function, the weighted logrank statistics, the Cox proportional hazards regression model, and the accelerated failure time model.

E. Educational Objectives

Students will receive a systematic training in popular theoretical approaches dealing with survival data. Such training is necessary and important for understanding literature in the area of survival data analysis. The coherent and uniform treatment of popular survival analysis methods using martingale theory is itself a beautiful theory to study. Besides its application in the survival analysis, martingales are important stochastic processes which have wide applications in other statistical areas such as adaptive clinical trial design, stochastic control theory, game theory, etc. which will further benefit students in their other statistical adventures.

F. Course content and format

1. About 80% of the lectures will follow the required textbook closely.
   The following topics will be covered.
   - Introduction to popular survival analysis procedures (10%)
   - Theory of Counting Processes and Asymptotics (20%)
   - One Sample Problem (10%)
   - Two Sample Problem (10%)
   - Proportional Hazard Modeling Censored Survival Data (20%)
   - Semiparametric Accelerated Failure Time Models (10%)

   About 20% will cover topics including additive hazards models, multivariate failure times, and recurrent events. Examples of data analysis will be illustrated. As an alternative tool to prove asymptotic results for survival models, the modern empirical process theory will be introduced briefly.
2. Homework
   About 5 assignments. Handout on Wednesdays; due following Wednesday.
3. Exams
   There will be a midterm exam.
4. Project
   A paper about 10 pages based on literature review, plus a 30-minute talk toward the end of the term. A list of potential topics and papers will be supplied. A topic related to your own (potential) dissertation research would be the best.

G. Textbooks

- **Required**
  The Statistical Analysis of Failure Time Data, 2nd Ed., by J. D. Kalbfleisch and R.L. Prentice, Wiley (2002).
  Counting Processes and Survival Analysis, by T. R. Fleming and D. P. Harrington, Wiley (1991).

- **Recommended**
  Statistical Models and Methods for Lifetime Data, 2nd Ed., by J. F. Lawless, Wiley (2003).
  Analysis of Survival Data, by D. R. Cox and D. Oakes, Chapman & Hall/CRC (1984).
  Statistical Models Based on Counting Processes, by P. K. Andersen, Â. Borgan, R.D. Gill, and N. Keiding, Springer (1993).

H. Grading

Attendance: 10%; Homework: 30%; Midterm: 30%; Project: 30%

I. Cheating and Plagiarism

Academic misconduct will *not* be tolerated and all cases will be reported. Examine the IU Code of Student Rights, Responsibilities, and Conduct at http://www.iupui.edu/code and in particular examine the rules regarding academic misconduct at http://www.iupui.edu/code/#P2_G. Violations of these rules will result in a grade of "F" (or 0%) for the assignment in question, and may result in an "F" for the course or even expulsion from the university (see http://life.iupui.edu/rights/undergrad/sanctions.html).

J. Americans with Disabilities Act

If you need any special accommodations due to a disability, please contact Adaptive Educational Services at (317)-274-3241. Joseph T. Taylor Hall (UC), Room 137.