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Fall 2017

BIOS 9135 - Advanced Survival Analysis

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Georgia Southern University
Jiann-Ping Hsu College of Public Health
BIOS 9135– Advanced Survival Analysis
Fall 2017

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Prerequisites: BIOS 6131, BIOS 6531 and BIOS 7131

Course Description: This course will be placed on the theory on survival data. Counting processes and martingale method will be introduced. Emphasis will be place on the applications of the theory on the methodologies for survival data, such as Kaplan-Meier estimate, log-rank test, Cox model, etc. The students will learn how to use R language to setup survival dataset and perform analysis.

Required Textbook:

1. John D. Kalbfleisch and Ross L. Prentice (2002). *The Statistical Analysis of Failure Time Data*. Second Edition. Wiley. ISBN: 978-0471363576.
2. Thomas R. Fleming and David P. Harrington (1991). *Counting Processes and Survival Analysis*. Wiley.

Reference Textbook: *Design and Analysis of Clinical Trials with Time-to-Event Endpoints (2009)* [Peace, KE (Ed.)]. Chapman & Hall/CRC Biostatistics Series; ISBN: 9781420066395.

Dr.P.H Biostatistics Concentration Competencies:

Upon graduation a Biostatistics student with a Dr.P.H should be able to...

1. Demonstrate skills for translating objectives of a public health and biomedical research question into the appropriate biostatistical questions.

2. Design a public health and biomedical investigation in terms of the experimental design, data to be collected to reflect research objectives, number of subjects needed to address the objectives, and specification of appropriate methods for analysis.
3. Develop a theoretical foundation for commonly used topics in inferential statistics such as probability, sampling, discrete and continuous distributions and their moment generating functions, point and interval estimation, likelihood ratio tests, hypothesis testing, and nonparametrics found in advanced analyses of public health and biomedical studies.
4. Compare Bayesian methods to frequentist methods for analyzing data.
5. Evaluate a public health and biomedical research proposal to determine the more appropriate biostatistical analysis methodology, including Bayesian and frequentist approaches.
6. Analyze public health and biomedical data via classical and Bayesian approaches using statistical software packages such as SAS, R/S-plus, and WinBUGS.
7. Develop a protocol for performing meta-analyses of data to be collected to address a question requiring collection of summary data across several sources.
8. Demonstrate use of meta-analytic methods for combining information across public health and biomedical studies.
9. Apply meta-analysis to estimate the sources and magnitude of heterogeneity across public health and biomedical studies.
10. Explain underlying theory in longitudinal data analyses of public health and biomedical studies.
11. Analyze longitudinal data in public health and biomedical studies with appropriate longitudinal data analysis methods.
12. Interpret analytic methods used throughout the literature in biostatistical and public health journals.
13. Interpret results of classical and Bayesian biostatistical analyses so that valid and reliable conclusions regarding a public health and biomedical research question may be drawn from the analyses.
14. Develop new ideas for applying existing biostatistical methods to applications in public health.
15. Develop statistical reasoning skills to work independently on ideas for research in public health and biomedicine.
16. Develop written and oral reports to communicate effectively to research investigators pivotal aspects of a study, including its design, objectives, data, analysis methods, results, and conclusions.
17. Create a collaborative environment for working on written and oral reports and developing critical thinking skills.

Course Objectives: At the completion of this course the student will be able to:

1. Distinguish survival type data from other data types; (competency 1,2,6,12,13,17)
2. Understand and use counting process to express survival data; (competency 1,2,6,12,13,14,15,16,17)
3. Understand stochastic integrals, martingale, submartingale, supermartingale, filtration, predictable process and compensator; (competency 1,2,6,12,13,14,15,16,17)

4. Understand Doob-Meyer decomposition; (competency 1,2,6,12,13,14,15,16,17)
5. Apply stochastic processes, martingals and Doob-Meyere decomposition to local square integrable martingales; (competency 1,2,6,12,13,14,15,16,17)
6. Counting process and martingale representation for Nelson cumulative hazard estimator, logrank test statisitcs, and Cox model; (competency 1,2,6,12,13,14,15,16,17)
7. Proof of the consistency of the Kaplan-Meier Estimator;
8. Understand Martingale central limit theorem; and(competency 1,2,6,12,13,14,15,16,17)
9. Understand the distribution theory for proportional hazards regression. (competency 1,2,6,12,13,14,15,16,17)

Grading Scheme:

Weighting of assignments for purposes of grading will be as follows:

Midterm Exam (30%)

(competency 4,5,6,7,8,9,10,11)

Final Exam (40%)

(competency 4,5,6,7,8,9,10,11,12,13,14)

Assignments (30%)

Note: All exams and assignments will be graded and returned promptly so that students may accurately calculate their grades at any point in time during the semester.

Grading Scale:

The following point scale will be utilized in grading:

(90%-100%) A

(80%-90%) B

(70%-80%) C

(60%-70%) D

(0%-59%) F

For calculation of your final grade, all grades above will be included.

Your grades ***will not*** be posted. All exams and assignments will be graded and returned promptly so that students may accurately calculate their grades at any point in time during the semester.

There are times when extraordinary circumstances occur (e.g., serious illness, death in the family, etc.). In such circumstances, and/or if you need additional time to satisfactorily complete any course requirement, please consult with the instructor within a reasonable amount of time. *Nota Bene:* Extensions are not guaranteed and will be granted solely at the discretion of the instructor.

Overview of the Content to be Covered During the Semester:

Week	Topic	Readings	Assignment
1	Review of the basic concepts for survival data	Chapter 0: The applied setting	
2-3	The Counting Process and Martingale Framework	Chapter 5: A.S.A.	TBA
4-5	Local Square Integrable Martingales	Chapter 5: A.S.A.	TBA
6-8	Finite sample moments and large sample consistency of tests and estimators	Chapter 5 : A.S.A.	TBA
9-10	Likelihood construction and Further results	Chapter 6: A.S.A.	TBA
11-12	Rank regression and the AFT model	Chapter 7: A.S.A.	TBA
13-14	Competing risks and multistate models	Chapter 8: A.S.A.	TBA

Samples of your work may be reproduced for search purposes and/or inclusion in the professor's teaching portfolio. You have the right to review anything selected for use, and subsequently ask for its removal.

Instructional Methods: Class meetings will be a combination of lecture, class discussion, and computer software demonstration. Written homework assignments and examinations constitute the basis of student evaluation.

**Exam Schedule and
Final Examination:**

Midterm Examination: October 25, 2017
Final Examination: December 5, 2017

Academic Misconduct: "According to the Academic Dishonesty Policy of GSU, Plagiarism includes (but is not limited to):

- A. Directly quoting the words of others without using quotation marks or indented format to identify them.
- B. Using published or unpublished sources of information without identifying them.

- C. Paraphrasing material or ideas without identifying the source.
- D. Unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic material.

If you are accused of plagiarism by a JPHCOPH, the following policy, as per the Judicial Affairs website (<http://students.georgiasouthern.edu/judicial/faculty.htm>) will be enforced:

PROCEDURES FOR ADJUDICATING ACADEMIC DISHONESTY CASES

First Offense - In Violation Plea

1. If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, the professor should contact the Office of Judicial Affairs to determine if this is a first violation of academic dishonesty. The incident will be reported via the following website:
<http://students.georgiasouthern.edu/judicial/faculty.htm>
2. If it is a first violation, the professor should talk with the student about the violation. If the student accepts responsibility in writing and the professor decides to adjudicate the case, the following procedures will be followed:
 - a. The student will be placed on disciplinary probation for a minimum of one semester by the Office of Judicial Affairs.
 - b. The student will be subject to any academic sanctions imposed by the professor (from receiving a 0 on the assignment to receiving a failing grade in the class).
 - c. A copy of all the material involved in the case (Academic Dishonesty Report Form and the Request For Instructor to Adjudicate Form) and a brief statement from the professor concerning the facts of the case and the course syllabus should be mailed to the Office of Judicial Affairs for inclusion in the students discipline record.

First Offense - Not In Violation Plea (student does not admit the violation)

If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, the professor should contact the Office of Judicial Affairs to determine if this is the first or second violation of academic dishonesty. The student will be charged with academic dishonesty and the University Judicial Board or a University Hearing Officer would hear the case. If the student is found responsible, the following penalty will normally be imposed:

- a. The student will be placed on Disciplinary Probation for a minimum of one semester by the Office of Judicial Affairs.

- b. The student will be subject to any academic sanctions imposed by the professor.

Second Violation of Academic Dishonesty

If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, and if it is determined this is the second violation, the student will be charged with academic dishonesty and the University Judicial Board or a University Hearing Officer would hear the case.

If the student is found responsible, the following penalty will normally be imposed:

- a. Suspension for a minimum of one semester or expulsion.
- b. The student will be subject to any academic sanctions imposed by the professor.

NOT RESPONSIBLE FINDING

When a student is found not responsible of academic dishonesty, the work in question (assignment, paper, test, etc.) would be forwarded to the Department Chair. It is the responsibility of the Department Chair to ensure that the work is evaluated by a faculty member other than the individual who brought the charge and, if necessary, submit a final grade to the Registrar. For the protection of the faculty member and the student, the work in question should not be referred back to the faculty member who charged the student with academic dishonesty.

In the case of a Department Chair bringing charges against a student, an administrator at the Deans level will ensure that the students work is evaluated in an appropriate manner.

Academic Handbook:

Students are expected to abide by the Academic Handbook, located at <http://students.georgiasouthern.edu/sta/guide/>. Your failure to comply with any part of this Handbook may be a violation and thus, you may receive an F in the course and/or be referred for disciplinary action.

University Calendar for the Semester:

The University Calendar is located with the semester schedule, and can be found at: <http://www.collegesource.org/displayinfo/catalink.asp>.

Attendance Policy:

Federal regulations require attendance be verified prior to distribution of financial aid allotments. Attendance will not be recorded after this initial period.

One Final Note:

The contents of this syllabus are as complete and accurate as possible. The instructor reserves the right to make any changes necessary to the syllabus and course material. The instructor will make every effort to inform students of changes as they occur. It is the responsibility of the student to know what changes have been made in order to successfully complete the requirements of the course.