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Spring 2015

BIOS 9433 - Analysis with Missing & Miss-specified Data

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GEORGIA SOUTHERN UNIVERSITY
Jiann-Ping Hsu College of Public Health
BIOS 9433 Analysis with Missing & Miss-specified Data
Spring, 2015

Instructor: Robert Vogel

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Office: Hendricks, 1013

Office Hours: Tuesday and Thursday 9:30am-1:00pm and by appointment

Web Page:

Class Meeting: *Date: Tuesday and Thursday Time: 8:00am-9:15am Room:*

Prerequisites: Permission of the Instructor

Course Description:

This course is designed to provide the student with the basics of methods for analyzing data with missing data and misspecified data. This course will cover the following topics: missing data in experiments, complete case analysis, weighted complete case analysis, available case analysis, single imputation methods such as mean, regression, last value varied forward, hot deck imputation, cold deck imputation, Bayes Imputation, Multiple imputation, and non-ignorable missing data models. Prerequisite: A minimum grade of "B" in BIOS 9131. Co-requisite: BIOS 9231.

3 hours.

Required Textbook: *Molenberghs Geert, Kenward Michael G. (2007) Missing Data in Clinical Studies. New York: Wiley.*

Secondary Textbooks: Enders Craig K. (2010) Applied Missing Data Analysis. New York: Guilford Press.

National Research Council (2010) The Prevention and Treatment of Missing Data in Clinical Trials. Washington, DC: The National Academies Press.

Van Buuren Stef. (2012) Flexible Imputation of Missing Data.
Boca Raton: CRC Press.
Little Roderick J.A. and Rubin Donald B. (2002) Statistical
Analysis with Missing Data, 2nd edition. New York: Wiley.

Biostatistics Concentration Competencies

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

1. Design a public health and biomedical investigation in terms of the experimental design, data to be collected that reflect research objectives, number of subjects needed, and specification of appropriate methods for analysis.
2. Analyze public health and biomedical data using appropriate statistical software such as SAS, R and S-plus.
3. Interpret analytic methods used in the public health and biomedical journals, as well as critique published reports of public health and biomedical experiments as to the validity of the inferential conclusions.
4. Develop new biostatistical methods and new ideas for applying existing biostatistical methods to applications in public health and the biomedical sciences.
5. Develop written and oral reports to communicate effectively with research investigators the pivotal aspects of a study, including: design, study objectives, data analysis methodology, results and conclusions.
6. Create a collaborative environment for working on written and oral reports.

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

1. Identify missing data framework and missing data Mechanisms (Competencies 1, 3, 4) Activities (1)
2. Impute data using simple single imputation methods, direct likelihood methods and multiple imputation methods. (competencies 1, 2, 3, 4, 5, 6) (Activity 2)
3. Understand the theoretical justification for multiple imputation. (competencies 3, 4, 5, 6) (Activity 2)
4. Perform analysis using generalized estimating equations (competencies 1-6, 10-17) (Activity 2 and 3)
5. Understand the behavior of the likelihood ratio test for MAR verses MNAR (competencies 1,2,3,4) (Activity 3)
6. Formalize ignorance and uncertainty (competencies 1,2,3,4,5,6) (Activity 4)

Assessment of students Learning

Activity 1: Use course lectures and class discussions to explain the basic terminology and definitions of missing and mis-specified data, including, but not limited to: missing data mechanisms, ignorable and non-ignorable mechanisms, single imputation, direct methods, multiple imputation and the EM algorithm. Competence in basic terminology will be evaluated using two activities: (1) weekly homework (2) student presentations of analysis of data sets with missing and mis-specified data.

Activity 2: Use course lectures, class discussions and class exercises illustrate how to use SAS to analyze data sets with missing and mis-specified data. This will include single imputation, multiple imputation, direct maximum likelihood, GEE, and weighted estimation. Competence will be evaluated using two activities: (1) weekly homework (2) student presentations of analysis of data sets with missing and mis-specified data.

Activity 3: Use course lectures, class discussions and real data projects to explain the basic applications of the estimation techniques used with missing and mis-specified data. Competence in ability to integrate concepts will be evaluated using final class project data.

Activity 4: Competence in written and oral communication to the lay professional audience will be evaluated using final project written report and oral presentation evaluation.

Overview of the content to be covered during the semester:

Week	Topic	Readings	Assignment
1	Introduction and terminology	Chapters 1, 2, and 3	TBA
2	Simple single imputation methods	Chapters 4, 5, and 6	TBA
3	Direct Likelihood Method	Chapter 7	TBA
4	E-M Algorithm	Chapter 8	TBA

5-6	Multiple Imputation	Chapter 9	TBA
7	Weighted Estimating Equations	Chapter 10	TBA
8	GEE and MI	Chapter 11	TBA
9	Likelihood-Based Frequentist Inference	Chapter 12	TBA
9	Overview of Methods and SAS	Chapters 13 and 14	TBA
10	Selection Methods	Chapter 15	TBA
11	Pattern Mixture Models	Chapter 16	TBA
12	Protective Estimation	Chapter 18	TBA
13	MNAR, MAR and Sensitivity	Chapter 19	TBA
14	Regions of Ignorance and Uncertainty	Chapter 21	TBA
15	Wrap-up with Case Studies	Chapter 25 and 26	TBA

Problems will be due within one week of completion of topic

Samples of your work may or may not be reproduced for search purposes and/or inclusion in the professor's teaching portfolio. You have a 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 Exam:

Final Exam: MayXX, 2013

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

Assignments/projects.....	75%
Final Exam	25%
Total Possible	<u>100%</u>

* *Integrated* refers to assessing all or some of the 14 learning objectives simultaneously, while *individually* refers to assessing the learning objectives as we cover them.

The following point scale will be utilized in grading:

90% - 100%	A
80% - 90%	B
70% - 80%	C
60% - 70%	D

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.

(Your grades will not be posted.)

Academic Misconduct: As a student registered at this University, it is expected that you will adhere to only the strictest standards of conduct. It is recommended that you review the latest edition of the *Student Conduct Code* book, as well as the latest *Undergraduate & Graduate Catalog* to familiarize yourself with the University's policies in this regard. Your continued enrollment in this course is an implied contract between you and the instructor on this issue; from this point forward, it is assumed that you will conduct yourself appropriately.

Academic integrity relates to the appropriate use of intellectual property. The syllabus, lecture notes, and all materials

presented and/or distributed during this course are protected by copyright law. Students are authorized to take notes in class, but that authorization extends only to making one set of notes for personal (and no other) use. As such, students are not authorized to sell, license, commercially publish, distribute, transmit, display, or record notes in or from class without the express written permission of the instructor.

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.

The Fine Print:

"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.

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).

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 student's 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.

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.

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 Dean's level will ensure that the student's work is evaluated in an appropriate manner.

CONFIDENTIALITY

In accordance with provisions of the Family Educational Rights and Privacy Act of 1974 and the Georgia Open Records Act, any information related to a violation of academic dishonesty or the outcome of a judicial hearing regarding academic dishonesty, is prohibited and must be treated as confidential by members of the faculty."