

Georgia Southern University
Jiann-Ping Hsu College of Public Health

BIOS 9131 – Advanced Statistical Inference for Biostatistics I
Fall 2009

<u>Instructor:</u>	Hani M. Samawi
<u>Office:</u>	1024 Cone
<u>Phone:</u>	478-1345
<u>E-Mail Address:</u>	hsamawi@georgiasouthern.edu
<u>Office Hours:</u>	Thursday – 4:00 pm-to-6:00 pm Monday and Wednesday – 2:00 pm-to-4:00 pm Other times by appointment
<u>Web Page:</u>	Yes
<u>Class Meets:</u>	Monday and Wednesday – 5:00 pm-to-6:15 pm Hollis Building 1118

-- Course schedules can be found at: https://wings.georgiasouthern.edu/pls/WINGS-PROD/ywskclas.P_CrseSearch

<u>Prerequisites:</u>	None
<u>Course Credit:</u>	This is a three-credit hour course designed for the DrPH core curriculum.
<u>Course Structure:</u>	This course is an in-person meeting class.
<u>Catalog Description:</u>	This course provides an advanced study of theoretical statistics. Topics include: an introduction probability and sample space, conditional probability and Bayes Theorem, probability distribution of a random variable, discrete and continuous random variables, functions of random variables, moments and moment generating functions, order statistics and their distributions, discrete distributions, continuous distributions, bivariate and multivariate normal distribution, modes of convergence, limiting moment generating functions, and the central limit theorems. 3 hours
<u>Required Textbook:</u>	Vijay K. Rohatgi and A. K. Md. Ehsanes Saleh (2000). <i>An Introduction to Probability and Statistics</i> , Second edition. John Wiley & Sons, INC.

Secondary Text: Peter J. Bickel and, Kjell A. Doksum (2006). *Mathematical Statistics*, 2nd Edition, by Prentice Hall.

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. Understand and use probability concepts which include sample space, probability axioms, combinatorics (finite sample space), conditional probability and Bayes theorem, and independent events. (competency 3, 4, 5, 6, 14, 15, 16, 17)
2. Understand random variables and be able to differentiate between discrete and continuous types, learn probability distribution functions of random variables (continuous and discrete), and find distribution of a function of a random variable. (competency 3, 4, 5, 6, 14, 15, 16, 17)
3. Understand moments of a distribution function and moments generating functions and some moment's inequalities. (competency 3, 4, 5, 6, 14, 15, 16, 17)
4. Understand and use multiple random variables concepts which include independent random variables, functions of several random variables, covariance, correlation and moments, conditional expectations and order statistics and their distributions. (competency 3, 4, 5, 6, 14, 15, 16, 17)
5. Understand and use some special distributions, discrete and continuous, bivariate and multivariate normal distribution, and the exponential family of distributions. (competency 3, 4, 5, 6, 14, 15, 16, 17)
6. Understand and use limits theorems which include modes of convergence, Weak Law of Large Numbers, Strong Law of Large Numbers and Central Limit Theorem. (competency 3, 4, 5, 6, 14, 15, 16, 17)

Overview of the Content to be Covered During the Semester:

Week	Topic	Readings	Assignment: Due within 1 week of completion of topic
1-2	Probability (Learning Objectives: 1)	Chapter 1	1.2.2, 1.3.1, 1.3.2, 1.3.7, 1.3.10, 1.4.1, 1.4.12, 1.4.13, 1.5.10, 1.5.13, 1.6.1, 1.6.5, 1.6.11
3-4	Random Variables and Their Probability Distributions (Learning Objectives: 2)	Chapter 2	2.2.1, 2.2.4, 2.2.5, 2.3.3, 2.4.3, 2.4.5, 2.4.6, 2.5.1, 2.5.2, 2.5.6, , 2.5.10
5-6	Moments and Generating Functions (Learning Objectives: 3)	Chapter 3	3.2.3, 3.2.6, 3.2.14, 3.3.1, 3.3.4, 3.3.7, 3.4.1, 3.4.4, 3.4.8
7-10	Multiple Random Variables (Learning Objectives: 4)	Chapter 4	4.2.1, 4.2.4, 4.2.9, 4.3.2, 4.3.3, , 4.3.14, 4.4.2, 4.4.13, 4.4.17, 4.5.1, 4.5.3, 4.6.3, 4.6.4, 4.6.5,4.7.4
11-13	Some Special Distributions (Learning Objectives: 5)	Chapter 5	5.2.3, 5.2.7, 5.2.8, 5.2.10, 5.3.3, 5.3.4, 5.3.8, 5.4.1, 5.4.6, 5.5.1, 5.5.3

14-16	Limit Theorems (Learning Objectives: 6)	Chapter 6	6.2.2, 6.2.5, 6.2.9, 6.2.11, 6.3.5, 6.3.8, 6.4.1, 6.4.7, 6.5.1, 6.5.2, 6.5.5, 6.6.1, 6.6.2, 6.6.5
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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 19, 2009

Final Examination: December 7, 2009; 5:30 pm-7:30 pm

Grading:

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

Midterm Exam	(Learning Objectives: 1, 2, 3)	150 points (30%)
Final Exam	(Learning Objectives: 4, 5, 6)	200 points (40%)
Assignments	(Learning Objectives: 1-6)	150 points (30%)

Total Possible Points	500 points (100%)
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The following point scale will be utilized in grading:

450-to-500 points (90%) A

400-to-449 points (80%) B

350-to-399 points (70%) C

300-to-349 points (60%) D

A cumulative total of 299 points or less will be considered as failing.

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.

NO EXTRA CREDIT PROJECTS WILL BE ASSIGNED!

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.