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BIOS 6331: Regression Analysis in Biostatistics

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Georgia Southern University
Jiann-Ping Hsu College of Public Health

BIOS 6331: Regression Analysis in Biostatistics

Fall 2018

Instructor: Jingjing Yin

Office: Hendricks Hall, Room 1007

Phone: 912-478-2413

Email: jyin@georgiasouthern.edu

Class Meeting: Tue and Thur 9:30am-10:45am, IT Bldg 3204

Office Hours: Wednesdays 1-5pm, preferably by appointment via email

Course Catalog available at:

<http://em.georgiasouthern.edu/registrar/resources/catalogs/>
under Jiann-Ping Hsu College of Public Health Programs

Prerequisites: N/A

FOLIO Access: <https://my.georgiasouthern.edu/portal/portal.php>

Access to course materials are available for up to one year after graduation.

Catalog Description

This course introduces the methods for analyzing biomedical and health related data using linear regression models. The course will introduce the student to matrix algebra as used in linear models. The course will involve model selection, diagnosis and remedial techniques to correct for assumption violations. The students will learn how to apply SAS procedures PROC REG, PROC CORR, and PROC GLM, etc and interpret the results of analysis. Emphasis will also be placed on the development of critical thinking skills.

Required Textbook:

Textbook:

Required: Applied Regression Analysis and Other Multivariable Methods, 4 or 5th edition, Kleinbaum, Kupper, Nizam and Muller. Duxbury Press, Belmont California.

Supplementary: Applied Linear Statistical Models, 5th edition, Kutner, Nachtsheim, Neter, and Li

Required Resource: TBA

The lectures will often follow the general organization of the text, but with some differences in emphasis and detail. Students will be responsible for **whatever material is covered in the lectures**, whether or not it is treated in the text.

MPH Core Student Learning Outcomes

To be reviewed/ revised during faculty retreat

CEPH Concentration Competencies

To be suggested/ written during faculty retreat

CEPH MPH Competencies

Evidence-based Approaches to Public Health

1. Apply epidemiological methods to the breadth of settings and situations in public health practice
2. Select quantitative and qualitative data collection methods appropriate for a given public health context
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate
4. Interpret results of data analysis for public health research, policy or practice

Public Health & Health Care Systems

5. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings
6. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels

Planning & Management to Promote Health

7. Assess population needs, assets and capacities that affect communities' health
8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs
9. Design a population-based policy, program, project or intervention
10. Explain basic principles and tools of budget and resource management
11. Select methods to evaluate public health programs

Policy in Public Health

12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence
13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes

14. Advocate for political, social or economic policies and programs that will improve health in diverse populations
15. Evaluate policies for their impact on public health and health equity

Leadership

16. Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making
17. Apply negotiation and mediation skills to address organizational or community challenges

Communication

18. Select communication strategies for different audiences and sectors
19. Communicate audience-appropriate public health content, both in writing and through oral presentation
20. Describe the importance of cultural competence in communicating public health content

Interprofessional Practice

21. Perform effectively on interprofessional teams

Systems Thinking

22. Apply systems thinking tools to a public health issue

Performance-Based Objectives Linked to Course Activities (Note: Assessment Activities Described in Next Section)

At the end of this course, students will be able to thoroughly understand and apply the following statistical concepts and methods (among others):

1. Interpret the regression coefficients for both continuous and categorical independent variables (including interactions) and apply inferential methods via confidence interval estimation and hypothesis testing for regression coefficients, correlation, the mean response and prediction of a new observation. Competency of this objective will be measured by Activities 1, 2, 3 and 4.
2. Describe the partitioning of total sums of squares, sequential and partial sums of squares and corresponding degrees of freedoms within an analysis of variance approach and apply lack-of-fit F-test for general linear test (i.e., full versus reduced model). Competency of this objective will be measured by Activities 1, 2, 3 and 4.
3. Apply fundamental matrix operations such as matrix addition, subtraction, multiplication, transpose, inverse, and linear dependence in the computations of a regression function. And to form linear regression model, parameter estimates, sum of squares in terms of matrix and quadratic forms. Competency of this objective will be measured by Activities 1 and 2.

4. Identify model departures (non-linearity, non-normality, heteroscedasticity, multicollinearity, etc.) and apply appropriate remedy (such transformations). Identify outliers in a regression analysis. Competency of this objective will be measured by Activities 1, 3 and 4.
5. Apply model selection procedures to select an appropriate regression model. Competency of this objective will be measured by Activity 4.
6. Develop written reports and orally present the data analysis to effectively communicate to research investigators pivotal aspects of a study, including study objectives, variables of interest, appropriate regression analysis methods (such as linear, polynomial and logistic regression), results, and conclusions. Competency of this objective will be measured by Activity 4.

Assessment of Student Learning

Activity 1: Weekly-assignments (Specific PBO and Comp, see table of Schedules)

Activity 2: Midterm in-class and take-home exams (PBO 1 to 3; Comp3, 4 and 5)

Activity 3: Final in-class and take-home exams (PBO 1 to 4; Comp2, 3, 4 and 5)

Activity 4: Perform regression analysis on a real or simulated data and write a statistical analysis report as well as give an oral presentation for the project. (PBO 1 to 6; Comp1 to 5)

Students may vary in their ability to achieve levels of competence in this course. Students can expect to achieve course competence only if they honor all course policies, attend classes regularly, complete all assigned work in good faith and on time, and meet all other course expectations of them as students.

Overview of the content to be covered the semester:

Chapter	Topic	Assignments
Week 1: Chapters 1, 2, 3, 4	Preliminaries	Hw1 (PBO1; Comp3)
Week 2: Chapters 5.1-5.6	Introduction of simple linear regression	Hw2 (PBO 1; Comp3)
Week 3: Chapters 5.7-5.11 and Chapter 7	Inferences in simple regression	Hw3 (PBO1; Comp3 and 4)
Week 4: Chapter 6	Correlation coefficient and Matrix introduction	Hw4 (PBO1 and 3; Comp3 and 4)

Week 5: Appendix B	Matrix intro and Matrix formulation in regression	Hw5 (PBO1 and 3; Comp3)
Week 6: Chapter 8	Multiple regression intro	
Week 6: Chapter 9	Multiple regression inferences based on sequential and partial sums of squares	Hw6 (PBO 1 to 3; Comp3 and 4)
Week 7: Chapter 10	Correlations in multiple regression	Hw7 (PBO 1 to 3; Comp3 and 4)
Week 8: Chapter 11	Interaction and confounding	
Week 9: Chapter 12	Categorical variable and ANCOVA	
Week 10: Chapter 13	Categorical variable and ANCOVA cont.	Hw8 (PBO 1 and 3; Comp3 and 4)
Week 11: NA	Mid-term	
Week 12: Chapter 14	Diagnostics	
Week 13: Chapter 16	Model selection	
Week 14: Chapter 15	Polynomial regression	Practice for final (PBO 1 to 5; Comp3 and 4)
Week 15: NA	No classes (Thanksgiving)	
Week 16: Aside	Weighted LSE	

Instructional Methods

Class meetings will be a combination of lecture, class discussion, and active participation. Computer-generated presentations will be used in the lecture portion of this course. Prior to each lecture, the student is encouraged to complete the recommended readings and actively participate in class discussions. In this way, it is hoped that the learner will be better prepared to successfully accomplish the learning objective of each lecture experience.

Grading Scheme:

Homework: 34%

Midterm: 33%

Final Exam: 33%

Grading Scale:

A 90 - 100%

B 80 - 89%

C 70 - 79%

D 60 - 69%

F 0 - 59%

Homework: Homework assignments are to be handed in **by the end of the lecture the day it is due**, unless otherwise announced in class. **Late homework will not be accepted** unless advanced permission was given by the instructor under extraordinary circumstances (e.g., serious illness/accident, death in the family, etc.).

Please describe and justify your answers with detailed reasoning, an answer with merely a final number receives no credit even it is correct. If SAS or R is used, please attach the commented code at the end of the homework, which I should be able to run and reproduce your results.

You may work together or individually on these assignments, however each student must submit his/her own assignment and state with whom he/she worked, if applicable. What does 'working together' mean? You are welcome to solve problems and discuss explanations in groups, however it is not acceptable to submit assignments with identical wordings and explanations. I will cheerfully address any homework questions during office hours. Emailing me about homework questions is not referred, but if you do, please allow me one business day to respond.

General Expectations

1. For every one-credit hour, you should expect to work roughly two hours outside the classroom each week. For example, for a three credit hour course, during a regular fifteen week semester, you should expect approximately ninety hours of work outside of class.
2. Students are expected to keep up with the class, to read the required material, and to submit assignments and activities by due dates and times.
3. Students are expected to independently complete all activities, exercises, assignments, and assessments including exams.
4. Students are expected to produce quality work. Typos and grammar errors should be kept to a minimum. The format and readability of submissions will be taken into consideration when assigning a grade.
5. Remember to check when assignments are due. It is recommended that you stay ahead of schedule on the assignments, so if an emergency happens, your assignment will be completed and ready to submit within the designated time frame. It is your responsibility to keep track of the due dates for each assignment.

Response Times

During a normal work week (i.e., Monday 9:00 AM through Friday 5:00 PM) students can expect responses as follows:

- Email: within 48 hours
- Discussion posts: within 72 hours
- Assignment grades: within 72 hours to one week of submission date.

Exceptions: I may not check FOLIO or GSU email over the weekends. If you send me an email after 5:00 PM on Friday, please do not expect a response until the following Monday.

All assignments will be graded 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. Extensions are not guaranteed and will be granted solely at the discretion of the instructor.

Course Expectations

Texting and Use of Cell Phones (and Other Technologies)

Please do not text in class or use your cell phone during class! Texting during class (or in a meeting) is disruptive. My preference is that you put cell phones away during class meetings so they are not a source of temptation. Offenders will be asked to leave.

Class Attendance and Participation Policy

Federal regulations require attendance be verified prior to distribution of financial aid allotments. Regular attendance is expected. Your attendance will be verified at the first regular class session.

It is the policy of the University to permit students, faculty, and staff to observe those holidays set aside by their chosen religious faith. The faculty should be sensitive to the observance of these holidays so that students who choose to observe these holidays are not seriously disadvantaged. It is the responsibility of those who wish to be absent to make arrangements in advance with their instructors.

Students participating in authorized activities as an official representative of the University (i.e., athletic events, delegate to regional or national meetings or conferences, participation in university-sponsored performances, and **JPHCOPH funded**) will not receive academic penalties and, in consultation with the instructor of record, will be given reasonable opportunities to complete assignments and exams or given compensatory assignment(s) if needed. The student must provide written confirmation from a faculty or staff advisor to the course instructor(s) at least 10 days prior to the date for which the student will be absent from the class. The student is responsible for all material presented in class and for all announcements and assignments. When possible, students are expected to complete these assignments before their absences. In the event of a disagreement regarding this policy, an appeal may be made by either the student or the instructor of record to the corresponding college dean. (*University Graduate Catalog*)

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.

Plagiarism

According to the Academic Dishonesty Policy of Georgia Southern University, 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 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.
- 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 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."

Disability-related Accommodations

Georgia Southern University is committed to providing reasonable accommodations to students with documented disabilities as required under federal law. Disabilities may include ADD or AD/HD, autism spectrum disorder, brain injury, chronic medical conditions, communication disorders, hearing loss, learning disabilities, mobility impairment, psychological disorders, visual impairment or temporary injuries. The purpose of disability accommodation is to provide equal access to the academic material and equal access to demonstrate mastery of the material. If you have a disability and need accommodations, please contact the Student Accessibility Resource Center (SARC). You will need to meet with a SARC staff member who can help you gather documentation of your disability or refer you to an appropriate resource for assessment. Once documentation of the disability is approved, SARC staff will provide you with an accommodation letter detailing the approved accommodations which you should present to me so we can discuss and implement your accommodations. Disability accommodations work best starting at the beginning of the semester, but can be approved and started at any point in the semester. Accommodations start at the time the accommodation letter is presented to faculty within reasonable timelines; accommodations are not given retroactively. SARC on the Statesboro campus is located on the second floor of Cone Hall and the phone number is (912) 478-1566. SARC for Savannah and Liberty campuses is located on the second floor of Memorial College Center and the phone number is (912) 344-2572.

University Calendar for the Semester

The University Calendar is located with the semester schedule, and can be found at:
<http://em.georgiasouthern.edu/registrar/resources/calendars/>

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 to ensure better student learning. The instructor will announce any such changes in class. It is the responsibility of the student to know what changes have been made in order to successfully complete the requirements of the course.

This syllabus, my lecture notes, and all materials distributed and presented during this course are protected by copyright law. You are authorized to take notes in this class but that authorization extends to only making one set of notes for your personal use and no other use. You are not authorized to sell, license, commercially publish, distribute, transmit, display, or record notes from this class unless you have my written consent to do so.

STUDENT CONDUCT CODE

The Student Conduct Code is the official University publication governing student conduct and behavior. It is the responsibility of each student to become familiar with the rules and regulations governing student life. Student conduct procedures, appeal procedures, and disciplinary sanctions are found in the Student Conduct Code at <http://students.georgiasouthern.edu/conduct>. I acknowledge that I have read and understand this statement referencing the Student Conduct Code.

ACADEMIC DISHONESTY

The University goal is to foster an intellectual atmosphere that produces educated, literate people. Because cheating and plagiarism are at odds with that goal, they shall not be tolerated in any form. Students are expected to adhere to the rules and regulations as set forth in the Student Conduct Code. Therefore, all work submitted by a student must represent that student's own ideas and effort; when the work does not, the student has engaged in academic dishonesty. Plagiarism occurs when a person passes in another person's work as his or her own, borrows directly from another person's work without proper documentation, and resubmits his or her own work that has been previously submitted without explicit approval from the instructor. For example, academic dishonesty occurs whenever a student participates in any of the following: Cheating submitting material that is not yours as part of your course performance; using information or devices that are not allowed by the faculty; obtaining and/or using unauthorized materials; fabricating information, research, and/or results; violating procedures prescribed to protect the integrity of an assignment, test, or other evaluation; collaborating with others on assignments without the faculty's consent; cooperating with and/or helping another student to cheat; demonstrating any other forms of dishonest behavior. Plagiarism directly quoting the words of others without using quotation marks or indented format to identify them; using sources of information (published or unpublished) without identifying them; paraphrasing materials or ideas without identifying the source; self-plagiarism - resubmitting work previously submitted without explicit approval from the instructor; unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic material. NOTICE: The list above is intended only to provide general guidelines for recognizing and avoiding common types of academic dishonesty. It is in no way an exhaustive or comprehensive list of all the types of academic dishonesty. For more information about academic honesty, see the Student Conduct Code at <http://students.georgiasouthern.edu/conduct>. I acknowledge that I have read and understand the Academic Dishonesty Policy.

I have read the syllabus and understand the contents and course requirements.

Student Name (print)

Student Signature

Date