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BIOS 663 - Spring 2022

Syllabus

BIOS 663: Intermediate Linear Models

Spring 2022

4 Credits

Course Description

Matrix-based treatment of regression, one-way and two-way ANOVA, and ANCOVA, emphasizing the general linear model and hypothesis, as well as diagnostics and model building. Reviews matrix algebra. Includes statistical power for linear models and binary response regression methods.

Prerequisites: BIOS 662, working knowledge of calculus and matrix algebra, working knowledge of R or SAS (some homeworks will involve computing with using your choice of R or SAS).

Instructor

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Teaching Assistant

Kyle Grosser

Doctoral Candidate in Biostatistics

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Office Hours: MIL is generally free 3:15-4:15 W, just email me ahead of time so I can coordinate an online meeting.

Note on course questions: you are welcome to email questions to MIL or KG, a benefit is that we can

then bring these questions up during class or recitation to the benefit of the entire class.

Course Website: On Sakai, use your ONYEN and password.

Class Days, Times, Location:

Monday and Wednesday 1:25-3:10 PM, McGavran-Greenberg PH-Rm 2306.

Recitation (optional): Monday 3:35-4:35 PM on Zoom: <https://unc.zoom.us/j/91087939791?pwd=Rm93T0hxMWVxeU14K3dlYzBhdElXdz09>

UPDATE: For the first 3 weeks of class (ending on Jan 28), all Gillings classes including BIOS 663 will have a temporary change of MOI (method of instruction) to remote only. Do not go to the classroom. I will inform you ahead of time for any potential changes to MOI made after this point. The zoom link will be:

<https://unc.zoom.us/j/98372494609?pwd=V1dXQnh2RWEyZWZlZlFHVzhXNmpGdz09>

Course Format

The course format will consist of a seminar-style class that meets twice weekly. The lectures starting at 1:25 PM are given by the instructor, while the recitation (optional) is led by the teaching assistant, and gives students the opportunity to ask questions beyond what is covered in class. Students are expected to complete the readings before class and come to each class prepared to discuss the texts (with the exception of week 1, where the readings will be done after the fact). Lectures will be supplemented in-class exercises.

Required Readings

- Muller and Fetterman, Regression and ANOVA: An Integrated Approach Using SAS Software (required)
- Weisberg, Applied Linear Regression, 3rd or 4th Edition. **NOTE:** You do not need to purchase a hard copy of Weisberg. The 4th edition is available online through UNC libraries. Go to <https://library.unc.edu> and type "Weisberg Applied Linear Regression". Look for the 4th edition (2014). After signing in you can read online, or download the full DRM book after installing some Adobe software. R supplement available at <http://users.stat.umn.edu/~sandy/alr4ed/links/alrprimer.pdf>

Course-at-a-Glance

The instructor reserves the right to make changes to the syllabus, including topics, readings, assignments. Any changes will be announced as early as possible. For session-by-session course schedule details, please see below. Some of the topics will span multiple sessions as needed (we have 28 total class sessions + 1 session for midterm).

Session Number	Topic	Assignment Due
1	Linear Algebra Review	
2	The Linear Model: Estimation and Testing	HW1, late Jan
3	Some Distributional Results for the LM	
4	Multiple Regression: General Consideration	
5	Testing Hypotheses in Multiple Regression	HW2, mid Feb
6	Correlation	
7	Assumption Diagnostics	
8	Computation Diagnostics	HW3, late Feb
-	Review of material up until this point	Midterm, March 9
9	Polynomials and Splines	
10	Transformations	
11	Logistic Regression	HW4, mid April
12	Power and sample size calculation	
13	Coding Schemes for Regression	
14	One-Way ANOVA	

Session Number	Topic	Assignment Due
15	Two-Way ANOVA	
16	ANCOVA and the Full Model	
-	Kyle Grosser's lectures on missing data	4/18 & 4/25
-	Review of second half material + comprehension of first half	Final exam, May 2 12:00PM

Course Assignments and Assessments

This course will include the following graded assignments that contribute to your final grade in the course. For assignment descriptions and assignment grading rubrics, please see below.

Graded Assignments	Points/Percentages of Final Course Grade
1. Homework assignments	30%
2. Midterm exam	35%
3. Final exam	35%
TOTAL	100%

Assignment Descriptions

Homework assignments are typically 2-5 questions each with multiple parts, points per question will be indicated. Longer homeworks will be due 2 weeks from date of assignment, but shorter homeworks may be due in 1 week. Longer homeworks with more points will contribute more to the total 25% for homeworks.

Midterm and final exams will be given in class (permitting campus conditions). A page of reference equations will be provided beforehand.

Course Grading Scale(s)

Final course grades will be determined using the following [UNC Graduate School grading scale](#). The relative weight of each course component is shown in the Graded Assignments section.

- H—High Pass (93-100): Clear excellence
- P—Pass (80-92): Entirely satisfactory graduate work
- L—Low Pass (70-79): Inadequate graduate work
- F—Fail (0-69)

Final course grades will be determined using the following [UNC Undergraduate grading system](#).

A (90-100): Mastery of course content at the highest level of attainment that can reasonably be expected of students at a given stage of development. The A grade states clearly that the students have shown such outstanding promise in the aspect of the discipline under study that he/she may be strongly encouraged to continue.

B (80-89): Strong performance demonstrating a high level of attainment for a student at a given stage of development. The B grade states that the student has shown solid promise in the aspect of

the discipline under study.

C (70-79): A totally acceptable performance demonstrating an adequate level of attainment for a student at a given stage of development. The C grade states that, while not yet showing unusual promise, the student may continue to study in the discipline with reasonable hope of intellectual development.

D (60-69): A marginal performance in the required exercises demonstrating a minimal passing level of attainment. A student has given no evidence of prospective growth in the discipline; an accumulation of D grades should be taken to mean that the student would be well advised not to continue in the academic field.

F (0-59): For whatever reason, an unacceptable performance. The F grade indicates that the student's performance in the required exercises has revealed almost no understanding of the course content. A grade of F should warrant an advisor's questioning whether the student may suitably register for further study in the discipline before remedial work is undertaken.

Map of Competencies to Learning Objectives and Assessment Assignments

Below you will see the program competency you will develop in this course, the learning objectives that comprise the competency, and the assignment(s) in which you will practice demonstrating each competency.

Competency: MS # 2 - Demonstrate ability to apply the elementary methods of statistical analysis, including those based on classical linear models and on nonparametric alternatives, involving categorical, discrete, normal, or ranked data, to problems of description, goodness of fit, univariate, location and scale, bivariate independence and correlation, regression analysis, and the comparison of independent and matched samples possibly adjusting for covariables.

Assessment Assignment: Final exam.

Expectations, Policies, and Resources

Accessibility at UNC Chapel Hill

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities. Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the [ARS Website](#) for contact information or email ars@unc.edu.

Attendance/Participation

Your attendance and active participation are an integral part of your learning experience in this course. If you are unavoidably absent, please notify the course instructor (and Teaching Assistant if one is assigned). No right or privilege exists that permits a student to be absent from any class

meetings, except for these University Approved Absences:

1. Authorized University activities
2. Disability/religious observance/pregnancy, as required by law and approved by [Accessibility Resources and Service](#) and/or the [Equal Opportunity and Compliance Office](#).
3. Significant health condition and/or personal/family emergency as approved by the [Office of the Dean of Students](#), [Gender Violence Service Coordinators](#), and/or the [Equal Opportunity and Compliance Office](#).

Community Standards in Our Course and Mask Use.

This semester, while we are still in the midst of a global pandemic, all enrolled students are required to wear a mask covering your mouth and nose at all times in our classroom. This requirement is to protect our educational community — your classmates and me – as we learn together. If you choose not to wear a mask, or wear it improperly, I will ask you to leave immediately, and I will submit a report to the [Office of Student Conduct](#). At that point you will be disenrolled from this course for the protection of our educational community. Students who have an authorized accommodation from Accessibility Resources and Service have an exception. For additional information, see [Carolina Together](#).

Counseling and Psychological Services at UNC Chapel Hill

CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to the [CAPS website](#), call them at 919-966-3658, or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.

Honor Code

As a student at UNC Chapel Hill, you are bound by the [university's Honor Code](#), through which UNC maintains standards of academic excellence and community values. It is your responsibility to learn about and abide by the code. To ensure an effective Honor System at UNC, in this course students are expected to:

- Conduct all academic work within the letter and spirit of the Honor Code, which prohibits the giving or receiving of unauthorized aid in all academic processes.
- For homework, students may verbally discuss approaches to the problems with each other but each student *should independently write up the answer* and verify solutions. Likewise, for assignments involving code, verbally discussing approaches is allowed but it would be a violation to copy the code from a solution of a fellow student and turn this in as one's own. It is to the student's benefit to attempt homework problems on their own initially as practice for later in-class exams.
- For midterm and final exam, students must work *completely independently* without communicating with other students, tutors, or anyone else about any material related to the test questions. Sharing of homework, midterm, or final exam content beyond the class is prohibited.

If you have any questions about your rights and responsibilities, consult the [Office of Student](#)

Conduct or review the following resources: [Honor System](#); [Honor System module](#); [UNC Library's plagiarism tutorial](#); [UNC Writing Center's handout on plagiarism](#).

Inclusive Excellence

We are committed to expanding diversity and inclusiveness across the School — among faculty, staff, students, on advisory groups, and in our curricula, leadership, policies and practices. We measure diversity and inclusion not only in numbers, but also by the extent to which students, alumni, faculty, and staff members perceive the School's environment as welcoming, valuing all individuals, and supporting their development.

For more information about how we are practicing inclusive excellence at the Gillings School, visit the following webpages: [Inclusive Excellence](#), [Inclusive Excellence Action Plan](#), [Minority Health Conference](#), and [National Health Equity Research Webcast](#).

Additional campus resources include: the [LGBTQ Center](#); [Non-Discrimination Policies at UNC Chapel Hill](#); [Ombuds](#); and [Prohibited Discrimination, Harassment, and Related Misconduct at UNC Chapel Hill](#).

In this class, we practice the Gillings School's commitment to inclusion, diversity, anti-racism and equity in the following ways.

- Develop classroom participation approaches that acknowledge the diversity of ways of contributing in the classroom and foster participation and engagement of *all* students.
- Structure assessment approaches that acknowledge different methods for acquiring knowledge and demonstrating proficiency.
- Encourage and solicit feedback from students to continually improve inclusive practices.
- Treat all members of the Gillings community (students, faculty, and staff) as human persons of equal worth who deserve dignity and respect, even in moments of conflict and disagreement.
- Contribute to creating a welcoming and inclusive classroom environment, where all are able to learn and grow from one another.
- Acknowledge and respect the diversity of experiences that others bring to the classroom and the ways in which this richness enhances everyone's learning
- Strive to maintain a spirit of curiosity and generosity, particularly in the face of new and/or seemingly contradictory information and perspectives Encourage and solicit feedback from students to continually improve inclusive practices.

Land Acknowledgement

Please read The Gillings School's [Land Acknowledgement](#).

Student Feedback and Equity Concerns

The Gillings School has in place a [mechanism for students to provide feedback](#), including specifically equity concerns and bias-related issues. You can use this form to describe feedback, both positive and negative, about anything including issues related to your experience as a student at Gillings, administrative processes, and classroom activities. This form will also allow you to specifically

describe incidents in which racial or other equity-related bias, or microaggressions, occurred. You may submit this form anonymously. However, for us to follow up and provide the necessary support, we encourage you to include your contact information. For further information, please visit the [Student Feedback and Equity Concerns FAQ](#).

Please note that this form does not take the place of any University process or policy. If you would like to report an incident under the University's policy on [Prohibited Discrimination, Harassment, and Related Misconduct including Sexual and Gender Based Harassment, Sexual Violence, Interpersonal Violence, and Stalking](#), please visit [Safe At UNC](#) or the [Equal Opportunity and Compliance Office](#) (EOC) for additional information, including resources, contact, and reporting options.

Technical support

The best way to help prevent technical issues from causing problems for assignments and quizzes is to submit them at least 24-36 hours before the due date and time. Your instructor cannot resolve technical issues, but it's important to notify them if you are experiencing issues. If you have problems submitting an assignment or taking a quiz in Sakai, immediately do the following:

1. Contact the UNC Information Technology Services (ITS) department with the time you attempted to do your course action and what the course action was.
2. Email your instructor with the information you sent to ITS and what time you sent the information.

The ITS department provides technical support 24-hours per day, seven days per week. If you need computer help, please contact the ITS Help Desk by phone at +1-919-962-HELP (4357), or by [online help request](#), or by [UNC Live Chat](#).

Title IX at UNC Chapel Hill

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitations, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance / Title IX Coordinator ([Adrienne Allison](#)), [Report and Response Coordinators in the Equal Opportunity and Compliance Office](#), Counseling and Psychological Services (confidential), or the [Gender Violence Services Coordinators](#) (confidential) to discuss your specific needs. Additional resources are available at the ["Safe at UNC" website](#).