94603 Syllabus

Multilevel Modeling, PSYC 7304 A, 3.00 Credits
Tuesday & Thursday, 2:00pm – 3:15pm, J. S. Coon 150

Instructor Information

Instructor	Email	Drop-in Hours & Location
Audrey J. Leroux, Ph.D.	aleroux@gatech.edu	Thursdays 3:30-4:30pm, J.S. Coon 220A or https://gatech.zoom.us/my/audreyleroux

General Information

Description

This course is designed to provide theoretical and applied understanding of multilevel modeling. Foundational knowledge of multilevel modeling is taught by extending knowledge of regression analyses to designs involving a nested data structure that lead to violations of the independence assumption in linear modeling. Nested data structures include, for example, students within classrooms, professionals within corporations, patients within hospitals, or repeated observations from the same person. Other basic concepts in multilevel modeling are taught, including intraclass correlation, cross-level interaction, binary outcomes, and longitudinal data. The course also includes instruction in R programming and interpretation of the software output for conducting multilevel modeling.

Pre- &/or Co-Requisites

This course assumes a solid understanding of multiple regression (i.e., PSYC 2020/6020). This course will also require the use of R, SPSS, SAS, Stata, or any other software of your choice for data cleaning.

Course Goals and Learning Outcomes

By the end of this course, students should be able to:

- Recognize when response variables and predictor variables have been collected at multiple (nested) levels.
    - Write out a multilevel statistical model, including assumptions about variance components, in both by-level and composite forms.
    - Interpret model parameters (including fixed effects and variance components) from a multilevel model, including cases in which covariates are continuous, categorical, or centered.
    - Understand why we start with an unconditional model.
    - Build and select a final model, using criteria such as AIC, BIC, and deviance.
    - Check assumptions of a multilevel model.
- Recognize longitudinal data as a special case of multilevel data, with time at level one.
    - Interpret model parameters in longitudinal models.
- Recognize when generalized linear multilevel models are appropriate.
    - Write out a multilevel logistic model, including assumptions about variance components.
    - Interpret model parameters (including fixed effects and variance components) from a multilevel logistic model.
- Apply multilevel modeling with data from your area of research or evaluate a methodological issue in using multilevel modeling

Course Requirements & Grading

Assignment	Date	Weight
Homework 1	Sept. 17	10%
Homework 2	Oct. 1	10%
Exam 1	Oct. 8	15%
Homework 3	Oct. 22	10%
Homework 4	Nov. 5	10%
Homework 5	Nov. 19	10%
Project	Dec. 8	20%
Exam 2	Dec. 15	15%

Description of Graded Components

Homework Assignments

Homework is assigned about every two weeks. The five homework assignments provide further opportunity for you to apply and test your understanding of the material discussed in class and involve using R software to analyze data.

- HW 1: Basic Models & Random Effects
- HW 2: R Software & Estimation
- HW 3: Centering & Model Building/Testing
- HW 4: Interactions, Contextual Effects, & Assumption Checking
- HW 5: Longitudinal Modeling & Binary Outcomes

Note, for these assignments (except the first one) you need access to R software. Assignments are submitted through Canvas as a **PDF file**.

Take-home Exams

Exam 1 covers the first half of the course and Exam 2 covers the second half of the course. However, Exam 2 is cumulative in a way, as the last half of the course is built upon the knowledge from the first half. You do not need access to R software for the exams. Exams are submitted through Canvas as a **PDF**.

Project

You will write a conference paper proposal between 1,500 and 2,000 words in which a hierarchical linear model is the primary method of analysis conducted in R. You should choose one of the following topics for your paper proposal:

- Analysis of your own or advisor's data (assuming IRB approval)
- Analysis of public data
    - For example, datasets are publicly available on the ICPSR site, Harvard Dataverse, and other data repositories online.
- A methodological study in the area of multilevel modeling

The paper proposal must follow American Psychological Association (APA) format and include a description of the study, methods, results, and discussion/conclusions. More details about what should be contained in your proposal and the rubric for assessing your proposal will be provided later in the semester. The project is due at the end of the semester and submitted through Canvas as a **PDF file**.

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Course Materials

Course Text

O'Connell, A. A., McCoach, D. B., & Bell B. A. (Eds.). (2022). *Multilevel modeling methods with introductory and advanced applications*. Information Age Publishing.

(Available for free online through the Georgia Tech Library)

Additional Materials/Resources

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications* (2nd ed.). Routledge.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage.

Roback, P., & Legler, J. (2021). *Beyond multiple linear regression: Applied generalized linear models and multilevel models in R*. Taylor & Francis Group.

Snijders, T. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling* (2nd ed.). Sage.

Course Website and Other Classroom Management Tools

Important course information will be posted on Canvas. The site contains a copy of the syllabus, course lecture notes, homework assignments, relevant links, and supplemental materials. Due to copyright constraints, please DO NOT distribute any materials posted on the site. Please login to Canvas as well as check your Georgia Tech email on a regular basis. Failure to do so is NOT an excuse for not knowing about information pertaining to the course.

Course Policies, Expectations, & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the Student Code of Conduct.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

Class meetings consist of a mixture of lecture, demonstration, and exercises designed to help you master the relevant material. Your active engagement in the class meetings is ***essential*** for success in the course.

Attendance in class meetings is expected, except under extenuating circumstances. Tardiness and early exits disrupt class. Students are responsible for all the material discussed during the class meetings. If you miss a class meeting, it is your responsibility to find out what you missed, including any lecture notes, handouts, homework assignments, etc.

Public health continues to be an important concern, and students should be encouraged to stay home when sick in order to take care of themselves and each other. An option to join the course remotely may be possible for students to participate when they cannot be present physically.

Collaboration & Group Work

You are encouraged to discuss the concepts, material, and homework (including the project) with other students in order to better understand them. However, you must write your own responses to the homework (and project) assignments, which should be neat and free from spelling, grammar, and punctuation errors. **Although the exams are open book, students are expected to work independently on the exams.** You may work in a group of two for the project assignment.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Late work is not accepted for a few reasons. Assignments are posted at least two weeks in advance of their due date. Grading is done one question at a time and without knowing the student's name on the assignment to ensure as much grading consistency and fairness as possible. Graded assignments are also returned in about a week (or less) so that you have feedback prior to submitting the next assignment. This process would not be possible to accomplish if late work were accepted. If you have special circumstances, then please reach out to me before the assigned due date.

Inclement Weather and Digital Learning Days

If a weather-related event affects campus operations, instructors (informed by departmental and/or program considerations) have the discretion to cancel class or pivot to remote instruction.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Campus Resources for Students

Graduate Student Academic and Professional Success Resources

A list of resources for graduate students is given on the Office of Graduate and Postdoctoral Education website. Specific information for current graduate students includes:

- Academic Resources such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance.
- Student Resources such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide.
- Professional Development such as the programming from the Career Center and other professional development resources and events.

Student Well-Being

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being.

Tentative Course Schedule

Week	Date	Topic	Reading Before Class	Assignment	Due
1	8/25	Course introduction			
	8/27	Review of regression	Ch. 1		
2	9/1	From regression to MLM	Ch. 2, pp. 13-16, 20-21		
	9/3	From regression to MLM, cont'd	Ch. 2, pp. 31-34		
3	9/8	Random effects	Hox, Ch. 2, pp. 11-19		
	9/10	Random effects, cont'd	Ch. 2, pp. 21-24		
4	9/15	Introduction to R software	Torfs & Brauer, pp. 1-5		
	9/17	Estimating MLMs in R	Finch et al., pp. 55-61	HW 1	11:59pm
5	9/22	Estimation	Ch. 3, pp. 51-56		
	9/24	Estimation, cont'd	Ch. 3, pp. 56-57		
6	9/29	Centering predictors	Ch. 2, pp. 24-29		
	10/1	Centering predictors, cont'd	Enders & Tofighi (2007)	HW 2	11:59pm
7	**10/6**	**No Class – Fall Break**			
	10/8	Contextual effects	Ch. 3, pp. 78-86	Exam 1	11:59pm
8	10/13	Model building/testing	Ch. 3, pp. 57-62		
	10/15	Model building/testing, cont'd	Ch. 3, pp. 62-70		
9	10/20	Interactions	Ch. 2, pp. 18-20, 34-37		
	10/22	Interactions, cont'd	Hox, Ch. 4, pp. 63-68	HW 3	11:59pm
10	10/27	Assumption checking	O'Connell et al., pp. 97-108		
	10/29	Assumption checking, cont'd	O'Connell et al., pp. 113-125		
11	11/3	Longitudinal modeling	Ch. 9, pp. 307-318		
	11/5	Longitudinal modeling, cont'd	Ch. 9, pp. 318-325	HW 4	11:59pm
12	11/10	Binary outcomes	Ch. 7, pp. 209-219		
	11/12	Binary outcomes, cont'd	Ch. 7, pp. 227-239		
13	11/17	Power and sample size	Ch. 5, pp. 127-136		
	11/19	Power and sample size, cont'd	Ch. 5, pp. 136-141	HW 5	11:59pm
14	11/24	Cross-classified modeling	Ch. 6, pp. 165-175		
	11/26	**No Class – Thanksgiving**			
15	*12/1*	*Project presentations*	Ch. 17		
	12/3	*Project presentations, cont'd*			
16	12/8	Multiple membership modeling	Beretvas, Ch. 16	Project	11:59pm
	12/10	**No Class**			
17	**12/15**	**No Class**		Exam 2	11:59pm

The last day to withdraw and receive a "W" is October 31st.