Course and Contact Information:

Course: Department of Statistics, Longitudinal Data Analysis, Stat 6225
Semester: Fall 2021
Meeting Time: Mondays, 6:10pm-8:40pm
Location: Phil 108

Instructor:

Name: Dr. Colin O. Wu
Campus Address: Rome Hall, 801 22nd St. NW, Room (To be determined)
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Office Hours: Mondays, via email

Grader: TBA
Email: TBA

Course Description:
This course gives an introduction to the statistical models, estimations methods and inferences for the analysis of longitudinal data, i.e., repeated measurements data. The main topics include most of the well-known parametric and nonparametric regression models for longitudinal analysis, such as the parametric marginal models, the linear and generalized linear mixed-effects models, semiparametric or nonparametric regression models, and the structured nonparametric regression models. We will mostly focus on the practical aspects of the statistical methods, such as different longitudinal data structures, model construction and interpretations, estimation and inference methods, and application of the methods to real longitudinal studies. Theoretical justifications of the estimation and inference methods will also be outlined in the course, but the detailed theoretical derivations will only be assigned as reading materials. Students are expected to analyze real datasets from biomedical studies using different models, conduct sensitivity studies and interpret the results. The main objective of the course is for students to build a solid understanding of the available tools for longitudinal analysis and be able to apply these tools in practice. The R packages for longitudinal data will be used throughout the course.

Course Prerequisite:
Basic knowledge of regression methods, such as STAT 6210 or STAT6214; statistical methods for estimation and inferences, such as STAT 4157 or STAT 6201. If you have not taken these courses, you may need to do some extra reading to get some basic background knowledge.

Learning Outcomes:
As a result of completing this course, students will have an overall background of the major theory and methods of longitudinal analysis and their applications in practical settings. For students who are looking for a research topic in longitudinal analysis, some recent research results and topics in the methods and applications will be beneficial.

Course Homepage: http://blackboard.gwu.edu. Please check this page frequently.

Course Structure: The class consists of one lecture and some question/answer time per week. During the lectures, we will cover the basic formulations of statistical models for longitudinal data, some theoretical background, and some real examples of longitudinal analysis in biomedical studies.

Commonly used statistical software packages, such as SAS and R will be introduced in the lectures and used for homework assignments and projects

Required textbooks, materials, and recommended readings:

1) *"Nonparametric Models for Longitudinal Data: With Implementation in R,"* 2018, by Colin O. Wu and Xin Tian, Monographs on Statistics and Applied Probability #159, Chapman and Hall/CRC, CRC Press, Boca Raton.
2) *"Linear Mixed Models for Longitudinal Data,"* 2000, by Geert Verbeke and Geert Molenberghs, Springer, New York
3) *"Models for Discrete Longitudinal Data,"* 2005, by Geert Molenberghs and Geert Verbeke, Springer, New York

Major Topics:
Structures of longitudinal data; estimation and inference for the marginal models; inference for the random effects; estimation and inference of the linear mixed-effects models, the conditional linear mixed-effects models, joint modeling of measurements and missingness, the pattern-mixture models, the shared parameters models, the generalized linear mixed-effects models and the likelihood-based marginal and mixed-effects models; local and smoothing methods for the partially linear models, the varying-coefficient models, and the nonparametric mixed-effects models.

Average Minimum Amount of Out-Of-Class or Independent Learning Expected per Week:
Students are expected to spend a minimum of 2.5 hours of out-of-class work and a minimum of 5 hours of independent learning every week. In fact, for this course, it is expected that the independent learning outside of the classroom will exceed the minimum numbers of hours listed above.

Tentative Schedule (pending modification):

Date	Topics (expected 9 hours of independent work per week)
August 30	Introduction to Longitudinal Data
September 6	MLE and RMLE of the Marginal Models
September 13	Inference for the Marginal Models
September 20	Estimation of the Linear Mixed-Effects Models
September 27	Inference and Prediction for the Linear Mixed-Effects Models
October 4	Local Estimation of the Marginal Nonparametric Models
October 11	Global Estimation of the Marginal Nonparametric Models
October 18	Local Estimation of the Time-Varying Coefficient Models
October 25	Global Estimation of the Time-Varying Coefficient Models
November 1	Formulation Nonparametric Mixed Effects Models
November 8	Estimation of the Nonparametric Mixed Effects Models
November 15	Estimation of Conditional Distribution Functions
November 29	The Generalized Linear Mixed-Effects Models
December 6	New Developments in Functional Analysis

Homework: 4 homework/project assignments will be assigned.
You may discuss with me or with each other about the potential approaches for the homework for the purpose of improving your knowledge of the course material. But, you must solve the problems by yourself and show the necessary steps of your solutions. Please submit the assignments on time and do not share assignments with students who are not taking the course.

Midterm: None.

Final Examination: One final take-home project covering all the topics discussed in the course.

Statistical Computing Packages: You will need to use a statistical package in order to perform some of the statistical analyses covered in this course. *We will focus on R*.

R is a freeware that we will use extensively in this course. A basic tutorial can be found at http://www.math.ilstu.edu/dhkim/Rstuff/Rtutor.html and a more advanced at http://zoonek2.free.fr/UNIX/48_R/all.html.

Course Grading: Homework/computing project (60%), Final (40%)

Important Notes:
- A grade of INCOMPLETE will ONLY be given to a student who is passing the course and cannot complete the course due to illness or other well documented circumstances beyond their control.
- Make-up exam is possible after obtaining the permission from Dr. Wu prior to the exam date.

NOTE: IN ACCORD WITH UNIVERSITY POLICY, THE FINAL EXAM WILL BE GIVEN DURING THE FINAL EXAM PERIOD AND NOT THE LAST WEEK OF THE SEMESTER

Academic Integrity:
I personally support the GW Code of Academic Integrity. It states:: "Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information." For the remainder of the code, see: http://www.gwu.edu/~ntegrity/code.html

Support for Students Outside the Classroom:
DISABILITY SUPPORT SERVICES (DSS)
Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Marvin Center, Suite 242, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: http://gwired.gwu.edu/dss/
UNIVERSITY COUNSELING CENTER (UCC) ***202-994-5300***
The University Counseling Center (UCC) offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include:
crisis and emergency mental health consultations
confidential assessment, counseling services (individual and small group), and referrals
http://gwired.gwu.edu/counsel/CounselingServices/AcademicSupportServices

Security:
In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location.