STAT 574 Linear and Nonlinear Mixed Models

Spring 2025

Time:	Tu/Th 1:30 – 2:45 PM	**Location:**	CUE 418
Instructor:	Chencheng Cai	**Email:**	chencheng.cai@wsu.edu
Prerequisites:	STAT 530, STAT 556 and R	**Credit Hours:**	3
Office Hours:	Wed 12 – 3 PM or by appointment	**Office Location:**	Neill Hall 405

Course Materials

1. **Lecture Notes**:
   available on both Canvas and the course website (https://chenchengcai.com/teaching/Stat574)
2. **Textbook**:
   Mixed Models: Theory and Applications with R, 2nd Edition. Eugene Demidenko. Wiley 2013.
   Free online access through WSU library (https://libraries.wsu.edu/)
3. **Recommended Reading:**
   Mixed-Effects Models in S and S-PLUS. José C. Pinheiro and Douglas M. Bates. Springer 2000.

Course Description

The course will focus on mixed models and related topics including the methodologies and practices in a programming language (R or Python). Specifically, the following topics will be covered in the course.

- Linear mixed-effect (LME) models.
- Algorithms and programs related to the estimation for LME models.
- Marginal models.
- Generalized LME models.
- Nonlinear mixed-effect models
- Case studies on real datasets.

Learning Outcomes

Week 1-2	Overview the topic and review prerequisites on linear algebra and regression theories
Week 3-6	Master the estimation and statistical properties of linear mixed-effect models and the corresponding programming
Week 7-8	Master the marginal models and the corresponding programming in R
Week 9-11	Master the generalized linear mixed models and the corresponding programming.
Week 12-13	Master the nonlinear mixed models and the corresponding programming.
Week 14-15	Master model diagnostics for the mixed-effect models.

Assessment

The grading of this course will be assessed based on (1) Homework, (2) Exams, and (3) Final project according to the following allocations.

Homework	40%
Exams	40%
Project	20%
Total	100%

The grading scale table is as follows.

A	93% - 100%	C+	77%-79.99%
A-	90% - 92.99%	C	73% - 76.99%
B+	87% - 89.99%	C-	70% - 72.99%
B	83% - 86.99%	D+	66% - 69.99%
B-	80% - 82.99%	D	60% - 65.99%
		F	0% - 59.99%

Homework

There are approximately six homework to be assigned throughout the semester. These will come from problems provided by the textbook or materials discussed in the lectures. Homework assignments will primarily consist of methodological exercises and programming exercises, and both the two parts of the exercises need to be completed. Please organize the methodological part (either typed or scanned) and the codes (including outputs) into one PDF file and submit them through Canvas. Late homework without exemption from the instructor will be graded 0 points.

Exams

There are two exams to be given during the semester, including a mid-term and a final. The quiz problems will be developed from materials presented in lectures and the textbook. These will primarily consist of some methodological questions and programming exercises. All exams are conducted in an open book and open notes manner.

Case Study Project

In the final project, the students will be asked to investigate special data types/models/methodologies that are not covered in the lecture notes. The project will be graded based on the 20-minute group presentation.

Class Participation

To properly gain a working knowledge of the material, attendance and participation in class are necessary. While this will not be graded, enrolled students are highly encouraged to attend the class.

Policies

Students with Disabilities

Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center at 509-335-3417 to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information contact a Disability Specialist on your home campus. Provide disability Specialist contact information: Pullman or WSU Online: 509-335-3417, Washington Building 217; http://accesscenter.wsu.edu, Access.Center@wsu.edu

Academic Integrity Statement

You are responsible for reading WSU's Academic Integrity Policy, which is based on Washington State law. If you cheat in your work in this class you will:

- Fail the course.
- Be reported to the Center for Community Standards.
- Have the right to appeal my decision.
- Not be able to drop the course or withdraw from the course until the appeals process is finished.

If you have any questions about what you can and cannot do in this course, ask me.
If you want to ask for a change in my decision about academic integrity, use the form at the Center for Community Standards website. You must submit this request within 21 calendar days of the decision.

Expectations for Classroom Conduct

Respect each other and treat others how you want to be treated. Please silence your cell phones and all other electronics and refrain from using these items during class. Do not disrupt the class, students are here to learn and cannot do so if others are being disruptive. If I feel you are disrupting the class or are disrespectful of anyone, I reserve the right to ask you to leave class for the day. Success in class requires reading the textbook, listening and asking questions in lectures, and doing all assigned work. Only you choose whether or not to succeed by doing these things.

Workload Expectations

This course meets for a total of 2.5 hours per week. For each hour of lecture equivalent, students should expect to have a minimum of two hours of work outside class

University Syllabus

Students are responsible for reading and understanding all university-wide policies and resources pertaining to all courses (for instance: accommodations, care resources, policies on discrimination or harassment), which can be found in the **university syllabus**.

Tentative Schedule

Week 1	Jan 7, Jan 9	Overview and introduction
Week 2	Jan 14, Jan 16	Review on linear algebra and regression theory.
Week 3	Jan 21, Jan 23	Linear mixed-effect models: estimation
Week 4	Jan 28, Jan 30	
Week 5	Feb 4, Feb 6	Linear mixed-effect models: statistical properties
Week 6	Feb 11, Feb 13	
Week 7	Feb 18, Feb 20	Marginal models
Week 8	Feb 25, Feb 27	
Week 9	Mar 4, Mar 6	Generalized linear mixed models
Week 10	Mar 10 – Mar 14	**Spring Break**
Week 11	Mar 18, Mar 20	Generalized linear mixed models
Week 12	Mar 25, Mar 27	Nonlinear mixed-effect models
Week 13	Apr 1, Apr 3	
Week 14	Apr 8, Apr 10	Model diagnostics
Week 15	Apr 15, Apr 17	
Week 16	Apr 22, Apr 24	Case study presentation
Week 17	Apr 28 – May 2	**Exam Week**