STAT 52600

Advanced Statistical Methodology (3 credits)

Dr. Qifan Song, MATH 208

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Lectures: TR 12:00 am - 1:15 am **Classroom**: Schleman Hall 113

Office hours: Tues 2:00-3:00pm at `https://purdue.webex.com/meet/qfsong` or by appointment

TA: (All inquiries about homework/exam grading should be sent directly to Dr. Song, the TA will not directly response to students' requests)

Name: Xiaojing Sun (sun1131@purdue.edu@purdue.edu)

Office Hours: Monday 2:00-3:00 pm at MATH 519

Course Objective and topics:

This course introduces statistical models for data analysis problems where standard least-squares techniques may not be appropriate. Its objectives are to (1) conceptually understand general and generalized linear mixed effects models, nonparametric regression and generalized additive models, and lastly, survival models for the analysis of lifetime data, (2) use these models in real data applications, (3) draw valid conclusions and clearly present the results.

Prerequisites: STAT 516, 517 and 525.

Recommended texts/additional reading:

Extending the Linear Model with R (2nd Edition) - Faraway. (Required)

Applied Linear Statistical Models (5th Edition) - Kutner, Nachtsheim, Netter & Li. (Optional)

An Introduction to Statistical Learning: with Applications in R (2nd Edition) - James, Witten, Hastie, Tibshirani (Optional)

Categorical Data Analysis (3nd Edition) - Agresti (Optional)

Applied Survival Analysis - Le (Optional)

Course website:

All teaching material, announcement homeworks will be posted on Brightspace website `http://purdue.brightspace.com`.

Software:

We will primarily use R in lectures, homework, and exams. Please visit `https://cran.r-project.org/` and `https://posit.co/products/open-source/rstudio/`. Statistical software, such as SAS, STATA, and MATLAB, can be used for homework and the project but the instructor is not responsible for technical support.

Grading Rule: Assignments: 20%; Midterm: 30%; Midterm II: 30%; Final project: 20%. The percentage grades needed to achieve an A, B, C, or F will follow approximately the following scale: $90-100=A$, $80-89=B$, $70-79=C$, $55-69=D$, below 55 is F. The instructor reserve the right to change the rule of letter grade assignment.

Midterm Examinations (Date subjected to change):

Midterm I: Thursday 02/15, 2024 during class time

Midterm II: Thursday 04/11, 2024 during class time

Final Project:

At the end of the semester there will be a final project where groups of 1-2 students find a real-world problem to analyze and summarize. A month before the end of the semester, each group must submit a project proposal and I will provide feedback on the appropriateness of the proposal. The proposal will describe group members, the scientific question to be addressed, the available data, and statistical analysis methods that will be used. I encourage you to talk to me before submitting the proposal. Each group will write a final report that will be due a week before the end of the class.

Attendance, Homework, Exam policy:

- Class attendance is an important part of your success in the class. The syllabus, homework assignments, exam dates, etc. may be changed by in-class announcements. Low attendance without proper excuses may cause penalty to the final grade.

- The homework will be assigned approximately one week before its due date and will also be posted on the class website. The homework must be finished (written) independently. Discussion is okay, but identical copies are not acceptable since your homework must reflect YOUR understanding of the material. If identical solutions are found, all the parties involved will receive a 0 on that assignment.

  Please submit hard copy of your homework during class time. Homework must always be stapled if it is longer than one page.

- No late assignments will be graded. To allow for illness, family emergencies, etc., the lowest homework score will be dropped at the end of the fall semester.

Exam policy Under current protocols, exams will be in-person. The allowed exceptions are:

- Students who registered with DRC can take the exam at DRC facility. Those students must contact Dr. Song asap to discuss the exam time and submit a DRC test request at `https://www.purdue.edu/drc/testing/requesting-an-exam.php`, at least one week prior to the exam date.
- Students who have schedule conflict may take the exam at a different time upon Dr. Song's approval. Acceptable excuses include Grief, Military, Jury Duty Absences and etc. Those students must contact Dr. Song asap, and provide necessary proof.
- Students who have a medical emergency on the exam date, may take the exam at a different time upon Dr. Song's approval. Those students must contact Dr. Song asap with proper doctor's note.

Students, who are eligible for the above exceptions, but fail to contact Dr. Song properly and don't attend the in-person exam, will be considered absent from the exam and receive 0 pt for the midterm.

ADA, Plagiarism, Academic Integrity and Nondiscrimination Statement:

- STATEMENT ON DISABILITIES: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation for their disabilities.

  Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center (DRC) at: drc@purdue.eduor by phone: 765-494-124. If you have registered with DRC and have an Accommodation Letter from DRC, or you are in need of academic accommodations, please contact me as soon as possible.

- STATEMENT ON PLAGIARISM: The handouts used in this course are copyrighted. By "handouts," I mean all materials generated for this class, which include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless I expressly grant permission. As commonly defined, plagiarism consists of passing off as one's own ideas, words, writing, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

- ACADEMIC INTEGRITY STATEMENT:

  Academic integrity is one of the highest values that Purdue University holds. Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, University Regulations] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972].

  Individuals are encouraged to alert university officials to potential breaches of this value by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

  The Purdue Honor Pledge "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do.Accountable together - we are Purdue".

  Any confirmed academic misconduct activity in this course leads to punitive grading.

- NONDISCRIMINATION STATEMENT: Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

- VIOLENT BEHAVIOR POLICY: Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activities.

- EMERGENCY PREPARATION: In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

  Guidelines regarding ensuring access to emergency information:

  – Keep your cell phone on to receive a Purdue ALERT text message

  – Log into a Purdue computer connected to the network to receive any Desktop Popup Alerts

  – If you have a "no cell phone" in class policy allow one or two students who have signed up for Purdue ALERT to keep their phones on to receive any alerts

- **Tentative Course Schedule (subject to change)**:

Chapter(s)	**Description**	**Approx. Time**
1	Review of Linear Models	1 wk
8	Introduction to Generlized Linear Models	1 wk
2-4, 7	Analysis of Binary/Multinomial Data	3 weeks
5-6	Analysis of Count Data	2 weeks
10	Linear Mixed Models	1 week
11,12,13	Analysis of Correlated Data	2 weeks
–	Survival Analysis	2 weeks
14	Nonparametric Regression	1.5 weeks
15	Additive Models	1.5 weeks