STAT 8020: Statistical Methods II

Summer I 2026 — Asynchronous Online

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Office Hours:

Tuesdays 2:00–3:00 PM; Thursdays and Fridays 10:00–11:00 AM.

Reference Books

- *Linear Models with R*, 2nd Edition, **Julian Faraway (2014)**. Book page
- *An Introduction to Statistical Learning: with Applications in R*, 2nd Edition, **James, Witten, Hastie, Tibshirani (2021)**. ISLR website
- *Extending the Linear Model with R*, 2nd Edition, **Julian Faraway (2016)**. Book page
- *A First Course in Design and Analysis of Experiments*, **Gary W. Oehlert (2010)**. PDF
- *Design and Analysis of Experiments*, 2nd Edition, **Dean, Voss, Draguljic (2017)**. Publisher page

Statistical Software

The `R` Project for Statistical Computing (`https://www.r-project.org/`) and `RStudio` (`https://rstudio.com/products/rstudio/`), an integrated development environment (IDE) for `R`, will be used extensively throughout the course.
In addition, `R Markdown` will be used regularly for `R` sessions and `R` Labs. Students are expected to use `R Markdown` to produce well-organized, reproducible reports in which code, output, and written explanations are seamlessly integrated. The use of `R Markdown` is also **strongly encouraged** for course projects to ensure clear presentation and professional formatting of analyses.

Course Website:

https://whitneyhuang83.github.io/STAT8020/2026_Summer.html

Course Description and Learning Objectives (CLOs):

This course covers advanced statistical methods including regression analysis, experimental design, and spatial and time series modeling, with an emphasis on applied data analysis using statistical software.
Upon successful completion of this course, students will be able to:

1. **(CLO 1) Model Formulation:** Formulate appropriate statistical models for different types of data, including linear, nonlinear, and nonparametric regression, generalized linear models, experimental designs, time series models, and spatial models.
2. **(CLO 2) Statistical Inference and Interpretation:** Conduct statistical inference for model parameters and interpret results in context using hypothesis tests, confidence intervals, and prediction methods.
3. **(CLO 3) Model Fitting and Implementation:** Implement statistical models using R, including regression models, generalized linear models, mixed-effects models, time series models, and spatial prediction methods.
4. **(CLO 4) Model Evaluation and Diagnostics:** Evaluate model adequacy using diagnostic tools, goodness-of-fit measures, residual analysis, and model comparison criteria.
5. **(CLO 5) Applied Statistical Reasoning and Decision Making:** Select, justify, and apply appropriate statistical methods to analyze real-world data, addressing issues such as model complexity, nonlinear relationships, experimental design, dependence structures, and uncertainty quantification.

Attendance

This course is delivered in an asynchronous online format, and there are no required live class meetings. Students are expected to engage with the course materials regularly and keep up with weekly assignments and activities. Optional Zoom office hours will be offered on a regular basis to provide support and answer questions.

Make-up Work and Missed Deadlines:

1. As this course is delivered in an asynchronous format, students are expected to manage their own pace and stay on track with all deadlines. Regular engagement with course materials is essential for success.
2. If a student anticipates difficulty meeting a deadline due to extenuating circumstances, they should contact the instructor as early as possible to discuss possible arrangements.
3. In the case of unexpected emergencies, students should notify the instructor as soon as reasonably possible. Documentation may be required at the instructor's discretion.
4. Reasonable accommodations may be made on a case-by-case basis; however, students are responsible for completing all required coursework. Make-up work, if permitted, will be comparable in scope and difficulty to the original assignment.
5. Students participating in University-sponsored activities should communicate in advance. While reasonable flexibility will be considered, all course requirements must still be met.

Project Information:

There will be **two online projects** throughout the course. The project topics are somewhat independent, but each is designed to reinforce key concepts covered in the course. All projects must

be completed independently, and students are expected to use statistical software (e.g., `R/RStudio`) to carry out their analyses.
In addition to obtaining results, students are expected to clearly demonstrate their understanding of the underlying statistical concepts and provide thoughtful interpretation and discussion. Emphasis will be placed not only on computation, but also on reasoning, explanation, and clarity of presentation.
The project schedule is as follows:

- **Project I**: June 3 (Wednesday)
- **Project II**: June 18 (Thursday)

Homework:

Homework will be assigned regularly throughout the 5-week summer session and graded in a timely manner. All assignments must be uploaded to Canvas by 3:30 PM on the due date. **No late homework will be accepted under any circumstances**. To accommodate unforeseen situations, the lowest homework grade will be dropped when calculating the homework average.
In addition, there will be **10 R Labs** designed to help students become familiar with the course material and, more importantly, to develop the ability to implement statistical methods in practice. Students are required to complete the labs using **R Markdown**, producing well-organized, reproducible reports in which code, output, and written explanations are seamlessly integrated.
For grading, the **highest 5 out of the 10 labs** will count toward the final grade. However, students are strongly encouraged to complete all labs, as they are cumulative and provide essential preparation for the course projects.
Each lab will be graded primarily on effort and completion, with **90% based on completeness** and **10% based on correctness**. Suggested solutions will be posted shortly after the submission deadline.

Evaluation

- **Grade Distribution:**

Component	**Weight**
Homework Assignments	20%
Project I	40%
Project II	40%

- **Letter Grade:**

Score Range	Grade
≥ 90.00	A
88.00–89.99	A-
85.00–87.99	B+
80.00–84.99	B
78.00–79.99	B-
75.00–77.99	C+
70.00–74.99	C
68.00–69.99	C-
≤ 67.99	F

Key Dates:

- **May 12, Tue.**: Classes begin
- **May 13, Wed.**: Last day to register or add a class or declare audit
- **May 18, Mon.**: Last day to drop a class or withdraw from the University without a W grade
- **June 4, Thu.**: Last day to drop a class or withdraw from the University without final grades
- **June 16, Tue.**: Last day of classes

Academic Integrity Statement:

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.
Using materials generated by artificial intelligence (AI) without proper attribution is considered plagiarism.
All infractions of academic dishonesty by undergraduate students must be reported to Undergraduate Studies for resolution through that office. In cases of plagiarism, instructors may use the Plagiarism Resolution Form. Please refer to the following resource:

- Graduate Student Handbook

Disability Access Statement:

It is university policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students with disabilities requesting accommodations should make an appointment with Disability Services (656-6848), to discuss specific needs within the first month of classes. Students should present a Faculty Accommodation Letter from Student Disability Services when they meet with instructors. Accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester.

Online Testing

By enrolling in a course with online assessments, students agree to the use of online test proctoring services or software as described in the course. Students also consent to the recording of their activity, including video and audio of their workspace, for review by the proctoring system, the course instructor, and Clemson University personnel.
For more information, please refer to the Academic Regulations section of the Undergraduate Catalog.

Technical Support

If you experience issues with Canvas or other university systems, first check the Clemson System Status webpage for any known outages. If no issues are reported, try logging out and restarting your browser before attempting again. Additional guidance can be found in the Canvas Help Guides.
The CCIT Support Center provides technical assistance and hardware support:

- Phone: (864) 656-3494
- Email: `ITHelp@clemson.edu`
- Services: IT Help and Support (including online chat and Knowledge Base)

Canvas is supported on major web browsers, including Chrome, Firefox, Edge, and Safari. However, Safari may not fully support all features, and its use is not recommended.
Canvas mobile apps are available for students and can be useful for viewing announcements, reminders, and messages. However, they may not fully support all course components, such as exams or detailed course materials.

Emergency Preparedness

Emergency procedures are available on the Clemson University Emergency Management website and in the purple emergency flipbooks located in classrooms and offices across campus.
Students are encouraged to:

- Sign up for CU Alert text notifications
- Familiarize themselves with emergency procedures
- Follow all directions from emergency responders during an emergency

For additional safety information, please visit:
`https://www.clemson.edu/cusafety`

Clemson Libraries Resources

The Clemson Libraries provide a wide range of resources and services to support your academic work throughout this course.

Research Support

Need academic sources but unsure where to begin? Do not spend hours searching on your own—ask a librarian. The Libraries offer curated online subject guides to help you find articles, databases, books, and more. Personalized research assistance is available by appointment with subject-specialist librarians. You can also receive help in person, via live chat on the Libraries website, or by texting 864-762-4884.

Using AI for Research

If you need to verify a book, article, or dataset suggested by AI, you can use the online catalog, the Libraries AI Research Assistant, or verified AI tools embedded in databases such as JSTOR and EBSCO. Additional resources include an online guide on AI tools for research and a "10-Step AI Challenge" to help you explore effective and responsible AI use.

Citation and Academic Integrity

If you are unsure how to cite sources properly, the Libraries provide guides for various citation styles as well as citation management tools such as RefWorks and EndNote. Interactive online tutorials are also available to help you understand and avoid plagiarism.

Creative and Technical Support

Working on a creative project? The Adobe Studio and Makerspace, located on the 5th floor of Cooper Library, offer support for digital and hands-on projects. Staff can assist with video production, 3D design, and more. Equipment such as high-resolution cameras, green screens, and projectors is also available for checkout.

Data Visualization Support

Need help creating charts or visualizing data? The Data Visualization Lab on the 4th floor of Cooper Library provides support for data visualization, data analysis, and digital research methods.

For more information, visit:
`https://www.libraries.clemson.edu`

Title IX Statement:

The Clemson University Title IX statement: Clemson University is committed to creating and continuously fostering a caring community based on the core values of integrity, honesty and respect. Sexual discrimination, which includes sexual harassment, sexual violence, stalking and domestic and/or relationship violence, is unacceptable and has no place in Clemson's community. Consistent with its Title IX obligation, the University prohibits discrimination, including sexual and gender-based harassment and violence, in all its programs and activities, including academics, employment, athletics, and other extracurricular activities. This Title IX policy is available online. Katherine Weathers is the Clemson University Title IX Coordinator and VP of Inclusive Excellence. She can be reached at (864) 656-3413 or via email at kweath3@clemson.edu. Remember, email is not a fully secured method of communication and should not be used to discuss Title IX issues.

Online Course Etiquette ("Netiquette")

Online Communication Guidelines

Even if you have experience communicating in an online environment, online courses may require extra effort to remain civil. An online classroom is still a classroom, and we should all behave professionally. Please read and follow the guidelines below.

While in our class, please remember:

- **Be respectful.** Consider the person on the receiving end of your comments. If you were sitting in front of that person, would you say the same thing?
- Humor and sarcasm do not always translate well in online discussions. Consider your tone and whether your words can be clearly understood.
- Only share information that you are comfortable revealing to your classmates.
- Please spell-check your responses. You may compose your work in another program (such as Word) and then paste it into the discussion.
- Posts do not need to be perfect, but they should be clear and readable.
- The law still applies online. Do not engage in illegal acts such as libel or slander, and do not joke about such behavior.

Please do not:

- Use offensive language, even in jest. Comments that could be interpreted as racist, sexist, or otherwise inappropriate may be removed.
- Use `ALL CAPS` in posts. This is considered shouting and is inappropriate.
- Post large, unbroken blocks of text. Break your writing into paragraphs for readability.
- Post the same message multiple times. If you experience technical issues, please contact me.
- Re-post or forward communication without explicit permission. Please respect responses if permission is not granted.

Course Schedule:

Week	Dates	Topic
1	May 12–15	Course Overview & Review of Simple Linear Regression; Introduction to Multiple Linear Regression
2	May 18–22	Multiple Linear Regression: Prediction, Diagnostics, and Mixed Continuous & Categorical Predictors
3	May 26–29	Advanced Regression Topics: Nonlinear, Nonparametric, Shrinkage, and Logistic/Poisson Models (GLMs)
4	June 1–5	Experimental Design: Principles; CRD, RCBD, Factorial & Split-Plot Designs; Random & Mixed Effects; Computer Experiments
5	June 8–12	Time Series: Dependence, Stationarity& ACF; AR/MA/ARMA Identification; SARIMA Forecasting & Diagnostics; Spatial Statistics: Dependence, Covariance and Variogram
6	June 15–16	Spatial Statistics: Variogram Modeling, Estimation, Kriging Prediction & Uncertainty