Applied Linear Models

STAT 7630, Spring 2024

- Time: 1000-1115 TR
- Room: 1026 Pavilion I
- Textbook: A Modern Approach to Regression with R, Simon Sheather, Springer, [https://link.springer.com/book/10.1007/978-0-387-09608-7 (https://link.springer.com/book/10.1007/978-0-387-09608-7)]
- Supplementary Materials: [https://gattonweb.uky.edu/sheather/book/ (https://gattonweb.uky.edu/sheather/book/)]
- Credits: 3
- Instructor: Dustin Pluta, PhD
- Email: dpluta@augusta.edu (mailto:dpluta@augusta.edu)
- Office: 1011 Pavilion I
- Office Hrs: 1200-1300 W, and by appointment

Catalog Course Description

> This course will cover simple linear regresssion with extension to multiple linear regression models including model selection, validation, diagnostics and remedial measures. Additionally, one-way analysis of variance (ANOVA), multiple > >treatment comparisons, factorial ANOVA, randomized complete-block designs, analysis of covariance (ANCOVA), ANOVA with unbalanced data, fixed-/random-/mixed-effect models, repeated-measures designs, and nested designs.
>
> Lecture Hours: 3
>
> Grade Mode: Normal, Audit Prerequisites: STAT7110 >= C and STAT7510 >= C Repeat Status: No Schedule Type: Lecture, Asynchronous Instruction

Student Learning Outcomes

At the end of the course, students will be capable of analyzing data using linear regression, ANOVA, mixed-effect models, and other related methods. This will include cleaning and visualization of the data, choosing an appropriate model design, diagnosing model performance, and preparing summary plots and a written report interpreting the results of the analysis.

Course Evaluation and Grading

Assessments

- 4 Homework Assignments **(50%)**
- 1 Midterm Exam **(20%)**
- 1 (Course Project+Final Exam) **(30%)**

Homework Assignments

- Homework assignments consist of a combination of theory and application problems based on the lecture and book material, and involve, e.g., coding, mathematical derivations, and interpreting model results.
- Due date will typically be 1 - 2 weeks after it is assigned.
- Late assignments will not be accepted without prior approval.
- Your submitted assignments should be organized, with the assignment number, your name, and the date all clearly visible on the first page.
- Any results, derivations, or any other form of work you include that is not your own must be cited with a full reference.
- I **strongly** prefer you type your assignments using $\LaTeX$ or Markdown.
- Homework submission will occur online. See the course webpage for further instructions.

Midterm Exam

- In-class, closed book, one page of notes (standard letter paper, front and back).
- Questions similar to homework assignments.
- Specific material covered and further details on the exam will be provided in class.

Course Project+Final Exam

Students will be tasked with conducting a thorough analysis on a real world data set, producing a written report that includes a practical interpretation of results. Students will need to: find a real world data set, identify a question of interest that can be assessed with the data, develop and apply the appropriate linear model, and interpret the model results to answer the motivating question. Students will be required to make use of statistical modeling software (R, Python, ~~SAS~~) to conduct their analyses and generate the required plots.

A take home final exam will be assigned as a component of the course project. Details provided in class.

Grading Scale

A-F Grading Scale:

A: >= 90% & <= 100%

B: >= 80% & < 90%

C: >= 70% & < 80%

D: >= 60% & < 70%

F: < 60%

Course Topics & Schedule

(Tentative)

1. JAN 09 Course introduction, Review of Pre-requisite material.
2. JAN 16 Intro/Review of Linear Regression; **Homework 1** Assigned
3. JAN 23 Multiple Linear Regression (MLR): Model Assumptions, Theoretical Properties.
4. JAN 30 MLR: Application, Diagnostics; **Homework 2 Assigned**
5. FEB 06 MLR: Model Design, Variable Selection.
6. FEB 13 MLR: More Application, Interpretation of model results, Summary plots; **Homework 3 Assigned**
7. FEB 20 **MIDTERM**
8. FEB 27 Review of ANOVA.
9. MAR 05 Intro to Experimental Design. (*Spring Pause MAR 07-08*)
10. MAR 12 Connecting ANOVA and Linear Regression.
11. MAR 19 Models for heteroskedastic data; **Homework 4 Assigned**
12. MAR 26 Models for correlated data.
13. APR 09 *Spring Break*
14. APR 16 Mixed Effects Models
15. APR 23 *TBD*

16. APR 30 Discuss course project.

Policies & Guidelines

Students are required to follow and be aware of the Augusta University Student Attendance Policy, which states

> regular, punctual attendance is expected of students in all courses at Augusta University and is counted at >the first class meeting each term. Faculty members are required to monitor student attendance and ongoing >participation in the course. Additional attendance requirements may be established by the individual schools >or programs as well as by the individual faculty member in each course. Students who incur an excessive >number of absences, as defined by the faculty member and/or college, may be subject to academic penalty.

The full Student Attendance policy can be found in the AU Policy Library at https://www.augusta.edu/compliance/policyinfo/policies.php (https://www.augusta.edu/compliance/policyinfo/policies.php), and from the Graduate School at https://www.augusta.edu/gradschool/student-resources.php (https://www.augusta.edu/gradschool/student-resources.php).

Course Attendance Policy

- Please inform me in advance, either in person or by email, if you anticipate being absent.
- In case of emergency that prevents contacting me prior to the class meeting, inform me as soon as you can.
- If you anticipate consecutive absences or an extended period of absence, contact me to discuss arrangments.
- Being absent does not permit you to turn in an assignment late.
- Frequent absenteeism will be frowned upon :(

AU Academic Honesty Policy

> “Augusta University (“AU”) recognizes that academic honesty is essential to its academic function. The following regulations protect the equity and validity of the University’s grades and degrees, and help students develop ethical standards and attitudes appropriate to academic and professional life. Violations of academic honesty include, but are not limited to, cheating of all kinds, plagiarism, research misconduct, collusion, and false statements made to avoid negative academic consequences.” - from the AU Academic Honesty policy

> “It is the duty of the student to practice and preserve academic honesty. Each student should be aware of the specific policies governing academic conduct for the program(s) and course(s) in which he or she is enrolled, as well as the grievance and appeals processes put in place for adjudicating such policies. If the student has any doubt about a course policy, s/he should consult with her/his instructor or the course director.” - from the AU Academic Honesty policy

Students are responsible for reading the full AU Academic Honesty policy which can be found

- AU Policy Library at https://www.augusta.edu/compliance/policyinfo/policies.php (https://www.augusta.edu/compliance/policyinfo/policies.php)
- The Graduate School Website https://www.augusta.edu/gradschool/student-resources.php (https://www.augusta.edu/gradschool/student-resources.php)

- The AU Student Manual found on the Enrollment and Student Affairs Website https://www.augusta.edu/student-affairs/ (https://www.augusta.edu/student-affairs/)

Additional Expectations/Suggestions

- All students are required to check their AU email account on a regular basis.
- Maintain a respectful and professional attitude toward your peers, staff, and faculty.
- Attend class, ask questions, complete your homework on time, prepare for the exam, work hard on the final project.
- Please reach out if you are having difficulties with the course material or otherwise that may impact your performance in the course.

Support Services & Resources

Testing and Disability Services

(https://www.augusta.edu/tds/about.php (https://www.augusta.edu/tds/about.php))

“Augusta University believes academically qualified individuals with disabilities should have equal opportunity and access to a quality education.

We have been actively involved in fostering an environment that encourages full participation by students with disabilities in every segment of the University.” https://www.augusta.edu/tds/disabilityservices.php (https://www.augusta.edu/tds/disabilityservices.php)

- Accommodations for students with disabilities are made on an Individual basis. Students must register and request services from the Director of Testing and Disability Services. In order to receive services, students must provide current documentation of their disability from a qualified health professional.

(visit https://www.augusta.edu/tds/criteria.php (https://www.augusta.edu/tds/criteria.php) for documentation criteria)

- Appointments can be made by calling The Office of Testing and Disability Services at (706) 737-1469 or by emailing tds@augusta.edu (mailto:tds@augusta.edu).
- It is the student’s responsibility for initiating an appointment and following “How to Receive Service” instructions found at: https://www.augusta.edu/tds/accommodation.php (https://www.augusta.edu/tds/accommodation.php)
- If the student does not obtain academic accommodations through The Office of Testing and Disability Services, it is assumed no special accommodations or modifications will be necessary to meet the requirements of this course.

Technical Support Services

If you need technical assistance related to IT needs (including Brightspace D2L Learning Management System), contact the 24-hour Augusta University Service Desk at (706) 721-4000 or at http://www.augusta.edu/its/help/ (http://www.augusta.edu/its/help/)

DISCLAIMER

This syllabus is subject to change at the discretion of the course instructor. Students will be informed in advance of any changes that may impact the course schedule or grading policies.