

STAT 525: Regression Analysis (Spring 2023)

Course Description:

Regression analysis answers questions about the dependence of a response variable on one or more predictors, including prediction of future values of a response, discovering which predictors are important, and estimating the impact of changing a predictor or a treatment on the value of the response. This course focuses on *linear* regression, which is the basis for many modern, advanced regression techniques, including those used by in statistics, machine learning, and data science. Specific topics include:

- Simple linear regression and statistical inferences
- Correlation analysis
- Diagnostics and remedial measures
- Matrix approach to simple linear regression analysis
- Multiple linear regression and statistical inferences
- Regression models for quantitative and qualitative predictors
- Model building (and variable selection) and validation
- Model diagnostics

A matrix formulation of the linear regression model is given partway through the course. This is for ease in presenting models and results and understanding some of the computational documentation, not for proving regression results using matrix theory. This is primarily an applied statistics course. While models and methods are written out carefully with some basic derivations, the primary focus of the course is on the understanding and presentation of regression models and associated methods, data analysis, interpretation of results, statistical computation, and model building.

Prerequisites: Stat 516 or equivalent previous coursework in probability and statistics, which includes knowledge of estimation, confidence intervals, and hypothesis testing and its use in at least one and two sample problems. You must be familiar with these statistical concepts beforehand. Stat 515 by itself is NOT a sufficient background for this course! Familiarity with basic matrix notation and operations is helpful.

Administrivia:

- Time: TTh 10:00AM-11:15AM
- Location: LGRT 206
- Learning Management System: Moodle
- Discussion Forum: TBD
- Instructor: Maryclare Griffin
- Instructor Office: LGRT 1342
- Instructor Office Hours: Tuesdays 9:00AM-9:30AM, 2:00PM-3:00PM, Wednesdays 9:30AM-11:00AM
- Instructor E-mail: mgriffin@math.umass.edu or maryclaregri@umass.edu
- Teaching Assistant: Anjali Albert
- Teaching Assistant Office: LGRT 1435D
- Teaching Assistant Office Hours: Tuesdays 1:00PM-2:00PM, Wednesdays 11:30AM-12:30PM
- Teaching Assistant E-mail: gnagulpally@umass.edu
- Textbook: Applied Linear Regression Models by Kutner, Nachsteim and Neter (4th edition) or, Applied Linear Statistical Models by Kutner, Nachtsteim, Neter and Li (5th edition). Both published by McGraw-Hill/Irwin.
 - Note: The first 14 chapters of Applied Linear Statistical Models (ALSM) are EXACTLY equivalent to the 14 chapters that make up Applied Linear Regression Models, 4th ed., with the same pagination. The second half of ALSM covers experimental design and the analysis of variance, and is used in our STAT 526. If you are going to take STAT 526, you should buy the Applied Linear Statistical Models (but it is a large book).

- The computing in this course will be conducted in R (<https://www.r-project.org>) using RStudio (<https://rstudio.com>), both of which are freely available software available for multiple platforms. There are many good online tutorials that can be helpful for getting started. I recommend <https://moderndive.com/1-getting-started.html>.

Schedule and Key Dates:

Week 1	2/7	2/9	
Week 2	2/14	2/16	
Week 3	2/21	2/23	Quiz 1 Thursday
Week 4	2/28	3/2	
Week 5	3/7	3/9	Quiz 2 Thursday
Week 6	3/21	3/23	
Week 7	3/28	3/30	
Week 8	4/4	4/6	
Week 9	4/11	4/13	Quiz 3 Thursday
Week 10	No class!	4/20	
Week 11	4/25	4/27	
Week 12	5/2	5/4	
Week 13	5/9	5/11	Quiz 4 Tuesday
Week 14	5/16	No class!	Poster Session Tuesday

- May 25: IE Final Papers Due by 5:00PM EST

Grading:

- Homework 20%
- Project 40%
- Quizzes 20%
- Newsgressions 20%

Letter grades are typically as follows:

F	D	D+	C-	C	C+	B-	B	B+	A-	A
<60	60+	65+	70+	74+	77+	80+	84+	87+	90+	94+

Homework:

Homework will be assigned weekly, and will typically be due at 10:00AM ET on Thursdays. The lowest homework grade will be dropped. For homework including code, please turn in your homework as a narrative, addressing the question in the homework. RMarkdown or similar homework approaches that interweave pieces of text, code, and output are good, as long as you use the code, output, and plots to support the words and summary numbers, rather than expecting the reader to read what you've done or pick out the right numerical answers directly from raw output. Please include all code either with each question or at the end.

Project:

STAT 525 counts as an integrative experience (IE) course for undergraduate Math-Stat primary majors. The students in STAT 525 will complete a team project involving data analysis and interpretation in R, based on the principles introduced in class, as well as drawing on students' other learning and experience. Projects will be done in groups of about 4 students. Deliverables will include a project proposal, a poster presentation, and a final written report. Details of this project will be discussed in class.

Quizzes:

There will be four small exams (quizzes) conducted online using Moodle. All four quizzes will be weighted equally. Each quiz will be cumulative, but will primarily focus the most recent material. They will be short (15 minutes), open for a 24 hour period. The lowest quiz grade will be dropped.

Newsgressions (Regressions in the News):

Starting on Tuesday 2/14, each Tuesday class session will begin with three mini-presentations in which three students describe a regression described in a news article. This component is worth 20 points. Half (10 points) will be based on the student's own mini-presentation and their responses to questions (live or within twenty four hours via Moodle). Detailed guidelines and a rubric will be posted to Moodle. The remaining half (10 points) will be defined as $2 \times \min\{k, 5\}$, where k is the number of unique mini-presentations that a student participated in besides their own. Participation is defined as asking a question live.

Late Work:

Late work will not be graded. In documented extenuating circumstances, I reserve the right to make reasonable arrangements.

Grading Errors:

If you believe there was an error in grading your work, please return the work, along with a written description of the problem to me within 1 week of the return of that assignment, and I will re-evaluate.

Excused Absences:

If you miss class, it is your responsibility to find out what you missed, both class material and announcements. Because the lowest homework and quiz grades will be dropped, there will be no make-up homeworks or quizzes. Missed homeworks and quizzes will be graded 0. If, due to extreme health or personal circumstances, you are unable to complete a quiz you must notify me in advance to make alternate arrangements. In documented extenuating circumstances, I reserve the right to make reasonable arrangements.

Collaboration and Academic Honesty:

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent (http://www.umass.edu/dean_students/codeofconduct/acadhonesty/).

Students with Disabilities:

The University of Massachusetts Amherst is committed to making reasonable, effective and appropriate accommodations to meet the needs of students with disabilities and help create a barrier-free campus. If you have a disability and require accommodations, please register with Disability Services (<https://clockwork.oit.umass.edu/user/intake/>; 161 Whitmore Administration building; phone 413-545-0892), meet with an Access Coordinator and send an accommodation letter to your faculty. Information on services and materials for registering are also available on the website (www.umass.edu/disability).

Names and Pronouns:

Everyone has the right to be addressed by the name and pronouns that they use for themselves. Students can indicate their preferred/chosen first name and pronouns on SPIRE, which appear on class rosters. Please let me know what name and pronouns I should use for you if they are not on the roster. A student's chosen name and pronouns are to be respected at all times in the classroom.