STAT 415/615 Regression
American University

James Dickens

- **Time**: Mondays and Wednesdays (5:30pm to 8:40pm)
- **Course Meeting Location**: Myers Building 114
- **Instructor**: Dr. James Dickens
- **Email: jdickens@american.edu**
- **Office**: Myers Building 208C
- **Office Hours**: TBD

Overview of Topics and Course Objectives

Regression uses data to study mathematical relations among two or more variables, with the purpose of understanding trends, identifying significant predictors, and forecasting. The course covers simple and multiple regression, the method of least squares, analysis of variance, model building, regression diagnostics, and prediction. Students estimate and test significance of regression slopes, evaluate the goodness of fit, build optimal models, verify regression assumptions, suggest remedies, and apply regression methods to real datasets using statistical software.

This course satisfies the AU Core Integrative Capstone Requirement for the Statistics BS, having you build on your prior statistical knowledge to apply it in the new context of linear modeling. Also as part of the capstone experience, this course will require you to identify and execute a significant project that you will work on throughout the semester.

Textbooks

> **Required**: Applied Linear Statistical Models (Fifth Edition) by Kutner, Nachtsheim, Neter, and Li. They also released a book called “Applied Linear Regression Models (Fourth Edition)” which is just a subset of this book, and this is fine too. I will generally abbreviate this book as KNNL.

Computing and Software

We will use the R computing language to complete assignments. R is free and may be downloaded from the R website (http://cran.r-project.org/). In addition, I highly recommend you interface with R through the free RStudio IDE (https://www.rstudio.com/). R and RStudio are also available on computers in the Anderson Computing Complex, the Center for Teaching, Research, and Learning Lab (CTRL) in Hurst Hall, in addition to various labs across campus. R Studio may also be run from your web browser using American University’s Virtual Applications System. Please see me during office hours if you have questions regarding R.

Assignments and Grading

Graduate Students	Undergraduate Students
Classwork 10% Homework(40%)	Classwork 10% Homework (40%)
Exams (35% composed of : MidTerm 15%, Final Exam 20%)	Exams (35% composed of MidTerm 15%, Final Exam = 20%)
Final Project = 15%	Final Project =15%

Notes:

- All Exams are take home
- Exams and Homework assignments for Graduate Students will contain problems that are a bit more challenging than those designated for undergraduates.
- The Final Exam for Graduate Students is course comprehensive.
- Typically, students can anticipate one classwork assignment per session and 5 to 6 homework assignments for the summer session.

Grading Scale

- A (100 – 95), A- (94 – 89), B+ (88 – 85), B (84 – 80), C+ (79 – 75), C (74 – 70),
- D (69 – 50) F (49 – 0)

List of Topics

1. Simple Linear Regression (Chapters 1-5 of KNNL).
    a. The model and interpretation.
    b. Inference (estimation/hypothesis testing).
    c. Diagnostics and remedial measures.
2. Multiple Linear Regression (Chapters 6-8 of KNNL).
    a. The model and interpretation.
    b. Inference (estimation/hypothesis testing).
    c. Diagnostics and remedial measures.
3. Model Building (Chapters 9-11 of KNNL).
    a. Theoretical considerations.
    b. The limited usability of automated procedures

Important Dates

6/27/2022	Mon	Second 6-week (D) and Online Learning II (F) session begin
7/4/2022	Mon	Independence Day; no classes, university offices closed
8/1/2022	Mon	Last day to apply for summer graduation
8/6/2022	Sat	Second 6-week session ends

Course Learning Outcomes

The learning objective of this course is to give you the main concepts and a working knowledge of regression techniques that are routinely used to analyze different types of data. At the end of this course, you are expected to be able to:

- Identify studies and data sets where regression can be used to address the questions of interest.
- Use software to graphically display regression data.
- Propose a regression model to address the research questions in a study.
- Understand the principle of the Least Squares Estimation.
- Use software to conduct regression analysis. This includes variable selection, parameter estimation, diagnostics, and prediction.
- Interpret and summarize the results of regression analysis results in the context of the study.
- Understand limitations of the regression analysis.
- Design and conduct a study to investigate a research problem using real-world data and regression analysis.
- For STAT 615 Students only:
    - Derive the least squares estimators for linear regression.
    - Write the linear regression model in matrix form.
    - Understand matrix derivations for estimation, testing, and model building in multiple linear regression.

Late Work Policy

All assignments must be submitted, in class, on the day they are due. You will be penalized 15% every day an assignment is late. I will not accept assignments submitted over three days after the deadline. If you become ill or the victim of an emergency, please let me know within 48 hours.

Students requiring a temporary leave of absence for medical or mental health reasons must provide documentation to the Office of the Dean of Students (dos@american.edu), which will verify with the academic unit that the documentation is appropriate and supports the leave. Students with an ASAC-approved accommodation for disability reasons should, to the greatest extent possible, make arrangements in advance of the due date or deadline.

Incomplete Policy

At the discretion of the faculty member and before the end of the semester, the grade of I (Incomplete) may be given to a student who, because of extenuating circumstances, is unable to complete the course during the semester. The grade of Incomplete may be given only if the student is receiving a passing grade for the coursework completed. Students on academic probation may not receive an Incomplete. The instructor must provide in writing to the student the conditions, which are described below, for satisfying the Incomplete and must enter those same conditions when posting the grades for the course. The student is responsible for verifying that the conditions were entered correctly.

Conditions for satisfying the Incomplete must include what work needs to be completed, by when the work must be completed, and what the course grade will be if the student fails to complete that work. At the latest, any outstanding coursework must be completed before the end of the following semester, absent an agreement to the contrary. Instructors will submit the grade of I and the aforementioned conditions to the Office of the

University Registrar when submitting all other final grades for the course. If the student does not meet the conditions, the Office of the University Registrar will assign the default grade automatically.

The Associate Dean of the Academic Unit, with the concurrence of the instructor, may grant an extension beyond the agreed deadline, but only in extraordinary circumstances. Incomplete courses may not be retroactively dropped. An Incomplete may not stand as a permanent grade and must be resolved before a degree can be awarded.

More information on AU Regulations and Policies.

Sharing Course Content:

Students are not permitted to make visual or audio recordings (including livestreams) of lectures or any class-related content or use any type of recording device unless prior permission from the instructor is obtained and there are no objections from any student in the class. If permission is granted, only students registered in the course may use or share recordings and any electronic copies of course materials (e.g., PowerPoints, formulas, lecture notes, and any discussions – online or otherwise). Use is limited to educational purposes even after the end of the course. Exceptions will be made for students who present a signed Letter of Accommodation from the Academic Support and Access Center. Further details are available from the ASAC website.

Academic Integrity Code

- Standards of academic conduct are set forth in the university's Academic Integrity Code. By registering for this course, students have acknowledged their awareness of the Academic Integrity Code and they are obliged to become familiar with their rights and responsibilities as defined by the Code. Violations of the Academic Integrity Code will not be treated lightly and disciplinary action will be taken should violations occur. This includes cheating, fabrication, and plagiarism.
- I expect you to work with others and me, and I expect you to use online resources as you work on your assignments/projects. However, your submissions must be composed of your own thoughts, coding, and words. You should be able to explain your work on assignments/projects and your rationale. **Based on your explanation (or lack thereof), I may modify your grade.**
- If you use an online resource, please cite it with a URL (this is perfectly fine!).
- If you do not understand an online resource, but believe it to be useful for a project/assignment, please ask me for help.
- It is a violation of the Academic Code of Integrity if you obtain past homework solutions from students who took the course previously (whether they wrote those solutions, or I wrote those solutions). There are mistakes in my solutions that students point out to me. I look out for these while I grade to see if you have access to my solutions.
- All solutions that I provide are under my copyright. These solutions are for personal use only and may not be distributed to anyone else. Giving these solutions to others, including other students or posting them on the internet, is a violation of my copyright and a violation of the student code of conduct.

A short guide for students on how to meet the expectations of the AU's Academic Integrity Code