Regression
STAT 415/615

Fall 2019

Instructor:	Zois Boukouvalas	**Time:**	W 5:30PM – 8:00PM
Email:	boukouva@american.edu	**Room:**	Myers Building 119
Office:	Don Myers Building - 222		

Office Hours: W 3:00PM – 5:00PM, or after class, or by appointment. Always feel welcome to come visit me during my office hours. You are also encouraged to ask me questions online via email or through **Kaltura Capture**. If you are having **ANY** trouble with the class, please come see me about it as soon as possible. **Do not wait until it is too late!**

Course Pages: I will use Blackboard (`https://blackboard.american.edu`) to post any supplementary materials, suggested readings/practice exercises, assignments, and announcements. Sometimes I may also use my personal website (`https://zoisboukouvalas.github.io/`).

Textbook:

1. Applied Linear Regression Models, 4th edition, by M. Kutner, C. Nachtsheim, and J. Neter. McGraw-Hill, 2004 (701 pp). ISBN 0073014664

2. Applied Linear Statistical Models, 5th edition, by M. Kutner, C. Nachtsheim, J. Neter, and W. Li. McGraw-Hill, 2004 (1396 pp). ISBN 007310874X

You can either buy the 4th or the 5th edition, **BUT DO NOT BUY BOTH**. Chapters 1-14 are identical in these books. Text only, without a CD, is fine. All textbook data sets are available on our Blackboard course page.

Software: During the course, we will be learning regression methods and implementing them in **R**. However, for all computer assignments, use the language of your choice. Advanced programming skills and advanced computer knowledge are **not** required.

Course description: Simple and multiple regression, least squares, curve fitting, graphic techniques, and tests and confidence intervals for regression coefficients. Prerequisite: STAT-302, STAT-320, or STAT-514/614.

Assignments and Grading:

Weekly homework and mini-projects (25%): Homework will be assigned weekly and graded quickly. A steady effort to work out all the assigned problems is essential for the successful performance in this course. A typical homework will include a few problems to do by hand, and a few applied projects with realistic data sets to do using computer software.

Labs (25%): 45-minute labs at the end of each class. Each lab covers the material of the lecture.

Two Midterms (15%) each: The midterm covers several chapters of the material. Taken in class. Time: 1 hour.

Final Exam (20%): The final exam covers the last part of the course, but it is cumulative indirectly. Taken in class. Time: 2 hours.

Important Dates:

Midterm 1	October 16, 2019
Midterm 2	November 20, 2019
Thanksgiving Break (No Class)	November 28, 2019
Final Exam	TBA

Course Plan:

1. Introduction to **R**, notation, motivation, and examples. [1.1-1.2]

2. Linear regression: model, estimation, inference, prediction. Regression and correlation. R^2. [Chap. 1-2]

3. Regression diagnostics: non-normality, nonlinearity, heteroscedasticity [Chap. 3]

4. Simultaneous estimation. Other regression models [Chap. 4]

5. Multiple regression. Matrix approach (Stat-615). Analysis of variance. Analysis of residuals. Partial correlation and multiple correlation coefficient. [Chap. 5-6]

6. Model building. Model selection and validation. Extra sum of squares. [Chap. 7-8]

7. Regression diagnostics-II. Influential observations and outliers. Effect of multicollinearity. Robust regression. Ridge regression [Chap. 9-10]

8. Regression diagnostics-III. Symptoms and remedies. Transformation of variables. Missing data. Analysis of covariance. Comparison of regression lines. [Chap. 10]

9. Dummy variables and related methods [Chap. 11]

10. (If time permits) Nonlinear relations. Logistic regression. [Chap. 13-14]

Learning Objectives: (Acknowledgement: Thank you, Professor Jun Lu!)
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.

- 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.

Emergency Preparedness: In the event of an emergency, students should refer to the AU Web site `http://www.american.edu/emergency` and the AU information line at (202) 885-1100 for general university-wide information. In case of a prolonged closure of the University, I send updates to you by email and will post all announcements on Blackboard.

Support Services: A wide range of services is available to support you in your efforts to meet the course requirements.

1. Mathematics & Statistics Tutoring Lab (Don Myers Building) provides tutoring in Intermediate Mathematics and Statistics. `http://www.american.edu/cas/mathstat/tutoring.cfm`

2. Academic Support and Access Center (MGC 243) offers study skills workshops, individual instruction, tutor referrals, Supplemental Instruction, writing support, and technical and practical support and assistance with accommodations for students with physical, medical, or psychological disabilities. Writing support is also available in the Writing Center, Battelle-Tompkins 228.

3. Center for Diversity & Inclusion (X3651, MGC 201) is dedicated to enhancing LGBTQ, Multicultural,

First Generation, and Women's experiences on campus and to advance AU's commitment to respecting & valuing diversity by serving as a resource and liaison to students, staff, and faculty on issues of equity through education, outreach, and advocacy.

4. The Office of Advocacy Services for Interpersonal and Sexual Violence (X7070) provides free and confidential advocacy services for anyone in the campus community who is impacted by sexual violence (sexual assault, dating or domestic violence, and stalking).

Additional Notes:

1. I expect you to be courteous to me and your fellow classmates both inside and outside of the classroom. This generally just involves a bit of common sense. Cell phones need to be silenced and put away during class. Laptops should be out during class time for use only on class activities. Please save texting, typing/sending emails, checking Facebook, etc. for outside of class time. Any correspondence pertaining to the course needs to be handled in a respectful manner.

2. Please let me know during the first week of classes if you have any special needs that require accommodations.

3. Please be sure that you are familiar with AU's Academic Integrity Code, as I am required to report any cases of academic dishonesty to the dean of CAS. For your review: `http://www.american.edu/academics/integrity/`.