STAT 425   **Applied Regression**   **Spring 2020**
and Design

Course Policies and Syllabus

Instructor	Lelys Bravo de Guenni, PhD
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Email	lbravo@illinois.edu
Credit hours	4(GR) and 3(UG)
Course Space	compass2g.illinois.edu

Class Information	**1UG and 1GR**	**2UG and 2GR**
Lecture Times	MWF, 9:00-9:50 am	MWF, 2:00-2:50 pm
Lecture Location	1002 Lincoln Hall	1002 Lincoln Hall
Office Hours	Tue 01:00-03:00 pm	Tue 03:00-05:00 pm
Teaching Assistant	Brein Mosely	Yongchang Su
TA e-mail	bmosely2@illinois.edu	ysu17@illinois.edu
TA Office Hours	Th: 1:00-3:00 pm, 104 Illini Hall	T,Th: 2:00-3:00 pm, 104 Illini Hall

Course Description:

The purpose of this course is to give you an overview of the statistical methods using Regression analysis. We will cover linear regression, least- squares and generalized least-squares estimates, F-tests, analysis of residuals, regression diagnostics, transformations, polynomial and non-parametric regression, model building and variable selection, factorial designs, randomized complete block designs, Latin squares, split plot designs; logistic regression and regression trees. Computer work is an integral part of this class.

Pre-requisites:

PRQ: STAT 410 or department consent.

Class Material and Requested Textbook:

- **Requested**: "Linear Models with R" (2nd edition) by Julian Faraway: `https://people.bath.ac.uk/jjf23/LMR/` . An earlier version of this book, "Practical Regression and Anova Using R", as well as other related documentations, can be downloaded here: `https://cran.r-project.org/other-docs.html`.

- **Recommended**: "Applied Linear Regression" (4th Edition) by Sanford Weisberg: `http://users.stat.umn.edu/~sandy/alr4ed/`. An earlier version can be downloaded from our library `https://www.library.illinois.edu/`.

- **Recommended**: "A Modern Approach to Regression with R", by Simon J. Sheather.`http://gattonweb.uky.edu/sheather/book/`. You can download this book (pdf) from our library `https://www.library.illinois.edu/`.

- **Aditional Reading**: "An introduction to Statistical Learning" by G. James, D. Witten, T. Hastie and R. Tibishirani. You can download this book (pdf) from `http://faculty.marshall.usc.edu/gareth-james/ISL/`.

Textbook key: F= Textbook by Faraway; S= Textbook by Sheater; W=: Textbook by Weisberg; ISL= Textbook from James et al.

Reading: The material in this course may go quickly. It is expected that you will stay up to date in reading the relevant sections of the text. The tentative schedule is at the end of this document and it will be also available online. The reading material for each class is listed there. Selected exercises from each chapter will be part of the reading material and will be published in Compass each week.

Learning outcomes:

At the end of this class you should have sufficient knowledge in:

- Estimation and Inference on Linear Models

- Interpretation of the results and model Diagnostics.

- Variable selection methods including shrinkage methods

- ANOVA models with multiple factors and blocking designs

- Tree regression models and non-normal predictor models

Course Assessment and Grading Policy:

- **Homework (20%)**

  Homework due date will be indicated in the homework file. Normally it is one week after the assignment date. Approximately **eight graded homework will be assigned during the semester**. The dates for the assignments will be announced during class and/or in Compass. Assignment dates are also provided in the class schedule at the end of this document.

  Late assignments are not allowed. No score will be dropped. You will get 100% score in the homework if you complete 85% of the total homework grade.

  Homework presentation should be neat and submitted on loose leaf paper or online through Compass. If you are submitting on paper and more than one sheet of paper is used, the assignment should be stapled together. Please do NOT send your homework to the TA/Instructor by email attachment, unless you are asked to do so.

  You must show all work for full credit. For some problems, when a copy of an R code is required, it should be submitted through Compass.

  If you feel it would help, you are encouraged to work together on homework, but you have to present assignments individually using your own words. The aim of the homework is to learn the material and practice for the exams. Copying homework solutions from another student, from past Department solutions, or from online solutions is cheating and plagiarism, and is a violation of Academic Integrity.

Additional assignments might be given at the end of a lecture, but will not necessarily be graded. The aim of these assignments is to keep you updated with the class contents.

- **Midterms (50%):**

  There will be **two (2) midterms (50%)** (25% each), as indicated on the schedule. They will be held on Wednesday Feb 26th and Apr 08th.

  Each midterm will take place in the evening outside of regular class time.

  - Midterm 1: Wednesday Feb 26th, 7:00 pm - 8:30 pm. Room TBA
  - Midterm 2: Wednesday Apr 08th, 7:00 pm - 8:30 pm. Room TBA

  Make-up exams will only be allowed for excused absences with proper documentation. A make-up exam, which will be cumulative, will be given near the very end of the semester as a replacement for a missed exam that was due to a verifiable excuse. The date and location will be announced later.

- **Final Project (30%):**

  Instructions and data for the final project will be published shortly in Compass.

- **Lecture Attendance**:

  You are expected to attend all classes and to arrive on time. If you miss a class, you are responsible for all material and announcement covered in class on that day.

- **Additional information about exams**:

  You will need a calculator for all the exams. It is important that the calculator has a square root key and logarithms, in addition to the usual arithmetic operations. All the exams are closed book. **For the midterm exams and the final** you may bring one single $8\frac{1}{2}$in by 11 in piece of paper with formulas on both sides. This piece of paper should have your name and will be collected/checked at the end of the exam. **You are not allowed to include solutions to any of the homework or textbook problems in this piece of paper**. You must show all your work (when applicable) in the exams to get full credit.

Grading scale:

A+	100-97%
A	93-97%
A-	90-93%
B+	87-90%
B	84-87%
B-	80-84%
C+	77-80%
C	74-77%
C-	70-74%
D+	67-70%
D	64-67%
D-	60-64%
F	60-0%

Academic Integrity Statement:

All students must abide by the campus regulations on academic integrity: `http://studentcode.illinois.edu/article1_part4_1-401.html`. Infractions of these rules (detailed on `http://studentcode.illinois.edu/article1_part4_1-402.html`) will not be tolerated. Infractions include, but are not limited to, copying any part of another student's homework, allowing another student to copy any part of your homework or otherwise submitting the work of others as your own.

Copying homework solutions from another student, from past Department solutions, or from online solutions is cheating and plagiarism, and is a violation of Academic Integrity.

Disability Accommodations

Students with disabilities requiring assistance should contact the instructor as soon as possible.

Safety

We have been asked by public safety to share the following information in case of weather or security emergencies.

Emergency Response Recommendations:
`https://police.illinois.edu/emergency-preparedness/run-hide-fight/`
Video on Emergency Response: `https://youtu.be/8j0_8PCWASE`
LH 1st floor plan: `http://ada.fs.illinois.edu/0027Plan1.html`

Sexual Misconduct Policy and Reporting

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will

provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisers, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here:

`wecare.illinois.edu/resources/students/#confidential`.

Other information about resources and reporting is available here:

`wecare.illinois.edu`.

General information and guidelines:

- To do well in this course you should keep up with lectures, readings and assignments. If you feel you are falling behind please contact the TA and/or the Instructor as soon as possible.

- Read appropriate sections of the textbook before class and turn off your cell phones during class.

- Students are welcome to ask questions in class and participate of discussions. Please avoid disrupting talking during class.

- All class announcements will be also posted in Compass.

- Students are expected to attend class regularly.

- Make-up exams will generally not be accepted unless there is a legitimate reason (e.g., a serious medical emergency). Under such a situation, please contact the instructor as soon as possible. The acceptance of a late assignment or make-up exam will be determined based on each individual case. Proof of the event needs to be provided.

- This syllabus is a guide and every attempt is made to provide an accurate overview of the course and its requirements. However, certain circumstances may make it necessary for me to modify the syllabus during the semester for your benefit and the changes may depend, in part, on course progress and our needs. I will announce any change to the syllabus as early as possible so that you can adjust your schedule. The department/ school will also be notified of any change.

Computing:

All students are expected to have knowledge on R. A list of some resources suggested by professor **Feng Lian** follows:

- The official intro, An Introduction to R.

- Introduction to R (PDF)

- simpleR (PDF) by John Verzani.

- The R Inferno (PDF) by Patrick Burns

- R Fundamentals and Programming Techniques (PDF) by Thomas Lumley

- The R Markdown Cheat Sheet (PDF)

- The ggplot2 Cheat Sheet (PDF)

- R Class Notes: Introducing R (UCLA)

- Resources to help you learn and use R at UCLA

Tentative Schedule and Reading assignments*

Week	Book Sections and other Readings	Topics
Week 1 (Jan 21- 24)	Ch 1 (F) , Ch 1 (S), Ch 1(W)	Introduction
Week 2 (Jan 27- 31)	Ch 2 (S), Ch 2 (W)	Simple Linear Regression **Homework 1**
Week 3 (Feb 3-7)	Ch 2, 3 (F), Ch 5,6 (S), Ch 3 (W)	Multiple Linear Regression
Week 4 (Feb 10-14)	Ch 5.3 (F), Ch 15 (S), Ch 5.1 (W)	Analysis of Covariance **Homework 2**
Week 5 (Feb 17-21)	Ch 6 (F), Ch 3,6 (S), Ch 9 (W)	Regression Diagnostics
Week 6 (Feb 24-28)	Ch 8.1-8.3 (F), Ch 4,9 (S), Ch. 7.1-7.3 (W)	Generalized Least Squares **Midterm 1**. **Homework 3**
Week 7 (Mar 2-6)	Ch 7.3 (F), Ch 6.4 (S), Ch 4.2 (W)	Collinearity
Week 8 (Mar 9-13)	Ch 9.1-9.4 (F), Ch 3.3,6.2 (S), Ch 5.3 (W)	Polynomial Regression **Homework 4**
Week 9 (Mar 14-22)	**Spring Break. No lectures**	
Week 10 (Mar 23-27)	Ch 9.5 (F), Ch 7.4-7.6 (ISL)	Non-parametric Regression **Homework 5**
Week 11 (Mar 30- Apr 3)	Ch 14,16 (F), Ch 2.6 (S) Ch 5.2 (W)	One-way and two-way ANOVA
Week 12 (Apr 6-10)	Ch 17 (F) Notes from NIST, Notes from PSU	Block designs and higher order ANOVA **Midterm 2**. **Homework 6**
Week 13 (Apr 13-17)	Ch 10, 11 (F), Ch 7 (S), Ch 10 (W)	Variable Selection
Week 14 (Apr 20-24)	Notes from Breiman and Cutler	Tree models **Homework 7**
Week 15 (Apr 27-May 1)	Ch 8 (S), Ch 12 (W)	Logistic Regression
Week 16 (May 4-6)		Wrap-up. **Homework 8**
May 7	Reading Day	

* Please note that this schedule might change if this improves the learning process **Textbook key**: F= Textbook by Faraway; S= Textbook by Sheater; W=: Textbook by Weisberg; ISL= Textbook from James et al.