

Statistics
Course Number: 26:960:577
Course Title: Introduction to Statistical
Linear Models

COURSE DESCRIPTION

The aim of this course is to provide graduate students greater understanding of the analysis and statistics tools used in data analysis and business research. Our aim is to familiarize graduate students with basic techniques in statistics, so that they can use these techniques in their own research for collecting, analyzing and visualizing data in social sciences and applied sciences. We will cover the theory and concepts behind various models for linear and nonlinear regression and their practical implementation in R. There will be also (optional) regular tutoring classes in Stata.

COURSE MATERIALS

- Julian J. Faraway, [Linear Models with R](#), Second Edition, 2002. ISBN: 9781439887332 -

Supplementary Materials:

- Rachel A. Gordon, [Regression Analysis for the Social Sciences](#). New York: Routledge, 2010. ISBN: 0415991544
- John Marden, [Multivariate Statistics Old School](#), 2015. This is an online book freely available.
- Julian J. Faraway, [Practical Regression and ANOVA using R](#), 2002. This is an online book about R, freely available.
- Verzani, [Using R for Introductory Statistics](#) : An online tutorial for R programming.
- Supplementary Material: Michael Kutner, Christopher Nachtsheim, John Neter and William Li, [Applied Linear Statistical Models](#), Mc Graw-Hill Irwin, 2005. 5th Edition. ISBN: 007310874X.
- Supplementary Material: Anderson, [Statistics for Business and Economics](#), 11th Edition, ISBN: 0324783256

Other materials may be posted on Canvas. Please check Canvas (<https://canvas.rutgers.edu/>) and your official Rutgers email account regularly.

Learning Management System: Canvas.

LEARNING GOALS AND OBJECTIVES

- This course is designed to help students develop skills and knowledge in the following area(s):

- *Developing skills: Ability to interpret, visualize and analyze data collected from various resources using tools of basic statistics.*
- *Developing knowledge base: Students will get more familiar with elementary statistical operations so that they can use these operations in their own research both in social sciences and applied sciences. The students will have a good understanding of both the theory and practice for solving basic inference problems arising in the business world.*

- Students who complete this course will demonstrate the following:

- *Ability to apply statistical methods to quantify, analyze, visualize and interpret business data, ability to apply quantitative methods for solving and modeling some fundamental decision-making problems arising in the daily business life.*

- Students develop these skills and knowledge through the following course activities and assignments:

Students will complete homework assignments, a midterm and a take-home final exam. Lectures will be interactive with students, allowing them to interact with their peers in collaborative class discussions.

PREREQUISITES

A good knowledge of basic business mathematics and undergraduate-level statistics for social sciences including the essentials of statistical inference such as hypothesis testing and confidence intervals.

ACADEMIC INTEGRITY

I do NOT tolerate cheating. Students are responsible for understanding the RU Academic Integrity Policy <http://academicintegrity.rutgers.edu/>

I will strongly enforce this Policy and pursue *all* violations. On all examinations and assignments, students must sign the RU Honor Pledge, which states, “On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment.” I will screen all written assignments through *SafeAssign* or *Turnitin*, plagiarism detection services that compare the work against a large database of past work. Don’t let cheating destroy your hard-earned opportunity to learn. See business.rutgers.edu/ai for more details.

ATTENDANCE AND PREPARATION POLICY

- Expect me to attend all class sessions. I expect the same of you. If I am to be absent, my department chair or I will send you notice via email and Canvas as far in advance as possible. If you are to be absent, report your absence in advance at <https://sims.rutgers.edu/ssra/>. If your absence is due to religious observance, a Rutgers-approved activity, illness, or family emergency/death and you seek makeup work, also send me an email with full details and supporting documentation within 5 days of your first absence. Explain other aspects of your absence policy in detail; it will save you trouble later.
- For weather emergencies, consult the campus home page. If the campus is open, class will be held.
- Expect me to arrive on time for each class session. I expect the same of you. [If you are going to be tardy, then please send me an email in advance.]
- Expect me to remain for the entirety of each class session. I expect the same of you. [If you are going to leave early, then please send me an email in advance.]
- Expect me to prepare properly for each class session. I expect the same of you. Complete all background reading and assignments. You cannot learn if you are not prepared. The minimum expectation is that for each 3-hour class session, you have prepared by studying for at least twice as many hours.
- Expect me to participate fully in each class session. I expect the same of you. Stay focused and involved. You cannot learn if you are not paying attention.

For weather emergencies, please consult the campus home page. If the campus is open, class will be held.

FEEDBACK AND RESPONSE EXPECTATIONS

- Email Response Times: I will do my best to return your emails in 3 days please remind me if you do not hear back from me within 3 days. Please also feel free to join designated office hours. For matters that are not personal (such as queries about exam and homework deadlines), please do not email me directly but use the discussion board on the Canvas.
- Graded Materials Return Times: I will strive to have your assignments/exams graded within at most 2 weeks.
- Discussion Board Response Times: I aim to review and grade your posts within 3 days.

CLASSROOM CONDUCT

- Please silence your cell phones during the lecture time.
- No side conversations, sleeping, phone conversations and texting during lectures please.

EXAM DATES AND POLICIES

There is one final take-home exam for this course which is project based with the following date:

Final Exam Date: (). [Comprehensive].

During the exam mentioned above, the following rules apply:

- If you have a disability that influences testing procedures, provide me an official letter from the Office of Disability Services at the start of the semester.
 - No cell phones are allowed in the testing room.
 - You must show a valid Rutgers photo ID to enter the room and to turn in the exam.
 - Your exam will not be accepted unless you sign the Honor Pledge.
- Make-up exam policy: No make-up exams are given under any circumstances.

GRADING POLICY

Course grades are determined as follows:

50% Homeworks

40% Take-home final exam

10% Class participation

- There will be around 5-7 homeworks assigned once around every two weeks. Homeworks will include programming exercises as well as conceptual questions.
- Extra credit: Extra credit is available for students with excellent class participation.
- Grade posting: The grades will be posted on the Canvas website.

Grade grubbing: Your final grade is not subject to negotiation. However, if you feel I have made an error, submit your written argument to me within one week of receiving your final grade. Clarify the precise error I made and provide all due supporting documentation. If I have made an error, I will gladly correct it.

COURSE SCHEDULE

<u>Topic</u>
Introduction to R and regression: transforming, entering and graphing data
Reading: Lecture notes
Review of basic probability and statistics: measures of central tendency and dispersion, normal distributions, sampling distributions, simulating and graphing distributions in R
Reading: Lecture notes
Univariate linear least squares regression, tests of independence and difference in means, running t-tests and chi-square tests in R
Confidence intervals and hypothesis tests, testing hypotheses in R
Multi-variate regression, statistical inference for regression, goodness of fit and assumptions behind, leverage scores and practical implementations in R
Reading: Chapter 6 (Gordon), lecture notes

Dummy predictors and interactions, R techniques for categorical variables; graphing results
Reading: Chapter 7 (Gordon), lecture notes
Diagnostics: checking assumptions behind, outliers, collinearity and heteroskedasticity.
Reading: Chapter 11 (Gordon), lecture notes
Logistic regression
Reading: Class notes
Review of the class
The generalized linear models and generalized regression
Reading: Class notes
ANOVA and Experimental Design
Reading: Hand-written notes will be provided.
Mediation: Full versus partial mediation, Sobel's test, bootstrapping
Reading: Class notes
NO CLASS
Statistical power and power analysis, review of the class
Reading: Class notes
Review of the class
Take-home final exam is assigned

SUPPORT SERVICES

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination. More information can be found at ods.rutgers.edu.

[Rutgers University-New Brunswick ODS phone (848)445-6800 or email dsoffice@echo.rutgers.edu]

[Rutgers University-Newark ODS phone (973)353-5375 or email ods@newark.rutgers.edu]

If you are *pregnant*, the Office of Title IX and ADA Compliance is available to assist with any concerns or potential accommodations related to pregnancy.

[Rutgers University-New Brunswick Title IX Coordinator phone (848)932-8200 or email jackie.moran@rutgers.edu]

[Rutgers University-Newark Office of Title IX and ADA Compliance phone (973)353-1906 or email TitleIX@newark.rutgers.edu]

If you seek *religious accommodations*, the Office of the Dean of Students is available to verify absences for religious observance, as needed.

[Rutgers University-New Brunswick Dean of Students phone (848)932-2300 or email deanofstudents@echo.rutgers.edu]

[Rutgers University-Newark Dean of Students phone (973)353-5063 or email DeanofStudents@newark.rutgers.edu]

If you have experienced any form of *gender or sex-based discrimination or harassment*, including sexual assault, sexual harassment, relationship violence, or stalking, the Office for Violence Prevention and Victim Assistance provides help and support. More information can be found at <http://vpva.rutgers.edu/>.

[Rutgers University-New Brunswick incident report link: <http://studentconduct.rutgers.edu/concern/>. You may contact the Office for Violence Prevention and Victim Assistance at (848)932-1181]

[Rutgers University-Newark incident report link: https://cm.maxient.com/reportingform.php?RutgersUniv&layout_id=7 . You may also contact the Office of Title IX and ADA Compliance at (973)353-1906 or email at TitleIX@newark.rutgers.edu. If you wish to speak with a staff member who is confidential and does **not** have a reporting responsibility, you may contact the Office for Violence Prevention and Victim Assistance at (973)353-1918 or email run.vpva@rutgers.edu]

If students who have experienced a temporary condition or injury that is adversely affecting their ability to fully participate, you should submit a request via <https://temporaryconditions.rutgers.edu> .

If you are a military *veteran* or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. <http://veterans.rutgers.edu/>

If you are in need of *mental health* services, please use our readily available services.

[Rutgers University-Newark Counseling Center: <http://counseling.newark.rutgers.edu/>]

[Rutgers Counseling and Psychological Services–New Brunswick: <http://rhscaps.rutgers.edu/>]

If you are in need of *physical health* services, please use our readily available services.

[Rutgers Health Services – Newark: <http://health.newark.rutgers.edu/>]

[Rutgers Health Services – New Brunswick: <http://health.rutgers.edu/>]

If you are in need of *legal* services, please use our readily available services: <http://rusls.rutgers.edu/>

Students experiencing difficulty in courses due to *English as a second language (ESL)* should contact the Program in American Language Studies for supports.

[Rutgers–Newark: PALS@newark.rutgers.edu]

[Rutgers–New Brunswick: eslpals@english.rutgers.edu]

If you are in need of additional *academic assistance*, please use our readily available services.

[Rutgers University-Newark Learning Center: <http://www.ncas.rutgers.edu/rlc>]

[Rutgers University-Newark Writing Center: <http://www.ncas.rutgers.edu/writingcenter>]

[Rutgers University-New Brunswick Learning Center: <https://rlc.rutgers.edu/>]

[Optional items that many faculty include:

- Students must sign, date, and return a statement declaring that they understand the RU Academic Integrity Policy.

- Students must sign, date, and return a statement declaring that they understand this syllabus.]
