

Statistics
Course Number: 22:960:777
Course Title: Introduction to Linear Statistical Models

COURSE DESCRIPTION

This course discusses linear models and their applications to empirical data --- it covers the general linear model; ordinary least squares estimation; diagnostics, including departures from underlying assumptions, detection of outliers, effects of influential observations, and leverage; analysis of variance, including one-way and two-way layouts; analysis of covariance; polynomial and interaction models; model fitting and validation.

All data analysis models and approaches will be demonstrated in classes using data of two cases, and will be implemented in R, which is a powerful, extensible and free programming language, gaining popularity for data scientists and business analysts.

COURSE MATERIALS

There is no required textbook for the course. Instead, I will gradually post course materials on Canvas.

Reference text:

Fox, J. (2016). Applied Regression Analysis and Generalized Linear Models, the 3rd edition.

<https://us.sagepub.com/en-us/nam/applied-regression-analysis-and-generalized-linearmodels/book237254>

Software:

R (cran.r-project.org/ and www.rstudio.com/)

Recommended R programming books

R Cookbook (<https://rc2e.com/>)

R for Data Science (<https://r4ds.had.co.nz/>) ggplot2
(<https://ggplot2-book.org/>)

LEARNING GOALS AND OBJECTIVES

This course is designed to help students develop knowledge and skills on various topics related to linear models and their applications to empirical data; master the statistical and computing methods to generate

and interpret analytic outputs for different business scenarios; better understand how data analytics can help business management and improvement.

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

- ✦ **Lectures.** Various concepts and data analytics techniques on statistical linear models will be covered in the lectures, along with the discussions on their practical applications.
- ✦ **Case studies.** Each student is required to individually complete two case studies, respectively on retailing and JD.com. Students will be asked to practice in class using the realistic business data in the cases while learning the knowledge, methods and skills in the lectures. This helps them better understand how to implement the theoretical knowledge and data analytics techniques to tackle realistic business problems. Each case will then be discussed in great details to help students better and systematically understand the relevant works before the submission of the case study.
- ✦ **Quizzes.** Theoretical concepts and data analysis methods will be tested in quizzes. Two one-hour open-book quizzes are arranged.
- ✦ **Project.** Students will be grouped into teams. Each team shall identify a realistic data analysis project and apply the knowledge and skills covered in this course to perform data analysis and come up with business improvement recommendations. Each project will be discussed in class with peers and the instructor before the project report submission so that everyone can have a better understanding about the applications of the knowledge and skills learned from the classes under different business settings.

PREREQUISITES

Prerequisite: Undergraduate or master's level course in statistics.

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.

DEADLINE EXTENSION AND EXAM MAKE-UP POLICIES

Deadlines will not be extended (late submissions will not be graded) unless you have a serious reason, and, in such cases, you **must** notify the instructor **3 days** before the deadline.

There will be no make-up exams unless you have a serious reason, and, in such cases, you **must** notify the instructor **5 days** before the exams.

GRADING POLICY

Quiz 1	20%
Quiz 2	15%
Term Project	30%
Retailing Case	15%
JD.com Case	20%

A or A-: [90, 100]; B+ or B: [80-90); B-, C+ or C: [70-80); C-or D: [60-70); F [0, 60).

COURSE SCHEDULE

Lectures	Topic	Assignment
01	Syllabus and Course Introduction Review and Preparation	
02	Introduction to Regression Analysis Linear Regression with One Independent Variable	Retailing Case Assigned
03	Multiple Linear Regression Statistical Inference for Regression	
04	Multiple Linear Regression Continued	Project teams set up
05	Quiz 1 Retailing Case Discussion	Retailing Case due one week after the class
06	Analysis of Variance	JD.com Case Assigned
07	Unusual and Influential Data Missing Data in Regression Models	Projects determined
08	Building the Regression Model: Model Selection and Validation	
09	Quiz 2 JD Case Discussion	JD.com Case due one week after the class
10	Project Discussions	Project slides due before the Class Project report due one week after the class

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.]