Course Syllabus – Regression Methods
01:960:463 Spring - 2023

Section 01 (Index # 07283): Class Meets Tuesdays & Fridays: 10:20 AM – 11:40 AM
EN Building (School of Engineering), Room B120 – Busch Campus

INSTRUCTOR: Andrew Magyar, PhD
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Mail Box: Hill Center Room 558 – Busch Campus

COURSE DESCRIPTION: This course is an introductory level course on linear regression touching on its applications and theoretical background. Prior knowledge of linear regression is not required, nor assumed. Linear regression is perhaps one of the most used and abused statistical methods. Study of it is not only warranted because of its ubiquity, but also because it is a basic building block of more complicated statistical models and a good jumping off point for multivariate statistics.

CLASS STYLE: The class materials will be presented on slide decks, with supplementation of the material using computational examples (mostly in **R**). Lectures will be a mix of methodology, applications & examples and elementary theory.

PREREQUISITES: The Level II Statistics prerequisites for some courses may be fulfilled by 960:212 or 960:384 or 960:401 or 960:484 or 960:291 or the equivalent.

REQUIRED BACKGROUND KNOWLEDGE:

Pre-calculus level mathematical skills and basic working knowledge of statistical methods typically covered in an introductory statistics course. Previously covered concepts will be reviewed as they are needed. Basic computer skills are assumed.

Probability – Probability Spaces, Events, Basic Set Operations on Events and Related Probability Rules, Conditional Probability, Random Variables (Discrete and Continuous), Probability Density/Mass Functions, Cumulative Distribution Functions, Expectation/Variance of Random Variables, Jointly Distributed Random Variables, Marginal and Conditional Distributions, Covariance/Correlation

Statistics – Graphical Displays for Data (Barcharts, Histograms, Dotplots/Needle Plots, Scatter Plots), Measure of Central Tendency (Mode, Median, Average), Measures of Dispersion (Range, IQR, Standard Deviations) Sigma Notation, Sampling & Sampling Distributions (particularly *iid* sampling), Estimation (Sample Mean, Sample Variance/Standard Deviation, Sample Covariance/Correlation), Confidence Intervals (1-sided, 2-sided z-intervals/t-intervals for a population mean), Hypothesis Testing (z-tests, t-tests, ANOVA, ANCOVA)

SPECIAL PERMISSION NUMBERS: I cannot to dispense special permission numbers (SPNs). Direct all request for SPNs to the Department Undergraduate Administrator, Mrs. Eileen Sharkey. Her e-mail is: esharkey@stat.rutgers.edu

OFFICE HOURS: The proper arena for clarification and questions on course material is during office hours, NOT via e-mail.

Professor's

Location: SERC (Science and Engineering Resource Building), Room 202 – Busch Campus
Time: Tuesdays & Fridays from 12:00 PM – 1:00 PM

CLASS LEARNING MANAGEMENT SYSTEM (LMS): This class will utilize Canvas as its LMS. All class material will be posted on the Canvas Site.

TEXTBOOK: It is not required to purchase the textbook for the course, however, it is **STRONGLY** recommended you have access to ***a textbook***.

Department Recommended Textbook
Introduction to Linear Regression Analysis, 6th Edition
Douglas C. Montgomery, Elizabeth A. Peck and G. Geoffrey Vining, Wiley, 2021.
ISBN: 978-0-470-54281-1
https://www.wiley.com/en-us/Introduction+to+Linear+Regression+Analysis%2C+6th+Edition-p-9781119578758

ASSIGNMENTS: There will be approximately 6 assignments throughout the semester of differing point values. Collaboration on assignments is not only allowed, but strongly encouraged. However, each student must submit his/her own unique write-up. Students caught sharing part, or all, of their write-ups will also split the grade for the combined effort.

Unless stated otherwise, assignment solutions are to be typed. A ½ point deduction will be applied to an assignment if it is not typed. An electronic copy of the assignment solutions is to be submitted by uploading it to Canvas, not by e-mail. In the event of an emergency, students will be granted only one instance when it is permissible to e-mail an assignment to me. Any assignments that are e-mailed subsequent to this one instance will not be graded. ***Late assignments will not be accepted unless students are presented with extreme circumstances beyond their control which are documented.***

ASSIGNMENT REGRADES: After an assignment is graded, the solutions and grading criterion will be posted in Canvas. In the event you believe you were unfairly penalized points by the grader, you have the option of submitting your assignment to me for a regrade (except for the case where I was the original grader), but only after the solutions have been posted. The **entire** assignment will be regraded so it is possible the regrade could result in a lower score. In order to have an assignment considered for a regrade, the request must be made no later than one week after the solutions are posted. Only the original version that was submitted in Canvas will be regraded. Inquiries and appeals of grades should always be directed towards me, NEVER the graders or teacher assistants.

COMPUTING SOFTWARE: Assignments will require the use of a computer. In-class examples will be demonstrated using **R**. However, for those of you who are familiar with a particular statistical software commonly used in your respective academic area (SAS, SPSS etc.) you are encouraged to use this software.

R is a free statistical programming language that is easily downloadable from their website:

http://www.r-project.org/

R is open software, thus any user could create packages for download. Given its versatility and popularity, every practitioner of statistics should have some basic familiarity with it.

LETTERS OF RECOMMENDATION: Requests for letters of recommendation will only be considered for students who pass the course with an A. When writing letters of recommendations for students, the scope of the letter will be limited to your class performance and/or qualities you demonstrate as a student and how they relate to the position/program you are asking a letter of recommendation for. Prior to asking me to write on your behalf, please take the prior into consideration to properly evaluate my suitability to do so. I will not provide non-specific, blanket letters of recommendation.

MAKING UP INCOMPLETES: Not being party to discussions with previous professors, I am not obliged to honor any arrangements made between you and a previous professor regarding making up incompletes from a previous semester. Students wishing to take this class to make up an incomplete from a prior semester MUST contact me regarding this request as soon as possible. They must complete all assignments & exams as specified in this syllabus. The make-up grade will be the grade earned in my class with a grade deducted for each semester beyond the one the student was initially registered for the class. For example, if a student took an incomplete during the Summer of 2022, and earned an A in my class, the make-up grade would be a B since currently it is two semesters removed (i.e. Fall of 2022 and Spring of 2023).

GRANTING INCOMPLETES: Incompletes are intended for students experiencing circumstances beyond their control that interfere with their ability to successfully complete the course. Incompletes will NOT be granted solely as a means to avoid a bad grade. Students experiencing extraneous circumstances must make me aware of any issues as soon as possible and be able to provide confirmation of their situation. Requests for incompletes WILL NOT be granted once grades have been submitted to the Registrar.

COURSE GRADING CRITERION: I don't give you grades, you earn them!!!
As the assignments will have different point values, your Assignments Score will be calculated as:

$$Assignment\ Score = \frac{Total\ Assignment\ Points\ Earned}{Total\ Assignment\ Points\ Possible} \times 100$$

You final class score will be a weighted average of your assignment score (87%) and final examination score (13%). Class letter grades will be assigned based on the criterion in the table below

Grade	Final Score		Weightings	Percentage
A	$94 \leq x$		Assignments	87%
B+	$87 \leq x < 94$		Final	13%
B	$80 \leq x < 87$			
C+	$70 \leq x < 80$			
C	$60 \leq x < 70$			
D	$50 \leq x < 60$			
F	$x < 50$			

TOPICS TO BE COVERED:

- Review: Random Variables, Jointly Distributed Random Variables, Marginal Distributions, Joint Distributions and Conditional Distributions, Expectation Operator (Mean, Variance)
- The Simple Linear Model (SLM), Statistical Properties of the SLM, The Least Squares Estimates (LSEs), Inference for the SLM, The Coefficient of Correlation, Model Diagnostics, Addressing Model Deviations
- Maximum Likelihood Estimation for the Simple Linear Model, Robust Regression
- Multiple Linear Regression, Polynomial Regression, the ANOVA/ANCOVA Model, Logistic Regression
- Time-Series, Time Series and Autocorrelation Plots, The First Order Autoregressive (AR1) Model, Estimation for AR1 Models