Fall 2019

MATH 763-001: Generalized Linear Models

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NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 763: Generalized Linear Models
Fall 2019 Graduate Course Syllabus

NJIT Academic Integrity Code: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

COURSE INFORMATION

Course Description: Theoretical and applied aspects of generalized linear models. Classical linear models, nonlinear regression models, and generalized estimating equations.

Number of Credits: 3

Prerequisites: MATH 662 and MATH 665 or departmental approval.

Course-Section and Instructors

Course-Section	Instructor
Math 763-001	Professor S. Dhar

Office Hours for All Math Instructors: Fall 2019 Office Hours and Emails

Required Textbooks:

Title	*Generalized Linear Models: With Applications in Engineering and the Sciences*
Author	Myers, et al.
Edition	2nd
Publisher	John Wiley & Sons, Inc.
ISBN #	978-0470454633

University-wide Withdrawal Date:The last day to withdraw with a **W** is **Monday, November 11, 2019**. It will be strictly enforced.

COURSE GOALS

Course Objectives: This course teaches theory and practice of generalized linear models (GLM), testing, estimation, and confidence intervals of parameters, regression and analysis of variance, modeling nonlinear regression diagnostics and their plots, variable selection and model selection. Transformation method such as

Box-Cox is taught. In case over dispersion is present, how to correct for it is introduced. Also when, data are dependent generalized estimating equations are introduced. Statistical software such as SAS and R, are extensively used to analyze data.

Course Outcomes: Upon successful completion of this course, the student will be able to:

- Demonstrate conceptual understanding of GLM and related topics.
- Perform statistical analysis, such as estimation, hypothesis testing, and analysis of variance, under generalized linear models, nonlinear regression models and regression models.
- Use standard statistical software to develop models and analyze data that arise from different fields. Students who successfully complete this course will be able to use SAS and R to accomplish model building.
- Demonstrate using software to implement transformation method such as Box-Cox, proper transformations and correct for over dispersion when present to improve the model.
- Apply generalized estimating equations methodology.
- Read and use published research in GLM.

POLICIES

DMS Course Policies: All DMS students must familiarize themselves with, and adhere to, the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. DMS takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

Hand-in Homework and Quizzes	20%
Midterm Exam	25%
Course Project	25%
Final Exam	30%
TOTAL	***100%***

Your final letter grade will be based on the following tentative curve.

A	90 - 100	**C+**	75 - 79
B+	85 - 89	**C**	65 - 74
B	80 - 84	**F**	0 - 64

Attendance Policy: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the Math Department's Attendance Policy. This policy will be strictly enforced.

Course Policy: It is required that the student read the textbook for the material already covered in class by the instructor and confirm that the basic solved problems are understood and practice solving textbook problems. More explicitly, students must work on the examples and exercises and problems from the textbook on the topics already covered in class, and learn to solve them correctly. The student should compare his or her answers with those given at the end of the textbook or by the instructor. Instructor holds the right to modify in class exams, homework, quizzes dates in the best interest of the class. Official announcements are made using NJIT student emails or emails provided by students to NJIT as official emails. Only basic calculators without graphic capabilities are allowed during exams and quizzes.

Homework Policy: Homework will be assigned roughly every week. Late homework will not be accepted.

Class Policy:

- **Attendance and Participation**: Students must attend all classes. Absences from class will inhibit your ability to

fully participate in class discussions and problem solving sessions and, therefore, affect your grade. Tardiness to class is very disruptive to the instructor and students and will not be tolerated.
- Cell phones if used for communicating (e.g. texting, etc.) during lecture in the classroom will be confiscated and returned to the student only at the end of class. All cellular phones and beepers must be switched off during all class times.
- No assignments, homework, exams will be accepted late.
- Distracting the class such as eating during the class or exams, wandering in and out of the classroom is not allowed.
- Surfing on the internet using Laptops/computer/ pads, devices, etc., are not allowed when the instructor is lecturing.

Exams: There will be one midterm and one final exam (see course outline). All exams will be closed-book. No make-up exams are allowed in case of extenuating circumstances with legitimate and verifiable excuse, scores will be imputed. Calculators are allowed but should be basic and without graphing capabilities.

Midterm Exam	October 23, 2019
Final Exam Period	December 14 - 20, 2019

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the Math Department's Examination Policy. This policy will be strictly enforced.

Makeup Exam Policy: To properly report your absence from a midterm or final exam, please review and follow the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

ADDITIONAL RESOURCES

Accommodation of Disabilities: Disability Support Services (DSS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services at 973-596-5417 or via email at lyles@njit.edu. The office is located in Fenster Hall, Room 260. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Disability Support Services (DSS) website at:

- https://www.njit.edu/studentsuccess/accessibility/

Important Dates (See: Fall 2019 Academic Calendar, Registrar)

Date	Day	Event
September 3, 2019	T	First Day of Classes
September 13, 2019	F	Last Day to Add/Drop Classes
November 11, 2019	M	Last Day to Withdraw
November 26, 2019	T	Thursday Classes Meet
November 27, 2019	W	Friday Classes Meet
November 28-29, 2019	R-F	Thanksgiving Recess
December 11, 2019	W	Last Day of Classes

December 12, 13 2019	R & F	Reading Days
December 14-20, 2019	F - R	Final Exam Period

Course Outline

Week	Sections	Topic	Assignment
1 (9/4, 9/9)	Chapter 1 and 2.1, 2.2.1	Linear regression (matrix formulation, ordinary least squares (OLS) estimator, Gauss Markov theorem.)	Read Chapter 1. Assignment due week 2
2 (9/11, 9/16)	2.2.2-2.2.5	Linear regression models (other properties of the OLS estimator, estimation and hypothesis testing)	Assignment due week 3
3 (9/18, 9/23)	2.2.6-2.5	Linear regression models (residual diagnostics, maximum likelihood estimation [MLE], generalized least squares)	Using R and SAS to perform Regression Analysis. Assignment due week 4
4 (9/25, 9/30)	2.6-2.7	Linear and nonlinear regression models (weighted least squares, estimation in nonlinear regression models)	Assignment due week 5
5 (10/2, 10/7)	3.1-3.7	Nonlinear regression models (Gauss-Newton method, inference, weighted nonlinear regression)	Assignment due week 6
6 (10/9, 10/14)	4.1-4.2.6	Logistic regression models (model description, MLE and dispersion properties, likelihood ratio inference)	Assignment due week 7
7 (10/16, 10/21)	4.2.7-4.4	Logistic and Poisson regression models (odds ratios, estimation and inference for Poisson regression)	Assignment due week 9
8		MIDTERM EXAM October 23, 2018	
9 (10/28, 10/30)	5.1-5.4	GLM (components of a GLM, exponential family of distributions, formal structure for the class of GLMs, likelihood equations for GLMs, an algorithm for fitting GLMs, quasi-likelihood)	Assignment due week 10
10 (11/4, 11/6)	5.5-5.7	GLM (the gamma family, canonical and log links for the gamma family, a class of link functions -- the power function, inference for GLMs)	Assignment due week 11
11 (11/11, 11/13)	5.8-5.9	Examples with gamma family, Using R	Assignment due week 12
12 (11/18, 11/20)	5.10-5.11	GLM and data transformation, Modeling Processes Mean and Variance	Assignment due week 13
13 (11/25, 12/2)	1/5	Quality of asymptotic results. STUDENTS' PROJECT PRESENTATIONS	Assignment due week 14
14 (12/4, 12/9)	6.1-6.3	Generalized estimating equations (residual analysis for GLMs, layout for longitudinal studies, correlation matrix, identity link, examples) STUDENTS' PROJECT PRESENTATIONS	Assignment due week 15

15 (12/11)		Review	
		Final Exam (12/14 to 12/20)	

***DISCLAIMER**: There may be some changes. Any modifications will be announced in class.*

Updated by Professor S. Dhar - 8/8/2019
Department of Mathematical Sciences Course Syllabus, Fall 2019