**DEPARTMENT OF MATHEMATICAL SCIENCES**

**UNITED STATES MILITARY ACADEMY**

**WEST POINT, NEW YORK 10996**

MADN-MATH 15 Dec 2023

MEMORANDUM FOR Academic Year (AY) 2024: MA478 Students, United States Military Academy

SUBJECT: MA478 AY24-2 INSTRUCTIONAL MEMORANDUM

**MA478 – Generalized Linear Models**

**1. Purpose:** This instructional memorandum describes the course scope, objectives and opportunities, specifies required course materials, and announces administrative details necessary for students to successfully complete MA478 during the AY 2024-2 semester.

**2. Course Scope:** This course provides an introduction to statistical modeling beyond that gained in MA376. Students will learn statistical models for analyzing quantitative and qualitative data. Methods will generally be taught in the generalized linear model framework and may include binomial and multinomial regression, count regression, robust regression, and panel regression. Students will also be exposed to techniques for handling problems that arise when analyzing real data, such as missing data, outliers, and influential observations. Students will focus on understanding data, implementing advanced regression modeling techniques, and developing intuition from analyzed data. Students should understand when certain statistical methods are appropriate, how to use them using the R statistical programming language, and how to visually represent and explain results. The course also addresses issues of exploratory data analysis, data preparation, model development, model selection, and model validation.

**3. Course Objectives:** By the end of this course, students should:

a. Understand generalized linear models and other advanced regression methods.

b. Be able to independently learn and appropriately apply advanced statistical techniques.

c. Be able to critically read and interpret data science literature that applies advanced statistical techniques and understand ethical issues in statistical modeling.

d. Be able to successfully use R statistical programming software to analyze data.

e. When faced with a real-world problem, be able to select and ethically execute appropriate statistical modeling techniques to gain insight into the problem to help solve it.

**4. Course Opportunities:** This course provides the opportunity to explore statistical techniques that underpin the theory and application of generalized linear models. It provides a foundation for further study in data science and an appreciation for the use of data in decision making.

**5. Course Textbooks:** The first textbook for this course is *Foundations of Linear and Generalized Linear Models, First Edition* ([Wiley](https://www.wiley.com/en-us/Foundations+of+Linear+and+Generalized+Linear+Models-p-9781118730034)) by Alan Agresti. The second textbook for this course is *Extending the Linear Model with R: Generalized Linear, Mixed Effects and Nonparametric Regression Models, Second Edition* ([Chapman & Hall](https://www.taylorfrancis.com/books/mono/10.1201/9781315382722/extending-linear-model-julian-faraway)) by Julian J. Faraway.

**6. Course Software:** The primary course software is the latest version of R and RStudio. All students are expected to have this software on their computers prior to the first day of class. You must download R before you download RStudio. R may be downloaded at: <http://www.r-project.org/>. Your choice of mirror is not critical; typically, it is best to pick something geographically close. RStudio may be downloaded at <https://www.rstudio.com/ide/download/>. Students may use Python instead of R, if desired, but example code will not be covered in class.

**7. Course Approach:** All lessons for this course, unless otherwise noted, will be conducted in-person. The enclosed syllabus outlines the planned lesson sequence, readings, and assignments. Students will complete three individual homework assignments, re-enforcing course concepts via implementation in R. Students will form groups to conduct a final project using the generalized linear modeling techniques covered in class to investigate a real-world problem of interest. Students will complete a midterm examination along with a term end analysis competition. Students are expected to complete readings before class and all assignments by their assigned due dates. Late work is not accepted unless the student has made alternate arrangements ahead of time. There is no set additional instruction (AI) hour, but it can be arranged upon request by the student. Students are expected to bring course textbooks and computers to each class. Students may use any available reference material in preparing coursework, but it must be property cited.

**8.**  **Course Grading:** Assessment tools that contribute to your final grade are itemized below.

Event Points

Homework Assignments (Three) 300

Final Project (Proposal, Report & Briefing) 300

Midterm Exam (WPR) 150

Term End Analysis Competition (TEE) 200

Instructor Grade (Participation) 50

Total 1000

**9. Administrative Policies:** Policies and procedures of the Department of Mathematical Sciences pertaining to core and elective mathematics courses will continue in effect unless amended by the instructor or when obviously not applicable. The Dean’s policy for the Documentation of Written Work is in effect for all graded events.

**10. Contact Details:** You can reach COL Clark via email at [nicholas.clark@westpoint.edu](mailto:nicholas.clark@westpoint.edu) or 262-442-7011. His office is TH229.

NICHOLAS J. CLARK

COL, FA47

Program Director - ASDS