University of Maryland, College Park
EDMS 646: General Linear Models I
Fall 2021
Class Location: EDU (Benjamin Bldg) 3315
Class Meeting Time: Tuesday 4:15-7:00pm

Instructor
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Office Hours: Tuesday 1:30–3:30pm, or by appointment

Course Description
    EDMS 646 is the second course of a three-course sequence in basic statistical methods (EDMS 645, 646, and 651) offered by EDMS. The course builds on topics covered by EDMS 645 such as data display, sampling distribution, one- and two-sample tests of the mean, etc. The goal of EDMS 646 is to provide a solid training in general linear models. It covers multiple linear regression, one-way analysis of variance (ANOVA), multiple comparison procedures, factorial ANOVA, Analysis of Covariance (ANCOVA), repeated-measures ANOVA, etc. The course focuses on the elementary statistical theory of general linear models as well as applications in educational and psychological research.

Prerequisites
    All students taking EDMS 646 should have successfully completed **EDMS 645** or an alternative introductory statistics course that includes:

- Displaying data / frequency tables
- Percentiles and percentile ranks
- Measures of central tendency and variability
- Probability
- Normal distribution / z-score
- Sampling distribution
- Introduction to hypothesis testing
- One-sample z- and t-tests
- Confidence intervals
- Independent- and paired-sample t-tests
- Correlation
- Simple linear regression
- Chi-square goodness-of-fit tests

Objectives
    In this course, students are expected to be able to explain what the general linear model is, understand its assumptions and various designs, compute the statistics introduced along the way, generate and interpret computer output for each analytic procedures discussed, and have a better understanding of in what situation the use of a given design/technique is appropriate. Conceptual understanding of fundamental statistical methods centering around ANOVA and multiple regression analysis is the minimally satisfying level for all the students at the end of the semester. For students who need more in-depth technical knowledge for further methodological research, we also provide additional materials that cover the underlying statistical theory.

References
    There is **no required textbook** for this course. However, there are some recommended books for your reference:

- Most relevant to course materials
  - Agresti, A., & Finlay, B. (2009). Statistical methods for the social sciences (4th ed.). Upper Saddle River, NJ: Prentice Hall. (Novice)
  - Cohen, J., Cohen. P., West, S. G., & Aiken, L. S. (2003). Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates. (intermediate)
  - **Fox, J. (2008 or 2015). Applied regression analysis and generalized linear models. Thousand Oak, CA: Sage. (intermediate)**

- Lomax, R. G. & Hahs-Vaughn, D. L. (2012). **Statistical Concepts: A Second Course (4th ed.). New York, NY: Routledge. (Novice)**
- Focusing on software
  - Fox, J., & Weisberg, S. (2011). An R companion to applied regression (2nd ed.). Thousand Oaks, CA: Sage. (Novice to intermediate)
  - Field, A. (2009). Discovering Statistics using SPSS, 3rd edition. Los Angeles, CA: Sage Publications. (Novice to intermediate)
  - Gelman, A. & Hill, J. (2006). Data Analysis Using Regression and Multilevel/Hierarchical Models. New York, NY: Cambridge. (Intermediate to advanced)
- Additional references
  - Glass, G.V. & Hopkins, K.D. (1984). Statistical methods in education and psychology (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall. (Moderately advanced)
  - Hays, W. (1999). Statistics (5th ed.). New York: Hot, Rinehart, & Winston. (Advanced)
  - Hinkle, D.E., Wiersma, W., & Jurs, S.G. (2003). Applied Statistics for the Behavioral Sciences (5th ed.). Boston, MA: Houghton Mifflin. (Novice to intermediate)
  - Howell, D.C. (2002). Statistical Methods for Psychology (5th ed.). Pacific Grove, CA: Duxbury Press. (Intermediate)
  - **Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2004). Applied linear statistical models (5th ed.). New York, NY: McGraw-Hill/Irwin. (Advanced)**
  - Pedhazur E. J. (1997). Multiple regression in behavioral research (3rd ed.). New York: Harcourt Brace College Publishers. (Novice to intermediate)

Course Delivery

The class meets every Tuesday from 4:15 to 7:00pm at EDU (Benjamin Bldg) 3315. Course slides and supplemental materials will be made available by 10am every Tuesday on the ELMS Canvas system. An automatic email notification will be sent out by ELMS when new materials are posted.

Statistical Software

Students will also need access to a statistical package such as SPSS, SAS, STATA, or R. **Students may use any software they are familiar with to complete the homework assignments; however, the course will focus exclusively on R in the sense that**

1. **example code will only be provided in R;**
2. **R output will appear in exams;**
3. **it may be difficult to answer certain homework questions with other software;**
4. **the instructor and TA will not help with questions related to other software.**

There will not be lab sessions on statistical software; however, annotated R code/output and tutorials will be distributed. R is free and easy to install on your own computer. It is currently maintained by the R Core Development Team. Students can download R at the home page of the R project (http://www.r-project.org). It is a very flexible environment that contains a wide variety of packages that allow students to do numerous mathematical and statistical operations ranging from data simulation to data analysis. If you plan to use other commercial software packages, the student license price can be found on TERPware.

Course Assignment

Homework (50%) There will be **five homework assignments** throughout the semester, **each of which is worth 10% of the final grade** and designed to give the students an opportunity to apply and practice the concepts and techniques learned in class. It is expected that students will be using computer software for their homework. Students are expected to refer to materials from lecture, textbooks, and supplementary notes.

Students are encouraged to work in groups on homework **(maximum of 3 students per group)** and to **turn in a single homework with the names of the group members**. It should be understood that **all members of a group receive the same score** on homework completed together. However, taking turns to complete each homework assignment, while time efficient, is not recommended for learning purposes.

The word-processed homework should conform as closely as possible to **APA-style** presentation of tables, graphics, and references. Students are expected to report statistical results as if it were going into a journal article or a thesis, and include the original software output as an appendix to show how they arrive at the solution. Please **do not just copy and paste all the software output** into the writing without necessary interpretation and formatting. Example write-ups of statistical results will be provided at the beginning of the semester. For the APA style, please refer to online resources such as the Purdue Online Writing Lab.

Please note that **late homework will not be accepted** unless pre-approval is given for exceptional circumstances. You are required to upload a **typed document in pdf format** on the specified due date of each assignment. Graded assignments will typically be returned within a week.

Quizzes (10%) A short quiz will be given at the beginning of each class meeting for the purpose of reviewing content from the previous lecture as well as tracking attendance. **Quizzes will not be graded**. Students get full credit (10%) for this part as long as they turn in **eight quizzes** in total throughout the semester. Otherwise, **1% is taken off for each missing quiz** until reaching the minimum score (2%).

Exams (40%) There will be an **in-class midterm (20% of the final grade)** and an **in-class final exam (20% of the final grade)**. The exams will be **closed book and closed notes**. However, students may prepare and use a **formula sheet (letter-size paper, one page, two sided)**; the formula sheet must be **hand-written**. Students should bring a calculator to the exam, and note that sharing calculators among students is not allowed.You are on your honor to **complete their exams independently**; academic misconduct (cheating, plagiarism, etc.) will be subject to the maximum University penalties.

Extra Credit There could be extra credit questions in homework assignments and exams.

Grading Scheme

Table 1: Grading scheme

Letter grade	Percentage	Letter grade	Percentage
A+	98.00--100.00%	C+	75.00--77.99%
A	92.00--97.99%	C	72.00--74.99%
A-	88.00--91.99%	C-	68.00--71.99%
B+	85.00--87.99%	D+	65.00--67.99%
B	82.00--84.99%	D	62.00--64.99%
B-	**78.00--81.99%**	D-	58.00--61.99%
		F	0.00--57.99%

With exceptions of computational error, **grades will not be changed once they are posted**. The **incomplete grade is not an option for poor performance** in the course. Unless the student can provide very compelling reasons with proof documents, incomplete will not be given.

Tentative Schedule

Table 2: Tentative schedule (subject to change)

Week	Date	Topic	Assignment posting	Assignment due
1	8/31	Welcome & review	HW1	
2	9/7	Test of variances; introduction to R		
3	9/14	Correlation; simple linear regression	HW2	HW1
4	9/21	Multiple regression I		
5	9/28	Multiple regression II	HW3	HW2
6	10/5	Multiple regression III		
7	10/12	ANOVA I		HW3
8	**10/19**	**Midterm exam**		
9	10/26	ANOVA II		
10	11/2	ANOVA III	HW4	
11	11/9	ANCOVA		
12	11/16	Repeated-measures ANOVA	HW5	HW4
13	**11/23**	**Thanksgiving week, no class**		
14	11/30	Linear mixed-effects models		HW5
15	**12/7**	**Final exam**		

Course Procedures and Policies

Please visit https://gradschool.umd.edu/course-related-policies for a summary of course-related policies. See below for several points to emphasize.

Masking Requirement   [University policy](#) requires that **masks be worn over the nose and mouth while indoors at all times, regardless of vaccination status**. There are no exceptions. Students not wearing a mask will be given a warning and asked to wear one, or will be asked to leave the classroom immediately. Students who have additional issues with the mask expectation after a first warning will be referred to the Office of Student Conduct for failure to comply with a directive of University officials.

Accommodations for emergency and email communication   All students are expected to submit assignments and exams on the specified dates. You must contact the instructor ahead of time if re-scheduling is needed or delays are expected; otherwise, not being able to submit the assignment in time will result in a zero score for that assessment. The primary communication tool will be email in cases of emergency. Emergency deserves prompt replies, but last minute questions with respect to assignments might not be well taken. I strongly recommend that you should plan ahead to meet the deadlines properly.

Accessibility and Disability Services   The University of Maryland is committed to creating and maintaining a welcoming and inclusive educational, working, and living environment for people of all abilities. The University of Maryland is also committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of the University, or be subjected to discrimination. The [Accessibility & Disability Service (ADS)](#) provides reasonable accommodations to qualified individuals to provide equal access to services, programs and activities. ADS cannot assist retroactively, so it is generally best to request accommodations several weeks before the semester begins or as soon as a disability becomes known. Any student who needs accommodations should contact me as soon as possible so that I have sufficient time to make arrangements. For assistance in obtaining an accommodation, contact Accessibility and Disability Service at 301-314-7682, or email them at adsfrontdesk@umd.edu. Information about [sharing your accommodations with instructors](#), [note taking assistance](#) and more is available from the [Counseling Center](#).

Academic integrity The University of Maryland, College Park, has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible to uphold these standards for this course. It is imperative that you are aware of the consequences of **cheating, fabrication, facilitation, and plagiarism**. For more information on the code of Academic Integrity or the Student Honor Council, please see http://www.president.umd.edu/policies/docs/III-100A.pdf. Plagiarism and other forms of academic fraud are a violation of university regulations and unacceptable under any circumstance. These instances have to be and will be reported to the Honor Council in writing. Notes on plagiarism in this class: Due to the nature of reporting statistical results, some expressions are commonly used and should be phrased in the same/similar ways. However, how to approach a problem and end up with the solution is definitely a result of logic process, and this should not be stolen and used with proper citations.

Religious observances   The University of Maryland policy on religious observances states that students not be penalized in any way for participation in religious observances. Students shall be allowed, whenever possible, to make up academic assignments that are missed due to such absences. However, they must contact the instructor **before the absence** with a written notification of the projected absence, and arrangements will be made for make-up work or examinations.

Student Resources and Services   Taking personal responsibility for your own learning means acknowledging when your performance does not match your goals and doing something about it. I hope you will come talk to me so that I can help you find the right approach to success in this course, and I encourage you to visit [UMD's Student Academic Support Services](#) website to learn more about the wide range of campus resources available to you. In particular, everyone can use some help sharpening their communication skills (and improving their grade) by visiting [UMD's Writing Center](#) and schedule an appointment with the campus Writing Center. You should also know there are a wide range of resources to support you with whatever you might need ([UMD's Student Resources and Services website](#) may help). If you feel it would be helpful to have someone to talk to, visit [UMD's Counseling Center](#) or one of the many other [mental health resources on campus](#).

Basic Needs Security   If you have difficulty affording groceries or accessing sufficient food to eat every day, or lack a safe and stable place to live, please visit [UMD's Division of Student Affairs website](#) for information about resources the campus offers you and let me know if I can help in any way.

Participation   The classes will be composed of lectures and small group/class discussions. Each student's meaningful participation is very appreciated and will contribute to the entire learning process, promoting critical thinking skills. Throwing questions and bringing in topic-related problems to class are always welcomed.

Course Evaluation   Please submit a course evaluation through CourseEvalUM in order to help faculty and administrators improve teaching and learning at Maryland. All information submitted to CourseEvalUM is confidential. Campus will notify you when CourseEvalUM is open for you to complete your evaluations for fall semester courses. Please go directly to the [Course Eval UM website](#) to complete your evaluations. By completing all of your evaluations each semester, you will have the privilege of accessing through Testudo, the evaluation reports for the thousands of courses for which 70% or more students submitted their evaluations.

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