Instructor
Yang Liu
Office: EDU 1230B
Email: yliu87@umd.edu
Course Website: https://elms.umd.edu
Office Hours: Tuesday 1:30–3:30pm, or by appointment

Teaching assistants
Weimeng (Bonnie) Wang
Office: EDU 0202
Email: wwang111@umd.edu
Office Hours: Friday 10:00am–12:00pm

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, including data display, probability, normal distributions, one- and two-sample z/t-tests, confidence intervals, correlation, simple linear regression, 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), nested designs, etc. This course focuses on the applications of the general linear models in educational and psychological research. However, this does not mean that underlying statistical theory will not be presented. Technical aspects of the statistical analyses will be presented and emphasized as the materials warrants.

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 strongly recommended books for your reference:

- **Most relevant to the course materials**

- **Software related**

- **Additional references**

I might provide extra reading materials if necessary. For those who plan to take EDMS 651 later, Fox (2008 or 2015) is recommended along with Fox and Weisberg (2011).

Course delivery
Course slides and supplemental materials will be made available by 10am every Tuesday on the ELMS Canvas system (https://elms.umd.edu). An email notification will be sent out when new materials are posted on the board. It is your responsibility to print them or bring them to class.
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, but the course will focus on R examples. There will not be lab sessions on statistical software (unless there is a pressing need for doing so); however, annotated code/output and software tutorials will be distributed.

The R software 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, there are two options:
1. Go to a departmental computer lab. Please check the following link:
   https://umd.service-now.com/itsc?id=kb_article&sys_id=865ead4137b386002f11e97a43990e37
2. Check the student license price on TERPware:
   https://terpware.umd.edu

Course assignment
Homework 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 (e.g., SPSS, SAS, or R) 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 assignments, but the writing must reflect individual work. Copying other students writing is considered plagiarism, even among students who form a study group to complete the assignment collaboratively.

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 cut and paste all the software output into the writing without necessary interpretation and formatting. I will provide an exemplary writing to illustrate how to write up statistical results at the beginning of the semester. For the APA style, please refer to Douglas Degelman’s website for more information.

Please note that late homework will not be accepted unless pre-approval is given for exceptional circumstances. The homework must be typed: Students are required to hand in a printed copy at the beginning of the class on the specified due date. It might be wise to keep a photocopy or at the very least save assignments electronically for your own protection. Graded assignments will typically be returned during the next lecture. Homework will be graded on a scale of H (high pass), P (pass), or L (low pass). Getting either H or P means receiving a full credit for the particular assignment. In case of low pass,
there is one more opportunity to re-submit the assignment to get a full credit. However, this submission should be submitted no later than a week from the day the assignment is returned. The revised version should be a hard copy as well and the original version should be attached for comparison. Note that the opportunity of revision is granted only when you turn in the homework on time (and receive L). If a low-pass assignment does not follow by a resubmission or there is no substantial improvement shown in the resubmitted version, the student will receive only a partial credit depending on the level of completion. The high-pass grade is simply an acknowledgement of a great job; no extra credit will be given.

Exam There will be an in-class midterm exam (25% of the final grade) and an in-class final exam (25% 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. Students are on their 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 the homework assignments and exams.

Grades
Final grade consists of three parts: homework assignments (50%), midterm exam (25%), and final exam (25%). The final grading scale is tabulated as follows:

<table>
<thead>
<tr>
<th>Letter grade</th>
<th>Percentage</th>
<th>Letter grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>98.00–100.00%</td>
<td>C+</td>
<td>75.00–77.99%</td>
</tr>
<tr>
<td>A</td>
<td>92.00–97.99%</td>
<td>C</td>
<td>72.00–74.99%</td>
</tr>
<tr>
<td>A−</td>
<td>88.00–91.99%</td>
<td>C−</td>
<td>68.00–71.99%</td>
</tr>
<tr>
<td>B+</td>
<td>85.00–87.99%</td>
<td>D+</td>
<td>65.00–67.99%</td>
</tr>
<tr>
<td>B</td>
<td>82.00–84.99%</td>
<td>D</td>
<td>62.00–64.99%</td>
</tr>
<tr>
<td>B−</td>
<td>78.00–81.99%</td>
<td>D−</td>
<td>58.00–61.99%</td>
</tr>
<tr>
<td>F</td>
<td>≤57.99%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
Note: This schedule is subject to change.
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture</th>
<th>Homework</th>
<th>Resubmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1/30</td>
<td>Introduction and review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2/6</td>
<td>Tests of variances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2/13</td>
<td>Correlation and simple regression</td>
<td>HW1 due</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2/20</td>
<td>Multiple regression I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2/27</td>
<td>Multiple regression II</td>
<td>HW2 due</td>
<td>HW1 due</td>
</tr>
<tr>
<td>7</td>
<td>3/6</td>
<td>Multiple regression III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3/13</td>
<td>Midterm exam</td>
<td></td>
<td>HW2 due</td>
</tr>
<tr>
<td>9</td>
<td>3/20</td>
<td>Spring break, no class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3/27</td>
<td>One-way Analysis of Variance (ANOVA)</td>
<td>HW3 due</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>4/3</td>
<td>Two-way ANOVA I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>4/10</td>
<td>Two-way ANOVA II</td>
<td></td>
<td>HW3 due</td>
</tr>
<tr>
<td>13</td>
<td>4/17</td>
<td>Analysis of Covariance (ANCOVA)</td>
<td></td>
<td>HW4 due</td>
</tr>
<tr>
<td>14</td>
<td>4/24</td>
<td>Repeated-measures ANOVA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>5/1</td>
<td>Linear mixed-effects models</td>
<td></td>
<td>HW5 due</td>
</tr>
<tr>
<td>16</td>
<td>5/8</td>
<td>Final exam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>5/15</td>
<td></td>
<td></td>
<td>HW5 due</td>
</tr>
</tbody>
</table>

**Course procedures and policies**

Please visit [http://www.ugst.umd.edu/courserelatedpolicies.html](http://www.ugst.umd.edu/courserelatedpolicies.html) for a summary of course-related policies. Here are some that I want to emphasize.

**Accommodations for emergencies and email communication**  When the University closes on the day of class, we will have no class. Otherwise, I strongly urge you to be vigilant about your email and/or the course website on Canvas if there are any threats (e.g. extreme weather) that could potentially prohibit having class at our regular time. If you need to be absent from class or late for the class significantly (or leaving early), letting me know about it ahead of the time would be much appreciated. All students are expected to take the exams and/or submit assignments on the specified dates and no make-up exams are given. You must contact me before an exam if you are going to be absent or you will receive a zero for that assessment. The primary communication tool will be emails. However, I would like to remind you that you should allow me at least 24 hours to take care of emails due to my other duties as a faculty member. Emergencies deserve 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.

**Academic accommodations**  In compliance with and in the spirit of the Americans with Disabilities Act (ADA), I would love to work with you if you have a documented disability that is relevant to successfully completing your work in this course. If you need academic accommodation by virtue of a documented disability, please contact me as soon as possible to discuss your needs.
**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 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. **Unexcused absences from more than one third of the lectures (5 times) will result in an F.**