

# ADVANCED MULTIPLE REGRESSION ANALYSIS

Tuesday/Thursday | 9:45 AM-11:00 AM | Appleby Hall 204

## WELCOME TO EPSY 8264

In this class, we will work together to develop a learning community that is inclusive and respectful, and where every student is supported in the learning process. As a class full of diverse individuals (reflected by differences in race, culture, age, religion, gender identity, sexual orientation, socioeconomic background, abilities, professional goals, and other social identities and life experiences), I expect that different students may need different supports to promote their learning. The TAs and I will do everything we can to help with this, but as we only know what we know, **we** need you to communicate with us if things are not working for you or you need something we are not providing. I hope you all feel comfortable in helping to promote an inclusive classroom through respecting one another's individual differences, speaking up, and challenging oppressive/problematic ideas. Finally, I look forward to learning from each of you and the experiences you bring to the class.

<http://zief0002.github.io/epsy-8264/>

ANDREW ZIEFFLER  
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### OFFICE HOURS

M 9:00am-10:00am and by  
appointment  
[EdSciB 178](#)



### POLICY FOR IN-PERSON CLASS MEETINGS

Students in this class are expected to comply with all University public health policies, including the [wearing of face coverings](#) when in any enclosed or indoor space, including our classroom. [FAQ about the mask policy](#).

### TEXTBOOK

- **Required:** Fox, J. (2013). *A mathematical primer for social statistics*. Thousand Oaks, CA: Sage. [available as an e-text via [UMN library](#)]

### CEHD POLICY ON RECORDING CLASSES

All class sessions may be recorded by the instructor using the procedures in the CEHD Policy on Recording Classes, with or without prior notice. Students should assume that a class session is being recorded unless otherwise notified. No person (student or otherwise) may record a class without express written permission from the instructor or an authorized administrator implementing a disability accommodation. All permitted recordings are governed by this policy's limits on distribution and redistribution of recordings.

### APPROPRIATE STUDENT USE OF CLASS NOTES AND COURSE MATERIALS

Broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing notes violates the [Board of Regents Policy](#).

### COURSE PREREQUISITES

Prerequisites include a year-long Ph.D.-level statistics sequence in the social sciences or equivalent (in the Department of Educational Psychology this is EPsy 8251 and EPsy 8252), The use of statistical computing software for modeling and analysis is also required. A good working knowledge of algebra is also required.

### COURSE REQUIREMENTS

There are eight required homework assignments. The homework assignments and due dates will be posted on the course website. These assignments include problems that will help you learn the course material through reflection and practice. *Submit each assignment as a PDF file via email to the instructor.*

To foster cooperation and collaboration, you are permitted to form groups of no larger than three to work on the homework. Submit only one assignment per group, and list the names of each group member on the assignment. Each assignment will be scored and this score will be given to all individuals in the group.

### REQUIRED READING

There are several articles, etc. that you will need to read during the semester. Most of the articles themselves are accessible through the [University of Minnesota Libraries website](#). More detailed information and links to specific readings, are available to students on the course website.



### COURSE COMMUNICATION

Email is the primary source of communication among instructors, teaching assistants, and students for this course. As such, you will be expected to check your email frequently (i.e., at least once per day). Students are responsible for all information sent to them via their University assigned email account. If a student chooses to forward their University email account, they are responsible for all information, including attachments, sent to any other email account.

## EVALUATION OF STUDENT PERFORMANCE

Course grades will be based entirely on performance on the homework assignments. The points from the eight homework assignment will be pooled to compute the final course grade. Students who earn below 63% will receive the letter grade of F. If you are taking the course S/N, the minimum criterion to receive an S is 80% (the equivalent of a B– letter grade). Any student who does not complete all homework assignments without making prior arrangements with the instructor will receive a grade of F/N.

Cutoff	Grade	Cutoff	Grade	Cutoff	Grade
93%	A	83%	B	73%	C
90%	A–	80%	B–	70%	C–
87%	B+	77%	C+	63%	D

## DISCUSSION/PARTICIPATION

While not a part of the course grade, active participation in the course is expected of all students enrolled in EPsy 8264. Active participation includes, but is not limited to, being engaged during the class, asking questions, providing additional insight and material, responding to other students and the instructor, and always being open and inquisitive.

## INCOMPLETE

An incomplete will be assigned only in extraordinary circumstances (e.g., hospitalization). An incomplete is an arranged grade which requires a written contract between instructor and student that includes by when and how the incomplete will be satisfied. Incomplete contract forms are [available here](#) or from program staff in 250 EdSciB.

## ACCESSING COURSE GRADES

Shortly after the course, you may [access your grades online](#). Assignments will be handed back in class or during office hours. Uncollected assignments will be retained for six weeks after the course ends and then discarded.

### UNIVERSITY GRADING SCALES

The University has two distinct grading scales: A-F and S-N. You can learn more about each of these scales and their corresponding GPA points by consulting the [Board of Regents Policy](#).

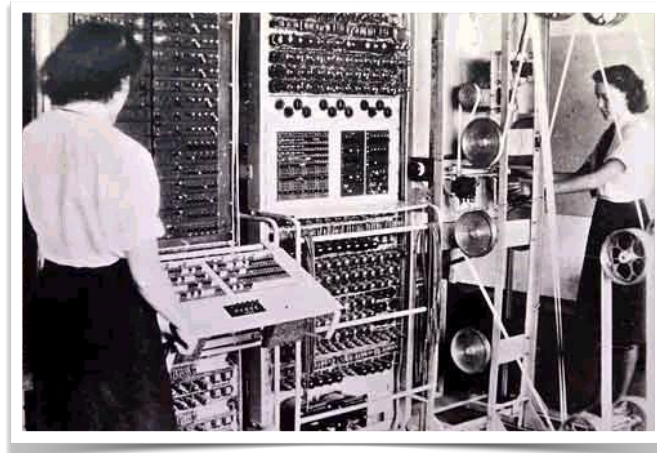
## TECHNOLOGY

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The course uses technology on a regular basis during both instruction and assessments. Student difficulty with obtaining or operating the various software programs and technologies—including printer trouble—will not be acceptable as an excuse for late work. Due to the variation in computer types and systems, the instructor or TA may not be able to assist in trouble shooting all problems you may have.

## STATISTICAL COMPUTING

Statistical computing is an integral part of statistical work, and subsequently, EPsy 8264. To support your learning in this area, this course will emphasize the [use of R](#). It should be noted that while some R syntax and programming is taught during class time, there is also a fair amount that you may need to learn on your own outside of class. There are several tutorials and resources available on the web to help you learn R.



### MENTAL HEALTH AND STRESS MANAGEMENT

Good mental health, including stress management is extremely important for success in graduate school. Several University of Minnesota services, including [Pet Away Worry & Stress \(PAWS\)](#), are available to assist you. is one of the many resources available to students. You can learn more about the broad range of confidential mental health services available on campus via the [Student Mental Health Website](#).

Tilly the Therapy Chicken  
(@TherapyChicken)



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## COURSE OUTLINE

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The outline below lists the tentative course topics. The dates listed are subject to change at the instructor's discretion. A more nuanced calendar, including links to readings, assignments, and course notes will be posted on the course website.

### Welcome to EPsy 8264 (Sept. 06)

Orientation to the course, setting expectations, talking through the semester.

### Introduction to matrix algebra (Sept. 08-13)

Basic ideas and operations of linear/matrix algebra.

### OLS Regression using matrices and its properties (Sept. 15-20)

Use of linear/matrix algebra to obtain regression estimates and develop properties of the model (e.g., BLUE)

### Simulating from the regression model (Sept. 22-29)

Ideas of simulation to further understand the regression model and its assumptions.

### Regression diagnostics (Oct. 04-06)

A series of methods to evaluate the distributional assumptions underlying the regression model and help diagnose problems (e.g., outliers, leverage, influence).

### Tools for dealing with heteroskedasticity (Oct. 11-13)

Methods for dealing with heteroskedasticity, including variance stabilizing transformations, WLS estimation, and sandwich estimation.

### Diagnosing collinearity and tools for dealing with it (Oct. 18-Nov. 08)

Methods for diagnosing and dealing with collinearity, including variable reduction, biased estimation, and shrinkage.

### Model selection (Nov. 10-29)

Criteria for model selection (e.g.,  $R^2$ , information criteria, Mallows  $C_p$ ) ; historical methods of automated model selection employed in education/psychology; overfit; and cross-validation.

### Path Analysis (Dec. 01-Dec. 13)

Method of path analysis for evaluating effects in an a priori defined causal structure, including DAGs, and estimation of direct and indirect effects

**QUANTITATIVE METHODS IN EDUCATION MISSION STATEMENT**

QME strives to be a premier program recognized for leadership, innovation, and excellence, and to enable human potential through the advancement of education. QME prepares students to become cutting-edge professionals in educational measurement, evaluation, statistics, and statistics education, through excellence in teaching, research, and service; and through investigating and developing research methodology in education.

**DEPARTMENT OF EDUCATIONAL PSYCHOLOGY MISSION STATEMENT**

Educational psychology involves the study of cognitive, emotional, and social learning processes that underlie education and human development across the lifespan. Research in educational psychology advances scientific knowledge of those processes and their application in diverse educational and community settings. The department provides training in the psychological foundations of education, research methods, and the practice and science of counseling psychology, school psychology, and special education. Faculty and students provide leadership and consultation to the state, the nation, and the international community in each area of educational psychology. The department's scholarship and teaching enhance professional practice in schools and universities, community mental health agencies, business and industrial organizations, early childhood programs, and government agencies. *Adopted by the Department of Educational Psychology faculty October 27, 2004*

**COLLEGE OF EDUCATION + HUMAN DEVELOPMENT MISSION STATEMENT**

The mission of the University of Minnesota College of Education and Human Development is to contribute to a just and sustainable future through engagement with the local and global communities to enhance human learning and development at all stages of the life span.



Goldy, c. 1965

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## ADDITIONAL POLICIES

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### STUDENT CONDUCT AND RESPONSIBILITIES

As a student at the University you are expected adhere to [Student Conduct Code](#). Additionally, there is [policy outlining a set of Student Responsibilities](#) that addresses things such as: the use of personal electronic devices in the classroom, and the appropriate use of class notes and course materials.

### SCHOLASTIC DISHONESTY

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty includes plagiarizing; cheating on assignments/assessments; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission. See the [Student Conduct Code](#) for more detail.

If it is determined that a student has cheated, the student may be given an “F” or an “N” for the course, and may face additional sanctions from the University. For additional information, please see [Board of Regents Policy](#).

The Office for Community Standards has compiled a useful list of [Frequently Asked Questions pertaining to scholastic dishonesty](#). If you have additional questions, please clarify with your instructor. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class—e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

### MAKEUP WORK FOR LEGITIMATE ABSENCES

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see [Board of Regents Policy](#).

### ACADEMIC FREEDOM AND RESPONSIBILITY

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.\* Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair (Kristen McMaster; [mcmas004@umn.edu](mailto:mcmas004@umn.edu)), your adviser, the associate dean of the college (Tabitha Grier-Reed; [grier001@umn.edu](mailto:grier001@umn.edu)), or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost (Rebecca Ropers-Huilman; [ropers@umn.edu](mailto:ropers@umn.edu)).

*\*Language adapted from the American Association of University Professors “Joint Statement on Rights and Freedoms of Students”.*



### DISABILITY ACCOMMODATIONS

The University of Minnesota views disability as an important aspect of diversity, and is committed to providing equitable access to learning opportunities for all students. The [Disability Resource Center \(DRC\)](#) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you have, or think you have, a disability in any area such as, mental health, attention, learning, chronic health, sensory, or physical, please contact the DRC office on your campus (612.626.1333) to arrange a confidential discussion regarding equitable access and reasonable accommodations.
- Students with short-term disabilities, such as a broken arm, can often work with instructors to minimize classroom barriers. In situations where additional assistance is needed, students should contact the DRC as noted above.
- If you are registered with the DRC and have a disability accommodation letter dated for this semester or this year, please contact your instructor early in the semester to review how the accommodations will be applied in the course.
- If you are registered with the DRC and have questions or concerns about your accommodations please contact your (access consultant/disability specialist).

Additional information is available on the DRC website or e-mail [drc@umn.edu](mailto:drc@umn.edu) with questions.

### SEXUAL ASSAULT, SEXUAL HARASSMENT, STALKING AND RELATIONSHIP VIOLENCE

In my role as a University employee, I am required to share information that I learn about possible sexual misconduct with the campus Title IX office that addresses these concerns. This allows a Title IX staff member to reach out to those who have experienced sexual misconduct to provide information about the personal support resources and options for investigation that they can choose to access. You are welcome to talk with me about concerns related to sexual misconduct. Within the requirements of my job, I will be as responsive to your requests for confidentiality and support as possible. You can also or alternately choose to talk with a confidential resource that will not share information that they learn about sexual misconduct. Confidential resources include [The Aurora Center](#), [Boynton Mental Health](#), and [Student Counseling Services](#).

The Department of Educational Psychology supports the efforts of the University of Minnesota towards prevention of sexual assault. We encourage all students to participate in the free online training that has been established for undergraduate students and graduate students. The training highlights pertinent issues regarding sexual assault, including, but not limited to: defining healthy relationships, consent, bystander intervention, and gender roles. The guide for the training is available in your [My Training page](#). Additionally, to learn more about how you can help reduce sexual assault at the University of Minnesota, please visit [The Aurora Center](#).

### EQUITY, DIVERSITY, EQUAL OPPORTUNITY, AND AFFIRMATIVE ACTION

The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, membership or activity in a local commission created for the purpose of dealing with discrimination, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult [Board of Regents Policy](#).