

Instructor: Dr. Amanda S. Hering

E-mail: ahering@mines.edu

Phone: 303.384.2462

Office: 235 Chauvenet Hall

Office Hours: Tuesday 9-10am, Wednesday 2-3pm, Friday 12-1pm.

Other times by appointment only.

Grader: Chris Lorenzini. His office hours are TBA.

Prereq: (MATH 334 & 335), (MATH 530), (MATH 535), or equivalent

In particular, a strong background in hypothesis testing, confidence intervals, and probability distributions is needed. In addition, it is assumed that students will have some knowledge of linear algebra and matrix algebra.

Course Schedule: MWF 1-1:50 pm, Location Green Center 257

Web Page: The username and password for the website will be given in class.

<http://inside.mines.edu/~ahering/secure/math531/>

Course Description: This course gives a thorough treatment of linear regression, including simple, multiple, and logistic. Different estimation techniques such as least squares, weighted least squares, generalized least squares, and nonparametric methods will be presented. Model diagnostics and model selection for the development of valid regression models will be covered. Analysis of covariance and one and two-factor balanced experiments will also be described. If time permits, bootstrapping regression models and LASSO estimation will also be presented.

Course Objectives: By the end of the course, the student should be able to:

1. Understand the settings wherein simple linear regression, multiple linear regression, and logistic regression are used.
2. Know how to build a model and verify that it fits the data well before inference occurs.
3. Understand the different methods of fitting models to data—LS, WLS, GLS, nonparametric, etc.
4. Apply the concepts of statistical regression to real datasets.
5. Use the R software (or other software package of your choosing) to perform regression analysis of real data sets.

Course Outline: The following is a rough list of topics that will be covered in this course:

- Simple Linear Regression: parameter estimation and inference, confidence intervals, prediction intervals, dummy variables.
- Weighted Least Squares: prediction intervals, leverage, and residuals
- Regression Diagnostics and Transformations: SLR, MLR, Multicollinearity
- Variable Selection: Selection criteria and algorithms, LASSO
- Logistic Regression: Modeling, deviance, residuals
- Serially Correlated Errors: Autocorrelation, generalized linear models (GLM)
- Nonparametric Smoothing: Kernel density estimation, nonparametric regression
- ANOVA: One and two-way Analysis of Variance (tentative)

Textbook: (Required) Sheather, S. (2009) *A Modern Approach to Regression with R*. Springer, ISBN: 978-0-387-09608-7.

Can be accessed for free through the university at the following website:

<http://www.springerlink.com/content/978-0-387-09608-7/#section=18277&page=4&locus=37>

The textbook website, which contains datasets and R code, is as follows:

<http://www.stat.tamu.edu/sheather/book/>

Other References: Some other commonly used texts in regression statistics:

Faraway, J. J. (2004) *Linear Models with R*. Chapman & Hall. ISBN 978-1584884255.

Kutner, M., Nachtsheim, C., Neter, J., and Li, W. (2004) *Applied Linear Statistical Models*. McGraw-Hill. ISBN 978-0073108742.

Weisberg, S. (2005) *Applied Linear Regression*. Wiley. ISBN 978-0471663799.

Course Work: Your grade for the course will be based on the following (relative weights given in percentage):

- **Homework Assignments (20%):** Bi-weekly homework assignments will be given throughout the semester. Assignments will be collected at the START of class on the due date. Late assignments will not be accepted.
- **Midterm Exam (30%):** There will be one in-class midterm exam (tentatively scheduled for Wed., March 23rd)
- **Final Exam (35%):** The final exam is likely to be a take-home exam.
- **Participation (15%):** This is a relatively small class, so participation is important. A weekly participation score will be recorded for you based on your attendance during the week and on having participated at least once during the week. "Participation" is defined as asking a question, answering a question, or making a comment related to the class content.

The following letter grades are guaranteed:

A	B	C	D	F
100-90%	89-80%	79-70%	69-60%	59-0%

Notes: A few more things...

- Check the website frequently for updates.
- I would like to know about any particular academic difficulties or personal problems that are affecting a student's performance.