STAT 505: Linear Models
Fall 2019 Syllabus

Course Webpage: http://www.math.montana.edu/shancock/courses/stat505

See our Brightspace (D2L) course page for homework assignments, discussion boards, and grades.

Course Information:

Class times: MWF 10:00–10:50am Wilson 1-126

Instructor: Dr. Stacey Hancock, Wilson 2-195, 994-5350, stacey.hancock@montana.edu.
See Dr. Hancock's webpage (http://www.math.montana.edu/shancock/) for office hours.

Prerequisites: STAT 412 or STAT 512, or equivalent.

Course description and learning outcomes: STAT 505 is the first semester in a two semester sequence of courses designed to help you gain a deeper level of understanding of the most common statistical methods used by statisticians. STAT 505 is a course in the theory and application of linear models, the foundation of most models used in statistical analysis. Topics include: Special matrix theory for statistics, multivariate normal distribution, distributions of quadratic forms, estimation and testing for the general linear model, one-way and two-way classification models, contrasts (main effect, simple effect and interaction), and multiple comparison techniques. By the end of this course, the successful student should be able to:

1. Use rigorous mathematical techniques and methods of proof to derive results in matrix theory for statistics.
2. Derive estimators, hypothesis tests, and confidence intervals related to linear models.
3. Understand the assumptions, uses, and limitations of linear models.
4. Use R to fit linear models to data and conduct inference on linear model parameters, with and without using built-in functions.
5. Communicate (written, visually, and orally) results of a statistical analysis and statistical concepts in non-technical terms.

Required Texts:

- Robert J. Boik's STAT 505 Lecture Notes, available in the MSU Bookstore.
- Journal articles and chapters from various books will be provided on D2L.

Computing: We will use the free R interface RStudio and RMarkdown for the computing portion of this course. Directions for downloading and further resources are provided on the course webpage.

Grading: See course webpage for calendar of material covered and due dates.

Component	Percent of grade
Homework	20
Quizzes	50
Final exam	30

Homework: HW will be assigned approximately weekly. Only a sample of problems will be graded; selected problems are graded as Pass, Fail, or Redo. A HW assignment may be completed by an individual or by a team of 2–4 students. Each team member is responsible for understanding the solutions to all problems, and a team submits only one set of solutions.

- Pass: Problem was successfully solved and all sources (books, papers, solutions, websites, people) were acknowledged. HW was turned in on time.
- Fail: Sources were used by not acknowledged, multiple write-ups per team were turned in, and/or write-up was late.
- Redo: Problem was not successfully solved, but all sources (books, papers, solutions, websites, people) were acknowledged. Late HW does not earn a Redo. Redo problems are due within one week of when the graded HW is returned to the class.

There will be 11 HW assignments throughout the semester; the lowest one will be dropped and each of the 10 remaining assignments will count as 2% of your course grade.

Format of homework write-ups:

- Number all answers and write-up your answers to the problems in the order that they appear on the assignment.
- Theoretical problems: May be (legibly!) handwritten, or formatted using LaTeX. (Do not use Microsoft Word.)
  - Pay attention to writing style. An equation is part of a sentence. Punctuate equations accordingly. Sometimes it is convenient to number an equation.
  - Give motivation and/or justification for major steps in a proof. Often, citing a previously established theorem or result is sufficient justification.
- Computational problems: Must be submitted as an R Markdown file that compiles without errors.
  - Computer code and output alone is not sufficient. Answers to computational problems must include a paragraph of explanation, and code must be appropriately commented.
  - Always include relevant source code with comments, and necessary output to justify your answers. Your written answer should make reference to the output.

Quizzes: In-class quizzes will occur approximately every three weeks. The lowest quiz grade will be dropped.

Final Exam: Our final exam is comprehensive; it is scheduled for *Thursday, December 12, 6:00-7:50pm.*

Course Policies:

- **Academic Expectations:** Discussing problems with colleagues is allowed and is often a good way to learn, but do so only after you have attempted to complete the problem independently. It is expected that students may form study groups and may collaboratively discuss homework problems. However, any collaborations and other sources must be acknowledged. Copying from others is cheating, and will not be tolerated. Academic misconduct as described in Section 420 of the Student Conduct Code (http://www.montana.edu/policy/student_conduct) will result in zero credit for all parties involved and will be reported.

- **Behavioral Expectations:** Montana State University expects all students to conduct themselves as honest, responsible and law-abiding members of the academic community and to respect the rights of other students, members of the faculty and staff and the public to use, enjoy and participate in the University programs and facilities. For additional information reference see MSU's Student Conduct Code at: http://www.montana.edu/policy/student_conduct. Behavioral expectations and student rights are further discussed at: http://www.montana.edu/deanofstudents/studentrights.html.