

Math 410B, Winter 2019
Advanced Statistical Methods

Meeting times: Monday, Thursday, 10:00 – 10:50 in Samuelson 102
Tuesday, Friday, 10:00 – 10:50 in Samuelson 138

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Office Hours: Monday 10–12, Wednesday 10–11, Thursday 10–11, Friday 1–2, and by appointment

Course Goals and Description: This course is the second of a two-part sequence designed to cover beginning and intermediate regression, ANOVA, classification, and machine learnings. We will learn the theory behind these models, and we will spend a lot of time using them to answer questions about real-world data. We will also begin to explore methods in predictive analytics, including classification methods, random trees, and random forests. Additional topics will likely include: linear regression, multiple regression, logistic regression, ANOVA, two-way ANOVA, bootstrapping, permutation methods, Principal Component Analysis, random trees and random forests, and time series analysis.

The first half of the course (410A) will include some very basic ANOVA, a lot of more advanced details about regression, and an introduction to R. This half of the course will also have a significant project component, in which students work with a stakeholder who has collected real data they would like to have analyzed.

The second half (410B) will cover one- and two-way ANOVA, multiple correction procedures, ANCOVA, non-parametric procedures, bootstrap and permutation tests, and (if time permits) an introduction to experimental design. The second half of the course will include a public speaking component, and we will spend time discussing and practicing the art and science of presenting statistics in public.

A tentative plan for the course schedule follows the syllabus.

Required Text: Gareth James, et al. *An Introduction to Statistical Learning with Applications in R*, Springer.

Recommended Text: Jared P. Lander, *R for Everyone: Advanced Analytics and Graphics*, Addison Wesley Data & Analytics Series.

Evaluation and Grading: Grades will be calculated via the following components: Regular labs (20%), two “R skills’ labs (10%), homework (10%), weekly reading responses (10 %), two midterm exams (20% each), a public speaking component (15%), and a large quarter-long project (15%) in which you will complete and write about a significant statistical analysis of your own (or with your team).

Grades will be assigned according to the following scale:

	A	93-100%	A-	90-93%	
B+	87-90%	B	83-87%	B-	80-83%
C+	77-80%	C	73-77%	C-	70-73%
D+	67-70%	D	63-67%	D-	60-63%
	F	60% and below			

Tentative Schedule of topics

Week 1	Two-way ANOVA and ANCOVA
Week 2	Bootstrapping
Week 3	Permutation tests
Weeks 4-5	Time Series Analysis
Week 6	Principal Component Analysis
Weeks 7-8	Decision trees
Week 9	Cluster analysis
Week 10	Final Project

Homework

A small amount of homework) will be assigned from the book most weeks. These are designed to let you practice the basics of the new statistics we are covering, and the corresponding techniques in R.

Labs

Most Tuesdays and Fridays we will meet in the computer lab for an opportunity to learn new statistical techniques and put them into practice. We will likely suspend a few of these during our oral presentations.

Midterm Exams

There will be two take-home mid-term exams, given during Week 4 and Week 8.

Public Speaking

This is the only course in the mathematics major (or actuarial science major) which teaches skills in public speaking. This is a crucial life skill, and one that can't be fully taught in one term. Rather, this class will provide you with some tools which will improve your speaking during this quarter, but will also enable you to continue improving after the course is done. We will complete a series of public speaking assignments. Several of these will involve a short reading, the watching of some videos or life talks, and a thoughtful analysis of what you observed. You will also prepare slides for a presentation.

After completing these steps, each person (or team) will give a talk about their work in class. These talks will be recorded. Students will take their videos home, watch them (twice!), and reflect and comment on their performance.

Please note that all students are encouraged to consider giving a talk at SOURCE – Central Washington University's "Symposium Of University Research and Creative Expression." This is an excellent opportunity, and one not to be missed. Abstracts for SOURCE are due soon on March 30, so talk to your professor immediately if you would like to pursue this option!

General Course Policies: Come to class. Do your own work. Work really hard; this class is likely to be quite difficult, but you will leave it with a useful set of skills, and a better understanding of statistics!

Students with disabilities who wish to set up academic adjustments in this class should give me a copy of their "Confirmation of Eligibility for Academic Adjustments" from the Center for Disability Services as soon as possible so we can discuss how the approved adjustments will be implemented in class. Students without this form should contact the Center for Disability Services, Bouillon 205 or dssrecept@cwu.edu or 963-2171.

I reserve the right to change the policies contained in this syllabus as dictated by developments during the quarter.