Statistical Methods II
STAT 220/ Spring 2025

Instructor: Adam Childers childers@roanoke.edu

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Office Hours: 11:00-12:00 PM, Tuesday, Thursday, and by appointment. Please send me an email to schedule an appointment if you need to meet at another time.

Zoom Link: https://roanoke-edu.zoom.us/j/5403752449

Meeting Time: 10:50 – 11:50 AM, Monday, Wednesday, Friday.

Meeting Place: Miller 114

Required Text: The Statistical Sleuth – Third Edition by Ramsey and Schafer

Course Objective: To understand how to use statistical methods to describe data and make statistical inferences. Building on the techniques from STAT 210 (or INQ 240), we will ask more sophisticated research questions and generalize our statistical methods. We will expand our understanding of simple linear regression by studying inferences for regression and multiple regression. We will take a closer look at one-way ANOVA and consider multiple comparisons. We will look carefully at assumptions for statistical methods and learn nonparametric methods to analyze data when the assumptions for the traditional tests are violated. We will also consider problems in big data and how to work with large data sets. Our focus throughout will be on statistical computing with R and clearly articulating our results in formal reports.

Intended Learning Outcomes: By the end of this course, students will be able to … …clearly state a research question and pick an appropriate statistical method.
…describe the key features of a data set using graphical and numerical methods.
…understand general linear modeling including regression and ANOVA.
…understand how to design and experiment and determine sample size.
…determine when a nonparametric test is appropriate and how to use them.
…articulate statistical methods and results to an audience of experts and non-experts.

Content:

- Drawing Statistical Conclusions
- Visualizing Data
- 2-sample inference
- Transformations
- Linear Regression
- ANOVA
- Contrasts
- Categorical Analysis
- Nonparametric Methods (Wilcoxin Rank Sum, Wilcoxin Signed Rank, Runs Test, Kruskal-Wallis) Logistic Regression
- R
- R Markdown

Tests: There will be four tests during the semester. They will be on

- February 12
- February 28

- April 1
- April 19

Technology: We will use R and its companion integrated development environment RStudio throughout the semester. Both are free and can be downloaded from the internet. Please see Inquire for complete instructions.

Structure of the course: We will be simultaneously learning statistical methods covered in the book and how to implement them in R and R Markdown in class. Please bring your laptop with you to class every day.

Homework: Homework problem sets will be assigned regularly. The problems will be posted on Inquire with their due date. The homework will be graded for correctness and completeness. Additionally, there will be reading assignments, quizzes, and reflections.

Project: There will be a group project with a presentation to the class. The project will ask an interesting research question and use statistical methods to answer it. There must be one new topic not covered in class in the report. The project will consist of a written report and a presentation to the class.

Final Exam: The final exam is cumulative and is on April 25 at 8:30 AM.

Grading: Grades will be assigned based on written assignments, tests, and a final exam.

Tests	40%
Homework/Quizzes	25%
Project/Presentation	15%
Final Exam	20%

A tentative guideline for the determination of grade will then be:

A	> 93			B	83 – 86.9			C	73 – 76.9		D	63 – 66.9
A-	90 – 93	B-	80 – 82.9			C-	70 – 72.9		D-	60 – 62.9	B+	87 – 89.9
	C+	77 – 79.9		D+	67 – 69.9			F	< 60			

Attendance: Attendance is required and expected and is crucial to be successful in this course. An absence that is not discussed with the instructor before class is considered unexcused. Regardless of whether the absence is excused or not, you are responsible for all the material covered in class.

Missed Test: If you must miss a test and have discussed it with me before the class takes the test, we can work together to re-schedule the test up to two days after the scheduled date. If it is not possible to take the test in that period, I will replace that test grade with your final exam grade.

Make-up Work: Make-up work can be turned in up to 2 days after it is originally due but will have a 25% penalty.

Expected Hours of Work: This course expects you to spend at least 12 hours of work each week inside and outside of class.

Academic Integrity System: Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be your own work! I encourage collaboration on homework but when you write up your solutions you should never be looking at someone else's work. Note that looking at or using your cell phone during a test or quiz is considered a violation of Academic Integrity regardless of your purpose or intent in doing so. If you use generative AI in any way on an assignment, you need to specify exactly how you used it, or it will be considered an Academic Integrity Violation.

Class Schedule: You can also find this on our Inquire page. Note, this is subject to change, but I will post any changes on Inquire.

Day	Date	Topic
M	13-Jan	Introduction
W	15-Jan	Intro to R and RStudio
F	17-Jan	Intro to R Markdown and the Tidyverse
M	20-Jan	1: Drawing Statistical Conclusions
W	22-Jan	2: t-tests
F	24-Jan	2: t-tests
M	27-Jan	3: Assumptions
W	29-Jan	3: Assumptions
F	31-Jan	4: t-test Alternatives
M	3-Feb	4: t-test Alternatives
W	5-Feb	4: t-test Alternatives
F	7-Feb	Test #1
M	10-Feb	5: Multiple Samples
W	12-Feb	5: Multiple Samples
F	14-Feb	5: Multiple Samples
M	17-Feb	6: Linear Combinations
W	19-Feb	6: Linear Combinations
F	21-Feb	6: Linear Combinations
M	24-Feb	Test #2
W	26-Feb	7: SLR
F	28-Feb	Spring Break
M	3-Mar	Spring Break
W	5-Mar	Spring Break
F	7-Mar	7: SLR
M	10-Mar	7: SLR
W	12-Mar	8 SLR Assumptions
F	14-Mar	8 SLR Assumptions
M	17-Mar	8 SLR Assumptions
W	19-Mar	9: Multiple Regression
F	21-Mar	9: Multiple Regression
M	24-Mar	Test #3
W	26-Mar	No Class – Good Friday
F	28-Mar	18 Proportions and Odds
M	31-Mar	18 Proportions and Odds

W	2-Apr	18 Proportions and Odds
F	4-Apr	19 Counts and Tables
M	7-Apr	19 Counts and Tables
W	9-Apr	20 Logistic Regression
F	11-Apr	20 Logistic Regression
M	14-Apr	20 Logistic Regression
W	16-Apr	Presentations
	18-Apr	Presentations
M	21-Apr	Presentations
T	22-Apr	Final Exam – 2:00 PM