Statistical Methods II
STAT 220/ Spring 2023

Instructor: Dr. Adam Childers / childers@roanoke.edu

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

Office: Trexler 270G

Phone: 540-375-2449

Office Hours: 12:00-1:00, Monday, Wednesday Friday, and by appointment. Please send me an email to schedule an appointment outside of these times. I'm happy to meet on Zoom or in-person.

Meeting Time: 9:40-10:40AM, Monday, Wednesday, Friday

Meeting Place: Olin 230

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

Course Objective: The objective of this course is 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 statistic 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 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
- The Tidyverse

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

- Wednesday, February 22
- Friday, March 24 Friday, April 19

Technology: We will be using 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 on getting set up.

Structure of the course: We will be simultaneously being 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: There will be reading assignments, problems assigned, and reflections. You can find all of them and their due dates on Inquire.

Projects: Throughout the semester we will be completing data driven assignments that you will complete using the statistical software R. Your assignments are to be completed in R Markdown and will be graded for correctness, organization, and presentation.

Final Exam: The final exam will be cumulative and will be given on April 27 at 8:30AM.

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

Tests	50%
Homework/Projects	30%
Final Exam	20%

A tentative guideline for 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

MCSP Conversation Series: Attending at least two MCSP conversation series events is required. Within one week of the lecture, a one-page reflection paper will be due and will count in your HW grade. You find the upload link on Inquire.

Attendance: Attendance is required and expected and is crucial to be successful in this course. An absence that is not discussed with the instructor prior to 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 have to 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 time period, I will replace that test grade with your final exam grade.

Make-up Work: No make-up work will be accepted. Any excused work will be replaced by the final exam. If an assignment is not turned in before the deadline and you have not contacted me about the assignment, it is considered unexcused.

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 you should never be looking at someone else's work when you are writing up your solution. Do not communicate with any person during a test except for me.

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.

Week	Day	Date	Topic
1	W	18-Jan	Introduction
1	F	20-Jan	Intro to R and RStudio
2	M	23-Jan	Intro to R Markdown and the Tidyverse
2	W	25-Jan	1: Drawing Statistical Conclusions
2	F	27-Jan	2: t-tests part 1
3	M	30-Jan	2: t-tests part 2
3	W	1-Feb	3: Assumptions part 1
3	F	3-Feb	No Class
4	M	6-Feb	3: Assumptions part 2 - transformations
4	W	8-Feb	4: t-test Alternatives
4	F	10-Feb	4: t-test Alternatives
5	M	13-Feb	4: t-test Alternatives
5	W	15-Feb	5: Multiple Samples
5	F	17-Feb	5: Multiple Samples
6	M	20-Feb	5: Multiple Samples

6	W	22-Feb	Test 1
6	F	24-Feb	6: Linear Combinations
7	M	27-Feb	6: Linear Combinations
7	W	1-Mar	6: Linear Combinations
7	F	3-Mar	7: SLR
8	M	13-Mar	7: SLR
8	W	15-Mar	7: SLR
8	F	17-Mar	8 SLR Assumptions
9	M	20-Mar	8 SLR Assumptions
9	W	22-Mar	8 SLR Assumptions
9	F	24-Mar	Test 2
10	M	27-Mar	18 Proportions and Odds
10	W	29-Mar	18 Proportions and Odds
10	F	31-Mar	18 Proportions and Odds
11	M	3-Apr	19 Counts and Tables
11	W	5-Apr	19 Counts and Tables
11	F	7-Apr	No Class – Good Friday
12	M	10-Apr	20 Logistic Regression
12	W	12-Apr	20 Logistic Regression
12	F	14-Apr	20 Logistic Regression
13	M	17-Apr	Project
13	W	19-Apr	Test 3
13	F	21-Apr	Project
14	M	24-Apr	Project
14	T	25-Apr	Review
EXAM	R	27-Apr	EXAM 8:30AM