Quantitative Reasoning II

Introduction to Data Science (INF 1220, 3 credits)

The University of Austin

Instructors: David Puelz and Dorothy Dickmann
Course Webpage: https://github.com/dpuelz/Quantitative-Reasoning-II
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Meeting Schedule: Mondays and Thursdays. See webpage for section meeting times.
Office Hours: Please consult the webpage and your instructor.

Course Description

This course focuses on visualizing, learning, and decision-making with data. We will cover uncertainty characterization via probability, model-building, statistical adjustment via regression, and interrogating model assumptions, precision, and accuracy. We will be move fast and cover many important concepts. In addition to conceptual training, students will to learn write and deploy computer code to answer data-driven questions. Finally, a data-focused class wouldn't be fun without practical and provocative examples. Our in-class and homework questions revolve around music festivals, dating apps, assassination attempts, stock returns, discrimination, and economic policy. It'll be an exciting term!

Course Objectives

→ Apply statistical reasoning to real-world data problems.

→ Use `R` to build reproducible and rigorous data analyses.

→ Understand, deploy, and evaluate predictive models.

→ Explain the limitations and assumptions of empirical methods.

Required Readings

There is no course pack. All lecture notes and course materials will be available on the course webpage in advance of our meetings. Please obtain copies of the following books that will complement our work in class:

Naked Statistics (NS) – Charles Wheelan

The Art of Statistics (AS) – David Spiegelhalter

Homework

Exercises will be assigned each Monday and due the following Tuesday. Please submit a pdf knitted from an `Rmarkdown` file with your solutions to Populi. The exercises will be graded on a scale from 1 to 5. The grading criteria are:

- Did you make an honest, concerted attempt at each problem?
- Did you attempt to address all parts of the question?

- Did you include enough detail on what you actually did so that a well-informed reader could understand your analysis in detail? (You won't receive full credit if it's not clear what steps you actually took in your analysis.)
- Did you include properly annotated figures/tables where appropriate?
- Did you write up your solution professionally, with an actual narrative flow (good), or did you just copy and paste a bunch of `R` code without much in the way of explanation (bad)?
- Did you use sensible procedures to answer a given question?
- Did you make any significant technical mistakes?

The modal grade for the homeworks will be a 4/5. If your homework write-up is exceptional, you have the opportunity to earn a 5/5. If your homework write-up is not a knitted `Rmarkdown` file, you will receive no credit.

Research Project

There will be a final research project where teams of **two** will conduct a significant data analysis. The deliverables will be a brief class presentation of research findings as well as a comprehensive write-up. The write-up should be structured like an academic paper. More details about expectations and grading criteria for the research projects will be provided later in the semester.

Evaluation

The class grade is comprised of the following:
– Homework (25%).
– Midterm (30%)
– Research Project (30%)
– Engagement (15%). How often did you participate in class and contribute to class discussion?

Topics and Timing

Below is a timeline for the semester. It is subject to change as we make our way through these topics. Please also pay attention to the course website. I will include supplemental readings beyond those in our textbooks.

Date	Topics	Reading
Week 1 (Sep 8, Sep 11)	Intro + `R` + Data/Probability	NS: ..., AS: ...
Week 2 (Sep 15, Sep 18)	Data/Probability	NS: ..., AS: ...
Week 3 (Sep 22, Sep 25)	Prediction	NS: ..., AS: ...
Week 4 (Sep 29, Oct 2)	Prediction	NS: ..., AS: ...
Week 5 (Oct 6, Oct 9)	Prediction + Precision	NS: ..., AS: ...
Week 6 (Oct 13, Oct 16)	Precision	NS: ..., AS: ...
Week 7 (Oct 20, Oct 23)	Precision + **midterm** (10/23)	NS: ..., AS: ...
Week 8 (Nov 3, Nov 6)	Causality	NS: ..., AS: ...
Week 9 (Nov 10, Nov 13)	Causality	NS: ..., AS: ...
Week 10 (Nov 17, Nov 20)	Project presentations	

Accessibility Statement

Please review the University Accessibility Statement in the student catalog. Students having special needs should contact the Polaris Center or email Accomodations@uaustin.org. Disability Support Services: The University will make reasonable accommodations for students with disabilities in compliance with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. The purpose of accommodations is to provide equal access to educational opportunities for eligible students with academic and/or physical disabilities.

Attendance Policy

Attendance is mandatory. If you don't show up, you will fail the course. Each student may miss up to 10% of classes for any reason—no excuse required and without penalty—corresponding to 1, 2, or 3 classes in a 1.5, 3.0, or 4.5 credit course, respectively. Any additional absences will result in a final grade penalty of 12% (1.5 credits), 6% (3.0 credits), or 4% (4.5 credits), regardless of the reason. Missing more than 25% of classes—including the allowable absences—without a medical excuse will result in failing the course. Being more than 20 minutes late to class counts as an unapproved absence.

Late Policy

Sometimes we have bad days, bad weeks, and bad terms. In an effort to accommodate any unexpected, unfortunate personal crisis, I have built a grace policy into the course: that is, a one-time, three-day grace period for one homework assignment. You do not have to utilize this policy, but if you find yourself struggling with unexpected personal events, I encourage you to e-mail me and our TA as soon as possible to notify us that you are using our grace policy. **All other late assignments will be penalized 20 percentage points per day or partial day that they are late.** This policy does not apply to the final project.

STEM Center Learning Objectives

→ Speak, read, and write in mathematical language.

→ Formulate and solve quantitative problems using appropriate technical language, models, and techniques.

→ Collect and analyze data using appropriate technology tools.

→ Communicate technical solutions clearly through writing, speaking, and visualization.

Final Course Notes: AI Help, Academic Misconduct, etc.

I encourage the use of ChatGPT and other AI tools for coding. They are tremendously useful calculators that will continue to grow in importance. I have zero tolerance for submitting work that is not your own, regardless of whether it is plagiarized or copied from a fellow student. If this occurs on either the homework, midterm, or project, I will issue an automatic zero for the deliverable. Finally, if you are reading this sentence, please send me and Professor Dickmann a note stating, "I have read the syllabus Prof Dave and Dorothy!", and we will give you 2 bonus points on your raw midterm grade!