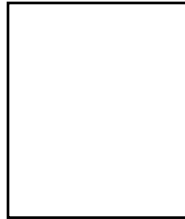


Statistics for Future Presidents

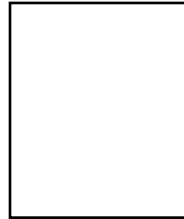
COURSENUMBER: Fall 2022



Instructor
Kim Hochstedler, MS
(kah343@cornell.edu)
Office: Malott Hall 301



TA #1



TA #2



TA #3

Lectures, Labs, and Office Hours

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 am					
9:30 am					
10:00 am	TA Office Hour				
10:30 am		TA Office Hour		Lab	
11:00 am					
11:30 am					
12:00 pm					
12:30 pm					
1:00 pm					TA Office Hour
1:30 pm					
2:00 pm	Lecture		Lecture		
2:30 pm					
3:00 pm		Kim's Office Hour			
3:30 pm					

All TA Office Hours will be located in ROOM NUMBER.

Textbooks:

None required. Useful references listed below.

- *Statistics done wrong* by Alex Reinhart
- *Statistical thinking* by Russell Poldrack

Statistical Fallacies Project:

The midterm will consist of individual projects on “statistical fallacies”.

“Statistics in the Wild” Project:

There is no final exam. There will be a final project, which will culminate in a written report (due during finals week).

Pre-requisites:

None.

Course Website: www.cornell.instructure.com/courses/mycoursenumber.html

Course Description

Numerical analysis and statistical claims are present in much of the media, journalism, and research that we consume. This course is designed to introduce undergraduates in humanities disciplines to the general principles of statistical reasoning. Students will learn about common statistical methods, study designs, and data presentation techniques. Importantly, students will learn how to evaluate the appropriateness of a variety of statistical analyses and assumptions for real-world questions. Each student will be required to complete projects critiquing popular news reporting of statistical results. The focus of this course will be on **statistical literacy** (reading, writing, and speaking about statistics) rather than statistical computation (use of software packages, data analysis, etc.). As such, students who anticipate being consumers, but not practitioners, of statistical analyses should enroll in this class.

Course Goals

1. **Identify appropriate statistical analyses for a given problem or question.**
 - Describe and discern between various data types (continuous, categorical).
 - Describe general assumptions of various statistical methods (t-test, ANOVA, linear regression, etc.)
 - Evaluate the appropriateness of various analysis methods for a given research problem or question.
2. **Evaluate the strengths and weaknesses of various methods of data collection for a given problem or question.**
 - Define and distinguish between probability and non-probability sampling.
 - Describe various sampling strategies.
 - Evaluate the appropriateness of sampling strategies based on population size and the research goal.
 - List different methods for writing survey questions, including strengths and weaknesses.
3. **Evaluate the validity and appropriateness of statistical claims and assumptions made in media and research articles.**
 - Define and distinguish between traditional aspects of research validity (external validity, internal validity, and construct validity).
 - Interpret statistical results in problem context.
 - Critique statements conveying statistical results.
4. **Read and interpret statistical graphics and visualizations.**
 - Accurately and concisely describe statistical graphics.
 - Incorporate appropriate statistical language into written descriptions of graphics.
 - Give oral presentations of statistical graphics to both technical and non-technical audiences.

Course Components

1. **Lectures:** Lectures will cover the main topics of the course. Printed lecture outlines (to be annotated and filled in during lecture) will be available for you at the beginning of class. You are responsible for any announcements and materials covered in lectures.
Most (but not all) lecture outlines and examples will be posted on the course website.
2. **Labs:** Lab sessions are designed to add context and allow hands-on practice of topics covered in lecture. The instructor and TA(s) are in lab to help you, so please ask questions when you need assistance. Additionally, feel free to talk with other students, ask other students for help, and help other students with the lab.
Lab attendance is mandatory. Please see additional details under “Oral Evaluations” below.
3. **Oral Evaluations:** During each lab session, a random selection of students will be asked to give a short, one-on-one presentation of a single statistical claim or graphic to the instructor. The claim or graphic will be provided to you before lab. During the first week of the course, the instructor will give an example of what is expected for these oral presentations. No students will be required to give presentations during Lab 1. In addition, students who are giving their “Statistical Fallacies” presentation in lab are not eligible to be selected for that day’s oral evaluation.
These oral evaluations are strictly for your benefit and will be graded on **completion only**. If you are not in lab when you are selected to give a presentation, you will lose credit. You may be selected for oral evaluations multiple times during the semester. The instructor will provide feedback on these presentations in order to help you improve your oral presentation skills.
4. **Mini Assignments (Homework):** Mini assignments give you the opportunity to apply and practice statistical reasoning, based off of material covered in lecture. For each 2-3 week long course unit, you will be required to complete 2-3 mini assignments from a bank of assignment options. One mini assignment option will be required for all students. You may choose which options you want to complete for the remaining mini assignments in the unit.
Students may turn in their self-selected mini assignments at any point during the unit period. Feedback will be provided on a *weekly basis*, so if you turn in assignments throughout the unit, you will receive grades and updates on your progress periodically. To facilitate this schedule, recommended deadlines are provided in the course calendar. The required mini assignment is due at the end of each unit, and no intermittent feedback is provided.
5. **“Statistical Fallacies” (Midterm) Project:** The “Statistical Fallacies” project is designed to assess your understanding of statistical reasoning and your skill at communication of statistical topics. Within your lab section, you will select a statistical fallacy from a provided list of options. Options are ordered by their appearance in class material. This means that earlier items on the list will relate to material in the first few class lectures. For items appearing later in the list, project material will not be covered until the end of the course and grading criteria will reflect this for students that select these topics. All statistical fallacy options are of equal difficulty, so please base your selection on your schedule to ensure that you can produce your best work for this project. For their selected topic, each student will produce a communication piece (i.e. podcast, poster, report, presentation, etc.) explaining the fallacy, when it occurs, and how to avoid it. Communication pieces will be assembled into a “Statistical Fallacy Portfolio” for each lab. As part of your grade on this project, you will evaluate your own performance

and will peer review the work of two other students. More details on project expectations will be provided in an assignment document within the first week of the class.

6. **“Statistics in the Wild” (Final) Project:** Students will select a news or research article (“article” is used loosely here – it can be a podcast, video piece, PowerPoint presentation, etc. as long as it is publically available) of interest that includes statistical claims. Your job is to investigate the claims made in this article. Are the claims accurate? Are they fair? Is there a better way of presenting the results? You will create a report that describes the claims made in your selected article and critiques the methods and conclusions that are presented. More details about the expectations and guidelines for the “Statistics in the Wild” project will be made available after Fall Break.

What can you take away from these Course Components after this semester?

- Lecture notes will serve as a reference guide for evaluating statistical methods for later classes and projects.
- Oral evaluation feedback (provided during lab sessions) will guide students to become better presenters.
- Mini assignments will serve as examples of statistical reasoning that students can use as (1) guides for later projects and (2) evidence of proficiency in statistical communication for employers.
- The “Statistical Fallacies” project and resulting portfolio will alert you to common pitfalls in statistical analysis, and how to avoid them in future work.
- The “Statistics in the Wild” project will take you through the entire process of evaluating and critiquing a statistical claim.

Grading Policies

- All numeric grades are on a scale from 0 to 100.
- Final grades will be computed according to the following weights:

Average Selected Mini Assignment Score	20.0%
Average Required Mini-Assignment Score	25.0%
Oral Evaluations (completion only)	5.0%
“Statistical Fallacies” Project	25.0%
“Statistics in the Wild” Project	25.0%

- Final letter grades will be determined according to the following rules (subject to change at the instructor’s discretion, though lower bound of each letter grade cut off will *not* increase).

A	≥ 90
B	[80, 90)
C	[70, 80)
D	[60, 70)
R	< 60

- The lowest self-selected *and* required mini assignment scores are not included in the calculation of final grades.

Administrative Procedures and Logistics

Lectures: Much of the learning in lecture will be done through active participation, so you should be prepared to participate during class. Use common courtesy: please arrive on time, do not leave early, and do not be disruptive in class. You are responsible for any announcements and materials covered in lectures.

Course Materials, Canvas: The syllabus, lab assignments, oral evaluation graphics, assignment solutions, assigned readings, any supplementary material, grades, and announcements for the course can be found on the course web page on Canvas:
www.cornell.instructure.com/courses/mycoursenumber.html. **Please check Canvas regularly.**

Discussion Board: All class discussions that take place outside of lecture and lab should occur on Ed:
Ed.com/cornell/fall2022/coursenumber/home

Communication: If you have questions related to the class material, lab assignments, the lab exam, or projects, feel free to ask the instructor during class or, preferably, the instructor and TA(s) during office hours. Questions concerning the current mini assignments submitted by email will not be answered. Please use email only to address administrative and logistic issues, or personal questions.

Please include COURSENUMBER in the subject line of all emails. You should expect a reply within 3 days, with the exception of Fall Break and Thanksgiving Break. Questions about mini assignments should be submitted to the course discussion board. **Emails to TAs will not be answered.**

Mini Assignment (Homework)
Format: Mini assignments take various forms. Specific details about submitting a mini assignment will be given within the assignment's instructions. In general mini assignments, all answers should be clearly labeled. Mini assignments should be treated as formal reports. This means that proper spelling and grammar is expected.

You are encouraged to discuss mini assignment problems and collaborate with your classmates (both on the discussion board and in person). However, the work you submit must be your own. This means that each student must independently complete each answer. Instances of identical, nearly identical, or copied mini assignments will be considered cheating and plagiarism.

Extensions: In general, extensions will not be granted for students (because they are behind on work, had a busy week, etc). Extensions for **reasonable academic purposes** (e.g. job interview, conference attendance) or **extreme circumstances** (e.g. family emergency) may be granted at the

instructor's discretion. If you have a request for an extension, please request this at least 48 hours before the assignment is due, if possible. Please recognize that the rolling nature of mini assignment deadlines is designed to ensure that you have a great deal of flexibility in determining your work schedule. Please use this flexibility and/or your dropped lowest mini assignment grades if you foresee a busy week around deadlines. If you require special accommodations via disability services or for religious observance, please see "Student Accommodations" below.

Regrades: If you believe a mistake was made when your assignment was graded, you must write a clear description of the issue. Please include your name, and the number of points under consideration at the top of the page. Please submit this, along with a copy of your assignment to the instructor's mailbox (Malott) or via email **within one week of when the assignment was graded.** The instructor reserves the right to regrade the entire assignment during the regrade review process.

Academic Integrity: The faculty and staff of the Bowers C-IS College believe that the conduct of a student taking courses in the School should be consistent with that of a professional person. Courtesy, honesty, and respect should be shown by students toward faculty members, guest lecturers, administrative support staff,

community partners, and fellow students. Similarly, students should expect faculty to treat them fairly, showing respect for their ideas and opinions and striving to help them achieve maximum benefits from their experience in the School.

Student academic misconduct refers to behavior that may include plagiarism, cheating, fabrication, falsification of records or official documents, intentional misuse of equipment or materials (including library materials), and aiding and abetting the perpetration of such acts.

Cell Phones, Laptops, Tablets, etc:

Students may bring a laptop or tablet to lectures, though handwritten lecture notes are provided. Please no cell phone use during class.

Phone, Audio, and Video

Recording: Photo, audio, and video recordings of the course lectures, lab session, lab exam, and all other course materials are strictly prohibited.

Student Well-being: I believe that your physical and emotional well-being is very important. If you have a physical or mental health issue that is affecting your performance or participation in any course, and/or if you need help connecting with university services, please contact the instructor or Cornell Health and CAPS [include websites].

Student Accommodations:

Students should speak with the instructor before or during the first week of classes regarding any special needs and no later than two weeks before an exam or assignment due date. Students seeking academic accommodations should register with Student Disability Services (SDS). SDS arranges reasonable and appropriate academic accommodations for students with disabilities. Please visit <https://sds.cornell.edu/> for more information on student accommodations.

Students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall be provided with a reasonable alternative opportunity to complete such academic responsibilities. It is the obligation of the student to provide faculty with two weeks' notice of the dates of religious holidays on which they will be absent.

Students are multifaceted individuals, and I cannot hope to name every type of accommodation that might be required for your unique needs. If you require additional accommodations to succeed in this class, besides those that are listed, please make an appointment to speak with the instructor. We will make a plan to ensure that you are able to fully participate in the classroom.

Diversity, Equity, and Inclusion:

I am committed to creating an equitable learning environment in this class. The goal of this course is to bring together people from diverse backgrounds (be it educational, social, regional, etc.) and promote the different perspectives that each person brings to the art of statistical reasoning. Regardless of an individual's prior experience with statistics, students will have the tools they need to become a proficient member of the classroom community. In that community, we value the diversity of opinions and approaches to statistics that everyone brings to the table. That diversity enriches everyone's educational experience and results in a creative atmosphere where all student's efforts and perspectives are valued. After learning the core principles of statistical methods, students are encouraged to adapt the course material to benefit their own needs and interests. Fellow students are expected to respectfully and constructively comment on the data science methods other students employ in their work.

Course Schedule

- Course schedule is subject to change.

Date	Class Session	Topic
UNIT 1: Sampling and study designs		
8/22	Lecture 1	Goals of statistics, populations and samples
8/24	Lecture 2	Sampling techniques I
8/25	Lab 1	Population and sample mismatch
8/29	Lecture 3	Sampling techniques II
8/31	Lecture 4	Experimental vs. observational studies, experimental design I
9/1	Lab 2	Evaluating sampling techniques
9/5	Labor Day – No class!	Do not come to class
9/7	Lecture 5	Experimental design II, observational study design I
9/8	Lab 3	Identifying the appropriate study design
9/12	Lecture 6	Observation study design II, quasi-experimental design
UNIT 2: Human research and measurement		
9/14	Lecture 7	Research ethics, validity
9/15	Lab 4	Threats to internal validity
9/19	Lecture 8	Validity, reliability
9/21	Lecture 9	Scaling, question wording
9/22	Lab 5	Writing survey questions
UNIT 3: Displaying data		
9/26	Lecture 10	Data types
9/28	Lecture 11	Summary statistics, outliers
9/29	Lab 6	Lying with summary statistics
10/3	Lecture 12	Goal of graphics, tables vs. plots, univariate graphics
10/5	Lecture 13	2D graphics
10/6	Lab 7	Presenting a statistical graph
10/10	Indigenous Peoples Day – No class!	Do not come to class
10/12	Lecture 14	3D graphics and data visualization principles
10/13	Lab 8	Lying with a plot
UNIT 4: Probability		
10/17	Lecture 15	Probability axioms
10/19	Lecture 16	Conditional probability
10/20	Lab 9	Evaluating probabilistic claims
10/24	Lecture 17	Risk assessment bias
UNIT 5: Analysis		
10/26	Lecture 18	Hypothesis testing
10/27	Lab 10	What is a p-value?
10/31	Lecture 19	Halloween! One parameter hypothesis testing
11/2	Lecture 20	Two-group hypothesis testing
11/3	Lab 11	Statistical fallacies portfolio assembly and peer review
11/7	Lecture 21	Linear Regression I
11/9	Lecture 22	Linear Regression II
11/10	Lab 12	Interpreting regression coefficients

11/14	Lecture 23	Chi-square
11/16	Lecture 24	ANOVA
11/17	Lab 13	Appropriateness of statistical tests II
UNIT 6: Applications		
11/21	Thanksgiving Break – No class!	
11/23	Thanksgiving Break – No class!	
11/24	Thanksgiving Day – No class!	
11/28	Lecture 25	Case study I
11/30	Lecture 26	Case study II
12/1	Lab 14	Work time for “Statistics in the Wild” project
12/5	Lecture 27	Last day of class!

- “Statistics in the Wild” Project report **due 12/18**.

Assignment Deadlines

Unit	Assignment	My assignment choice (fill in)	Optional deadline	Final deadline
1	Self-selected 1		8/26 at 5:00 pm	9/13 at 5:00 pm
1	Self-selected 2		9/2 at 5:00 pm	9/13 at 5:00 pm
1	Required	Fill in by instructor		9/13 at 5:00 pm
2	Self-selected 1		9/16 at 5:00 pm	9/23 at 5:00 pm
2	Required	Fill in by instructor		9/23 at 5:00 pm
3	Self-selected 1		9/30 at 5:00 pm	10/14 at 5:00 pm
3	Self-selected 2		10/7 at 5:00 pm	10/14 at 5:00 pm
3	Required	Fill in by instructor		10/14 at 5:00 pm
4	Self-selected 1		10/21 at 5:00 pm	10/25 at 5:00 pm
4	Required	Fill in by instructor		10/25 at 5:00 pm
5	Self-selected 1		10/28 at 5:00 pm	11/18 at 5:00 pm
5	Self-selected 2		11/4 at 5:00 pm	11/18 at 5:00 pm
5	Self-selected 3		11/11 at 5:00 pm	11/18 at 5:00 pm
5	Required	Fill in by instructor		11/18 at 5:00 pm
6	Required	Fill in by instructor		12/2 at 5:00 pm
	“Statistical Fallacy” project			10/28 at 5:00 pm
	“Statistics in the Wild” report			12/18 at 5:00 pm