Syllabus
36-200/36-247
(*Reasoning with Data / Statistics for Lab Sciences)*
Fall 2020

Course Description

This course is an introduction to learning how to make statistical decisions and how to reason with data. The approach will emphasize the thinking-through of empirical problems from beginning to end and using statistical tools to look for evidence for/against explicit arguments/hypotheses. Applications will largely be drawn from interdisciplinary case studies spanning the humanities, social sciences, and related fields (for 36-200); and case study examples in biology and chemistry (for 36-247). Methodological topics will include basic exploratory data analysis, elementary probability, significance tests, and empirical research methods.

Not open to students who have received credit for 36-201, 36/70-207, 36-220, 36-247, or any 300- or 400-level Statistics course.

Learning Objectives

1. Learn the empirical research process including data collection and design methods.
2. Develop and use methods for summarizing and evaluating numerical data.
3. Learn and apply the basic concepts of probability and hypothesis tests.
4. Develop skills in the applications of statistical methods to problems in the sciences and the humanities/social sciences, including interpretation and communication of results.

Course Staff

Instructors

Primary/Lead Instructor: Gordon Weinberg
3719 Wean
gordonw@andrew.cmu.edu
412-268-5496
[Email is the best way to contact me.]

Instructor Weinberg's office hours: Tuesdays, 9:30–11:00AM (Pittsburgh time);
Instructor Weinberg's office hours zoom link:

By web:
https://cmu.zoom.us/j/99229249994?pwd=amUzd01ubTRyc2NOeXpJbkt4MC81dz09

By phone:
Meeting ID: 992 2924 9994
Passcode: 387238
Find your local number: https://cmu.zoom.us/u/aeEyV3qNoR

By SIP:
99229249994@zoomcrc.com

In addition to these posted times, extra office hours can be arranged within the limitations of schedules; please contact us and we can make arrangements.

Rebecca Nugent
232-F Baker
rnugent@stat.cmu.edu
Professor Nugent is Associate Department Head, and Departmental Director of Undergraduate Studies and the Data Science Initiative (DSI). She is leading the development of the computing platform 'ISLE' (Interactive Statistics Learning Environment) which you will use in the labs and to create your reports for your projects.

Philipp Burckhardt
pgb@andrew.cmu.edu or pburckhardt@cmu.edu
Dr. Burkhardt is a postdoc in Statistics; for his research he is developing and testing the computing platform 'ISLE' (Interactive Statistics Learning Environment) which you will use in the labs and to create your reports for your projects. Philipp will help out in labs and will administer make up labs.

Associate Instructor (36-247)

Ciaran Evans
clevans@andrew.cmu.edu
Ciaran is a PhD student in Statistics, and is involved in the course development as well as overseeing the lab section for 36-247.

Teaching Assistants

Various TAs will lead the lab sections and will share in the grading.
Some of the TAs will hold office hours (to be posted on Canvas).

Course Requirements and Semester Grade

Your semester course grade consists of:

Labs	10% of grade [all labs counted, nothing dropped]
Homework	15% of grade [two lowest hw's dropped before calculating average]
2 Projects	20% (10% each) [both projects counted]
2 exams	30% (15% each) [all exams counted, nothing dropped]
Final Exam	25% of grade [final exam not optional]

In other words, the semester course percentage will be computed as follows:

Semester Course Percentage =

0.1(lab avg) + 0.15(hw avg*) + 0.1(project 1) + 0.1(project 2) + 0.15(exam1) + 0.15(exam2) + 0.25(final)

[* after dropping lowest two homeworks]

The scale that will be used for assigning end-of-semester letter grades is as follows:
A = 90 – 100; B = 80 – 89; C = 70 – 79; D = 60 – 69; R (fail) = 59 – 0.

Midsemester Grade

Midsemester grades will be calculated after the first project and first midterm exam. The midsemester percentage will be computed as follows:

Midsemester Percentage =

0.1(lab avg thus far) + 0.15(hw avg thus far after dropping lowest two) + 0.2(project 1) + 0.55(exam1)

In cases of an excused first midterm exam, the midsemester percentage will be computed as follows:

Midsemester Percentage in case of excused first exam =

0.2(lab avg thus far) + 0.4(hw avg thus far after dropping lowest two) + 0.4(project 1)

The scale that will be used for assigning midsemester letter grades is as follows:

A = 93 – 100	B+ = 87 – 89	C+ = 77 – 79	D+ = 67 – 69	R (fail) = 62 – 0
A– = 90 – 92	B = 83 – 86	C = 73 – 76	D = 63 – 66	↑
	B– = 80 – 82	C– = 70 – 72	D– = not available on midsemester grade	see 2nd note below

Note that the University only allows for plus/minus on midsemester grades, not on semester grades.

Note also that midsemester grade of D– ["D minus"] is not available on the midsemester grading system; so, for midsemester grades, any overall midsemester percentages of 62, 61, or 60 will be assigned the letter grade of R (fail); whereas, for end-of-semester grades, any overall course percentage from 69 down to 60 will count as an end-of-semester letter grade of D, including overall semester percentages of 62, 61, or 60.

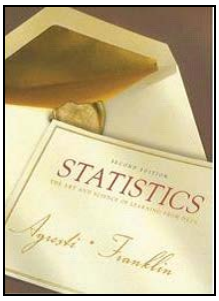
Materials

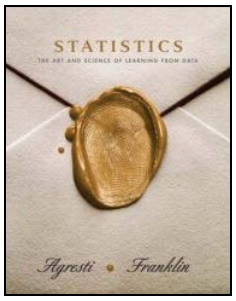
▪ Optional Texts

There is no required text for the course. Daily outlines will be posted for download, to guide your note-taking in lecture; homework answer keys will be posted on a regular basis; and reviews materials will be given. Most students in past semesters have found these materials to be sufficient for succeeding in the course. But if you want to browse optional resources, here are some references:

Statistics: The Art and Science of Learning from Data,
(1st or 2nd editions)
by Agresti and Franklin.

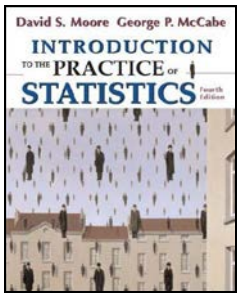
A PDF of the 3rd edition is on Canvas.

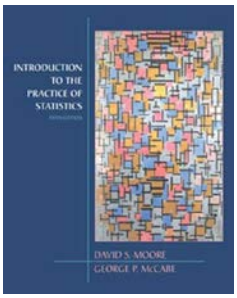


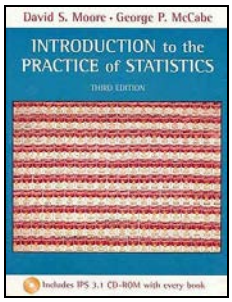


Introduction to the Practice of Statistics,
(various editions available)
by Moore and McCabe.

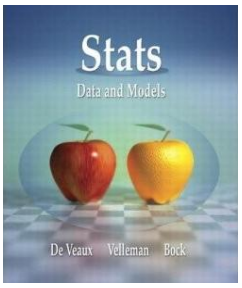
A PDF of the 6th edition is on Canvas.

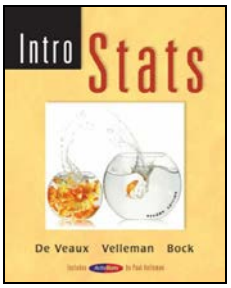


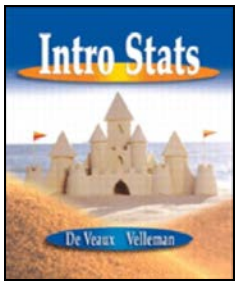




Stats, or Intro Stats,
(various editions available of either)
by DeVeaux, Velleman, and Bock.







▪ Online 'OLI' Materials at CMU

The CMU Open Learning Initiative (OLI) offers free educational materials for a variety of introductory courses. Their statistics materials closely parallel the course. You are free to use these materials to assist your learning.
https://oli.cmu.edu/courses/probability-statistics-open-free/ → click the green button "enter open and free course"→ then under "enter without an account", click the "I'm not a robot" captcha and then click "enter course"

Materials, continued

Calculator

For the exams, any physical or online calculator that can at least do square root is required; it may be convenient if the calculator can also do powers (mainly for the binomial formula).

Lecture Days / Time / Zoom link

Lecture: M, W, F, 10:40–11:30AM (Pittsburgh time)
Lecture zoom link:

By web:
https://cmu.zoom.us/j/96957765860?pwd=ay9iSG1nR0NDTEl6bmtHVnRRMmFOQT09

By phone:
Meeting ID: 969 5776 5860
Passcode: 201899
Find your local number: https://cmu.zoom.us/u/abaIQz11b

By SIP:
96957765860@zoomcrc.com

Lecture sessions will be recorded, and the recordings will be posted.

Daily Lecture Outlines

Each Mon/Wed/Fri lecture will use prepared outlines which will contain material like graphs, examples, or datasets that the instructor will refer to throughout the lecture, and which will also contain spaces for you to take notes. For each lecture, you will need a copy of that day's outline to view in lecture (either in hardcopy or else in electronic format), and you will also need note-taking materials.

Daily lecture outlines will be posted electronically on Canvas:

https://www.cmu.edu/canvas/ → 'files'

Each lecture outline will generally be available online a day in advance.

Lab Days / Times / Zoom links

Lab sessions will be recorded, and the recordings will be posted.

Note that lab begins the first week of the semester.

- **Lab days / times / zoom links for 36-200, Reasoning with Data:**

36-200-A (Thursday, 10:40–11:30AM):

By web:
https://cmu.zoom.us/j/97801191384?pwd=eXBTV0kyUGRDclNISkJZQVhwNXBLdz09

By phone:
Meeting ID: 978 0119 1384
Passcode: 038136
Find your local number: https://cmu.zoom.us/u/abhXIjhdL7

By SIP:
97801191384@zoomcrc.com

36-200-B (Thursday, 10:40 –11:30AM):

By web:
https://cmu.zoom.us/j/95023659529?pwd=UXZqNVFnTWxJRWdoTEwzZ1lFRFBDZz09

By phone:
Meeting ID: 950 2365 9529
Passcode: 219603
Find your local number: https://cmu.zoom.us/u/asubB6VUL

By SIP:
95023659529@zoomcrc.com

36-200-C (Thursday, Noon–12:50PM):

By web:
https://cmu.zoom.us/j/96401853326?pwd=OU5hMnRlc0QvYm5XelhWUW5mZWpZQT09

By phone:
Meeting ID: 964 0185 3326
Passcode: 904359
Find your local number: https://cmu.zoom.us/u/adYnf81jL6

By SIP:
96401853326@zoomcrc.com

Lab zoom links continued on next two pages:

36-200-D (Thursday, Noon–12:50PM):

By web:
https://cmu.zoom.us/j/95095807438?pwd=eU5QY0hpRmlBK1l0MmxxYnprRHUzZz09

By phone:
Meeting ID: 950 9580 7438
Passcode: 630312
Find your local number: https://cmu.zoom.us/u/acchrabljd

By SIP:
95095807438@zoomcrc.com

36-200-E (Friday, 1:20–2:10PM):

By web:
https://cmu.zoom.us/j/94266141702?pwd=TDlzN2ZwMkdVeEtwR2VsTW5YRmZlZz09

By phone:
Meeting ID: 942 6614 1702
Passcode: 069351
Find your local number: https://cmu.zoom.us/u/arRh9mAvI

By SIP:
94266141702@zoomcrc.com

36-200-G (Friday, Noon–12:50PM):

By web:
https://cmu.zoom.us/j/98492390808?pwd=R0lWTU9DWWI2Y0dVR2ZESHRvaDJydz09

By phone:
Meeting ID: 984 9239 0808
Passcode: 770138
Find your local number: https://cmu.zoom.us/u/aczVI1bUc3

By SIP:
98492390808@zoomcrc.com

36-200-H (Friday, Noon–12:50PM):

By web:
https://cmu.zoom.us/j/91428226591?pwd=Nmx3RWlkcjFWWkFveVh6cWpGcndIdz09

By phone:
Meeting ID: 914 2822 6591
Passcode: 157320
Find your local number: https://cmu.zoom.us/u/adzBzLavDQ

By SIP:
91428226591@zoomcrc.com

Lab zoom links continued on next page:

36-200-I (Friday, 2:40–3:30PM):

By web:
https://cmu.zoom.us/j/97000556366?pwd=M0ppQWkvbzVsRWxlMENZc0ZSTHg2Zz09

By phone:
Meeting ID: 970 0055 6366
Passcode: 479329
Find your local number: https://cmu.zoom.us/u/atsmepOU0

By SIP:
97000556366@zoomcrc.com

- **Lab day / time / zoom link for 36-247, Statistics for Lab Sciences:**

36-247-A (crosslisted as 36-200-F): Fri, 1:20–2:10PM

By web:
https://cmu.zoom.us/j/92763622894?pwd=VDhkYU10cWtjeFRNWWJ6S2hWNmlIdz09

By phone:
Meeting ID: 927 6362 2894
Passcode: 108068
Find your local number: https://cmu.zoom.us/u/aehl90vaAq

By SIP:
92763622894@zoomcrc.com

Remark: Lab 36-200-F should only be registered by students in 36-247. 36-247-A is crosslisted with lab section 36-200-F.

Registration and Waitlist Issues

- **Regarding lab section 36-200-F**

Lab 36-200-F should only be registered by students in 36-247. 36-247-A is crosslisted with lab section 36-200-F.

- **Switching 36-200 labs**

Note that registration is handled by lab section. If you drop a lab section, you will start at the back of any waitlist for whichever section you then add, even if it is the same section you originally dropped. Conduct drop/add with caution.

Note that the TAs are not empowered to make registration decisions. If you have registration issues or waitlist questions, communicate with the instructor.

Attending while waitlisted

Waitlisted students will be given temporary Canvas access in order to access and submit course materials.

While you are waitlisted, you should attend lecture, you should attend the lab section you are waitlisted for, and you should submit homeworks along with the rest of the class.

We ask that you be removed from the waitlist if you are still not officially registered by the semester course early add deadline.

If you can't get into the course, note that it is also offered in other semesters including summer.

Homework

How and When Homework is Assigned and Collected

Homework assignments will be posted electronically on Canvas:

https://www.cmu.edu/canvas/ → "files"

Waitlisted students will be given temporary Canvas access, and are expected to submit homework with the rest of the class.

Homework assignments will generally be posted each Wednesday night.

Homework will be submitted electronically through Gradescope (instructions will be given in homework 1), and will generally be due by 8:00PM on the Wednesday of the week after the homework is posted. (See schedule at the end of this syllabus.)

Homework Content and Purpose

Homework will emphasize the course material covered in lecture, but may also contain exercises that extend the course material beyond lecture. Homework will also help to practice and solidify skills in the data analysis workflow, beginning with a dataset, understanding the context of the question, producing appropriate analyses, and articulating a conclusion.

You should generally be spending a few hours on each homework.

Homework Grading

Homework will be graded by the course staff, with different staff members grading different exercises each week, to ensure uniformity and fairness. Partial credit will be given where appropriate.

Homework Policies Continued

Homework re-grades

Requests for homework re-grades must be made within one week of the day the grade is posted; and should be addressed to the Instructor (gordonw@andrew.cmu.edu). [Note, you can activate a regrade request on Gradescope, which will then alert the Instructor.]

Missed Homework Policy

Homework will not be eligible for any credit after the posted due date/time.

Two homework scores are dropped at the end of the semester to account for illness or other emergency reasons for missing a homework submission. This policy is chosen instead of extensions so that that all homeworks are graded together (which ensures grading uniformity), and to avoid the need to evaluate requests for extensions (which are inevitably subjective and thus potentially unfair to students).

Lowest Homework Scores

Your lowest two (2) homework scores will be dropped before tallying your semester homework average. This is intended to account for occasional illness or other emergency.

Computer Labs

Purpose of Lab

Weekly computer lab assignments will give you practical experience analyzing real data, using the computing platform 'ISLE' (Integrated Statistics Learning Environment). (On exams, you will not be required to know any computer functionality; but you will be expected to understand and interpret simple computer output or computer-generated graphs.)

Various TAs will be available to help you.

Each lab assignment will generally be based on recent lecture material, so lab will also serve as preparation for the upcoming homework assignment on that same material.

Lab Credit

Labs will be worth 1 point apiece, for working on the lab during the live lab session and then finishing the lab by 8:00PM (Pittsburgh time) the same day.

If you will be unable to attend the live lab session (for instance due to time zone issues), please let the Instructor know (gordonw@andrew.cmu.edu).

Labs will be scored mostly for completion. The lab completion is generally graded leniently, but if you submit a mostly incomplete lab, part of the completion point may be docked.

Lab Policies, continued

No Dropped Labs

No labs will be dropped. All lab scores will count towards your semester lab average.

Lab Attendance

If you will be unable to attend the live lab session (for instance due to time zone issues), please let the Instructor know (gordonw@andrew.cmu.edu).

From the Eberly Center

For this class, a postdoc, Philip Burckhardt, is conducting research on the impacts of various teaching methods and materials on student learning. You will not be asked to do anything above and beyond the normal learning activities and assignments that are part of this course. You are free not to participate in this research, and your participation will have no influence on your grade for this course or your academic career at CMU. Please note that students choosing not to participate in the research will not be excused from required course activities. Participants will not receive any compensation. The data collected as part of this research will include student grades. All analyses of data from participants' coursework will be conducted after the course is over and after final grades are submitted. The Eberly Center may provide support on this research project regarding data analysis and interpretation. To minimize the risk of breach of confidentiality, the Eberly Center will never have access to data from this course containing your personal identifiers. All data will be analyzed in de-identified form and presented in the aggregate, without any personal identifiers. Please contact Philip Burckhardt at pgb@andrew.cmu.edu or pburckhardt@cmu.edu, if you have questions or concerns about your participation.

Data Analysis (DA) Projects

There will be 2 data projects.

For the projects, you will get to choose a real dataset (we will provide a selection) to analyze, using the course concepts and methods taught up to that point. In the projects, you will execute the data analysis workflow, from articulating the real-world motivation for the question, to the exploration of the data (for project 1), then applying appropriate inferential techniques (for project 2), and using those results to help answer your question of interest. Appropriate guidance and prompts will be provided.

Projects will be done 'report style' (you should think of it like a report that you would submit to a statistical consulting client or to an academic research journal).

▪ Project Dates

Project 1: Due **Wednesday, September 30**, by 8:00PM (Pittsburgh time), on Gradescope

Project 2: Due **Wednesday, December 2**, by 8:00PM (Pittsburgh time), on Gradescope

▪ Project Grading

Projects will be graded by the course staff. Grading rubrics will be provided with project instructions.

▪ Project re-grades

Requests for project re-grades must be made within one week of the day the grade is posted; and should be addressed to the Instructor (gordonw@andrew.cmu.edu). [Note, you can activate a regrade request on Gradescope, which will then alert the Instructor.]

Exams

Dates/Times/Coverage

Exam 1: Emailed 8:00PM (Pittsburgh time) Sunday, October 4;
due on Gradescope by 8:00PM (Pittsburgh time) Monday October 5.
Covers: Big picture of statistics; 1-variable EDA;2-variable EDA; and experimental design.

Exam 2: Emailed 8:00PM (Pittsburgh time) Sunday, November 8;
due on Gradescope by 8:00PM (Pittsburgh time) Monday November 9.
Covers: Probability; discrete and continuous 1-variable distributions; and sampling distributions and the Central Limit Theorem.

Final Exam: Final exam scheduling to be determined by the Registrar
(probably determined after the first month of the semester).

Coverage: Cumulative (including, but not limited to, material not on exam 2).

Exam Format

Exams will generally be a combination of short answer / 'work-out' exercises / multiple choice.

Allowed Materials on Exam

Exams (including the Final Exam) will be open note, including allowed use of any documents or resources that have been made available for the course this Semester; and computing devices are allowed.

Exams must be completed individually, without communication of any form to or from anyone else regarding any aspects of the exam.

Exam re-grades

Requests for exam re-grades must be made within one week of the day the grade is posted; and should be addressed to the Instructor (gordonw@andrew.cmu.edu). [Note, you can activate a regrade request on Gradescope, which will then alert the Head TA and the Instructor.]

Missed Midterm Exam Policy

Absence from a midterm Exam may be excused at the discretion of the instructor. If the absence is excused, the missing Midterm Exam grade will be replaced with the grade on the final exam grade (or on the parts of the final exam specific to the missing Midterm material).

Academic Honesty on Exams

Exams must be completed individually, without communication of any form to or from anyone else regarding any aspects of the exam. Appearance of giving or taking unauthorized assistance on exams will be subject to penalties under the University cheating/plagiarism policy.

Academic Honesty

Academic Honesty on Exams

On exams, all work must be completed individually, without communication of any form to or from anyone else regarding any aspects of the exam.

Academic Honesty on Projects and other Expository Writing

On expository writing such as course projects or free-response homework questions, the words, phrases, and sentence construction you use must demonstrably be your own and therefore should not be copied from other people or resources (including posted practice materials or lectures). [Exception made for a standard phrase in Statistics like "reject null hypothesis."]

Academic Honesty on Homeworks

If you work with someone else on an assignment, or if you get assistance on an assignment from someone (even if they're not in the class), you should disclose that fact, for instance by writing, "**I worked on this assignment with … [and then the complete list of names of everyone you worked with]**" at the top of your assignment. This is akin to the proper academic practice of listing all the collaborators on a scholarly article.

Disclosing your study partner(s) is a necessary step in academic openness. However, disclosure is not sufficient to indicate individual effort. **If an assignment in 36-200/247 is not specified as a group project then it is graded individually, and, therefore each student's assignment should demonstrate individual effort**. Identical or suspiciously-similar work will still be docked for credit if it indicates lack of meaningful individual effort. If you work on an assignment with a study partner, you should re-write your assignment with your own words and your own work before submission.

A good recommendation for getting the most out of collaboration while still ensuring academic honesty and genuine individual learning is to use the '**one-hour whiteboard rule**,' a technique akin to something used in other departments, in which students may discuss the assignment together using a whiteboard, *but you are not allowed to copy anything down while you are looking at the whiteboard*. You must then go somewhere else away from the whiteboard, wait a reasonable amount of time (like an hour), and then each student writes up their assignment individually *without any further collaboration during the write up of the assignment*. This technique forces you to check your own understanding of what you are writing, and it helps to ensure that no two students should have the identical work or words.

Cheating / Plagiarism

Definition

Cheating and plagiarism are defined by University policy which is available online:
https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html

Penalties

Course penalties can range from a zero on the item to an R ("fail") in the course.
Additional penalties are possible beyond the course grade, as described on:
https://www.cmu.edu/student-affairs/theword/academic-discipline/index.html

What to Prepare for Lecture

Each Mon/Wed/Fri lecture will use prepared outlines which will contain material like graphs, examples, or datasets that the instructor will refer to throughout the lecture, and which will also contain spaces for you to take notes directly on the outline.

Daily lecture outlines will be posted electronically on Canvas:

https://www.cmu.edu/canvas/ → "files"

Each lecture outline will generally be available online a day in advance.

Lecture and Lab Attendance and Behavior

Lecture attendance and lab attendance are not graded in 36-200/247. However, it is to the student's benefit to attend each session. The reason we have lecture in the first place (rather than just notes) is because most people find it much easier to learn from a live person.

While in lecture and lab zoom sessions, please be respectful to others, by keeping your microphone muted if you are not speaking (you might also want to keep your camera feed off if there are other people in your environment). If you have a question during the lecture, please make use of the zoom chat feature.

Accommodations

Eligibility for accommodations is determined by the Carnegie Mellon Office of Equal Opportunity Services (EOS).

If you are eligible for accommodations for this course, please communicate with the instructor to determine how to appropriately apply the accommodations for the course.

Recommended Weekly Habits for Success

1. First, **review the previous lecture's notes** before each lecture (to have the recent material fresh in your mind), and **read the upcoming topics in an optional text if you feel the need** (to familiarize yourself with the topics that will be covered, and so that there is time for potential questions to occur to you, which you might want to ask in lecture).

2. Prepare to view a copy of the outlines in lecture, by printing them the night before each lecture; or else by downloading them to your laptop or tablet computer.

3. Then, **attend lecture, and be engaged** while in lecture (try to anticipate answers to examples as they are presented in lecture, and ask questions in lecture); note that lecture outlines will be generally made available, but they will only be topic outlines and therefore won't be very useful to you if you don't attend lecture.

4. Next, after each lecture, **re-write your lecture notes** 'in your own words' (to test if you can explain the ideas to yourself without any logical gaps and to practice appropriate statistics terminology), and re-do any lecture examples (to take the time to go through each step carefully on your own).

5. Attend labs and **be engaged**: Try to envision how each lab's topics fit into a larger overall picture of the course material; teach and debate the lab questions with your peers; and formulate thoughtful questions to ask the lab TAs (you are encouraged to discuss labs in office hours for more feedback).

6. Review your lab answers after lab; and complete the lab assignment on your own if you did not have time to complete it during lab hour.

7. Then, **do the homework assignments**; spend at least a few hours alone on the homework and formulate an answer on your own for each exercise; then ask about the homework in office hours, and re-do if necessary before submitting.

8. Attend office hours, even if you don't have questions on a current homework assignment (ask questions on lecture or reading or lab; and have the TA or instructor go over previous graded material with you); gaps in your understanding that you might not have realized you had can be identified through one-on-one discussion.

9. Get **a good night's sleep** prior to exams. A clear head is more important than cramming.

Personal Stress Care and Psychological Assistance

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep, and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefits from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, the University strongly encourages you to seek support. Consider reaching out to a friend, faculty, or family member.

If you or someone you know is feeling suicidal or in danger of self-harm, call someone immediately, day or night:

- **CMU Counseling and Psychological Services (CaPS)**

  412-268-2922
  http://www.cmu.edu/counseling/

- **ReSolve Crisis Network**

  888-796-8226

- **CMU Campus Police**

  412-268-2323

  (or dial 911 for emergency if off campus)

Diversity/Equity/Inclusion

In tumultuous times, it is important to remember that we come together in University in a shared endeavor to improve ourselves and the world. The new ideas and new viewpoints for solving problems and for improving ourselves arise from diverse perspectives. Diversity is our strength. In our shared work we welcome everyone, from all backgrounds, ethnicities, genders, orientations, and life experiences.

At Carnegie Mellon, and in this course, everyone is respected, and everyone is welcome.

Welcome and good luck!

Day	Lecture Schedule / Exam Schedule	Homework Schedule / Project Schedule
M, Aug 31	Lecture 1 [Course intro; and elements of statistical thinking]	
W, Sep 2	Lecture 2 [The 'big picture' of inference; categorizing variables; and EDA for univariate categorical data]	
F, Sep 4	Lecture 3 [Begin EDA for univariate quantitative data: Describing histograms; and defining and exploring measures of center (if time)]	
M, Sep 7	**No Classes [Labor Day Holiday]**	
W, Sep 9	Lecture 4 [Continue EDA for univariate quantitative data: Defining and exploring measures of center (if not done previously); and defining and exploring measures of spread]	Homework 1 due on Gradescope by 8:00PM [covers intro material (categorizing variables; big picture), and univariate categorical EDA]
F, Sep 11	Lecture 5 [Finish EDA for univariate quantitative data: Quartiles, boxplots; and begin EDA for bivariate data relationships through beginning contingency tables]	
M, Sep 14	Lecture 6 [Continue EDA for bivariate data relationships: Contingency tables for exploring categorical data relationship; begin scatterplots for exploring quantitative data relationship)]	
W, Sep 16	Lecture 7 [Finish EDA for bivariate relationships: More scatterplots; Correlation; and regression]	Homework 2 due on Gradescope by 8:00PM [covers univariate quantitative EDA, and maybe bivariate EDA through contingency tables]
F, Sep 18	Lecture 8 [Begin topics in study design: Focus on bias; begin lurking variables and association vs. causation if time]	
M, Sep 21	Lecture 9 [Finish topics in study design: Lurking variables, association vs. causation/ observational vs. experimental] *Exam* 1 *covers through this lecture*	
W, Sep 23	Lecture 10 [Begin elementary probability rules (up to general addition rule)] *Exam* 2 *material starts here*	Homework 3 due on Gradescope by 8:00PM [covers bivariate EDA and study design] Project 1 released by tonight (due Wed, Sep 30)
F, Sep 25	Lecture 11 [Continue elementary probability rules (through conditional probability)]	
M, Sep 28	Lecture 12 [Continue elementary probability (statistical independence)]	
W, Sep 30	Lecture 13 [Finish elementary probability: review exercise on terminology; and some famous applications of probability (the Sally Clark case; and polygraph testing)]	PROJECT 1 due on Gradescope by 8:00PM No homework due this week because of project
F, Oct 2	Lecture 14 [Begin 1-variable discrete distributions (mean and st dev of; and begin binomial)]	

[schedule continued on next three pages]

Day	Lecture Schedule / Exam Schedule	Homework Schedule / Project Schedule
M, Oct 5	EXAM I – covers through study design (i.e., covers lecture 1 – 9 / lab 1 – 4 / hw 1 – 3). Will be emailed 8:00PM Sunday Oct 4 (Pittsburgh time); due on Gradescope by 8:00PM Monday Oct 5 (Pittsburgh time). [The exam is meant to be done in about two hours.] No lecture today because of exam	
W, Oct 7	Lecture 15 [Finish 1-variable discrete distributions (Binomial mean and st dev; Binomial probability formula); begin density curves for continuous distributions]	No homework due this week because of exam
F, Oct 9	Lecture 16 [Continue 1-variable continuous distributions; begin Normal Density Curves (68-95-99.7 approximation; z scores)]	
M, Oct 12	Lecture 17 [Finish normal density curves (standardizing and using the Normal table)]	
W, Oct 14	Lecture 18 [Begin sampling distributions, and Central Limit Theorem for mean]	Homework 4 due on Gradescope by 8:00PM [covers elementary probability]
F, Oct 16	**No Classes [CMU Community Engagement Day]**	*No labs this Thursday or Friday*
M, Oct 19	Lecture 19 [Continue sampling distributions (practice the Central Limit Theorem for mean)]	
W, Oct 21	Lecture 20 [Continue sampling distributions (introduce sampling distribution of p-hat)]	Homework 5 due on Gradescope by 8:00PM [covers discrete distributions and the Binomial]
F, Oct 23	**No Classes [Mid-Semester break]**	*No labs this Thursday or Friday*
M, Oct 26	Lecture 21 [Finish sampling distributions and CLT (practice the Normal approximation of proportion; and video of physical demonstration of the CLT)] *Exam 2 covers through this lecture*	
W, Oct 28	Lecture 22 [Introduce confidence intervals for one parameter, using z]	Homework 6 due on Gradescope by 8:00PM [covers sampling distributions and the CLT]
F, Oct 30	Lecture 23 [Finish z-based confidence intervals for one parameter (intervals for proportion; inference using confidence intervals; and some theories and cautions with confidence intervals)]	
M, Nov 2	Lecture 24 [Begin elementary significance testing for one parameter, using z]	
W, Nov 4	Lecture 25 [Finish elementary significance testing for one parameter, using z (including the connection between significance testing and confidence intervals)]	Homework 7 due on Gradescope by 8:00PM [covers confidence intervals]
F, Nov 6	Lecture 26 [the t distribution]	

[schedule continued on next two pages]

Day	Lecture Schedule / Exam Schedule	Homework Schedule / Project Schedule
M, Nov 9	EXAM II – covers probability rules, discrete and continuous distributions, and the Central Limit Theorem (i.e., covers lecture 10 – 21 / hw 4 – 6.) Will be emailed 8:00PM Sunday Nov 8 (Pittsburgh time); due on Gradescope by 8:00PM Monday Nov 9 (Pittsburgh time). [The exam is meant to be done in about two hours.] No lecture today because of exam	
W, Nov 11	Lecture 27 [Inference for 2 means]	No homework due this week because of exam
F, Nov 13	Lecture 28 [Inference for 2 proportions]	
M, Nov 16	Lecture 29 [One-Way ANOVA (with emphasis on concepts)]	
W, Nov 18	Lecture 30 [chi-square inference for contingency tables]	Homework 8 due on Gradescope by 8:00PM [covers inference up to possibly chi square] Project 2 released by tonight (due Wed, Dec 2)
F, Nov 20	Lecture 31 [inference for linear regression; and linearizing transformations]	
M, Nov 23	Lecture 32 [cautions about inference; and brief discussion of type I and type II errors]	
W, Nov 25	**No Classes [Thanksgiving Break]**	No homework due this week because of Thanksgiving Break
F, Nov 27	**No Classes [Thanksgiving Break]**	*No labs this week*
M, Nov 30	Lecture 33 [Data dredging and the 'multiple comparisons' problem (a.k.a. the 'sharpshooter fallacy': the danger of asking the wrong question)]	
W, Dec 2	Lecture 34 [Inference for matched pairs]	PROJECT 2 due on Gradescope by 8:00PM No homework due this week because of project
F, Dec 4	Lecture 35 [Begin review of inference]	
M, Dec 7	Lecture 36 [continue review of inference]	
W, Dec 9	Lecture 37 [Finish of Inference]	No homework due this week because of end-of-semester
F, Dec 11	**Last Day of Lecture** Lecture 38 [Successes, lessons, and perspectives]	

[schedule continued on next page]

Fall 2020 Finals Week:

Final Exam schedule will be announced when decided by Registrar
(final exam schedule should be available within the first month of the semester).

M, Dec 14	
T, Dec 15	
W, Dec 16	[reading day, no exams]
Th, Dec 17	
F, Dec 18	
Sat, Dec 19	[reading day, no exams]
Sun, Dec 20	
M, Dec 21	Make Up Exam Day
T, Dec 22	
W, Dec 23	Course grades available on SIO by 8:00PM