MATH-UA.0234-003: Mathematical Statistics

semester	Spring 2021
time	Tues, Thurs 3:30-4:45PM
location	Zoom (`link`)
recitation	Fri 3:30-4:45PM
instructor	Dr. Christopher Miles
email	chris.miles@nyu.edu
office	Zoom (`link`)
office hours	M 1030-1130 EST, Thurs 1300-1400 EST
teaching assistant	Terrence Alsup taa357@nyu.edu
Campuswire	

Textbook

*The class material will draw from two textbooks, but the class will be self-contained so **no purchases are necessary.***

1) *All of Statistics* by Larry Wasserman. It can be accessed online **for free** through Springer from NYU connected computers at this link:

Wasserman book link

Definitely download the Wasserman book and read the sections as we progress through the course material.

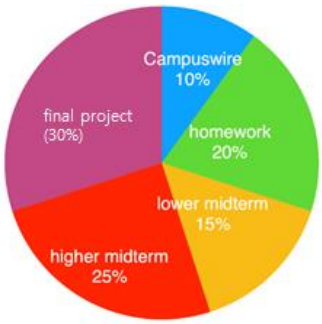
2) *Statistical Inference* 2nd edition by Casella and Berger is a classical textbook but a bit more difficult to "read" so I'll use it supplementally. You **DO NOT NEED TO BUY THIS BOOK.** However, there are fairly cheap (~$20) international editions easily available. Ask me for details about this if you can't find any.

Community

This course aims to offer a joyful, meaningful, and empowering experience to **every** participant; we will build that rich experience together by devoting our strongest available effort to the class. You will be challenged and supported. Please be prepared to take an active, critical, patient, and generous role in your own learning and that of your classmates.

Grading

The final assigned grades for the course will be computed from the following breakdown:



Participation (Campuswire) (10%)

To earn the full 10% participation grade, you must earn 10 points from the possible categories.

- **Ask a question on Campuswire (2 pts, no max).** The question should be **relevant to the content of the course**, but quality will not be judged otherwise. For instance, a question that *would* earn this is

  "Can someone explain the difference between a definite and indefinite integral?"

  But a question that would *not* is

  "Do we have a quiz this week?"

  (Although these are still okay to ask!) Campuswire does indeed allow anonymous questions which is also allowed and can be properly tallied at the end of class.

- **Answer a question on Campuswire (2 pts, no max).** Again, the quality won't be judged as long as there is content to the response but it is best for everyone to provide as much information as possible. Please do not just reply with the final answer but try to help with understanding too. Therefore, one word or yes/no answers will not yield credit.

- **Create a midterm or final exam study sheet to share (4 pts, 2 max).** Create a study sheet and post to share with other students prior to the exams. These can be typed or handwritten.

- **Organize a study session (4 pts, 1 max).** Schedule and host a study session open for **all** students in the class. For instance, on Campuswire you could say "I'm studying for the exam on Sunday at 8 PM, join me at the following Zoom link" If these get too large, breakout rooms on Zoom can work. Regardless, please make these a **welcoming and inclusive space.**

No max means you *can* (and should) do more than one of those to earn the points. For instance, one way to earn full credit would be:

2x questions asked (4 pts) + 1x question answered (2 pts) + 1x midterm study sheet (4 pts) = 10 pts.

Earning above 10 points will not yield any extra credit, but is still encouraged.

Homework (20%)

- Homework will be due **at the beginning of class Tuesday every week unless noted otherwise.**
- The lowest homework grade will be dropped in the calculation of this grade.
- The problems will primarily be assigned from the Wasserman text but other computational assignments might be added.
- You are to turn your homework in on **Gradescope.** A link can be found on the left toolbar of NYUClasess. Instructions for using Gradescope.
- Some programming will be required. Previous knowledge is not necessary, but willingness to learn is. I'm always happy to work with you if you're having troubles with this, just come to office hours.
- No late homeworks will be accepted.

Midterm Exams (15+25=40%)

- Two non-cumulative midterm exams will be given with format TBD (maybe oral or written).
- Tentative dates: **March 9** and **April 14**. **THESE HAVE A GOOD CHANCE OF CHANGING BUT STUDENTS WILL BE GIVEN SEVERAL WEEKS NOTICE.**
- Whichever grade ends up being lowest, it will be weighted 15% and the higher will be 25%. **This can only help your grade.**
- If you have a conflict or issue with a scheduled exam, please try to talk to me far in advance of the exam. Emergencies, etc can also be discussed.
- If you receive accommodations for exams, please let me know as soon as possible and I'm happy to help with these.

Final project (30%)

- Students will spend the last few weeks of the class preparing a project demonstrating and utilizing the mathematical tools discussed in the class applied to a particular dataset.
- The grade will be computed based on a mix of a written submitted writeup and a presentation component.
- More specific details about the project will be released closer to the end.

Flexibility

As the instructor, I reserve the right to modify any of the policies listed in the syllabus with appropriate notice given to the students. Updates to the syllabus will be highlighted.

List of topics

This list is tentative (especially the timing), and likely will change.
W=Wasserman, CB=Casella & Berger. Numbers are chapter #'s.

1. Review of probability, random variables, moments (W1,2,3, CB1,2,3,4) ~ 1 week
2. Sampling distributions, CLT, delta method, convergence (W5, CB5) ~ 1 week
3. Intro to inference; (W 6) ~ 0.5 weeks
4. Parametric inference; MLE, method of moments(W9, CB7) ~ 2 weeks
5. Confidence intervals (W9, C9) ~ 1 week
6. Bootstrapping (W7) ~ 1 week

7. Hypothesis testing, p-values; UMP, Neyman-Pearson (W10, C8) ~ 1.5 weeks
8. Bayesian inference (W11) ~ 1.5 weeks
9. Linear regression; ANOVA? (W13, CB11-12) ~ 2 weeks
10. Simulation (W14) ~ 1 week