

NCB 210: Introduction to Statistics in Neuroscience

Dr. Monica Thieu

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E-mail: mthieu@sandiego.edu

Office hours: Tues 10 am-12 pm; Wed 2-5 pm

Office: Saints Hall 107A

Canvas site: sandiego.instructure.com/courses/22376

Class hours: TR 2:30-3:50 pm; 4:00-5:20 pm

Classroom: Saints Hall 314

Course description

Statistics are our tool for making sense of the noisy world with numbers. This is a statistics course designed to develop critical thinking skills in statistical intuition and practical skills in inferential statistics, with a special emphasis on the use of statistical computing software.

This course is required for the BS in Neuroscience, and satisfies the statistics requirement for the BS in Cognition & Behavior. This course also fulfills the quantitative reasoning competency requirement of the Core Curriculum.

Course objectives

By the end of this course, you should be able to:

- Identify and evaluate patterns in data
- Select, apply, explain, and justify inferential statistics for a dataset
- Understand and write basic R code for calculation and inference
- Understand and identify sources of inferential uncertainty and bias
- Apply statistical intuition to interpret the validity of data and analysis

Kumeyaay land acknowledgment

The University of San Diego acknowledges that the land on which the university community gathers is the traditional and unceded territory of the Kumeyaay Nation. The University wants to pay respect to the citizens of the Kumeyaay Nation, both past and present, and their continuing relationship to their ancestral lands.

Prerequisites

There are no prerequisites for this course.

Textbook & readings

The majority of readings will be assigned from **Statistical Thinking: Analyzing Data in an Uncertain World** by Russ Poldrack. Readings from other sources will be linked or posted on Canvas.

Equipment

We will be analyzing data using the statistical computing language **R**, so you will need a computer to use during class and to complete problem sets and exams.

We will be using [RStudio Cloud](#), a web app, to write R code and manage data in the class. RStudio Cloud runs from a cloud server and is beamed into your browser, so it should not require you to download any additional software. As long as you log into your account, you can access RStudio Cloud from a personal computer or a lab computer with internet access. You can also use a personal tablet and keyboard, but sometimes, tablets will have typing/scrolling issues that laptops/desktops would not have, so *use a tablet at your own risk*.

If you have any concerns about whether your particular device will be sufficient for you to complete your coursework, please consult with me about your device details so I can assist you.

Course structure

Before each class, you will complete pre-class readings and activities to introduce you to the core concepts relevant to our work in class.

During each class, we will practice new statistical skills and build new knowledge by discussing concepts you learned about before class.

At the end of each unit, you will complete problem sets to demonstrate your learning.

At the end of the term, you will complete a final exam to synthesize your learning over the whole course.

Assessments

Your learning in this course will be assessed through **in-class activities, unit problem sets, and a final exam**.

In-class activities

Coming to class and engaging with the material will help you learn. Accordingly, there will be a graded activity during each class. Activities may include short in-class quizzes, reading responses, coding exercises, or group discussions.

In-class activities will count for 1 point each. All class days except the first day of class and the midterm exam day will have an activity at some point during class.

You must be present in class to earn credit. However, to allow flexibility for unexpected personal emergencies, including **illness**, **you will be able to drop up to 3 missed activity points toward your final course grade**. If you expect in advance to miss class for USD-protected commitments, like Division I athletic travel or Title IX-protected medical appointments, please contact me *as far in advance as possible* to discuss alternative activities.

Problem sets

The problem sets give you a place to practice your new skills from each unit, and help me (and you!) keep tabs on your progress so that you can keep up through the semester. Each problem

set will consist of a combination of math exercises, code exercises, and short-answer questions, depending on what best fits the unit's learning objectives.

Statistics is naturally cumulative! Problem sets will be cumulative to the degree that you need earlier skills and concepts to complete later problems.

Problem sets are due at *noon* before class the day they are due. **Late problem sets will not be accepted!**

Problem set revisions

Should you receive less than full credit on a problem set, you may submit revisions within one week of receiving feedback to earn back credit on that problem set, contingent on addressing all of the points in the feedback you received.

Midterm & final exams

The midterm will be more like a second problem set, administered in exam format to help you benchmark your learning in case you need to make adjustments in your study habits for the second half of the course.

The final exam is intended to assess your learning in a larger-scale way that better represents how you might apply skills from the course outside of the classroom. On the final exam, you will synthesize skills you've been practicing in class and on your problem sets, and apply those skills in new ways you may not have tried before.

Again, statistics is naturally cumulative, so exams will be cumulative to the degree that you need earlier skills and concepts to complete later problems.

The midterm and final exams will count for up to 12 points each.

Grading

Final course grades will be given as letter grades. Your overall letter grade (A, B, C, D, F) will be determined by the total number of assignments marked “complete” that you have accrued over the course of the semester.

- **Daily** in-class activities: 1 point each, 24 assignments, 24 possible points total
- **Unit** problem sets: 2 assignments, 12 possible points total
 - Unit 1 problem set: 6 points
 - Unit 3 problem set: 6 points
- **Midterm** exam (in place of Unit 2 problem set): 12 points
- **Final** exam: 12 points

To reward improvement from the midterm to the final, if your final exam grade is *greater than* your midterm exam grade, your final exam grade will be weighted up to 18 points and your midterm exam grade will be weighted down to 6 points.

60 points are possible across all assignments. Letter grade breakdowns will be as follows. Fractional points will be left as is.

Letter	Range
A	54-60 pt
B	48-53.99 pt
C	42-47.99 pt
D	36-41.99 pt
F	0-35.99 pt

To reward exemplary effort on the final exam, and improvement from the midterm to the final, pluses on your overall course grade will be determined by your grade on the final exam. No minuses will be given on overall course grades.

+ or - on overall grade	Final exam grade
Letter +	6-12 pt OR final exam > midterm exam
Letter	0-5.99 pt

For example, a student earning 12/12 points on the final exam and 50/60 total points in the course would receive a B+ course grade.

Please note that *in order to receive credit toward departmental requirements, you must receive an overall grade of C- or better*. Any grade below a C- requires that you take the course again (or another course that satisfies the statistics requirement) and pass with a C- or better.

Participation

Participation may involve, but is not limited to:

- Coding along with me to practice new statistical techniques
- Answering poll questions to check your understanding and brainstorm new ideas
- Group work to complete exercises

You are much more likely to succeed in independently applying concepts and skills on problem sets and your final exam if you take advantage of participation opportunities during class. I hope you will participate for your own benefit, and for the benefit of your peers. Graded in-class activities are designed in part to encourage participation, and there is not a separate participation grade.

Generative AI policy

I do not use generative AI to prepare any of my teaching materials, or to evaluate any of your assignments. I ask that in return, you refrain from using generative AI to complete any of your assignments in this class.

In order for you to build *foundational* statistical reasoning skills, I believe you need to hone them *without AI assistance* in order to *understand* and *retain* the skills you're building. This is a large reason why I have designed this course with so much in-class work, so that I can keep track of your learning growth in class over the course of the semester.

If you do wish to use AI to scaffold your learning, **I ask that you only use Google Gemini through your USD account**, which should not save your input data for Google's personal use. **I do not wish my course materials to be used to train any AI models**, so *please* do not paste any of my course materials into any other AI chatbot.

If I believe you have submitted any generative AI outputs as your own personal work on a problem set or exam, I reserve the right to treat your submission as **potential plagiarism** and grade it proportional to what I perceive to be your personal contribution.

Emailing me

When you email, please help me sort your email in my inbox by writing the subject line as “NCB 210: [topic of email].” I will try my best to respond to emails within 48 hours. Please note that **I will not be able to respond to emails between 7pm-9am, or anytime on Sundays.**

Office hours

I would love to chat with you during office hours—I can of course answer questions about problem sets and course content, but we can also talk about lab research, course planning, careers, and more.

If you want to talk at another time, please book an appointment using [this appointment page](#). You can book appointments day-of. If it's on the calendar, I'm available!

Finally, I know it can feel a little awkward to talk to your professor, but I promise coming to office hours does NOT mean you're in trouble.

Please stay home if you are ill!

Protect yourself and your classmates by **staying home if you have been exposed to, or are suffering symptoms of, a communicable illness**. Remember that **you can drop some in-class activities**. I encourage you to use the drops if you are sick!

Take care of your mental health

Maintaining your mental and spiritual health are key to thriving in class. USD offers several resources to support you outside of the classroom, including:

- [Multifaith spiritual counseling](#) at the Ministry; appointments via [email](#)
- A directory of 24-hour help hotlines at [Be Well USD](#)
- Mental health counseling at the [Counseling Center](#)
- [Campus Assault Resources & Education](#)

Faculty (including me!) and staff are working together to support you at USD. *Please* make use of the resources available to you!

Peer tutoring match through Knack

Students seeking additional support outside the classroom are encouraged to connect with a peer tutor through the [Knack](#) app, which will help match you with a fellow USD student tutor.

Be aware that because this course is being taught under a new course number as NCB is a young department, so you may need to request tutors who have taken other stats classes.

Accommodations from Disability Services

If you would benefit from academic accommodations to support your learning in this class, please contact the [Disability and Learning Difference Resource Center](#) on campus as early in the semester as possible. Once you have worked with the DLDRC to evaluate your needs, please bring or send me a copy of your accommodation letter and I will work with you to implement it in this class.

Classroom recording policy

My teaching materials, including lectures, are my intellectual property as the instructor and protected by copyright unless otherwise designated. To protect my intellectual property as well as the privacy of me and your classmates, video, and/or audio recordings of class lectures, discussions, and activities are only allowed with DLDRC accommodation.

Schedule

The schedule of topics is subject to change throughout the semester. Please refer to Canvas for the most updated schedule.

Date	Topic	Assignment due
Statistical intuition		
Sep 04	Welcome!	
Sep 09	Measurement	
Sep 11	Central tendency	
Sep 16	Dispersion & relative position	
Sep 18	Introduction to R/RStudio	
Sep 23	The normal distribution	
Sep 25	Estimating population means from samples	
Sep 30	Sampling distributions & standard error	
Oct 02	The history of statistical inference	
Statistical inference: Population means		
Oct 07	Confidence intervals (single mean)	Problem set 1 (noon before class)
Oct 09	Difference in means (paired samples)	
Oct 14	Difference in means (independent samples)	
Oct 16	Effect size	
Oct 21	Midterm review	
Oct 23	Midterm exam	Midterm exam (aka problem set 2)
Statistical inference: Correlations & regressions		
Oct 28	Correlation 1	
Oct 30	Correlation 2	
Nov 04	Regression framework	
Nov 06	Fitting regressions & reading coefficients	
Nov 11	Difference in means (the regression way)	
Nov 13	Difference in means (3 or more conditions)	
Nov 18	No class: Society for Neuroscience conference	
Nov 20	Difference in means (2 IVs)	
Nov 25	Making regressions work for us	
Nov 27	No class: Thanksgiving break	
Cumulative review		
Dec 02	Cumulative review	Problem set 3 (noon before class)
Dec 04	Cumulative review	
Dec 09	Cumulative review	
Dec 11	Cumulative review	
Finals week		
Dec 16	Final exams	Final exam 2 - 4 pm (Section 2)
Dec 18	Final exams	Final exam 11 am - 1 pm (Section 1)