

# PSYC 3803: The Math of the Mind: An Introduction to Computational Cognitive Neuroscience

Instructor: Robert Wilson

## Course description

Welcome to PSYC 3803: The Math of the Mind. This class offers an introduction to the world of building mathematical and computational models to understand cognitive and neural processes. The philosophy of this course is to have you actually build these models and engage with the data to (re)discover the theories for yourself. To this end you will be deriving mathematical expressions for behaviors in different experiments, building computational models to simulate neural firing, and analyzing real behavioral and neural data. In addition, you'll have the opportunity to build your own models and experiments in a project that takes the place of the final. While computational methods can be applied to understand any aspect of Cognition, in this course we will focus on the computational modeling of decision making. By focusing on a single topic, the goal is to go deep down the modeling rabbit hole to really see how models are built, tested, and improved upon over time.

## Course objectives and learning outcomes

At the end of this course you should be able to:

- Understand how we can build mathematical and computational theories of cognitive and neural processes
- Understand how to test mathematical and computational theories against experimental data
- Build and simulate computational models of decision making on a computer (e.g. in Excel, Python or Matlab)

## Format of the class

This class is an in-person class. All material will be provided online on the class webpage and there will be regular meeting times where you will meet with me or the TAs in groups to discuss the current week's work.

## Office hours

I and the TAs will hold office hours every week in person and on zoom.

## Coursework and grading

### Grading scheme

Grades are based on a mixture of Assignments (80%) and Mini Projects (20%). Students may drop the lowest three assignments.

Grade boundaries will be at

- A - 90-100%
- B - 80-89%
- C - 70-79%
- D - 60-69%
- F - 0-59%

Depending on aggregate class performance, these boundaries may be revised downwards (e.g. to 87% for an A if the class is harder than expected) but will never be revised upwards.

### Assignments

The goal of the Assignments is to have you rediscover cognitive models of decision making for yourself. To this end assignments will involve working with the mathematics that underlies the models and connecting this mathematics to real behavioral and/or neural data. As often as not, you will be using neural data to *refute* models – exposing the limits of what is known and suggesting new modeling directions to explore.

### Projects

In place of exams, there will be a short project in at the end of the semester. In this project you will explore the material in a more open-ended manner – perhaps proposing your own model of decision making or testing an existing model on a new set of decision problems. The goal here is to have you think like a Computational Cognitive Neuroscientist.

### Extra credit

Occasionally Assignments will include an extra-credit problem for up to 5% extra credit. Completing these tasks is entirely optional.

## Grade disputes

Grade disputes about quizzes, paper grades or exams will be entertained for one week from the day the grade is posted.

If you feel your work has been incorrectly graded please write a short memo explaining your concerns clearly and concisely and submit this memo to the TA. We will then regrade the entire quiz, paper or exam, paying particular attention to the area of concern highlighted in the memo. Please note, however, that mistakes happen in both directions and it is possible that your grade could go down as a result of a regrade.

## Academic Integrity

All students are expected to adhere to the Georgia Tech Honor Code in all respects. Violations of the Honor Code are taken extremely seriously and will result in a failing grade in the course and a referral to the Dean of Students for further action. The full Honor Code can be found at <http://osi.gatech.edu/content/honor-code>.

## AI policy

You are free to use AI as a tutor but not a worker. That is, you may ask the AI for feedback and suggestions, but not have the AI simply do the work. This class is a chance to learn how to work with the AI.

## Accessibility and Accommodations

If you are a student with a disability and need academic accommodations, please see me and contact the Disability Resource Office (404-894-2563). Accommodations must be arranged through that office.