**UCB PSYCHOLOGY c123: *Computational Models of Cognition***

**UCB COGNITIVE SCIENCE c131: *Computational Models of Cognition***

**Lectures:** Tue & Thu, 8:00 am - 9:29 am on Zoom (instructions below)

**Sections:** 101 (W 3-3:59pm; YM); 102 (W 5-5:59pm; JS); 103 (W 6-6:59pm; JS); 104 (F 12-12:59pm; MR); 105 (F 1-1:59pm; MR); 106 (F 2-2:59pm; YM).

**Instructor**

Professor Anne Collins, Ph.D. (she, her). annecollins@berkeley.edu

**Graduate Student Instructors**

Yuan Meng (they, them); yuan\_meng@berkeley.edu

Milena Rmus (she, her); milena\_rmus@berkeley.edu

Jennifer Senta (she, her); jsenta@berkeley.edu

**Overview**

The objective of this course is to provide advanced students in cognitive science, psychology, and computer science with the skills to develop computational models of human cognition. Computational modeling is one of the central methods in cognitive science research, and can help to provide insight into how people solve the challenging problems posed by everyday life, as well as how to bring computers closer to human performance for some of these problems. The course will explore four ways in which researchers have attempted to formalize cognition – symbolic approaches, neural networks, probability and statistics, and neuroscience inspired methods – considering the strengths and weaknesses of each.

*Learning Objectives*

Acquiring a broad overview of the types of computational models and modeling methods used in the Cognitive Sciences; being able to implement and test a computational model.

*Course requirements*

The course is designed for advanced students in cognitive science, psychology, or computer science who are interested in developing computational models of cognition. Prerequisites are:

* a basic familiarity with programming in python (as might be obtained from CS 61A or Eng 7)
* exposure to cognitive science (e.g., CogSci C1)
* comfort with basic calculus (e.g., Math 1A) and discrete math (e.g., Math 55 or CS 70)

**Readings**

There exists no up-to-date undergraduate-level textbook on this topic. We will provide optional readings for those wanting to go further

**Lectures**

Please use the link below to register the first time you join a lecture. Note that you will need to sign into zoom with an account linked to your berkeley.edu email address.After registering, you will receive a confirmation email containing information about joining the meeting. The password is CompModCog.

<https://berkeley.zoom.us/meeting/register/tJ0pf-qqqj0uGNNmxFVtz3Iyi7ecOX4BAPS0>

I advise you to attend lectures in real time on Zoom, since I will encourage questions as well as discussion in break-out sessions. Research suggests that students learn more from synchronous lectures. However, you may watch the webcasts and review the slides at your leisure. They will be uploaded to bCourses shortly after each lecture.

***Remote Participation during Lecture***

* Please type questions into the chat box while I'm lecturing. A GSI will either reply to your question in the chat box or ask me to answer it.
* You will be pre-assigned to breakout rooms for peer-to-peer discussions
* I will occasionally ask you to participate by answering questions via the Zoom poll feature.

**Sections**

Section attendance is not mandatory, but strongly encouraged. Please attend the section to which you are assigned. Sections will cover review and related material helpful for the weekly problem sets, and give you a chance to ask the GSIs questions about the problem sets and class material. Sections are **not** for GSIs to provide answers or debug your code – please keep your questions at the conceptual level, or at details of how methods and algorithms work.

Please use the link below to register every time you join Section.After registering, you will receive a confirmation email containing information about joining the meeting. The password is CompModCog.

Section 101:

<https://berkeley.zoom.us/meeting/register/tJ0rcO6oqzMpEtRe42uNiRrKo8DECrPFD4fp>

Section 102:

<https://berkeley.zoom.us/meeting/register/tJIkfumoqzojGtGKmpFFNh92rElJtB5GQnQh>

Section 103:

<https://berkeley.zoom.us/meeting/register/tJUudOutqDgjE9fGF6IaPZKBfk3-B1o6T_Qy>

Section 104:  
 <https://berkeley.zoom.us/meeting/register/tJAkfu6srD0iE9RIn4hoQPoIy62VjGZu-18B>

Section 105:  
<https://berkeley.zoom.us/meeting/register/tJArdO2sqTMrHdHHyvBfvxkjY6nhXphSE0zj>

Section 106:

<https://berkeley.zoom.us/meeting/register/tJYvduiqqjguHdQzWIfOZRhjjySkc9g7NM0e>

**Office Hours**

Please use the links below to register the first time you join a specific type of office hours.After registering, you will receive a confirmation email containing information about joining the meeting. The password for all meetings is CompModCog.

***Prof. Collins*** *(annecollins@berkeley.edu)*

* Office Hours: Thursdays, 10-11am

<https://berkeley.zoom.us/meeting/register/tJYvce-gqT8iGtCrwsdjbanOEnjbbZHj7aTy>

* If this time doesn’t work for you, feel free to e-mail me with the title "Psych c123 / CogSci c131: Request forindividual meeting".
* For questions related to problem sets and other logistical matters, please reach out to your GSI.

***GSI Office Hours***

Jennifer Senta (*jsenta@berkeley.edul*)

Time: Mondays, 9am – 10am

Zoom link: <https://berkeley.zoom.us/meeting/register/tJcqd-CuqTgvH9cnC3nfhGkjVUjVzLhbWkjE>

Milena Rmus ([*milena\_rmus@berkeley.edu*](mailto:milena_rmus@berkeley.edu))

Time: Wednesday, 3pm-4pm

Zoom link: <https://berkeley.zoom.us/meeting/register/tJcvduGtrT4sEtG7zdOxSrNX1rFQG-_V9Qms>

Yuan Meng ([yuan\_meng@berkeley.edu](mailto:yuan_meng@berkeley.edu))

Time: Wednesday, 4pm-5pm

Zoom link: <https://berkeley.zoom.us/meeting/register/tJ0tceCqqD0rGNW9YaCV46TsYAn6LqM-Z0_e>

***Data Science Connector Assistants (CAs)***

We have two CAs for the class. The CAs are here to help support students with technical questions and coding. Please reach out to them for those questions (e.g. debugging, etc.), and to GSIs for more conceptual and course – content related questions (including modeling and theoretical issues). You can reach them through email, on piazza, or at their office hours.

Jessica Hu ([jessicayhu@berkeley.edu](mailto:jessicayhu@berkeley.edu))

Office hours: Mon and Wed – 10:00-11:00 AM

Zoom link: [https://berkeley.zoom.us/meeting/register/tJUkduiprzsqGtAYdKquLFKd-VIV0\_VXyygx](https://slack-redir.net/link?url=https%3A%2F%2Fberkeley.zoom.us%2Fmeeting%2Fregister%2FtJUkduiprzsqGtAYdKquLFKd-VIV0_VXyygx)

**Assessments**

* Weekly problem sets: 80% of course grade
* Weekly participation quizzes: 15% of course grade
* RPP participation (3 SONA credits): 5% of course grade
* No midterm or final exam

To make up for an “off” week, you will be allowed to drop your lowest problem set grade, and your lowest quiz grade from your final grade. Note that this applies only to grades for problem sets/quizzes you submitted, not to non-submitted problem-sets/quizzes that earned a zero.

**Problem sets**

There will be weekly problem sets based on material covered the weeks before. Problem-sets will be *open-book exams*, and you will be expected to abide by the UC Berkeley Honor Code (see below).

There are two kinds of questions in each problem set. Some are labeled “[HELP]” – these are ones that you may ask GSIs about. They will not provide answers, but can help you think about it or get started. You can also work together on programming these questions, but everyone must do their own write- ups. Other questions are labeled “[SOLO]” – these questions must be worked on and written up entirely on your own.

Problem sets will be released on Mondays and will be due the next week, on **Mondays at 11:59pm PST**. Problem sets will be distributed via gradescope, and you will submit your answers via gradescope. We will provide instructions specific to using gradescope. You will be granted a maximum of three 1-day extensions for the entire semester which you may use to handle minor personal problems (1 day maximum per problem sets). Problem sets submitted less than 24h after the deadline after the extension will lose 20% of the grade. Problem sets submitted more than 24h after the deadline will not be graded, and will receive 0 points. Make sure to start early on your problem sets!

Instructions for setting up your local environment with Python and Jupyter notebooks are provided on BCourses under Files/Technical docs. We will also be providing the option of using Jupyter hub for this course. This is a link where you can run Jupyter notebooks on a separate UC Berkeley-hosted environment, regardless of your computer’s Python setup.

You can connect to Jupyter hub at the following link (you will be prompted to sign in through BCourses):

<http://datahub.berkeley.edu/user-redirect/interact?account=ds-modules&repo=COGSCI-C131-PSYCH-123-FA20&branch=master&path=>

For each problem set, we ask you to also submit your code as a python file. We usually don’t check your full code, but having it handy helps us grade in case of issues/disagreements. Submitting your code in the right format will be counted as extra-credit for the corresponding problem set, adding 1 point to your grade converted to 100 (e.g. if you earned a 36/40 grade in PS2, or 91%, having submitted your code will bump your grade up to 92%).

**Quizzes**

Quizzes are meant to be short, low-stakes assessment of your learning and will account for 15% of the course grade. Research shows that frequent testing enhances understanding and retention of the learned materials, and we hope these quizzes will consolidate your learning. We also hope that they will flag any gaps in your learning that we can address promptly. The quizzes will be live for **24 hours** after each Thursday lecture, and you can take them any time during that window.

**RPP participation (3 SONA credits)**

Please read the document, "RPP Information for students", which has been updated with new information for this year.  Make sure you sign up for a SONA account. We recommend doing this as soon as possible. If you have any questions, you can contact RPP at [rpp@berkeley.edu](mailto:rpp@berkeley.edu). Please also see the deadlines listed on the [RPP webpage](http://psychology.berkeley.edu/students/undergraduate-program/research-participation-program).

**Extra Credit**

We will offer extra credit assignments over the course of the semester. Extra-credit assignments will be either an essay based on a reading, or a programming assignment with less guidance than problem sets. You will have three weeks to submit an assignment after it is released. Each extra-credit assignment can increase your final grade by 1 percent point maximum, for up to three extra-credit assignments (or a maximum of 3 percent points on your final grade).

**Questions**

If you have a quick question about the class material or an assignment, chances are that many other students have the same question! Please post it to [Piazza](http://piazza.com/berkeley/fall2020/cogscic131psychc123/home) so that everyone can benefit from seeing the answer, and one of us will answer your question as soon as we can. Of course, you'll probably get more detailed answers when you attend office hours – but chances are, you will get a quicker response if you post it online.

**Grading Policy**

You are not graded on a ‘curve’: all students who work hard & perform well will receive an A, regardless of how many other students also do well. We will use gradescope for grading. There will be no grade changes except for clerical errors. In fairness to everyone in the class, no exceptions will be made, so please refrain from asking. If you do find a clerical error, please use the gradescope request regrade function within **48h** to request a verification.

*Grade conversion*

Final grade letters will roughly correspond to the following point totals:

A+: 97-100%; A: 93-96%; A-: 90-92%; B+: 87-89%; B: 83-86%; B-: 80-82%; C+: 77-79%; C: 73-76%; C-: 70-72%; D+: 67-69%; D: 63-66%.

Do point out any clerical errors to your GSI, but do not try to negotiate a better grade. Asking for special treatment puts your GSI in an awkward position... and reflects poorly on you (see UC Berkeley's Statement on Academic Integrity and Principles of Community below).

**Accommodations:** Please let your GSI know if you need accommodations for any physical, psychological, or learning disability (DSP program); or if you'd like to provide emergency medical information.We cannot handle last minute requests – ***please make your request at least 48h before an assignment due date.***

**Learning Goals**

Your GSIs and I hope you find this course interesting and challenging. We want you to get to the point where you have a broad enough overview of computational models of cognition to think critically about them, and to be able to go deeper by yourself if interested. We also want you to get to the point where you are able to code an existing computational model yourself – whether or not you ultimately pursue a career related to cognitive science or computational modeling.

**Statement on Academic Integrity**

You are expected to abide by the UC Berkeley Honor Code: “As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others.” The University defines academic misconduct as “any action or attempted action that may result in creating an unfair academic advantage for oneself or an unfair academic advantage or disadvantage for any other member or members of the academic community.”

**UC Berkeley's Principles of Community**

• We place honesty and integrity in our teaching, learning, research and administration at the

highest level.

• We recognize the intrinsic relationship between diversity and excellence in all our

endeavors.

• We affirm the dignity of all individuals and strive to uphold a just community in which

discrimination and hate are not tolerated.

• We are committed to ensuring freedom of expression and dialogue that elicits the full

spectrum of views held by our varied communities.

• We respect the differences as well as the commonalities that bring us together and call for

civility and respect in our personal interactions.

• We believe that active participation and leadership in addressing the most pressing issues

facing our local and global communities are central to our educational mission.

• We embrace open and equitable access to opportunities for learning and development as our

obligation and goal.

**Conduct:** The University of California strives to prevent and respond to harassment and discrimination. Engaging in such behavior – even online – may result in removal from class or the University.

**CLASS SCHEDULE (subject to change)**

**PART 0 Foundations**

*Lectures 0-3 (Aug 27 – Sept 8).*What is this course about? What is a model? How do I know if a model is good?

**PART 1 Rules and symbols**

*Lectures 4-8 (Sept 10 – Sept 24).* Logic, formal systems and cognitive architectures. Applications to language and categorization.

**PART 2 Networks, Features and Spaces**

*Lectures 9-15 (Sept 29 – Oct 20).* Spatial representations, similarity and neural networks. Applications to memory, language and categorization.

**PART 4 Probability and statistics**

*Lectures 16-21 (Oct 22 – Nov 10).* Bayes rule, graphical models, inference. Applications to decision making, memory, etc.

**PART 3 Neuroscience and dynamics**

*Lectures 16-21 (Nov 12 – Dec 3).* Biological neural networks, dynamic algorithmic models. Applications to memory, decision making and learning.

**Quizzes will be posted at 9:30am every Thursday, starting 9/3.** Complete within 24 hours.

**Problem sets will be posted every Mondays, starting 9/7.** They will be due the following week’s Tuesday (starting 9/15) **at 8am.**

**Problem set 0 released on 8/28.** This problem set will not be graded, but will provide a strong Python and Jupyter notebook brushup. Make sure to complete it to be prepared for the following problem sets.

**Resources**

***Educational***

● Student Learning Center – 642-9494, <http://slc.berkeley.edu>

● Disabled Students’ Program (DSP) – <http://dsp.berkeley.edu>

● Educational Opportunity Program: <https://eop.berkeley.edu/>

● Centers for Educational Equity and Excellence: [https://ce3.berkeley.edu/](mailto:https://ce3.berkeley.edu/)

***Remote instruction***

● Berkeley Fall Semester News:

<https://news.berkeley.edu/2020/07/21/fall-semester-update-student-resources-for-remote-instruction/>

● Remote learning resources – <https://publichealth.berkeley.edu/student-life/remote-learning/>

● Registrar instruction FAQ – <https://registrar.berkeley.edu/service-adjustments/instruction-faq>

● Student technology equity program – <https://technology.berkeley.edu/STEP>

***Research experience***

For those of you interested in gaining research experience, either as volunteers or for course credit: check out URAP (<http://urap.berkeley.edu/)> or the Student Services Office in Psychology.

***Mental health***

● Counseling and Psychological Services, Tang Center – 2222 Bancroft Way, 642-9494,

<http://uhs.berkeley.edu>

● Social Services (Counseling for specialized concerns): https://uhs.berkeley.edu/socialservices

***Assistance with basic needs***

● Basic Needs Center: [basicneeds.berkeley.edu](mailto:basicneeds.berkeley.edu)

***Campus climate and equity***

If you are the subject of harassment or discrimination, please contact the Confidential Care Advocate ([sa.berkeley.edu/dean/confidential-care-advocate](http://sa.berkeley.edu/dean/confidential-care-advocate)). Survivors of sexual violence may also want to view <http://survivorsupport.berkeley.edu/>.For more information, please visit <http://ophd.berkeley.edu/>.

● Report an incident: <https://campusclimate.berkeley.edu/report-incident>

● Report offensive online behavior: [zoom-misuse@berkeley.edu](mailto:zoom-misuse@berkeley.edu)

● Centers for Educational Justice and Community Engagement:

[https://campusclimate.berkeley.edu/students/ejce/about](mailto:https://campusclimate.berkeley.edu/students/ejce/about)

● Undocumented Student Program: [undocu.berkeley.edu](mailto:undocu.berkeley.edu)

● Office for the Prevention of Harassment and Discrimination: https://ophd.berkeley.edu/

● Support for Muslim Students: [campusclimate.berkeley.edu/sswana-initiative](mailto:campusclimate.berkeley.edu/sswana-initiative)

● Berkeley Hillel: [berkeleyhillel.org](mailto:berkeleyhillel.org)

***Interpersonal issues on campus***

● Ombudsperson for Students – 102 Sproul Hall, 642-5754

**Course evaluations**

Please take the time to provide constructive feedback by completing evaluations for your faculty instructor (me) and your GSI at the end of the semester. We value your feedback, and will use it to improve both the course and our instruction.