

# LING 3340: Introduction to Computational Linguistics

Yang Wang  
Syllabus (LONG)

---

## Course

Semester: Spring 2025

Time: T/TR 12:25 - 01:45PM

Textbook: None

Website: Canvas/Discord

Location: ARCH 229

Prerequisites: LING 2200 and (LING 2300 OR CS 1420)

## Instructor

Email: [yangx.wang@utah.edu](mailto:yangx.wang@utah.edu)

Office Hours: MW 10 AM-11:30 AM / by appt.

Pronoun: she/her/hers

Location: LNCO 2321

---

## 1 Important dates

Event	Date
Last day to add without a permission code	01/10, Friday Week 1
Last day to wait list	01/10, Friday Week 1
Last day to add, drop (delete), elect CR/NC, or audit classes	01/17, Friday Week 2
Last day to withdraw from classes	03/07, Friday Week 9
Last day to reverse CR/NC option	05/02, Friday Week 15

## 2 Course Description

An introduction to computational linguistics for students with previous programming experience. This course explores the models, algorithms, and techniques that dominate modern-day language technology, and it evaluates them from a linguistically informed perspective. Topics include corpus-based methods, finite-state approaches, word vectors, computational models of cognitive processes, and model evaluation techniques. Great emphasis is put on discussing the limitations of existing techniques and how they might benefit from linguistic insights. We also discuss Ethics in AI and in Natural Language Processing, and the way fairness considerations should inform data collection and algorithm design. Students will also hone their programming skills and develop familiarity with state-of-the-art software packages for computational linguistics.

### 2.1 More about this course

Computational linguistics is a large, multifaceted and rapidly expanding field. There are many different kinds of work that might be classified as “computational linguistics”, differing in

- goals (e.g., build a useful gadget, test a linguistic theory), and

- empirical domains (e.g., sounds, words, sentences),

but there are certain core analytical concepts, tools, and techniques that frequently appear throughout. Broadly speaking, the relevant foundational concepts concern the computational nature and properties of the kinds of systems that you have learned about in linguistics courses, namely grammars. This course aims to highlight these common ideas, starting with their simplest instantiations and gradually building up towards the more complex cases. The simple cases will probably closely parallel certain things you may have learned about in mathematics or computer science courses, and the more complex cases will hopefully look similar to things you have learned about in linguistics courses. An important goal is to highlight the connections between these areas. As a preview, some of the biggest ideas that will come up repeatedly are:

- recursive generation of infinitely many expressions by a finite machine,
- interchangeability/intersubstitutability of subexpressions within larger expressions, and
- an appreciation of the insights that can be gained by studying the human mind through the lens of formal/computational models

### 3 Course materials

#### 3.1 Readings

There is no required textbook for this course. All materials (assignments, notes, readings) will be distributed through the course website on Canvas. But if you are interested in the topics covered in this class and want to dive deeper into them, here are some popular textbooks that would be fun and helpful:

- Hopcroft & Ullman (1979), *Introduction to Automata Theory, Languages and Computation*: chapters 2–5
- Sipser (2013), *Introduction to the Theory of Computation* (3rd ed.): chapters 1, 2
- Manning & Schütze (1999), *Foundations of Statistical Natural Language Processing*: chapters 6, 9–12
- Jurafsky & Martin (2009), *Speech and Language Processing* (2nd ed.): chapters 2, 4, 6, 12–14, 16
- Partee, Meuleun & Wall (1987), *Mathematical Methods in Linguistics*: chapters 16, 17, 18

#### 3.2 Software

Most of the homework exercises will involve writing or modifying small programs. The programming language we will use is Python 3. You will need access to a computer with a text editor and Python 3 installed (<https://www.python.org/downloads/>).

## 4 Requirements and grading (tentative)

### 4.1 Grade break-down

		+		-
Homework assignments	60%	A	94–100%	90–93.99%
Class participation	10%	B	87–89.99%	84–86.99%
Reading reflections	10%	C	77–79.99%	74–76.99%
Final project	20 %	D	67–69.99%	64–66.99%
In total	<b>100%</b>	E	$\leq 59.99\%$	

### 4.2 Homework assignments (60% in total)

Six homework assignments will be a mix of theoretical exercises, and coding practices in Python. Please do not email me your assignments. **Late assignments will not be automatically graded.** If you need an extension to any homework, please contact me **prior to** the deadline to make arrangements.

Students are permitted (encouraged, even!) to collaborate on homework assignments. However:

- Each person must hand in their own assignment that is reflective of their own understanding (no direct copies or jointly authored assignments are allowed).
- You must list at the top of your assignment all of the people you’ve collaborated with.

Your discussions should abide by (both the letter and spirit of) the “whiteboard policy”: you may work together on a whiteboard and discuss things for as long as you wish and in as much detail as you wish, but then you must erase the whiteboard and not take any written notes away from this discussion. The idea is that being able to write up your solution individually establishes that you understand what you submit.

### 4.3 Class participation (10%)

Class participation is highly encouraged and can take various forms:

- asking questions in class and participating during in-class discussions
- participating in office hours
- pointing out problems with the lecture notes (e.g. typos, confusing wording, broken code)
- frequent use of the course Discord channel (this includes both asking questions of your own and answering fellow students’ questions)
- posting links to relevant online material (e.g. tutorials or news paper articles)
- participating in the Linguistics Department research events (e.g. colloquia)

#### 4.4 Reading reflections (10%)

During this course, we will conduct an in-depth analysis of five selected papers (see schedule for paper release and due). To guide your understanding and encourage critical thinking, I will provide prompts for you to reflect on as part of your reading assignments.

#### 4.5 Final project (20%)

A final project will be due by the end of the semester. I encourage students to work in groups with different backgrounds (e.g. a linguist and a CS/DS major), but I won't enforce it and I will also allow individual projects. Final projects can be of the following types:

1. Implement your own software targeting an NLP problem (max. 3 students per group)
2. An analysis of an interesting linguistic phenomenon using formal language theory (max. 1 student; this should include a brief write-up; ~ 5 pages; max 10 pages)
3. Implement a software implementation of an algorithm related to topics we discuss in class (max. 2 students per group; this must go beyond what's covered in the homework and include a brief write-up; ~ 5 pages; max 10 pages).
4. Formulate a research proposal for a computationally informed linguistic question, and conduct an extensive (critical) literature review on the topic (minimum 10 pages, max. 1 student)
5. Propose a pilot experiment that frames its hypothesis in terms of computational linguistics (max. 1 student per group; ~ 5 pages; max 10 pages)

Student projects (topic and group composition) must be approved by the instructor. Students are encouraged to attend office hours during the first half of the semester to brainstorm ideas. **An official proposal (max. 500 words) will be due at the end of week 8.** Rubrics for each project will be shared with the students following the approval of their proposals.

#### 4.6 Extra credits (up to 5% bonus to final grade)

##### SONA credit (1% bonus to final grade)

In this course students can earn one extra credit for participation in Linguistics studies this semester. For more information and to sign up for linguistics studies, please visit: <https://sites.google.com/view/speech-acquisition-lab/participate-in-experiments>.

If you need accommodation of any kind, have a question about accommodation, and/or prefer to complete an alternative assignment for any reason, please create a SONA account and then email us at [speechlab@utah.edu](mailto:speechlab@utah.edu). Arrangements for alternative assignments must be made before the current semester's add/drop deadline. If no study appointments are available, check back later, as new appointments are added periodically. If you have any questions or concerns regarding the Linguistics Study Pool or the Sona sign-up system, please contact the Linguistic Study Pool coordinators at [speechlab@utah.edu](mailto:speechlab@utah.edu).

### **Thinking beyond the class (2% bonus to final grade)**

On certain weeks, I will provide short questions to encourage deeper reflection. These questions may go beyond the material covered in class, requiring additional thought and potentially some extra research. The goal is to help you develop research and problem-solving skills that are valuable and transferable to various contexts. Since these tasks involve extra effort, they will be offered as opportunities for extra credit.

### **Learning beyond the class (2% bonus to final grade)**

You may receive 2 extra credits for learning on your own beyond this class. You can opt for

- attending an academic talk on any topic in the University of Utah community. For this, you will need to send me proof that you attended the talk (e.g., a picture of the speaker in the room), plus a one-page reflection on the talk.
- watching a colloquium talk online. For this, I will post some Youtube links at the end of this week. If there are some live events, I will also post the links on Discord. For this, again, you will need to send me a one-page reflection on the talk.

This extra credit assignment may be completed multiple times during the semester for multiple points of extra credit.

## **5 Course policies and getting help**

- **Discord:** I will create a discord server for this class. To join, use the invitation link on Canvas. You should use this server for discussions about the content of lectures or about homework assignments. Please don't reveal the answers to assignments!
- **Emailing:** You can email me at the address ([yangx.wang@utah.edu](mailto:yangx.wang@utah.edu)), with "LING 3340" somewhere in the subject line for any logistical/administrative matters. I will respond to emails within 24 hours.
- **Use of Generative AI (e.g., ChatGPT, Grok):** It is expected that students adhere to University of Utah policies regarding academic honesty, including but not limited to refraining from cheating, plagiarizing, misrepresenting one's work, and/or inappropriately collaborating. This includes the use of generative artificial intelligence (AI) tools without citation, documentation, or authorization. Yet if you believe that using AI tools is helpful for you to learn the concepts in this class, I am happy to discuss this together with you.

## 6 Course schedule (tentative)

<i>Week</i>	<i>Date</i>	<i>Topic</i>	<i>Homework (Monday)</i>	<i>Reading schedule</i>
1	1/07	Syllabus + big picture		
	1/09	Python basics		EOW: R1 assigned
2	1/14	Recursion and induction		
	1/16	Basics of formal language theory		
3	1/21	Finite state automata	HW1 due	
	1/23	Recursive generation using FSAs		
4	1/28	Relating regular expressions and e-FSAs		Mon: R1 reflection due
	1/30	Intersecting FSAs		EOW: R2 assigned
5	2/04	Forward-backward sets		
	2/06	Are natural languages regular?		
6	2/11	Probabilistic FSAs	HW2 due	
	2/13	Semirings		
7	2/18	Context-free grammars		Mon: R2 reflection due
	2/20	More on context-free grammars		EOW: R3 assigned
8	2/25	Inside outside values		
	2/27	Probabilistic CFGs		
9	3/04	Bottom-up parsing with CFGs		
	3/06	Top-down and left-corner parsing	HW3 due ( <b>Sunday</b> )	
10	3/11	<a href="#">Spring break</a>		
	3/13	<a href="#">Spring break</a>		
11	3/18	Tree languages		Mon: R3 reflection due
	3/20	Tree grammars		EOW: R4 assigned
12	3/25	Subregular languages I	HW 4 due	
	3/27	Subregular languages II		
13	4/01	Mildly context-sensitive grammars I		
	4/03	Mildly context-sensitive grammars II		
14	4/08	Word embeddings I	HW5 due	<b>Wed:</b> R4 reflection due
	4/10	Word embeddings II		<b>Wed:</b> R5 assigned
15	4/15	Connections to NLP I (POS tagging)		
	4/17	Connections to NLP II (Neural nets)		
16	4/22	Ethics in AI; Course wrap-up	HW6 due	Mon: R5 reflection due
	4/24	No class		
17	Finals week	Final project	Due: April 30th	11:59 pm MDT

*Note:* This syllabus is meant to serve as an outline and guide for our course. Please note that I may modify it with reasonable notice to you. I may also modify the Course Schedule to accommodate the needs of our class. Any changes will be announced in class and posted on Canvas under Announcements.

## 7 University Policies

1. **The Americans with Disabilities Act.** The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to [the Center for Disability & Access](#).

Given the nature of this course, attendance is required and adjustments will only be permitted as required by Policy 6-100(III)(O). If you need to seek an ADA accommodation to request an exception to this attendance policy due to a disability, please contact the Center for Disability and Access (CDA). CDA will work with us to determine what, if any, ADA accommodations are reasonable and appropriate.

In compliance with ADA requirements, some students may need to record course content. Any recordings of course content are for personal use only, should not be shared, and should not be made publicly available. In addition, recordings should be destroyed at the conclusion of the course.

2. **University Safety Statement.** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit <https://safeu.utah.edu>
3. **Addressing Sexual Misconduct.** Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information.

If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 383 South University Street, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

**Lauren's Promise:** Lauren's Promise is a vow that anyone – faculty, staff, students, parents, and community members – can take to indicate to others that they represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking. Anyone who makes Lauren's Promise vows to: 1.) listen to and believe those individuals who are being threatened or experiencing sexual assault, dating violence or stalking; 2.) represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking; and 3.) change campus culture that responds poorly to dating violence and stalking. By making Lauren's Promise, individuals are helping

to change campus cultures that respond poorly to dating violence and stalking throughout the nation.

4. **Academic Misconduct Statement.** It is expected that students adhere to University of Utah policies regarding academic honesty, including but not limited to refraining from cheating, plagiarizing, misrepresenting one's work, and/or inappropriately collaborating. This includes the use of generative artificial intelligence (AI) tools without citation, documentation, or authorization. Students are expected to adhere to the prescribed professional and ethical standards of the profession/discipline for which they are preparing. Any student who engages in academic dishonesty or who violates the professional and ethical standards for their profession/discipline may be subject to academic sanctions as per the University of Utah's Student Code: <https://regulations.utah.edu/academics/6-410.php>
5. **Drop/Withdrawal Policies.** Students may drop a course within the first two weeks of a given semester without any penalties. Students may officially withdraw (W) from a class or all classes after the drop deadline through the midpoint of a course. A "W" grade is recorded on the transcript and appropriate tuition/fees are assessed. The grade "W" is not used in calculating the student's GPA. For deadlines to withdraw from full-term, first, and second session classes, see the U's Academic Calendar.

## Acknowledgements

Much of the materials used in the lectures, assignments and quizlets in this course comes from previous iterations designed by Dylan Bumford, Tim Hunter, and Laurel Perkins from UCLA and Connor Mayer from UCI.



## 8 Calendar for our class (tentative)

<i>Week</i>	<i>Date</i>	<i>Comments</i>
1	1/12 (Sunday)	Reading 1 post
2	1/13 (Monday)	Homework 1 post
3	1/20 (Monday)	Homework 1 due Homework 2 post
4	1/27 (Monday)	Reading 1 reflection due
	02/02 (Sunday)	Reading 2 post
6	2/10 (Monday)	Homework 2 due Homework 3 post By this week, you should meet with Yang to talk about your final project
7	2/17 (Monday)	Reading 2 reflection due
	2/23 (Sunday)	Reading 3 post
8	03/02 (Sunday)	Project proposal due
9	03/09 (Sunday)	Homework 3 due Homework 4 post
11	3/17 (Monday)	Reading 3 reflection due
	3/23 (Sunday)	Reading 4 post
12	3/24 (Monday)	Homework 4 due Homework 5 post
14	4/07 (Monday)	Homework 5 due Homework 6 post
	4/09 (Wednesday)	Reading 4 reflection due Reading 5 post
16	4/21 (Monday)	Homework 6 due Reading 5 reflection due
17	04/30 (Wednesday)	Final project due