

CS 399 - Senior Thesis Seminar

Student Syllabus

Fall 2020 - Spring 2021

Course Details

Senior thesis seminar is a **required** course for computer science majors. It **must** be taken in the fall of senior year. The required fall course (CS 399 **A**) focuses on writing a literature review and developing a problem idea and associated formalized problem statement. The spring course (CS 399 **B**) is an *optional* research-focused semester during which students will perform the research that was proposed during the fall course. The spring semester of thesis seminar counts as a 300-level elective towards the computer science major. Students planning to do a full-year thesis should ideally get started with the research portion of their work during the fall semester so they have more time to perform the research.

All information about the course can also be found on the course website: <http://www.cs.haverford.edu/courses/cmsc399>

Instructor Sorelle Friedler sorelle@cs.haverford.edu

You will also be assigned a faculty thesis advisor who you will meet with regularly and who will supervise the content of your thesis.

Prerequisites Senior standing and a declared computer science major at Haverford.

Class Time and Office Hours

Class: F 1:30 - 4pm, **online** - see class Google calendar on the class website for the Zoom link.
Office Hours: by appointment.

Add the class Google calendar for all times and deadlines. Any changes to them will be indicated there. Some weeks this course will not meet - this will also be shown on the calendar.

Double Majors Students who are double majors may find that their other major seminar is at the same time as the CS seminar. In that case, it is the *student's* responsibility to ensure that they are communicating regularly with the instructors of both seminars as well as making all deadlines for both majors. Double majors are expected, at a *minimum*, to attend weeks 2 (thesis requirements), 5 (peer review in class), 10 (peer review in class), 13 (poster requirements), and 14 (poster session) of the CS fall seminar, and weeks 5 (peer review in class), 10 (peer review in class), 12 and 13 (thesis presentation practice), and Monday, May 17th (thesis presentation) of the spring seminar.

Navigating an online class

This class will be entirely remote, so wherever you are in the world I hope you will be able to fully participate in it. While many aspects of the class will be the same as in past in-person semesters, there will be a few important changes / additions to normal procedure:

Zoom attendance Students will be expected to attend all course sessions “in person” (on Zoom). Students who can not attend a specific class or lab during a week are expected to email the professor in advance - illness is a common and reasonable reason not to be able to attend.

Zoom etiquette When attending class via zoom, students should pay attention to the below aspects of their presence in the course:

video Students should keep their video on so that the class can feel as much like a group gathering as possible. However, this may not be possible for all students at all times given bandwidth, surroundings, and comfort given that the class sessions will be recorded. Students who are not able to have their video on during full class meetings should consider turning them on when in small breakout rooms (which are not recorded).

audio Students should remain on mute unless they would like to speak. We’ll use the “raise hand” feature when students have questions.

name Students should change their names to be the name they would like to be called during class (e.g., the nickname they go by) as well as enough information so that this name can be matched to the name on the class list easily (e.g., including a last name). Students should also include their desired pronouns. For example, the professor’s name on Zoom should be listed as: Sorelle Friedler (she/her). Please change this in your settings so that you do not need to remember to change it for each class.

Slack The QuaCS slack instance will be used regularly for short questions. A private class channel will be set up and class announcements will be posted there. Students are expected to monitor this slack channel at least daily so that any announcements are seen within *24 hours*.

Email Longer announcements may be sent to the class via email. Students are expected to check email at least daily so that any announcements are seen within *24 hours*.

Office hours Office hours will be by appointment only - email the instructor to arrange a time.

Prompt Responses We will not be able to track each other down in person this semester - I will not be traveling to campus, and many of you are also remote. That means that prompt responses to slack or email messages are especially important. Students are expected to respond to any (direct) message (via slack or email) from the professor *within 24 hours* (or on the next weekday) and the professor will also make every effort to do so. Responses that indicate receipt of the message with a longer (also prompt) response to follow are a reasonable way to respond immediately if a longer response is not yet possible.

Be on time Since all interaction with the professor and your advisor will be remote, it’s especially important to be on time! Sitting in a zoom room by yourself is sad. Please respect our time by being on time if you schedule an appointment. You should also be on time for all class sessions.

For students not in the Eastern U.S. time zone Students who can not attend *any* weekly lecture sessions because they are in a time zone where the class meets in the middle of the night must email the professor and will be excused from class attendance; such students will be required to be in regular email contact with the professor.

Main Student Checkpoints

Fall semester

- Second week: faculty advisors assigned.
- **Friday, Oct 16th by 5pm:** first draft of literature review completed. Any papers or sections that are incomplete should be fully outlined. You should expect to hand in about 10 pages of writing at this checkpoint - the exact number of pages may differ based on thesis topic / field, so double-check with your advisor if you are unsure.
- **Friday, Nov 20th by 11:59pm** before thanksgiving break: first *full* draft of literature review completed. You should expect to hand in 15-20 pages of writing at this checkpoint.
- Last day of classes: virtual poster presentation during class.

- Last day of exam period: finished literature review due. You should expect your final literature review to be 20 - 30 pages.

Spring semester

- First week: weekly meeting time set. You should meet with your advisor individually each week for at least 30 minutes.
- **Friday, March 26th**: first draft of full thesis completed. Any sections (e.g., experiments) that are incomplete should be fully outlined. Extended onto your fall literature review, you should expect your thesis to be 40-50 pages at this checkpoint
- **Monday, April 30th** - two weeks before classes end: **final version due**. Your final thesis should be 40 - 60 pages.
- **Monday, May 17th** - Monday after classes end: thesis presentations.

Fall literature review expectations

All theses should present an in-depth exploration of a topic in computer science. The paper should demonstrate the student's ability to apply, in a new context, the fundamental themes that connect all CS classes, such as:

- separating the problem definition from its solution
- describing clearly a proposed solution (typically with examples)
- understanding the correctness and applicability of a proposed solution
- comparing several proposed solutions in terms of clarity, resource requirements, etc.

It is common for the paper to center on a particular algorithm or computing system, and present the correctness and/or computational complexity thereof. However, this is not required; the one core requirement is that the student demonstrate the ability to think deeply and communicate clearly about a computer science topic.

In order to satisfy the requirements for graduation with a computer science major, students must write a literature review by the end of the fall semester that satisfies the below rubric for earning a 2.0 by writing a non-trivial literature review/exposition of existing graduate-level published work.

Rubric for a 2.0

For the introductory material, is it:

- readable by someone who has understood only the core CS undergrad material (e.g. programming languages, hardware, theory, algorithms, and at least one intensive systems course such as compilers or O.S.)
- detailed enough to be clear to someone within the field

For the discussion of related work, does it:

- include all the important related/foundational work
- clearly identify what problem is being addressed by each work (possibly one statement of this for many/all the works)
- clearly state the basic approach being taken
- explain how each paper supports/evaluates its own results (proof/empirical-study/ad-hoc argument)
- make clear how this work relates to the thesis itself
- in at least one case, really address the nuts and bolts of how the approach works (possibly several such discussions will be needed to address the point above)

Spring thesis expectations

Rubric for a 4.0

A substantial written contribution that demonstrates original thinking / insight about a research area inside computer science, under the supervision of a faculty member. This should include a full literature review, appropriate replication of existing work, and either:

- A clear hypothesis (model), validation (proof / experiments), and analysis; OR
- Original expository work, including the extension of a proof, or a new proof of an existing theorem.

Since such theses include original material, they may constitute part of a publication (typically a joint publication with the advisor). However, publication is not required to receive a 4.0.

An original insight, as would be found in a thesis at the 4.0 level, is by definition not previously discussed in the published literature. Such insights thus constitute contributions to the primary source material of the field, and are often suitable elements of an article at the level of a reputable workshop for faculty, e.g., CCCG or LCPC. Note that Haverford's CS department views the significance of a contribution in the terms used broadly in the natural sciences and mathematics, i.e., as a contribution to our understanding of a topic (many subfields of CS have an engineering sensibility, and consider a contribution significant only if it allows us to achieve some result in a better way). For example, a 4.0 thesis could be based on a new proof of a known fact, or on a well-conducted experiment that demonstrates that a given system or approach does not provide an expected benefit and sheds light onto why.

Rubric for a 3.0

A confirmation and reiteration of existing work with an incremental contribution. Specifically, this includes a full literature review and either:

- A good and complete confirmation of an existing experiment on new data, including a good analysis. OR
- An exposition of non-trivial graduate-level published work, including an existing proof or deep explanation of its extension / applicability (or its lack of extension) to other related concepts.

Grading

Grades for senior thesis will be determined based on two components:

1. 25%: attendance, participation, and meeting deadlines
2. 75%: assessment of the written thesis

The first component includes:

- a) attendance at each class meeting,
- b) participation in class,
- c) presenting at the poster presentation (fall) or thesis presentation (spring),
- d) attending at least one computer science (or related) talk on campus,
- e) meeting with your advisor regularly,
- f) and meeting all deadlines.

The second component is determined based on your first reader (advisor) and second reader's assessment of the quality of your written thesis as well as its demonstration of your understanding of the material (see rubric above).

Week-by-week course plan / Deadlines

If not otherwise indicated, deadlines are on **Friday at 5pm** and written work should be submitted via email to both your advisor and the instructor of this course. The schedule below is *tentative* and will be confirmed week-by-week in class.

Spring of junior year

Exam Week. Presentations by CS faculty on possible thesis topics, including links to further reading.

Summer before senior year

Summer. Further explore the possible topics by doing the suggested readings and, possibly, contacting faculty advisors for further information and self-study.

Fall semester

Week 1. Week of Sept 7th.

Topics:

- Discussion of expectations and requirements.

Weekly tasks:

- a) Before class: determine advisor preferences. Talk to potential advisors if necessary. Advisors will be determined based on the stable matching algorithm, so students should be prepared to give a ranked list of at least 3 potential advisors and topics.
- b) In class: graduation requirements worksheet.
- c) In class: faculty advisor request sheet.
- d) After class: read this syllabus and the faculty syllabus.

Week 2. Week of Sept 14th.

Topics:

- How to write a literature review.
- How to find appropriate sources.
- Using LaTeX.

Weekly tasks:

- a) Checkpoint: Faculty advisors assigned; assignments distributed in class. There may be a few students who need to meet with possible advisors to finalize their assignment.
- b) Read *before* class: *Reading with Purpose* by Suresh Venkatasubramanian

Week 3. Week of Sept 21st.

Weekly tasks:

- a) **Due:** Weekly meeting time arranged with your advisor (30 minutes minimum). First meeting held. You should have a clear list of written down assignments from this meeting that you will attempt to complete over the next week before your next meeting.

- b) Do a detailed reading of at least one of the papers assigned by your advisor. Your advisor may have a suggestion as to which paper to focus on first. There will be parts of this paper that you do not understand entirely yet - that's ok! Make a written list of questions you have about the paper. Start by searching online and talking to other classmates with the same advisor to see if you can answer the questions yourself. If not, come prepared to talk to your advisor about them at your next meeting.
- c) Come to class this week prepared to describe the above paper to your classmates in small groups.
- d) Read through, though potentially in less detail, at last two other papers assigned by your advisor. The goal of reading these papers is to get a general sense of what problems are studied in the subfield you'll be working in, and what various perspectives are on those problems. Thus, it's most important to understand the introductory sections and the conclusion for this first read-through of these papers, though you should attempt to understand all sections. In papers that have both theoretical and experimental sections you might find, e.g., that skipping ahead to the experimental section helps you understand the point of the paper. Even though the papers are short, you should expect that reading them well enough to understand them takes a long time!
- e) As you continue reading papers, start writing down summaries of important parts of those papers. You will keep extending these descriptions until you have a full literature review.

Week 4. Week of Sept 28th. No class: meet with your advisor.

Weekly tasks:

- a) Meet with your advisor. Report back on your progress from the past week and ask questions about the papers you read. Write down assignments for the coming week.
- b) Start writing your draft literature review. In addition to the descriptions of the papers you've already started writing, you'll need to write an introduction about the subfield and discuss your proposed research project plans.

Week 5. Week of Oct 5th. Peer review.

Weekly tasks:

- a) Class held: peer review in class.
- b) Continue weekly meetings with your advisor.
- c) **Due:** Bring a pdf copy of your literature review draft to class.
- d) In class: you will read and comment on two other students' literature review drafts. One will be a student also working with the same advisor and writing a thesis on a topic that is similar to yours. The other will be a student working with a different advisor on a very dissimilar topic.

Week 6. Week of Oct 12th. No class: meet with your advisor

Weekly tasks:

- a) **Due:** Draft literature review and project proposal. Email a pdf to your advisor and the instructor of this course to hand in your draft.

Week 7. Week of Oct 19th. No class: meet with your advisor

Weekly tasks:

- a) Keep reading papers and thinking about research project ideas.

Week 8. Week of Oct 26th.

Weekly tasks:

- a) Class held: check in meeting and discussion of spring semester.
- b) Continue weekly meetings with your advisor; receive feedback on your current draft.
- c) Incorporate your advisor's feedback into your literature review.

Week 9. Week of Nov 2nd. No class: meet with your advisor.

Weekly tasks:

- a) Continue weekly meetings with your advisor.
- b) Discuss potential plans for continuing your thesis work in the spring.

Week 10. Week of Nov 9th. Peer review.

Weekly tasks:

- a) Continue weekly meetings with your advisor.
- b) Discuss what a full draft of your literature review should include.
- c) **Due Friday, Nov 13th** Deadline to register for the spring semester of thesis (CMSC 399 B).
- d) Students planning to continue thesis in the spring should start their research at this point in the fall semester and continue it simultaneously with the further revision of their literature review.
- e) **Due Friday, Nov 13th:** Bring a pdf copy of your full draft of the literature review to class for peer review.

Week 11. Week of Nov 16th. No class.

Weekly tasks:

- a) Continue weekly meetings with your advisor.
- b) Due on **Friday, Nov. 20th** before break: full draft of the literature review. Should include revisions based on last week's Friday peer review.

Week 12. — **Thanksgiving break week** —

Week 13. Week of Nov 30th

Topics:

- a) How to make a CS research poster.
- b) Discussion of remaining sections to add and changes to make to your literature review.
- c) Discussion of plans for winter break with students continuing in the spring.

Weekly tasks:

- a) Continue weekly meetings with your advisor.
- b) **Due:** Watch *all* of this video **before** class: <https://www.youtube.com/watch?v=1RwJbhkCA58>.

Week 14. Week of Dec 7th

Weekly tasks:

a) **Due:** Virtual poster presentation on **Friday, 1 - 4pm**

Week 15. Exam period.

Due at the end of exams: your final literature review.

Winter break

Students who are continuing on in the spring and planning to do large implementation portions of their thesis should take advantage of the time over break to get started and ideally complete the bulk of the implementation over winter break. This will leave you time to refine, solve discovered issues, and run and revise experiments once you are back to having regular meetings with your advisor on campus.

Spring semester

Week 1. Week of Feb. 15th. **Due:** A weekly individual meeting should be set with your advisor.

Week 2. Week of Feb. 22nd. No class. Ongoing meetings with your advisor.

Week 3. Week of Mar. 1st. No class. Ongoing meetings with your advisor.

Week 4. Week of Mar. 8th. Class progress checkin. Ongoing meetings with your advisor.

Due: Any implementation work required for your thesis should be done or essentially done by this date.

Week 5. Week of Mar. 15th. **Due:** Peer Review in class.

Week 6. Week of Mar. 22nd. No class. **Due:** The full rough draft of your thesis.

Week 7. Week of Mar. 29th. — Spring pause. —

Week 8. Week of Apr. 5th. Class check in. The next few weeks will be devoted to extensive textual revision, in consultation with your advisor. The full draft should be the first of several iterations during this period; you and your advisor should exchange as many drafts as possible. Remember that it may take your advisor up to a week to read your draft carefully.

Week 9. Week of Apr. 12th. No class. Ongoing meetings with your advisor.

Week 10. Week of Apr. 19th. **Due:** Peer Review in class.

Week 11. Week of Apr. 26th. No class. **Due Friday, April 30th: your completed thesis.**

Week 12. Week of May 3rd. Practice thesis presentations.

Week 13. Week of May 10th. Practice thesis presentations.

Week 14. **Monday, May 17th:** thesis presentations

Late work policy

All extensions must be requested **at least 24 hours in advance** of the deadline and must be approved by *both* the instructor of the class and the thesis advisor.

Rules and Pet Peeves

- **Be on time.** This includes class, office hours, and appointments.
- **Expect 24 hours before an email response.**
- **Read email within 24 hours.**

Learning Accommodations

Haverford College is committed to supporting the learning process for all students. Please contact me as soon as possible if you are having difficulties in the course. If you think you may need accommodations because of a disability, please contact hc-ods@haverford.edu. If you have already been approved to receive academic accommodations and would like to request accommodations in this course, please meet with me privately at the beginning of the semester (within the first two weeks if possible) with your verification letter.