COMP 590: Computational Complexity **Spring 2026**

Scribe and Presentation Assignments

This document describes the scribing and presentation assignments that make up an important part of the computational complexity class.

1 Lecture Scribing

Each student will be assigned two lectures for which they will act as a *scribe*. The role of the scribe is to take detailed notes on the lecture and type up a document in LaTeX that presents the contents of the lecture. Each lecture will be assigned at least two scribes, and scribe notes will be posted on Canvas for the class to use as a resource when studying or completing assignments.

The goal of the scribing assignment is for you to engage deeply with some of the material from class, going beyond what is presented in lecture to fill in gaps in your understanding. You are welcome to consult the textbook or other online resources when preparing your notes, but you must write the notes entirely by yourself. Practicing technical writing and communication is the main skill developed by this exercise.

Logistics. Scribing assignments will be made in the first week of class, and students who cannot make it to their assigned day are expected to let the instructor know well in advance. Ideally, if you cannot make it one day, you will find a replacement who is willing to switch with you.

Notes for Tuesdays are due by Friday at 11:59pm, and notes for Thursdays are due by Monday at 11:59pm. The tight turnaround is to provide others in the class with quick access to resources. If a due date falls on a holiday, the notes are due on the next non-holiday day. Late submissions receive -1 points per day (including weekends but excluding holidays). Scribe notes will be submitted via Canvas.

Each scribe submission is graded out of ten points as follows.

- Greatly exceeds expectations: 10/10
- Generally meets expectations: 9/10
- Below expectations: 7/10
- Far below expectations: 5/10
- No submission or use of unauthorized tools: 0/10

An example of scribe notes for the first lecture will be made available to the class to demonstrate expectations, as will a template for preparing notes.

2 Whiteboard Presentation

Each student will be required to give a 10-20 minute whiteboard presentation on a topic related to the course. The topic can be chosen from the list of topics below, from another part of the book that we did not cover, or from any relevant outside subject that the student wishes to learn about and present. The 10-20 minute time period includes time for questions during the presentation. A physical copy of the student's presentation notes will be submitted at the time of the presentation.

The goal of the presentation assignment is to give you an opportunity to read and understand technical content independently and then to effectively communicate it. The whiteboard + Q&A format is a very common one for research reading group presentations and for impromptu technical discussions, and it requires deeper understanding and preparation than is typical for a slide presentation.

Logistics. Sign ups will begin shortly before spring break, and presentations will occur over the last five weeks of class. Since there is not enough class time for everyone to present in class, students will have the option of signing up for a presentation slot during class or for an office hours slot. Since there are a limited number of in-class slots, please email the instructor before sign ups begin if you anticipate problems making it to an office hours slot. Some in-class slots will be saved for students with challenging scheduling constraints.

No more than 3 students can present on the same topic, and the same topic cannot be presented twice in the same block of presentations. Topics that are not on the list below require instructor approval. The presentations are done individually, but you can prepare with others. Some suggested presentation topics go well in pairs, so you can coordinate to give back-to-back presentations that build on each other with someone else.

Presentations will be graded out of ten points as follows. Presentations that are too short or too long will will have 0.5 to 2 points deducted depending on the extent, in addition to any other issues that may be connected with the over long/short presentation. Students who do not sign up by the stated deadline will lose 1 additional point.

- Greatly exceeds expectations: 10/10
- Generally meets expectations: 8/10
- Below expectations: 6/10
- No presentation: 0/10

Presentation advice. Here is some advice that may help you prepare and give a better presentation.

- The goal of a presentation is not to list off a number of facts like you would on a test or oral exam; it's to communicate and teach something to your audience. To this end, it helps to pick a topic that has some technical depth so you're explaining something rather than writing up bullet points.
- It's helpful for your notes to include exactly what you want to put on the whiteboard and where, accompanied by some notes on what you want to say about each thing.
- Practicing doing the presentation out loud can help you identify gaps or issues in what you want to say. After doing some solo practice, practicing with a small audience who will ask questions can help even more.
- Since questions during the talk are part of your presentation time, there is a time management aspect to this presentation. If you prepare 20 minutes of material, you will go way over.
- Speakers often get nervous, especially at the beginning of a presentation, and speak faster than they otherwise would. It can be helpful to practice the opening sentences or first few minutes of your presentation more, so you can present it calmly even if you're nervous presenting.
- Presenters can assume the audience is familiar with topics from this class and other general CS/math requirements, but any additional required background knowledge should be briefly covered in the talk.
- Remember to bring a second copy of your notes to turn in!

List of potential topics. This is not an exhaustive list, just a list of topics that may be interesting to you that we did not cover in class. Other topics from the book or other sources may be presented, but they require instructor approval. Most chapters in the book that we did not cover contain several topics that would be good for a presentation.

Note that last few topics will have relevant background material covered in class after sign ups begin, so you should sign up for a slot after the background is covered if you want to do one of those.

- Berman's Theorem/Mahaney's Theorem (exercises 2.30 and 6.9)
- Proof of nondeterministic time hierarchy theorem (section 3.2)
- Proof of Ladner's theorem (section 3.3)
- Proof that PATH is **NL**-complete, certificate definition of **NL**, and exercise 4.7
  - potential topic for a coordinated follow-up presentation: Proof that **NL** = **coNL** (section 4.3.2)
- Alternating Turing machines (Section 5.3) and **AP** = **PSPACE**
  - potential topic for a coordinated follow-up presentation: Time/space tradeoffs for SAT (section 5.4)
- Circuits and straight-line programs (Note 6.4, exercise 6.2)
- DC-uniform circuits (sec 6.8) and exercises 6.17 or 6.18
- Median-finding algorithm (section 7.2.1)
- Probabilistic primality testing (section 7.2.2)
- Proof of Sipser-Gacs theorem (Theorem 7.15): $\mathbf{BPP} \subseteq \Sigma_2^p \cap \Pi_2^p$
- Randomized reductions and **NP**/**poly** (section 7.6 and exercise 7.7)
- Proof that if GI is **NP**-complete, then $\Sigma_2 = \Pi_2$ (section 8.2.4, with references to other sections)
- Hardness of approximation for vertex cover and independent set (sectoin 11.4)
- Counting can be harder than decision (a cycle finding algorithm from elsewhere and section 17.1.2)
- #**P**, **FP**, and #**P**-completeness (most of section 17.2, beginning of 17.3)