# Final Project Guidelines

As noted in the syllabus, students can choose between two grading options: (a) submitting six problem sets; (b) submitting four problem sets and a final project. We strongly encourage students to choose the second option.

## General Requirements and Timeline

1. **Registration.** Register your project title, team, and preferred oral presentation date at this Google form. Each team can contain one or two students. Project titles are tentative and can be changed later.
   Deadline: March 22 at 11pm PT.

2. **Project Proposal.** Submit a brief written outline of you project (one or two paragraphs). This is non-binding – the final submission can differ from the proposal. Submission is via Gradescope.
   Deadline: April 5 at 11pm PT.

3. **Advisory.** Schedule an advisory meeting with Jonathan to discuss your ideas. This is completely optional. Meetings should be scheduled via this calendar page.

4. **Oral Presentations.** Present your project in class.
   Dates: April 27 and April 29 at 5pm PT.

5. **Submission of Written Report.** Project reports should be typeset, preferably in LaTeX, and should be roughly 5–10 pages in length, not including the bibliography and appendices. Submission is via Gradescope.
   Deadline: May 12 at 11pm PT.

Students can choose between the following two types of final project.

## Option I: Original Research

1. **Problem Statement.** Identify and state an open problem or set of closely-related open problems that are broadly related to computational learning theory. These should be questions that, to the best of your knowledge, no one has solved yet. The question or questions should be fairly specific, and the statement should be as clear and rigorous as possible. For questions that are somewhat nebulous or inchoate, or that could admit a variety of formalizations, provide at least one example of a possible formal statement. These may either be known open questions that have been discussed in the literature before, or they may be original.

   [Approx. 1/2–2 pages; 20 points]

2. **Introduction.** Provide a brief motivation and literature review. This should: (i) explain the background and context necessary for understanding the question; (ii) explain why the question is important or interesting, and what consequences its resolution

might have; and (iii) broadly discuss what is known in the literature about the question or related questions. Briefly discuss at least two relevant publications.

[Approx. 1–2 pages; 15 points]

3. **Original Research.** Present your attempts to make progress towards resolving the open question. There is no expectation that you resolve it successfully. Describe a sequence of approaches, ideas, or directions that you pursued, and what you did in each of these. Directions could include: attempting to apply results and approaches we learned in class, reading papers that might be related and applying their ideas, identifying simple examples or special cases and attempting to solve the question for these special cases, presenting a conjecture and explaining why it might be true, attempting to devise counter-examples to a conjecture, running a simple empirical experiment to test an idea, creating diagrams to organize your thoughts, etc. The majority of your contribution should be theoretical (i.e., mathematical claims and proofs, or attempts thereof), but empirical experiment can also be used as a supplementary tool.

   For each direction you pursued: (i) give the direction a descriptive title; (ii) provide a brief outline of what you tried; (iii) explain why this direction was a sensible thing to try; (iv) provide a full and detailed description of what you did, including computations, proof fragments, claims that you proved, or attempted to prove, etc.; (v) discuss what can be learned from this attempt.

   [Approx. 5–8 pages; 60 points]

4. **Conclusions.** Briefly summarize what you have done, the current status of your research, what you learned, and what further directions or open sub-problems you would pursue were you to continue this research.

   [Approx. 1/2–1 page; 5 points]

5. **Bibliography.** List all publications mentioned throughout the report in a consistent format. Preferably, use BibTeX or a similar system, with records retrieved from DBLP.[1]

6. **Appendix.** If you have written any code or conducted any experiments, include the code and experimental data in an appendix.

## Option II: Literature Review

1. **Introduction.** Choose a topic or theme of research in computational learning theory. Then: (i) provide a clear description of the topic or theme, and explain what questions this line of research attempts to answer; (ii) clearly explain all background and context necessary for understanding these questions beyond the material covered in the course; (iii) explain why these questions are important or interesting, and what consequences their resolution might have; (iv) briefly outline what is known in the literature about these questions. [Approx. 1–2 pages; 15 points]

[1] For BibTex, see e.g. this tutorial. An example of a BibTex record from DBLP is here.

2. **Literature Review.** Choose three or four papers that discuss the topic or theme you chose. These should be theoretical papers, i.e., papers that focus on mathematical claims and rigorous proofs. For each paper: (i) identify the main questions that the authors set out to solve; (ii) describe the paper's contribution; (iii) provide a detailed description of one or two results from the paper, including proof outlines; (iv) discuss the strength and weaknesses of the paper – what is good about it, and what could be improved. Try to focus on the mathematical ideas present (or lacking) in the paper; (v) create an original diagram or figure that illustrates some aspect of the paper; (vi) identify two open questions or directions for future research related to the paper. These may be open questions mentioned explicitly in the paper, or they may be original.
   [Approx. 7–8 pages; 75 points]

3. **Conclusions.** Summarize how the papers you presented are related to each other, and where they fit within the the broader line of research on the topic or theme you chose. Discuss what can be learned from the papers you presented.
   [Approx. 1 page; 10 points]

4. **Bibliography.** List all publications mentioned throughout the report in a consistent format. Preferably, use BibTeX or a similar system, with records retrieved from DBLP.[1]