CS294-180 Partition Functions: Algorithms & Complexity

Course Project: Fall 2020

1. General

The goal of the project is to give you an opportunity to investigate part of the course material (or a closely related topic) in greater depth, by reading, digesting and presenting (in both oral and written form) one or more original research papers. Exceptionally, and subject to approval, you may substitute for this some creative work on an existing open problem mentioned in class or a problem of your own choosing.

I strongly encourage you to work in pairs on this, given that we have had few opportunities to collaborate during the pandemic. However, if you strongly prefer to work on your own please let me know. Please use Piazza to find a partner if you don't have one already. A list of suggested topics can be found on the class web page. In most cases a topic appears with two or three references; choosing a topic does not necessarily entail digesting all these references in detail—typically you might focus mainly on one of them and use the others as context or background.

The deliverables for all projects are:

- A presentation (of approximately 70 minutes duration, i.e., a normal lecture slot, allowing time for questions and a break), accessible to the class. You'll need to share your screen and use some suitable software for writing on a tablet; you may use prepared slides if you wish, or a combination of the two, but you should in any case make sure you can write in order to answer questions etc.
- A written report of 4–5 pages (11pt LaTeX, standard margins). [Note: The page limit is intentional. It is harder and arguably more useful to be able to write a report of four pages than one of ten pages.]

The presentation and the project are intended to complement one another, and should be prepared in parallel. The assessment will be based on both. The deadline for the reports will be Friday December 18th. The presentations will be scheduled during class times, beginning no earlier than November 12th and continuing through the end of the semester; depending on the number of slots, we may need to extend lectures slightly beyond the end of instruction. A schedule will be posted once topics have been chosen; less technically challenging topics will go earlier.

2. Choosing a project

You should choose a project and have it approved by me no later than **Monday November 2nd**. If you want to choose a project from the list, you should email your choice to me together with at least one, and preferably two alternatives in decreasing order of preference. First choices will be allocated on a first-come, first-served basis. Topics from the list will be marked as they are allocated.

If you want to propose a creative project, or any other project not on the list, you *must* discuss it with me before the above date.

3. More on reading projects

The idea here is that you should read, understand and fully digest one or two papers on a topic related to those discussed in class. You should understand the work well enough to give an intuitive explanation of it, answer questions about it, and assess its strengths and limitations. Your written report should consist of:

- Sufficient background to explain the results.

- Statement of the results.
- Assessment of how the results relate to other work in the field.
- Indication of the key ideas used in the proofs or technical development, distinguishing between novel and standard steps.

Your presentation should contain the same ingredients; however, you should use the different medium to complement your written report (e.g., by presenting examples, drawing pictures, giving some illustrative proofs, etc.)

4. More on other projects

These projects are inherently more open-ended and harder to describe in general terms. Possible examples are:

- Make some non-trivial progress on an existing open problem (either mentioned in class, or stated in a paper).
- Perform a rigorous and well informed experimental evaluation of theoretical results proved in class, with a view to illuminating the underlying theory.
- Apply some ideas or techniques from the class to a problem from your own research area.

Such a project may involve an experimental component, but should include at least some application of the analytical techniques we have discussed (e.g., analysis of a simple special case, or a precise heuristic discussion). *A mere implementation of some algorithm without reference to theoretical analysis is not sufficient.* Before embarking on such a project, it is essential that you specify your goals clearly and discuss them with me first.

The nature of the report and presentation for this type of project will depend on the material, but the essential ingredients should be similar to those listed above for reading projects. In addition, it may well be appropriate to attach an appendix giving technical proofs and/or experimental results.