SHORT PROJECT GUIDELINES, MATH 191 SPRING 2018

The short project is intended to be a self-directed exploration of the many facets of knots we've been introduced to in class. As compared to the long project, the short project can be more expository and/or computational.

Requirements.

- The project can be worked on individually or in groups of up to three. The size of your group will determine the page count required in your report: for individuals, the report should be 3-6 pages, for groups of two, the report should be 5-10 pages, and for groups of three, the report should be 7-14 pages.
- Schedule a 15 minute meeting with me **the week of February 20** (we'll do this via an online system the week before) to discuss your project topic. Come to the meeting with at least a general idea of what you're planning to do.
- Submit a short (< 1 page) informal progress report in class on **Thursday, March 1** (there will be no other homework due this date). If there are multiple members of your group, each one should submit one detailing what they have worked on so far. This is a good opportunity to practice your LaTeX!
- Schedule a 15 minute meeting with me **the week of March 5** to discuss progress so far and plan for your report and the discussion circle.
- Participate in a project discussion circle in class on **Thursday, March 15**. We will pair off project groups and teach each other what we've found. *If you cannot make class on this date, please let me know as far in advance as you can.*
- Hand in a report summarizing your findings on **Thursday, March 15**, with page count determined by your group size as indicated above. The page count does not include title, contents, or reference pages, but does include figures. The report must be in .pdf format, written up in LaTeX, with standard font, margins, and spacing (12 pt, 1.5 in, single spaced), or equivalent length if you choose to format differently. You need to include proper citations, just like in a paper for an English or History class.

Advice.

The goal of this project (and the long project) is *not* to pick the hardest problem you can find and solve it, though if you do, that's great. The point is to investigate some topic more deeply than you usually would in lecture, for homework, or for an exam, and then to communicate what you've learned. Pick something you find really interesting!

Therefore, it's totally okay for the short project to range from expository to computing invariants we've discussed in class to trying to construct examples for phenomena discussed in class. It's okay if you reprove something which is known, but explain how to do it in your own way. The main purpose is to describe how *you* understand what your project is about, not to copy anyone else.

Look up many resources! Google and the arXiv are your friends. Ask other students or teachers you've had in the past. Check the proofs you are citing. Check that you really understand the background material, even though you may have covered it in a previous course. You'll have to do a "lit review" of mathematical research. It can easily branch out into infinitely many other topics, so you'll learn how to keep yourself on track.

Motivation! Think about why the topic you're investigating is interesting: to you, to other mathematicians, to other students, to laypeople.

Question every step. Does this theorem need this particular assumption in its statement? Where does that assumption show up in the proof? Can I generalize this result? Is this theorem much easier to prove if I restrict attention to a particular class of examples? One type of great project would simply be an investigation of a cool theorem, where you explain several examples and cases where the proof generalizes or gets vastly easier.

Come up with your own problem! If there's a standard reference for that problem I'll work to help you find it, and if there isn't, try to solve it! Or you can give a history of an unsolved problem and explain why it's so hard.

Most importantly, *let yourself get stuck*. I'm happy to help, but know that the research process can take a long time. Be patient and know that with a few days of thinking you will be able to figure out more than you expect. Learn to tell the difference between a simple typo in your computation which is throwing you off and a larger need to change the way you are thinking.