Final Paper Topic Proposal (in lieu of a midterm paper)

Due Friday, March 12.

Given the snowpacolypse, I think it would be unreasonable to assign a midterm paper to be due on March 5.

As such, the due date is pushed back by a week to the 12th. Your submission will also not be a paper, but a proposal.

Background. Your Final paper, due Apr 3, is to be an original, written work which explicates some topic of (or a topic relevant to) topology.

The audience of your final paper is not me, per se, but meant to be someone of a peer level of mathematics; the goal is to teach a peer about the topic of your choice. Another framing for the assignment: Imagine you are writing 10 pages of a textbook that you wish were written for you and your peers (where the traditional format and conception of a "textbook" may be mutated to your liking). Those 10 pages will be your final paper. The topic you write about does *not* need to be a topic traditionally found in a textbook.

Prompt. (i) Find at least *two* topics that you would like to write about for the 10+ page final paper for this topology class. (Ideally, one of these two topics will end up being the focus of your final paper.)

(ii) Explain to me why you chose these two topics. You can cite any reason that you feel justifies your choices so long as you are honest and thoughtful.

(iii) Try (this is the hardest part) to indicate the scientific/mathematical importance of the topics you chose. "Importance" is subjective. For example, proving that some spaces are not homeomorphic may seem unimportant to many people, but it's important to others. You are allowed to use your own justifications. Another way to frame this: Indicate why you would want to teach this topic to a peer. Even professional scientists struggle with this kind of writing; you do not need to feel like a fraud for having to rely on an importance you find on a Wikipedia article, for example, so long as you cite appropriate.

(iv) Finally, write at least one page for each topic (so two pages at least) to "preview" your final paper, or to at least begin to give a proper mathematical explanation of the topic. As this is only a one page minimum, your

explanation may abruptly "cut off." But whatever you write must display proper mathematical conventions where necessary (and where unnecessary, you may exercise your creative freedoms). For example, a definition must be precise and correct, as must all proofs, propositions, lemmas, and theorems. However, remarks and other dicta/exposition may be more informal.

Format. Your writing must be at least 6 pages (excluding any figures). I would recommend using TeX to typeset any mathematics, but if learning TeX or using something like Overleaf is too burdensome, documents produced using Google Doc, Microsoft Word, Open Office, et cetera, are acceptable. (You will not be penalized for not using TeX.) Font size must be between 10 and 12 using standard fonts (no Comic Sans MS, for example). Please double-space. Submit in PDF format.

Tips. Topics can be varied. Here is a list of possible topics:

1. Definition and examples of topological spaces.
2. Definition and examples of continuous functions.
3. Some theorem with a name. (Ham sandwich, hairy ball, Hahn-Banach, Poincare-Hopf, Brouwer Fixed Point, Lefschetz Fixed Point, Invariance of Domain.) Or, a theorem that does not have a name but still sounds cool.
4. Topological data analysis.
5. Manifolds
6. Co/homology.
7. Projective spaces ($\mathbb{R}P^n$, aka P^n.)
8. Orthogonal groups
9. The fundamental group.