Paper Chase Assignment

For this assignment, I'd like you to get into the mindset of a reviewer, and to practice the skills of hunting down references to find clarifications and explanations. I also want you to start looking around for topics for your end-of-semester project.

- Find a research paper on computational topology; let's call this Paper 1. Paper 1 can be something related to your own research that you'd like to examine more closely, or you can dive into a relevant conference/journal and pick something you find interesting. I've included a list of potential starting points at the end of this handout, but only as suggestions; you're welcome to use papers outside this list.

- Now imagine that you were assigned Paper 1 as a reviewer. The first part of any paper review is a succinct summary (at most two short paragraphs) of the major contributions of the paper. **Write that summary.** Your summary should be objective; keep your *opinions* about the paper limited. (An actual paper review would also include your opinions about the paper after the summary, but they will not be a part of this assignment.) Your summary should also be easy for a program committee member / editor to read. Remember that even if they have more *general* expertise, they know less *about the paper* than you do!

- **Identify and explain the major topological and computational components of the paper**, using up to one full page. Again, your summary should be objective and easy for an inexpert editor / program committee member to read. (Imagine you six months ago.)

- Skim the rest of the paper to get a general idea of what is going on, and then read as much detail as you can. **Describe where you got lost**, using up to one full page. (This is *not* normally part of a review.) Include enough context that your point of confusion is clear to someone who is not familiar with the paper. If you can't figure out the major contributions of the paper, or if you never get lost, start over with a different Paper 1.

- Identify another paper that would help enhance your understanding of Paper 1; let's call this Paper 2. This could be a paper that Paper 1 cites, a paper that cites Paper 1, or just a result of your mad googling skills. Read Paper 2, first skimming to get a general idea of its content, and then trying to read as much detail as you can. **Briefly summarize paper 2, describe its connection to where you got lost in paper 1, and describe where you got lost in Paper 2.** Use up to one full page.

- Repeat the previous step one more time. Identify yet another paper that would help your understanding of Paper 2; let's call this Paper 3. Read Paper 3. **Briefly summarize Paper 3, describe its connection to where you got lost in previous papers, and describe where you got lost in Paper 3.** Use up to one full page.

Altogether, your review should be roughly 3–5 pages long. Don't forget to properly cite the papers you read (and any other papers that you reference in your review). Please submit your review on Gradescope by **Tuesday, February 28, 2023**. Reviews will be graded using the rubric on page 3. All reviews will also be made available to the entire class to help plan potential projects.

Choosing Papers

You're welcome to choose any three related papers on any aspect of combinatorial or computational topology, subject to the following restrictions:

- The papers must explicitly study, develop, use, or apply some nontrivial topological structure; most papers on graph algorithms or computational geometry don't qualify. Symmetrically, the topic of the paper must have some connection to computation; most pure topology papers don't qualify.

- Don't review papers that you already know well. I want you to deliberately go outside your comfort zone. I do *not* expect you to understand your papers in complete detail; in fact, I expect you *not* to understand your papers in complete detail.

- In particular, don't review any papers written by either you or your advisor; you have an obvious conflict of interest. (But you are welcome to use those papers to find *other* papers to read and review.)

- Similarly, don't review any of *my* papers; I have an obvious conflict of interest! (Again, you are welcome to use my papers to find *other* papers to read and review.)

I've included a list of possible starting points in the references, all published in 2021 or later. I've tried to choose papers on topics that we will cover in class (although I've also included several that stray further), that describe interesting results, that are relatively accessible, and that don't look like each other. Please don't be offended if your favorite papers, authors, venues, or topics are missing, *especially if your favorite topics are persistent homology and topological data analysis*. If you don't otherwise know where to start, I recommend looking at the abstracts and figures in these papers for something interesting. You are ***not*** required to choose your papers from this list.

Once you've chosen a paper to start with, there are several good strategies for finding additional papers to read, not only for this assignment or your project, but in your own research.

- **By citation**: Go backward in time: Look at the papers that your favorite papers cite. Or go forward in time: Look at the papers that cite your favorite papers, using an indexing service like Google Scholar or Scopus. These are often the most fruitful strategies, and the ones I recommend for this assignment, but they're not the only strategies you should use in general.

- **By keyword/topic**: Look for more papers (or lecture notes, or slides, or whatever) that use *similar* key terminology as your favorite papers. Try likely synonyms, even if you think they mean something completely different; different research communities use different words for the same concepts, and the same words for different concepts.

- **By venue:** Look at other papers in the venues (conference, journal, workshop, seminar series, arXiv category, github, ...) that published your favorite papers.

- **By author:** Look at other papers (or lecture notes, or slides, or whatever) produced by the authors of your favorite papers, as well as their coauthors, students, and advisors.

- **By recommendation:** Ask people who are likely to know something about your favorite topics to suggest papers you might not otherwise think of.

- **By chance:** Keep your eyes peeled for anything vaguely reminiscent of your favorite papers: figures in other papers, 3Blue1Brown videos, old Martin Gardner columns, whiteboard scribbles, video games, children's toys, bathroom graffiti, medieval manuscripts, or whatever. Use them to launch a Google Images/Scholar search. No, I'm not joking.

Grading Rubric

	Excellent	Good	Needs work	Unacceptable
Paper 1 summary	Clear summary of main contributions, and easy to follow for someone with general background in computatioal topology	Contributions are discussed, but some confusion or lack of clarity about main points or technical material	Summary includes some contributions, but does not rank major contributions or contains major errors	Completely unclear what major contributions are
Paper 1 tools	Clear discussion of major topological and computational tools and techniques	Discussion is unclear, or focuses only on topology or only on algorithms	Mention of topology and/or algorithms, but vague and/or clearly indicates misunderstanding	Misunderstood or omitted entirely
Paper 1 confusion	Clear description of where you got lost in Paper 1 and why, written for someone not familiar with the paper	Some discussion, but not clear what the problem was	No context, or discussion of paper without clear description of where you got lost	Omitted entirely
Paper 2	Brief summary of Paper 2; connection to where you got lost in Paper 1; clear description of where you got lost in Paper 2	Some discussion, but not at excellent level	More serious inaccuracies or issues in description	Major issues; for example, not clear what paper 2 was about
Paper 3	Brief summary of Paper 3; connection to where you got lost in Papers 1 and 2; clear description of where you got lost in Paper 3	Some discussion, but not at excellent level	More serious inaccuracies or issues in description	Major issues; for example, not clear what paper 3 was about

References

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Fruitful Venues

Conferences

- ATMCS: Algebraic Topology: Methods, Computation, and Science
- CCCG: Canadian Conference on Computational Geometry
- ESA: European Symposium on Algorithms
- FOCS: IEEE Symposium on Foundations of Computer Science
- GD: International Symposium on Graph Drawing and Network Visualization
- ISAAC: International Symposium on Algorithms and Computation
- SGP: Symposium on Geometry Processing
- SIGGRAPH: International Conference on Computer Graphics and Interactive Techniques
- **SOCG: International Symposium on Computational Geometry**
- SODA: ACM-SIAM Symposium on Discrete Algorithms
- SOSA: Symposium on Simplicity in Algorithms
- STOC: ACM Symposium on Theory of Computing
- TopoInVis: Workshop on Topological Data Analysis and Visualization

Journals

- *ACM Transactions on Graphics*
- *Computing in Geometry and Topology* (open access, first issue in 2023)
- ***Discrete & Computational Geometry***
- *Journal of the ACM* (publishes best papers from most theory conferences, including SOCG)
- *Journal of Computational Geometry* (open access)
- *Journal of Graph Algorithms and Applications* (open access)
- *Journal of Applied and Computational Topology*
- *SIAM Journal on Applied Algebra and Geometry*

Other

- Dagstuhl workshop reports
- arXiv categories: cs.CG, cs.DS, cs.GR, math.AT, math.GT