# LORENZO NAJT

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## EDUCATION

**Stuyvesant High School** *2005-2009*

**Carleton College** *2009-2013*
Mathematics Major

**University of Wisconsin-Madison** *2014-Current*
PhD Candidate in Mathematics department

## PREPRINTS

**Complexity and Geometry of Sampling Connected Graph Partitions**
Authors: Lorenzo Najt, Daryl DeFord, Justin Solomon
Abstract: In this paper, we prove intractability results about sampling from the set of partitions of a planar graph into connected components. Our proofs are motivated by a technique introduced by Jerrum, Valiant, and Vazirani. Moreover, we use gadgets inspired by their technique to provide families of graphs where the "flip walk" Markov chain used in practice for this sampling task exhibits exponentially slow mixing. Supporting our theoretical results we present some empirical evidence demonstrating the slow mixing of the flip walk on grid graphs and on real data. Inspired by connections to the statistical physics of self-avoiding walks, we investigate the sensitivity of certain popular sampling algorithms to the graph topology. Finally, we discuss a few cases where the sampling problem is tractable. Applications to political redistricting have recently brought increased attention to this problem, and we articulate open questions about this application that are highlighted by our results.
URL: https://arxiv.org/abs/1908.08881

**Compactness scores in redistricting**
Authors: Assaf Bar-Natan, Lorenzo Najt, Zachary Schutzman
Abstract: In political redistricting, the compactness of a district is used as a quantitative proxy for its fairness. Several well-established, yet competing, notions of geographic compactness are commonly used to evaluate the shapes of regions, including the Polsby-Popper score, the convex hull score, and the Reock score, and these scores are used to compare two or more districts or plans. In this paper, we prove mathematically that any map projection from the sphere to the plane reverses the ordering of the scores of some pair of regions for all three of these scores. Empirically, we demonstrate that the effect of using the Cartesian latitude-longitude projection on the order of Reock scores is quite dramatic.
URL: https://arxiv.org/abs/1905.03173

## WORK EXPERIENCE

**University of Wisconsin Madison** 2014-Current
*Teaching Assistant*

Leads discussion sections, grades papers, prepares material to help students pass exams in classes covering multivariable calculus, differential equations and linear algebra.

## ACADEMIC ACHIEVEMENTS

Graduate student mentor at the Voting Rights Data Institute at Tufts/MIT, Summer 2018

Visiting Scholar in Justin Solomon's Lab at CSAIL / MIT, Spring and Summer 2019

RSI mentor at MIT, Summer 2019 (and ongoing): Mentored a project about the fixed parameter tractability of counting simple cycles

Peer Reviewer for Election Law Journal

SuperUROP Mentor at MIT (through Justin Solomons lab), Fall/Spring 2020 : Mentoring a project about ensemble based approaches to defining gerrymandering that use Schramm-Loewner evolution.

URS Mentor / Independent Reading Supervisor at UW-Madison : Mentoring a project about examining the robustness of outlier methods in gerrymandering analysis.

Cyber Security Summer School (Cyber Toaster) Internship - Fellowship at Los Alamos National Lab during Summer 2020