Christopher Donnay

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SUMMARY

I am a recent mathematics PhD graduate from *The* Ohio State University specializing in data science and combinatorics with applications to democracy. I have demonstrated experience in computational and theoretical research projects, and have a unique ability to communicate high-level mathematics to non-technical audiences. I am seeking a position as a data scientist, quant researcher, or software engineer.

SKILLS & CERTIFICATIONS

- **Languages & Platforms**: Python, C++, Slurm, Bash, GitHub, QGIS, Mathematica, LaTeX.
- **Python libraries**: Jupyter, NetworkX, NumPy, (Geo)Pandas, Poetry, scikit-learn, uv.
- **Mathematics**: Markov chains, graphs and networks, data science, probability, topology, combinatorics, topological data analysis, asymptotic analysis, discrete geometry, gerrymandering, computational social choice, voting methods.
- **Certifications**: The Erdős Institute Data Science Boot Camp.
- **Soft skills**: Leadership, project managment, collaboration, public speaking, science communication, problem solving, open source contribution.

EXPERIENCE

Data and Democracy Lab, Cornell University   Remote
Lab Manager   January 2025 - Present

- Lead a team of six contributors to "VoteKit", the Lab's Python package for modeling and analyzing elections. Plan for the stable continuation of the package and implement speed improvements and organizational refactorings.
- Manage the development and successful public release of Districtr 2.0, a browser-based geospatial application for drawing legislative districts, with a remote team of five full-stack developers. Coordinate communication between the development team and the PI. Facilitate the addition of new features and improve user experience.
- Design, write, and execute training experiences for collaborators and partner organizations, including a 3-day workshop in modeling alternative systems of election, a 6-session program in statistical inference of polarized voting run by the Southern Poverty Law Center, and Python tutorials of the Lab's software.

Research Scientist   January 2024 - January 2025

- Developed and maintained the codebase, as well as produced documentation, for "VoteKit". Was the top contributor on GitHub with over 450 commits.
- Conducted computational research on the Voting Rights Act, polarized voting, and election modeling using Python and a high-performance cluster. Results were used to inform the efforts of political advocacy groups in three states and were incorporated into the paper "Proportionality for Ranked Voting, in Theory and Practice."
- Communicated and presented modeling results to community groups, academics, non-profits, and technical stakeholders.

STEM Teacher   Bryn Mawr, PA
The Shipley School, Penn GSE Teaching Fellow   June 2018 - June 2020

- Created a novel, year-long curriculum and accompanying materials for an Introduction to Python course.
- Taught high school computer science courses in Python and Processing, as well as Geometry.
- Conducted inquiry-based research to inform teaching practice and pedagogy for my dissertation.

EDUCATION

The Ohio State University	PhD Mathematics, December 2024
The Ohio State University	MS Mathematics, May 2024
University of Pennsylvania	MS Education, May 2020
Pomona College	BA Mathematics, May 2018

Selected Publications & Presentations

- **"Asymptotics of Redistricting the $n \times n$ grid"**: Together with M. Kahle, solved an open problem about the rate of growth of the number of redistricting plans using asymptotic combinatorics, spanning trees, and tilings. Presented at multiple invited seminars, and will appear in *The American Mathematical Monthly,* November 2025, a highly selective journal known for its quality of research and exposition.

- **"VoteKit: A Python package for computational social choice research"**: Together with M. Duchin, J. Gibson, Z. Glaser, A. Hong, M. Mukundan, and J. Wang, developed an end-to-end Python package for modeling and anlayzing ranked-choice elections, which is available on PyPI. The package is heavily used by academics for research and grassroots organizations for modeling democratic system reform. A summary of the package appeared in the *Journal of Open Source Software*, May 2025.

- **"3:1 Nesting Rules in Redistricting"**: Studied the impact of a particular redistricting rule on gerrymandering in Ohio and Wisconsin. This used Markov chain methods, geospatial data analysis, a high-performance cluster, and the Python package `gerrychain`. Was invited to present at the SIAM Annual Meeting, July 2022, and is in revisions with the journal *Statistics and Public Policy*.

- **"Portland, OR 2024 City Council Election Analysis"**: Provided Python support to an analysis of the recent STV election in Portland for the Data and Democracy Lab, including processing of the cast vote record with `pandas`, analyis of the ballots using `VoteKit`, developing visualizations with `matplotlib`, and explaining the code in an interactive `Jupyter` notebook. Presented the findings at five invited seminars and conferences in the spring of 2025. The white paper is available at mggg.org/ppm.

Awards

- **Distinguished First-Year Graduate TA**: Awarded to three first year TAs in the math department for demonstrated excellence in the classroom. The Ohio State University, April 2022.

- **1st Place Data Science Bootcamp**: Awarded by a panel of industry experts out of a cohort of 10 projects. Using the Python library scikit-learn, my collaborator and I developed a predictive model of the Great British Baking Show. Panelists noted that our presentation stood out due to clarity and understandability. The Erdős Institute, The Ohio State University, December 2020.

- **Bruce Jay Levy Prize in Mathematics**: Awarded to one student for excellence in mathematics, Pomona College, 2017.