

DARYL R. DEFORD

Curriculum Vitae

328 Neill Hall WSU Pullman, WA ◊ (509) 205-7347

daryl.deford@wsu.edu ◊ daryldeford.com

ACADEMIC APPOINTMENTS

- Washington State University**, Pullman, WA *August 2020 – Present*
Assistant Professor of Data Analytics – Department of Mathematics and Statistics
- Massachusetts Institute of Technology**, Cambridge, MA *June 2018 – July 2020*
Postdoctoral Associate – CSAIL Geometric Data Processing Group
Advisor: Justin Solomon
- Tufts University**, Medford, MA *June 2018 – July 2020*
Visiting Scholar – Jonathan M. Tisch College of Civic Life
Advisor: Moon Duchin

EDUCATION

- Dartmouth College**, Hanover, NH *September 2013 – June 2018*
Ph.D. Mathematics *Awarded June 2018*
Advisor: Dan Rockmore
Dissertation: Matched Products and Dynamical Models for Multiplex Networks
A.M. Mathematics *Awarded November 2014*
- Washington State University**, Pullman, WA *August 2010 – May 2013*
B.S. in Theoretical Mathematics *Awarded May 2013*
Summa Cum Laude

RESEARCH PUBLICATIONS

Accepted Papers

- A19: *Medial Axis Isoperimetric Profiles* (with J. Solomon and P. Zhang), SGP, 2020.
- A18: *On the Spectrum of Finite, Rooted Homogeneous Trees* (with D. Rockmore), Linear Algebra and its Applications, 598, 165-185, 2020.
- A17: *Random Walks and the Universe of Districting Plans* (with M. Duchin), Book Chapter in *Political Geography*, Birkhäuser, to appear, 2020.
- A16: *Competitiveness Measures for Evaluating Districting Plans* (with M. Duchin and J. Solomon), Statistics and Public Policy, to appear, 2020.
- A15: *Mathematics of Nested Districts: The Case of Alaska* (with S. Caldera, M. Duchin, S. Gutenkust, and C. Nix), Statistics and Public Policy, to appear, 2020.
- A14: *Aftermath: The ensemble approach to political redistricting* (with J. Clelland and M. Duchin), MAA Math Horizons, 28(1), 34-35, 2020.
- A13: *Total Variation Isoperimetric Profiles* (with H. Lavenant, Z. Schutzman, and J. Solomon), SIAM J. Appl. Algebra Geometry, 3(4), 585-613, 2019.
- A12: *Spectral Clustering Methods for Multiplex Networks* (with S. Pauls) Physica A: Statistical Mechanics and its Applications, 533, 121949, 2019.
- A11: *Redistricting Reform in Virginia: Districting Criteria in Context* (with M. Duchin), Virginia Policy Review, 12(2), 120-146, 2019.

- A10: *A New Framework for Dynamical Models on Multiplex Networks* (with S. Pauls), *Journal of Complex Networks*, 6(3), 353-381, 2018.
- A9: *Cyclic Groups with the same Hodge Series*, (with P. Doyle), *Revista de la Unión Matemática Argentina*, 59(2), 241-254, 2018.
- A8: *Multiplex Dynamics on the World Trade Web*, Proc. 6th International Conference on Complex Networks and Applications, *Studies in Computational Intelligence*, Springer, 1111-1123, 2018.
- A7: *Random Walk Null Models for Time Series Data*, (with K. Moore), *Entropy*, 19(11), 615, 2017.
- A6: *Enumerating Tilings of Rectangles By Squares*, *Journal of Combinatorics*, 6(3), 339-351, 2015.
- A5: *Enumerating Distinct Chessboard Tilings*, *Fibonacci Quarterly*, 52(5), 102-116, 2014.
- A4: *Pulsated Fibonacci Sequences* (with K. Atanassov and A. Shannon), *Fibonacci Quarterly*, 52(5), 22-27, 2014.
- A3: *Seating Rearrangements on Arbitrary Graphs*, *Involve: A Journal of Mathematics*, 7(6), 787-805, 2014.
- A2: *Empirical Analysis of Space-Filling Curves for Scientific Computing Applications* (With A. Kalyanaraman), Proc. 42nd International Conference on Parallel Processing, 170-179, 2013.
- A1: *Counting Rearrangements on Generalized Wheel Graphs*, *Fibonacci Quarterly*, 51(3), 259-273, 2013.

Preprints

- P6: *Implementing Partisan Symmetry: Problems and Paradoxes* (with Dhamankar, Duchin, Gupta, McPike, Schoenbach, and Sim), moggg.org/partisan-symmetry.
- P5: *Partisan Dislocation: A Precinct-Level Measure of Representation and Gerrymandering* (with N. Eubank and J. Rodden), http://www.nickeubank.com/defordeubankrodden_dislocation/.
- P4: *Complexity and Geometry of Sampling Connected Graph Partitions* (with L. Najt and J. Solomon), arXiv: 1908.08881.
- P3: *ReCombination: A family of Markov chains for redistricting* (with M. Duchin and J. Solomon), arXiv: 1911.05725.
- P2: *Fourier Transforms on $SL_2(\mathbb{Z}/p^n\mathbb{Z})$ and Related Numerical Experiments* (with B. Breen, J. Linehan, and D. Rockmore), arXiv:1710.02687.
- P1: *A Random Dot Product Model for Weighted Networks* (with D. Rockmore) arXiv: 1611.02530.

Technical Reports

- T4: *Comparison of Districting Plans for the Virginia House of Delegates* (with M. Duchin and J. Solomon), MGGG Technical Report, 2019.
- T3: *Amicus Brief of Mathematicians, Law Professors, and Students* (with M. Duchin and G. Charles et al.), *Rucho v. Common Cause*, Supreme Court, 2019.
- T2: *Study of Reform Proposals for Chicago City Council* (with M. Duchin et al.), MGGG Technical Report, 2019.
- T1: *An Application of the Permanent-Determinant Method: Computing the Z-Index of Arbitrary Trees*, WSU Department of Mathematics Technical Report Series 2013 #2, 2013.

TEACHING EXPERIENCE

Washinton State University

Instructor

Pullman, WA

Fall 2020 - Present

Designed syllabi and daily lectures. Wrote and graded homework, quizzes, and exams. Fully responsible for course content and material.

Data 115 - Introduction to Data Analytics

Fall 2020

Basic techniques and methodology of data science, with an emphasis on data processing and software tools. This course provides a foundation for beginning data analytics majors as well as students from across the university who are looking to develop data and quantitative literacy.

Introduction to computational methods and software for analyzing complex systems as well as applications of partition sampling to political redistricting.

Metric Geometry and Gerrymandering Group

VRDI Instructor

Cambridge, MA

Summer 2018, 2019

- Organized and led student research groups during an eight week summer program on political redistricting for 80+ graduate and undergraduate students. Met with students daily and both generated and supervised a wide variety of research projects in computational, mathematical, and political topics.

Tufts University

Co-Instructor

Medford, MA

Spring 2019

- Co-taught STS 10: Reading Lab on Mathematical Models in Social Context. This is a reading and discussion based course focused on providing an STS perspective to students who are taking technically-focused modeling classes.

Massachusetts Institute of Technology

IAP Instructor

Cambridge, MA

January 2019

- Developed a four-week course on computational methods for political redistricting. The course incorporated cutting edge mathematical and computational techniques for analyzing gerrymandering.

Dartmouth College

Instructor

Hanover, NH

September 2015 - May 2018

- Designed syllabi and daily lectures. Wrote and graded homework, quizzes, and exams. Fully responsible for course content and material.

Math 36/QSS 36 - Mathematical Modeling in the Social Sciences *Fall 2017*

Data driven course exploring mathematical models and analysis techniques

UNSG 100 - Graduate Ethics Seminar *Fall 2017, 2016, 2015*

Seminar on ethical and professional issues in science and mathematics

Math 8 - Calculus of Functions of one and Several Variables *Winter 2017*

Second term calculus course covering infinite series, vector functions, and partial derivatives

Math 1 - Calculus with Algebra *Fall 2015*

Introductory calculus course with an emphasis on limits and differentiation

Teaching Assistant

September 2013 - June 2015

- Held tutorial sessions three times per week. Graded quizzes and exams. Designed computing assignments and tutorials for linear algebra.

Math 23 - Differential Equations *Spring 2015*

Math 22 - Linear Algebra with Applications *Fall 2014*

Math 3 - Calculus *Winter 2014*

Math 12 - Calculus Plus *Fall 2013*

Washington State University

Undergraduate Teaching Assistant

Pullman, WA

August 2012 - May 2013

- Held tutorial sessions and graded homework and exams. Supervised a mathematical computing lab.

Math 320 - Modern Algebra *Spring 2013*

Math 330 - Secondary Teaching *Spring 2013*

Math 315 - Differential Equations *Fall 2012*

EDUCATIONAL OUTREACH

New Hampshire State Math Team

Math Team Coach

Manchester, NH

Fall 2018–Current

- Designed practice problems and preparatory exercises for the AMC exams, ARML, MMATH, and HMMT. Led monthly problem solving sessions and group activities.

L^AT_EX Workshops

Organizer

Hanover, NH

Fall 2016–May 2018

- Designed and presented a series of eleven one hour–long and two three hour–long workshops on mathematical typesetting in L^AT_EX with D. Freund and K. Harding.

Crossroads Academy Math Team

Math Team Coach

Lyme, NH

September 2015 – May 2018

- Designed practice problems and preparatory exercises for the AMC exams, MathCounts, and MathLeague. Led weekly problem solving sessions and group activities. During 2015–17, the Crossroads team twice won the Chapter and State MathCounts and MathLeague competitions and placed first in Northern New England on the AMC-8.

New Hampshire State MathCounts Team

Math Team Coach

Lyme, NH

March 2017 – May 2017

- Designed practice problems and preparatory exercises for the national MathCounts exam. Led bi-weekly problem solving sessions and group activities. Students competed in the national competition in Orlando, Florida.

Johns Hopkins Center for Talented Youth Science and Technology Series

Workshop Leader

Hanover, NH

- Developed and presented hour–long workshops for high school students.

Modern Cryptography (with D. Freund)

October 2014

Forensic Accounting

April 2016

Binary and Barcodes (with D. Freund)

April 2017

Dartmouth College Exploring Mathematics Camp

Co-Instructor

Hanover, NH

- Organized and presented week long math camps for high school students.

Mathematics of Games

August 2015

Cryptography

July 2015

RESEARCH PRESENTATIONS

Talks

* postponed or virtualized due to COVID-19

1. *JMM 2021, Washington DC, January 2021
Short Course: Mathematical and Computational Methods for Complex Social Systems
2. *INFORMS Special Session on Fairness in Operations Research, Baltimore, MD November 2020
Computational Methods For Assessing Districting Plans
3. Combinatorics, Linear Algebra, and Number Theory, WSU, Pullman, WA September 2020
Spectral Properties of Bethe Trees and representations of $SL_2(\mathbb{Z}/p^n\mathbb{Z})$
4. CGAD-GTOpt Seminar, Washington State University, Pullman, WA, July 2020
Geometric and Optimization Problems Motivated by Political Redistricting

5. *Random Walks in Math, Physics, and Society, Queen's University, Kingston, ON May 2020
Random Walks in Redistricting
6. *Common Experience Lecture, Texas State University, San Marcos, TX April 2020
Graphs, Geometry, and Gerrymandering
7. *Math Department Colloquium, St. Michael's College, Colchester, VT April 2020
Graphs, Geometry, and Gerrymandering
8. *Applied Math And Analysis Seminar, Duke University, Durham, NC March 2020
Computational Challenges in Redistricting
9. *AMS Southeastern Sectional Meeting, University of Virginia, Charlottesville, VA March 2020
Multiresolution Redistricting and Municipality Preservation
10. Redistricting Conference 2020, Duke University, Durham, NC, March 2020
Multiresolution Redistricting Algorithms
11. Math Department Colloquium, College of Charleston, Charleston, SC. February 2020
Geospatial Data, Markov Chains, and Political Redistricting
12. Math Department Colloquium, Washington State University, Pullman, WA. January 2020
Geospatial Data, Markov Chains, and Political Redistricting
13. JMM 2020, Denver, CO. January 2020
Markov chains for sampling connected graph partitions
14. Math Department Colloquium, Pacific University, Forest Grove, OR. January 2020
The Mathematics of Nested Legislative Districts
15. MIT Graphics Annual Retreat, North Falmouth, MA. October 2019
Connected Graph Partitions and Political Districting
16. Topology, Geometry and Data Seminar, Ohio State University, Columbus, OH. September 2019
Hardness results for sampling connected graph partitions with applications to redistricting
17. Math Department Colloquium, Denison University, Granville, OH. September 2019
Graphs, Geometry, and Gerrymandering
18. Math Department Colloquium, Oberlin College, Oberlin, OH. September 2019
Graphs, Geometry, and Gerrymandering
19. Math Department Colloquium, College of Wooster, Wooster, OH. September 2019
Graphs, Geometry, and Gerrymandering
20. Math Monday Colloquium, Kenyon College, Gambier, OH. September 2019
Graphs, Geometry, and Gerrymandering
21. Applied Math Seminar, University of Massachusetts Lowell, Lowell, MA. September 2019
Hardness results for sampling connected graph partitions with applications to redistricting
22. Math Department Colloquium, Yale University, New Haven, CT. August 2019
Mathematical Challenges in Neutral Redistricting
23. Voting Rights Data Institute Seminar, Cambridge, MA. June 2019
A Friendly Introduction to Discrete MCMC
24. Voting Rights Data Institute Seminar, Cambridge, MA. June 2019
Graphs and Networks: Discrete Approaches to Redistricting
25. Math Department Colloquium, Dartmouth College, Hanover, NH. April 2019
Total Variation Isoperimetric Profiles and Political Redistricting
26. ACM Seminar, Dartmouth College, Hanover, NH. April 2019
Hardness results for sampling connected graph partitions with applications to redistricting
27. Unrig Summit Masterclass, Nashville, TN. March 2019
Legal and Math Deep Dive: Gerrymandering and Redistricting
28. MIT Graphics Seminar, Cambridge, MA. March 2019
Computational Challenges in Neutral Redistricting
29. JMM 2019, Baltimore, MD. January 2019
Matched Products and Stirling Numbers of Graphs
30. Societal Concerns in Algorithm and Data Analysis, Weizmann Institute of Science, Rehovot, Israel. December 2018
Computational Problems in Neutral Redistricting

31. Math and Law of Redistricting, Radcliffe Institute, Cambridge, MA. *December 2018*
GerryChain and MCMC tutorials
32. Math Colloquium, Tufts University, Medford, MA. *November 2018*
Matched Products and Stirling Numbers of Graphs
33. MIT Graphics Annual Retreat, Dedham, MA. *October 2018*
Mathematical Challenges in Neutral Redistricting
34. SAMSI Workshop on Quantitative Redistricting, Duke University, Durham, NC. *October 2018*
Compactness Profiles and Reversible Sampling Methods for Plane and Graph Partitions
35. Election Teach-in, SMFA, Boston, MA. *October 2018*
Computational Challenges in Political Redistricting
36. STS Seminar, Tufts University, Cambridge, MA. *September 2018*
Mathematical Modeling of Social Connections
37. Voting Rights Data Institute Seminar, Cambridge, MA. *June 2018*
Introduction to Monte Carlo Methods
38. Mathematics Colloquium, University of Central Florida, Orlando, FL. *February 2018*
Dynamical Models for Multiplex Data
39. Mathematics Colloquium GVSU, Grand Valley, MI. *February 2018*
Random Walk Null Models for Time Series
40. Omidyar Fellowship Presentation, Santa Fe, NM. *January 2018*
Mathematical Embeddings of Complex Systems
41. Mathematics Colloquium at University of San Francisco, San Francisco, CA. *January 2018*
Dynamical Models for Multiplex Data
42. Mathematics Colloquium at Providence College, Providence, RI. *January 2018*
Dynamical Models for Multiplex Data
43. JMM, San Diego, CA. *January 2018*
Dynamical Modeling for Multiplex Networks
44. International Complex Networks Conference Lyon, France. *December 2017*
Multiplex Dynamics on the World Trade Web
45. Physics Colloquium at Washington University, St. Louis, MO. *October 2017*
Spectral Clustering on Multiplex Data
46. SIAM Annual Meeting, Pittsburgh, PA. *July 2017*
Permutation Complexity Measures for Time Series
47. Applied and Computational Mathematics Seminar, Hanover NH. *November 2016*
Random Dot Product Models for Weighted Networks
48. Inference on Networks: Algorithms, Phase Transitions, New Models and New Data, Santa Fe, NM. *December 2015*
Dynamically Motivated Models for Multiplex Networks
49. Applied Math Days, Troy, NY. *April 2015*
Multiplex Structure on the World Trade Web
50. Graduate Student Combinatorics Conference, Lexington, KY. *March 2015*
Total Dynamics on Multiplex Networks
51. Sixteenth International Fibonacci Conference, Rochester, NY. *July 2014*
Enumerating Distinct Chessboard Tilings
52. Dartmouth Graduate Student Seminar, Hanover, NH. *(Quarterly) 2013 - 2018*
Various Topics
53. Joint Mathematics Meeting, San Diego, CA. *January 2013*
Counting Combinatorial Rearrangements, Tilings with Squares and Symmetric Tilings
54. West Coast Number Theory Conference, Asilomar, CA. *December 2012*
Generalized Lucas Bases
55. Young Mathematician's Conference, Columbus, OH. *July 2012*
Combinatorial Rearrangements on Arbitrary Graphs
56. Northwest Undergraduate Mathematics Symposium, Portland, OR. *March 2012*
Combinatorial Rearrangements on Arbitrary Graphs

57. WSU Graduate Seminar on Combinatorial Geometry, Pullman, WA. *(Quarterly) 2012-2013*
Various Topics

Posters

1. SIAM Workshop on Network Science, Boston, MA. *July 2016*
Generalized Random Dot Product Models For Multigraphs
2. Dartmouth Graduate Student Poster Session, Hanover, NH. *April 2016*
Generalized Dot Product Models for Weighted Networks
3. Dartmouth Graduate Student Poster Session, Hanover, NH. *April 2015*
Multiplex Structures in the World Trade Web
4. WSU SURCA, Pullman, WA. *March 2013*
Empirical Analysis of Space Filling Curves for Scientific Computing Applications
5. WSU SURCA, Pullman, WA. *April 2012*
Combinatorial Rearrangements, Restricted Permutations, and Matrix Permanents

HONORS AND AWARDS

- Dartmouth Hannah Croasdale Award *2018*
College-wide award for the graduating Ph.D. student that best exemplifies the qualities of a scholar.
- Dartmouth Graduate Student Teaching Award *2017*
College-wide award for the graduate student who best exemplifies the qualities of a college educator.
- Dartmouth Graduate Fellowship *2014–18*
- NSF Graduate Research Fellowship: Honorable Mention *2014, 2015*
- Dartmouth GAANN Fellowship *2013*
- WSU Morris Knebelman Outstanding Senior Award *2013*
- WSU Department of Mathematics Outstanding Senior *2013*
- WSU Emeritus Society Award in the Physical Sciences *2013*
- WSU J. Russell and Mildred H. Vatnsdal Memorial Scholarship *2013*
- WSU SURCA Crimson Award: Computer Science and Mathematics *2012, 2013*
- WSU Auvil Undergraduate Scholars Fellowship *2012*
- WSU Leonard B. Kirschner Scholarship *2012*
- WSU College of Sciences Undergraduate Research Grant *2012*
- Norma C. Fuentes and Gary M Kirk Award for Excellence in Undergraduate Research *2012*

PROFESSIONAL SERVICE

Peer Reviewer

- International Conference on Artificial Intelligence and Statistics (AISTATS)
- AAAI Conference on Artificial Intelligence (AAAI)
- International Conference on Machine Learning (ICML)
- ACM-SIAM Symposium on Discrete Algorithms (SODA)
- Neural Information Processing Systems (NeurIPS)
- Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
- Chaos: An Interdisciplinary Journal of Nonlinear Science
- Involve: A Journal of Mathematics
- Entropy
- MATCH Communications in Mathematical and in Computer Chemistry

Other

- AMS MathReviews (20 reviews)
- Poster Judge – MAA undergraduate poster session at JMM *2019, 2020*