DARYL R. DEFORD

Curriculum Vitae

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ACADEMIC APPOINTMENTS

I am currently a postdoc in the **Metric Geometry and Gerrymandering Group** working on problems related to political redistricting. My official appointments are:

Massachusetts Institute of Technology, Cambridge, MA *June 2018 – Present*

Postdoctoral Associate – CSAIL Geometric Data Processing Group

Advisor: Justin Solomon

Tufts University, Medford, MA *June 2018 – Present*

Visiting Scholar – Jonathan M. Tisch College of Civic Life

Advisor: Moon Duchin

EDUCATION

Dartmouth College, Hanover, NH *September 2013 – June 2018*

Ph.D. Mathematics *June 2018*

Advisor: Dan Rockmore

Dissertation: Matched Products and Dynamical Models for Multiplex Networks

A.M. Mathematics *November 2014*

Washington State University, Pullman, WA *August 2010 – May 2013*

B.S. in Theoretical Mathematics *May 2013*

Summa Cum Laude

PUBLICATIONS

Accepted Papers

A1: *A New Framework for Dynamical Models on Multiplex Networks* (with S. Pauls), Journal of Complex Networks, 6(3), 353-381, 2018.

A2: *Multiplex Dynamics on the World Trade Web*, Proc. 6th International Conference on Complex Networks and Applications, Studies in Computational Intelligence, Springer, 1111–1123, 2018.

A3: *Cyclic Groups with the same Hodge Series*, (with P. Doyle), Revista de la Uniòn Matemática Argentina, 59(2), 241–254, 2018.

A4: *Random Walk Null Models for Time Series Data*, (with K. Moore), Entropy, 19(11), 615, 2017.

A5: *Enumerating Tilings of Rectangles By Squares*, Journal of Combinatorics, 6(3), 339-351, 2015.

A6: *Enumerating Distinct Chessboard Tilings*, Fibonacci Quarterly, 52(5), 102-116, 2014.

A7: *Pulsated Fibonacci Sequences* (with K. Atanassov and A. Shannon), Fibonacci Quarterly, 52(5), 22-27, 2014.

A8: *Seating Rearrangements on Arbitrary Graphs*, Involve: A Journal of Mathematics, 7(6), 787-805, 2014.

A9: *Empirical Analysis of Space-Filling Curves for Scientific Computing Applications* (With A. Kalyanaraman), Proc. 42nd International Conference on Parallel Processing, 170-179, 2013.

A10: *Counting Rearrangements on Generalized Wheel Graphs*, Fibonacci Quarterly, 51(3), 259-273, 2013.

Preprints and Technical Reports

P1: *On the Spectrum of Finite, Rooted Homogeneous Trees* (with D. Rockmore), in preparation.
P2: *Total Variation Isoperimetric Profiles* (with H. Lavenant, Z. Schutzman, and J. Solomon), arXiv: 1809.07943, submitted.
P3: *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.
P4: *Spectral Clustering Methods for Multiplex Networks* (with S. Pauls) arXiv: 1703.05355, submitted.
P5: *A Random Dot Product Model for Weighted Networks* (with D. Rockmore) arXiv: 1611.02530
P6: *An Application of the Permanent–Determinant Method: Computing the Z-Index of Arbitrary Trees*, WSU Department of Mathematics Technical Report Series 2013 #2.

TEACHING EXPERIENCE

Tufts University Medford, MA
Co-Instructor *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.

Massachuesetts Institute of Technology Cambridge, MA
IAP Instructor *January 2019*

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

Metric Geometry and Gerrymandering Group Cambridge, MA
VRDI Instructor *June 2018–August 2018*

Organized and led student research groups during an eight week summer program on poltical redistricting for 52 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.

Dartmouth College Hanover, NH
Instructor *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 Pullman, WA
Undergraduate Teaching Assistant *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

NH State Math Team Manchester, NH
Math Team Coach *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.

LaTeX Workshops Hanover, NH
Organizer *Fall 2016–May 2018*

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

Crossroads Academy Math Team Lyme, NH
Math Team Coach *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.

NH State MathCounts Team Lyme, NH
Math Team Coach *March 2017 – May 2017*

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

JHU- CTY Science and Technology Series Hanover, NH
Workshop Leader

· 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 Hanover, NH
co-Instructor

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

Mathematics of Games	*August 2015*
Cryptography	*July 2015*

RESEARCH PRESENTATIONS

Talks

1. JMM 2019, Baltimore, MD *January 2019*
   Matched Products and Stirling Numbers of Graphs
2. SCADA18, Weizmann Institute of Science, Rehovot Israel *December 2018*
   Computational Problems in Neutral Redistricting
3. Math and Law of Redistricting, Radcliffe, Cambridge, MA *December 2018*
   GerryChain and MCMC tutorials
4. Math Colloquium, Tufts University, Medford, MA *November 2018*
   Matched Products and Stirling Numbers of Graphs
5. SAMSI Workshop on Quantitative Redistricting, Duke University, Durham, NC *October 2018*
   Compactness Profiles and Reversible Sampling Methods for Plane and Graph Partitions
6. Election Teach–in, SMFA, Boston, MA *October 2018*
   Computational Challenges in Political Redistricting
7. STS Seminar, Tufts University, Cambridge, MA *September 2018*
   Mathematical Modeling of Social Connections
8. Voting Rights Data Institute Seminar, Cambridge, MA *June 2018*
   Introduction to Monte Carlo Methods
9. Mathematics Colloquium, University of Central Florida, Orlando, FL *February 2018*
   Dynamical Models for Multiplex Data
10. Mathematics Colloquium GVSU, Grand Valley, MI *February 2018*
    Random Walk Null Models for Time Series
11. Omidyar Fellowship Presentation, Santa Fe, NM *January 2018*
    Mathematical Embeddings of Complex Systems
12. Mathematics Colloquium at University of San Fransisco, San Fransisco, CA *January 2018*
    Dynamical Models for Multiplex Data
13. Mathematics Colloquium at Providence College, Providence, RI *January 2018*
    Dynamical Models for Multiplex Data
14. JMM, San Diego, CA *January 2018*
    Dynamical Modeling for Multiplex Networks
15. International Complex Networks Conference Lyon, France *December 2017*
    Multiplex Dynamics on the World Trade Web
16. Physics Colloquium at Washington University, St. Louis, MO *October 2017*
    Spectral Clustering on Multiplex Data
17. SIAM Annual Meeting, Pittsburgh, PA *July 2017*
    Permutation Complexity Measures for Time Series
18. Applied and Computational Mathematics Seminar, Hanover NH *November 2016*
    Random Dot Product Models for Weighted Networks
19. Inference on Networks: Algorithms, Phase Transitions, New Models and New Data, Santa Fe, NM. *December 2015*
    Dynamically Motivated Models for Multiplex Networks
20. Applied Math Days, Troy, NY. *April 2015*
    Multiplex Structure on the World Trade Web
21. Graduate Student Combinatorics Conference, Lexington, KY. *March 2015*
    Total Dynamics on Multiplex Networks
22. Sixteenth International Fibonacci Conference, Rochester, NY. *July 2014*
    Enumerating Distinct Chessboard Tilings
23. Dartmouth Graduate Student Seminar, Hanover, NH. *(Quarterly) 2013 - Present*
    Various Topics
24. Joint Mathematics Meeting, San Diego, CA. *January 2013*
    Counting Combinatorial Rearrangements, Tilings with Squares and Symmetric Tilings
25. West Coast Number Theory Conference, Asilomar, CA. *December 2012*

Generalized Lucas Bases

26. Young Mathematician's Conference, Columbus, OH. *July 2012*
    Combinatorial Rearrangements on Arbitrary Graphs
27. Northwest Undergraduate Mathematics Symposium, Portland, OR. *March 2012*
    Combinatorial Rearrangements on Arbitrary Graphs
28. 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

Academic 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*
- Dartmouth GAANN Fellowship *2013–14*
- WSU Department of Mathematics Outstanding Senior *2013*
- WSU Morris Knebelman Outstanding Senior Award *2013*
- WSU J. Russell and Mildred H. Vatnsdal Memorial Scholarship *2012–13*

Research Awards

- NSF Graduate Research Fellowship: Honorable Mention *2014, 2015*
- WSU Emeritus Society Award in the Physical Sciences *2013*
- WSU SURCA Crimson Award: Computer Science and Mathematics *2012, 2013*
- WSU Auvil Undergraduate Scholars Fellowship *2012–13*
- WSU Leonard B. Kirschner Scholarship *2012–13*
- WSU College of Sciences Undergraduate Research Grant *2012*
- Norma C. Fuentes and Gary M Kirk Award for Excellence in Undergraduate Research *2012*

PEER REVIEWER

- AMS MathReviews (15 reviews)
- Entropy
- Chaos: An Interdisciplinary Journal of Nonlinear Science
- Involve: A Journal of Mathematics
- International Conference on Machine Learning (ICML)
- ACM-SIAM Symposium on Discrete Algorithms (SODA)
- MATCH Communications in Mathematical and in Computer Chemistry

PROFESSIONAL MEMBERSHIPS

- Society for Industrial and Applied Mathematics (SIAM) *joined June 2016*
- American Mathematical Society (AMS) *joined April 2012*
- Mathematical Association of America (MAA) *joined April 2012*
- Fibonacci Association (FA) *joined February 2013*