

Professor and Chair
Department of Mathematics
Oberlin College

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<http://www.oberlin.edu/faculty/kwoods/>

Education and Employment

Chair of Mathematics, Oberlin College, 2017-2019.

Professor of Mathematics, Oberlin College, 2018-present.

Associate Professor of Mathematics, Oberlin College, 2012-2018.

Assistant Professor of Mathematics, Oberlin College, 2006-2012.

Visiting Assistant Professor, University of California, Berkeley, 2005-2006.

NSF Postdoctoral Fellow in Mathematics, University of California, Berkeley, 2004-2006.

Ph.D. in Mathematics, University of Michigan, Alexander Barvinok, advisor, 2004.

B.S., Summa cum Laude, with Honors in Mathematics, Wake Forest University, 2000.

Publications (available at <http://www.oberlin.edu/faculty/kwoods/papers.html>)

The parametric shortest and closest vector problems (with Tristram Bogart, John Goodrick), preprint (2019).

Parametric Presburger arithmetic: complexity of counting and quantifier elimination (with Tristram Bogart, John Goodrick, and Danny Nguyen), *Mathematical Logic Quarterly*, 65 (2019), 237-250.

The danger of testing by selecting controlled subsets, with applications to spoken-word recognition (with David Liben-Nowell, Julia Strand, Alexa Sharp, and Tom Wexler), *Journal of Cognition* 2(1):2 (2019).

AdaM and GrahaM Play the Stock Market, *The American Mathematical Monthly* 125 (2-18), p:257.

Parametric Presburger arithmetic: logic, combinatorics, and quasi-polynomial behavior (with Tristram Bogart and John Goodrick), *Discrete Analysis* (2017), #4.

The parametric Frobenius problem (with Bjarke Hammersholt Røne), *Electronic Journal of Combinatorics* 22 (2015), #P2.36.

Presburger arithmetic, rational generating functions, and quasi-polynomials, *Journal of Symbolic Logic* 80 (2015), 433-449. Extended abstract in Proceedings of ICALP '13, the *International Colloquium on Automata, Languages and Programming*.

The unreasonable ubiquitousness of quasi-polynomials, *Electronic Journal of Combinatorics* 21 (2014), #P1.44. Extended abstract in Proceedings of FPSAC '13, the *International Conference on Formal Power Series and Algebraic Combinatorics*.

Book review of *Symmetry: A Mathematical Exploration*, by Kristopher Tapp. In *The American Mathematical Monthly* 120 (2013), 477-481.

Computing Shapley value in supermodular coalitional games (with David Liben-Nowell, Alexa Sharp, and Tom Wexler), Proceedings of COCOON '12, the *International Computing and Combinatorics Conference* (2012).

- The price of civil society (with Russell Buehler, Zachary Goldman, David Liben-Nowell, Yuechao Pei, Jamie Quadri, Alexa Sharp, Sam Taggart, and Tom Wexler), Proceedings of WINE, the *Workshop on Internet and Network Economics* (2011).
- A finite calculus approach to Ehrhart polynomials (with Steven Sam), *The Electronic Journal of Combinatorics*, 17 (2010), #R68.
- An implementation of the Barvinok-Woods integer projection algorithm (with Matthias Koeppel and Sven Verdoolaege), Proceedings of the *International Conference on Information Theory and Statistical Learning* (2008), 53-59.
- Maximal periods of (Ehrhart) quasi-polynomials (with Matthias Beck and Steven Sam), *Journal of Combinatorial Theory, Series A*, 115 (2008), 517-525.
- Counting with generating functions (with Sven Verdoolaege), *Journal of Symbolic Computation* 43 (2008), 75–91.
- The probability of choosing primitive sets (with Sergi Elizalde), *Journal of Number Theory*, 125 (2007), 39-49.
- Bounds on the number of inference functions of a graphical model (with Sergi Elizalde), *Statistica Sinica*, 17 (2007), 1395-1415. Also in Proceedings of FPSAC, the *International Conference on Formal Power Series and Algebraic Combinatorics* (2006).
- Parametric alignment of Drosophila genomes (with Colin Dewey, Peter Huggins, Bernd Sturmfels, and Lior Pachter), *PLoS Computational Biology*, 2 (2006), 606-614.
- Neighborhood complexes and generating functions for affine semigroups (with Herbert Scarf), *Discrete and Computational Geometry*, 35 (2006), 385 – 403.
- Computing the period of an Ehrhart quasi-polynomial, *The Electronic Journal of Combinatorics*, 12 (2005), #R34.
- Short rational generating functions and their applications to integer programming (with Ruriko Yoshida), *SIAG/OPT Views and News*, 16 (2005), 15-19.
- Parametric Sequence Alignment (with Colin Dewey). In *Algebraic Statistics for Computational Biology*, Lior Pachter and Bernd Sturmfels, eds, Cambridge University Press (2005), 193-205.
- The minimum period of the Ehrhart quasi-polynomial of a rational polytope (with Tyrell McAllister), *Journal of Combinatorial Theory, Series A*, 109 (2005), 345-352.
- Rational Generating Functions and Lattice Point Sets*, Ph.D. thesis, University of Michigan (2004).
- Short rational generating functions for lattice point problems (with Alexander Barvinok). *Journal of the American Mathematical Society*, 16 (2003), 957-979.
- Parametric inference of HIV recombinant genomes (with Niko Beerenwinkel and Colin Dewey), unpublished manuscript.

Teaching

At Oberlin College:

STAT 113, Introduction to Statistics, Fall 2006, Spring 2007, Fall 2007, Fall 2011 (2 sections), Spring 2013, Fall 2013 (2 sections), Spring 2015, Fall 2016 (2 sections), Spring 2018 (2 sections), Fall 2018.

MATH 131, Calculus Ia, Fall 2006.

MATH 133, Calculus I, Spring 2014.

MATH 318, Cryptography, Spring 2019.

MATH 220, Discrete Mathematics, Spring 2008 (2 sections), Fall 2008 (2 sections), Spring 2011 (2 sections), Fall 2015.

MATH 231, Multivariable Calculus, Spring 2012, Spring 2016 (2 sections).

MATH 328, Computational Algebra and Algebraic Geometry, Fall 2010.

MATH 335, Probability, Fall 2007, Fall 2014, Fall 2015, Fall 2018.

MATH 342, The Mathematics of Social Choice, Spring 2012, Spring 2014, Spring 2016, Fall 2017.

MATH 343, Combinatorics, Spring 2009.

MATH 345, Information Theory, Spring 2007, Spring 2009, Spring 2011, Spring 2013, Spring 2015, Spring 2017.

MATH 348, Graphical Models, Spring 2008.

FYSP 067, Agreeing to Disagree: The Mathematics and Philosophy of Cooperation, Fall 2013, Fall 2014, Fall 2016.

FYSP 179, Symmetry in Science, Art, and Life (First Year Seminar), Fall 2008, Fall 2010.

At the University of California, Berkeley:

MATH 113, Abstract Algebra, Spring 2006.
MATH 172, Combinatorics, Fall 2005.

At the University of Michigan:

MATH 115, Calculus I, Winter 2001.
MATH 105, Data, Functions, and Graphs, Fall 2001.

Undergraduate Research Students Mentored

Eli Bixby, Pat Haggerty, Whit Schorn (with Alexa Sharp and Tom Wexler, Oberlin College), Summer 2012.

Fifteen students (with Alexa Sharp and Tom Wexler, Oberlin College; and David Liben-Nowell, Carlton College), Summer 2010.

Sam Cole, David Leibovic, Elara Willett, Jamie Quadri (with Alexa Sharp, Oberlin College), Summer 2009.

Steven Sam, University of California, Berkeley, 2005-2007.

Honors Students

Oliver Meldrum, 2018-2019.

Bobby Dorward, *Combinatorial statistics on restricted growth functions containing a pattern exactly k times*, 2016.

Sam Rossin, *Steiner Tree Games*, 2015-2016 (CS Honors Student).

Ryo Kimura (with Bob Bosch), *Quantum Computing: An Undergraduate's Guide to Shor's Algorithm*, 2013-2014.
James Foust, *Payment Schemes and Moral Hazard*, 2012-2013.
Shahab Raza, *The Probabilistic Method*, 2011-12.
Liam Solus, *Triangulations and Toric Ideals*, 2010-11.
Nicholas Lowery, *Topology and Infinite Graphs*, 2008.

Research Interests

Discrete and Computational Geometry.
Algorithmic Game Theory.
Computational biology from a combinatorial perspective.
Algorithms, generating functions, lattice points in polyhedra, integer programming (including test sets), geometry of numbers, complexity theory.
Applications in combinatorics, commutative algebra, logic, theoretical computer science.

Grants, Fellowships, and Scholarships

Research Status (competitive across Oberlin College), 2009-2010.
Project NeXT Fellowship, 2006-2007.
NSF Postdoctoral Fellowship, 2004-2007.
Clay Liftoff Fellowship, August 2004.
NSF Graduate Research Fellowship, 2000-2004.
VIGRE Graduate Fellowship, University of Michigan, 2000-2004.

Professional Activities

Associate Editor, *American Mathematical Monthly*, 2017-
Member AMS, AWM, MAA.
Co-organizer and Program Co-chair, Midstates Conference for Undergraduate Research in Computer Science and Mathematics, Oberlin College, November 2009.
Co-organizer, Special Session on the Linear Diophantine Problem of Frobenius, AMS-MAA Joint Meetings, January 2008.
Author of 20 Mathematical Reviews (the primary journal and database containing written summaries/reviews of mathematical articles, see <http://www.ams.org/mathscinet>).

Journals/Conferences/Grants refereed for:

Discrete Mathematics (2004, 2011, 2019)
Discrete and Computational Geometry (2003, 2007, 2008, 2019)
Combinatorica (2003, 2014, 2019)
Algebraic Combinatorics (2018)
American Mathematical Monthly (2010, 2018)
Journal of Integer Sequences (2017)

FOCS: Symposium on Foundations of Computer Science (2017)
CCC: Computational Complexity Conference (2017)
SIAM Journal on Discrete Mathematics (2013, 2014, 2017)
Electronic Journal of Combinatorics (2016, 2017, 2017)
Journal of Number Theory (2006, 2017)
IPCO: Conference on Integer Programming and Combinatorial Optimization (2013, 2016)
Annals of Combinatorics (2016)
Proceedings of the AMS (2016)
European Journal of Combinatorics (2016)
FPSAC: International Conference on Formal Power Series and Algebraic Combinatorics (2016)
Mathematics of Operations Research (2003, 2007, 2009, 2011, 2013, 2015)
Journal of Algebraic Combinatorics (2014)
NSA Mathematical Sciences Grant Program (2014, 2014).
Random Structures and Algorithms (2013)
College Mathematics Journal (2008, 2009, 2010, 2011, 2013)
ACM Symposium on Parallelism in Algorithms and Architectures (2013)
Journal of Combinatorial Theory – Series A (2005, 2007, 2008, 2012)
Transactions of the AMS (2011)
INTEGERS (2010)
Discrete Optimization (2010)
IMA Volumes in Mathematics and its Applications (2009)
Bulletin of Mathematical Biology (2009)
Journal of Pure and Applied Algebra (2008)
Communications in Algebra (2008)
Linear Algebra and its Applications (2008)
Snowbird Research Conference Proceedings (2007)
Algorithmica (2005, 2006)
Australasian Journal of Combinatorics (2004)
Discrete Applied Mathematics (2003)

Presentations

The Complexity of Presburger Arithmetic in Fixed Dimension

ISMP, the International Symposium on Mathematical Programming, July 2018.
Faculty Seminar, Oberlin College, February 2019.

Untangling Escher through complex analysis

Student / Faculty Lunch, Oberlin College, April 2018.
Science Friday, Oberlin College, October 2011.
Student / Faculty Lunch, Oberlin College, October 2011.

What is a “Nice” Formula, and Where Do I Get One?

Faculty Seminar, Oberlin College, March 2018.

Counting with Rational Generating Functions

Faculty Seminar, Oberlin College, November 2017.
Geometric Combinatorics minisymposium, SIAM Conference on Discrete Mathematics, June 2010.
Workshop on Dedekind sums in geometry, topology, and arithmetic, BIRS, Banff, October 2009.
Discrete Mathematics and Representation Theory Seminar, University of California, Davis, April 2005.
Algebra-Geometry-Combinatorics Seminar, San Francisco State University, April 2005.
MSRI post-doc seminar, November 2004.

Cubing the Pyramid: or, Why We Need Calculus (and Measure Theory)

Student / Faculty Lunch, Oberlin College, February 2019.
Colloquium, College of Wooster, February 2017.
Colloquium, Ohio Wesleyan, October 2014.
Colloquium, Kenyon College, October 2012.
Colloquium, Gettysburg College, January 2012.
Colloquium, Carleton College, January 2012.
Colloquium, Denison University, November 2011.
Undergraduate Colloquium, Colorado College, February 2010.
Student Research Colloquium, Oberlin College, July 2009.
Undergraduate Colloquium, Kent State University, July 2009.
Student / Faculty Lunch, Oberlin College, March 2007.

Counting with Colombians

Faculty Seminar, Oberlin College, September 2016.

Counting with Quasi-polynomials

Colloquium, Universidad de los Andes, August 2015.

Decidability and Quantifier Elimination

Faculty Seminar, Oberlin College, April 2015.

The Banach-Tarski Paradox

Student / Faculty Lunch, Oberlin College, February 2015.

The Parametric Frobenius Problem

Faculty Seminar, Oberlin College, February 2014.

Presburger arithmetic, rational generating functions, and quasi-polynomials

ICALP, the International Colloquium on Automata, Languages and Programming, July 2013.

The Unreasonable Ubiquitousness of Quasi-polynomials

FPSAC, the International Conference on Formal Power Series and Algebraic Combinatorics, June 2013 (poster).
Faculty Seminar, Oberlin College, December 2012.
Special Session on Toric Algebraic Geometry and Beyond, AMS Central Sectional, October 2012.

Generating Functions and the Two Stamp Problem

- Colloquium, College of Wooster, October 2012.
- Colloquium, Niagara University, February 2012.
- Colloquium, Loyola University Maryland, February 2012.
- Colloquium, James Madison University, January 2012.
- Colloquium, Vassar College, January 2012.
- Colloquium, Drake University, December 2011.
- Colloquium, Claremont Colleges, December 2009.
- Departmental Spring Banquet, Ohio Wesleyan University, April 2009.
- Colloquium, Denison University, March 2009.
- Colloquium, Franklin and Marshall College, January 2009.
- Colloquium, Ursinus College, December 2008.
- Undergraduate Colloquium, Kent State University, November 2007.
- Colloquium, Kenyon College, March 2007.
- Colloquium, Bard College, January 2006.
- Colloquium, Oberlin College, December 2005.
- Colloquium, Carleton College, February 2005.
- Colloquium, Bucknell University, February 2005.
- Colloquium, Washington and Lee University, January 2005.
- Session on Combinatorics, AMS-MAA Joint Meetings, January 2005.
- Colloquium, Wake Forest University, January 2005.

Computing Shapley Value in Supermodular Coalitional Games

- COCOON, the International Computing and Combinatorics Conference, Sydney, August 2012.
- Faculty Seminar, Oberlin College, February 2011.

The price of civil society

- Faculty Seminar, Oberlin College, November 2011.

Solving Lattice Point Problems Using Rational Generating Functions

- Discrete CATS Seminar, University of Kentucky, April 2010.
- Research Seminar, Colorado College, February 2010.
- Combinatorics Seminar, IPAM, UCLA, November 2009.
- Combinatorics Seminar, University of California, San Diego, November 2009.
- Faculty Seminar, Oberlin College, May 2009.
- Colloquium, Case Western Reserve University, October 2008.
- Colloquium, Cleveland State University, November 2007.
- Colloquium, Kent State University, November 2007.
- BAD (Bay Area Discrete) Math Day, October 2004.
- Geometry Seminar, Georgia Institute of Technology, February 2004.
- Microsoft Research, Redmond, WA, January 2004.
- Workshop on Combinatorial and Discrete Geometry, MSRI, November 2003.
- Combinatorics Seminar, Massachusetts Institute of Technology, October 2003.
- Integer points in Polyhedra, AMS-IMS-SIAM Joint Summer Research Conference, Snowbird, Utah, July 2003.
- Combinatorics/Geometry Seminar, University of Washington, Seattle, April 2003.

Cowles Foundation, Yale University, March 2003.
Discrete Mathematics Seminar, University of California, Davis, January 2003.
Miniworkshop on Algebraic Statistics, University of California, Berkeley, January 2003.
Combinatorics Seminar. University of Michigan, January 2003.
VIGRE Seminar, University of Michigan, September 2003.

Neighborhood Complexes and Rational Generating Functions

Faculty Seminar, Oberlin College, March 2010.
Algebra / Number Theory / Combinatorics Seminar, the Claremont Colleges, November 2009.
Session on Combinatorics, AMS-MAA Joint Meetings, January 2006.

A Finite Calculus Approach to Ehrhart Polynomials

Special Session on Algebra and Number Theory with Polyhedra, AMS Western Sectional, April 2009.

Combinatorics and Graphical Models: investigating inference functions

Special Session on Applications of Algebraic and Geometric Combinatorics, AMS Southeastern Sectional, April 2009.

Squooshing the Cube

Student/Faculty Lunch, Oberlin College, March 2008.

Parametric Inference for Graphical Models

Algebraic Statistics Seminar, Ohio State University, November 2007.

Periods of Ehrhart quasi-polynomials

Integer points in Polyhedra, AMS-IMS-SIAM Joint Summer Research Conference, Snowbird, Utah, August 2006.
Special Session on Enumerative Aspects of Polytopes, AMS Western Sectional, April 2006.

Computing the Period of an Ehrhart Quasi-polynomial

Mini-workshop on Ehrhart Quasipolynomials, Mathematisches Forschungsinstitut Oberwolfach, August 2004.

Various topics:

Mathematics Undergraduate Student Association Lecture Series, University of California, Berkeley, May 2005.
Student Combinatorics Seminar, University of Michigan, November 2001, November 2002, October 2003.
Student Theoretical Computer Science Seminar, University of Michigan, October 2003.
Mathematics Awareness Day. North Carolina A&T State University. April 2000.
Special Session on Undergraduate Research, Joint Meetings, Washington DC, January 2000 (with J. DeBlois, N. Boethe, L. Powell).
Poster Presented. Poster Session on Undergraduate Research, Joint Meetings, Washington DC, January 2000.

Conferences Attended

External Support Received:

- R.L. Moore Legacy Conference, Austin, TX, June 2010.
- Workshop on Dedekind sums in geometry, topology, and arithmetic, Banff International Research Station for Mathematical Innovation and Discovery (BIRS), October 2009.
- MAA MathFest, San Jose, August 2007.
- Data Analysis in Law Enforcement and Homeland Security, DyDAn Reconnect Conference, Rutgers University, August 2007.
- Inquiry-Based Learning Workshop, Orange County, California, June 2007.
- R.L. Moore Legacy Conference, Austin, April 2007.
- AMS-MAA Joint Meetings, New Orleans, January 2007.
- MAA MathFest, Knoxville, August 2006.
- Integer points in Polyhedra, AMS-IMS-SIAM Joint Summer Research Conference, Snowbird, Utah, June 2006.
- Summer School on Computing the Continuous Discretely, Banff International Research Station for Mathematical Innovation and Discovery (BIRS), August 2005.
- Mini-workshop on Ehrhart Quasipolynomials, Mathematisches Forschungsinstitut Oberwolfach, August 2004.
- Integer points in Polyhedra, AMS-IMS-SIAM Joint Summer Research Conference, Snowbird, Utah, July 2003.

Other:

- ISMP, the International Symposium on Mathematical Programming, July 2018.
- AMS-MAA Joint Meetings, Atlanta, January 2017.
- ICALP, the International Colloquium on Automata, Languages and Programming, July 2013.
- FPSAC, the International Conference on Formal Power Series and Algebraic Combinatorics, June 2013.
- Special Session on Toric Algebraic Geometry and Beyond, AMS Central Sectional, Akron, October 2012.
- COCOON, the International Computing and Combinatorics Conference, Sydney, August 2012.
- The Mathematics of Klee & Grünbaum, University of Washington, Seattle, July 2010.
- SIAM Conference on Discrete Mathematics, Austin, June 2010.
- AMS-MAA Joint Meetings, San Francisco, January 2010.
- Program on Combinatorics: Methods and Applications in Mathematics and Computer Science, IPAM, Los Angeles, September – December 2009.
- Special Session on Algebra & Number Theory with Polyhedra, AMS Western Sectional, San Francisco, April 2009.
- Special Session on Applications of Algebraic and Geometric Combinatorics, AMS Southeastern Sectional, Raleigh, April 2009.

AMS-MAA Joint Meetings, Washington, DC, January 2009.
Special Session on the Linear Diophantine Problem of Frobenius, AMS-MAA Joint Meetings, San Diego, January 2008 (Co-organizer).
Special Session on Enumerative Aspects of Polytopes, AMS Western Sectional, San Francisco, April 2006.
AMS-MAA Joint Meetings, San Antonio, January 2006.
AMS-MAA Joint Meetings, Atlanta, January 2005.
Workshop on Combinatorial and Discrete Geometry, MSRI, Berkeley, November 2003.
Miniworkshop on Algebraic Statistics, University of California, Berkeley, January 2003.

Honors and Awards

Horace H. Rackham Distinguished Dissertation Award (given to eight theses university-wide), University of Michigan, 2005.
Sumner Myers Prize (“for the best Ph.D. dissertation in mathematics”), University of Michigan, 2004.
Wirt and Mary Cornwell Award (“to a student who, during the four previous years, has demonstrated the greatest intellectual curiosity and has given the most promise of original study and creative work in mathematics”), University of Michigan, 2004.
William and Ruth Archie Award (“for the student who best exemplifies the ideals of a liberal arts education”), Wake Forest University, 2000.