

Yan Zhuang

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Appointments

(Last Updated: July 25, 2022)

Davidson College , Davidson, NC Assistant Professor of Mathematics and Computer Science	2018–present
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Education

Brandeis University , Waltham, MA Ph.D., Mathematics Dissertation: <i>Noncommutative Symmetric Functions and Permutation Enumeration</i> Advisor: Ira M. Gessel	2013–2018
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Goucher College , Baltimore, MD B.A., Mathematics and Philosophy. <i>Summa cum laude.</i> Phi Beta Kappa. Departmental Honors in Mathematics and Philosophy.	2009–2013
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Research Interests

Enumerative combinatorics and algebraic combinatorics: permutation enumeration; symmetric functions, quasisymmetric functions, noncommutative symmetric functions; combinatorial Hopf algebras.

Papers

All papers published in (or submitted to) peer-reviewed venues. Names marked with an asterisk (*) indicate undergraduate student co-authors.

16. **A lifting of the Goulden–Jackson cluster method to the Malvenuto–Reutenauer algebra.**
To appear in *Algebraic Combinatorics*. [arXiv:2108.10309]
15. **Fibonacci numbers, consecutive patterns, and inverse peaks**, with Justin M. Troyka.
Advances in Applied Mathematics 141: Article #102406, 19 pp., 2022. [arXiv:2109.14774]
14. **Refined consecutive pattern enumeration via a generalized cluster method.**
Proceedings of the 34th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), *Séminaire Lotharingien de Combinatoire* 86B: Article #2, 12 pp., 2022. [Link to S.L.C.]
13. **Plethystic formulas for permutation enumeration**, with Ira M. Gessel.
Advances in Mathematics 375: Article #107370, 55 pp., 2020. [arXiv:2001.00654]
12. **Counting permutations by peaks, descents, and cycle type**, with Ira M. Gessel.
Proceedings of the 32nd International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), *Séminaire Lotharingien de Combinatoire* 84B: Article #12, 12 pp., 2020. [Link to S.L.C.]

11. **On the joint distribution of cyclic valleys and excedances over conjugacy classes of \mathfrak{S}_n** , with M. Crossan Cooper* and William S. Jones*. *Advances in Applied Mathematics* 115: Article #101999, 15 pp., 2020. [arXiv:1906.05191]
10. **Hopping from Chebyshev polynomials to permutation statistics**, with Jordan O. Tirrell. *Electronic Journal of Combinatorics* 26(3): Paper #P3.27, 17 pp., 2019. [Link to E.J.C.]
9. **Homomorphisms on noncommutative symmetric functions and permutation enumeration**, with Ira M. Gessel. Proceedings of the 31st International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), *Séminaire Lotharingien de Combinatoire* 82B: Article #6, 12 pp., 2019. [Link to S.L.C.]
8. **Shuffle-compatible descent statistics and quotients of quasisymmetric functions**, with Ira M. Gessel. Proceedings of the 30th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), *Séminaire Lotharingien de Combinatoire* 80B: Article #5, 12 pp., 2018. [Link to S.L.C.]
7. **Shuffle-compatible permutation statistics**, with Ira M. Gessel. *Advances in Mathematics* 332: 85–141, 2018. [arXiv:1706.00750]
6. **A generalized Goulden–Jackson cluster method and lattice path enumeration**. *Discrete Mathematics* 341(2): 358–379, 2018. [arXiv:1508.02793]
5. **Eulerian polynomials and descent statistics**. *Advances in Applied Mathematics* 90: 86–144, 2017. [arXiv:1610.07218]
4. **Counting permutations by runs**. *Journal of Combinatorial Theory, Series A* 142: 147–176, 2016. [arXiv:1505.02308]
3. **Logarithmic representability of integers as k -sums**, with Anant P. Godbole, Samuel Gutekunst, and Vince Lyzinski. Proceedings of Integers 2013: The Erdős Centennial Conference, *Integers: The Electronic Journal of Combinatorial Number Theory* 15A: Paper #A5, 15 pp., 2015. [Link to Integers]
2. **Counting permutations by alternating descents**, with Ira M. Gessel. *Electronic Journal of Combinatorics* 21(4): Paper #P4.23, 21 pp., 2014. [Link to E.J.C.]
1. **Shattering thresholds for random systems of sets, words, and permutations**, with Anant P. Godbole and Samantha Pinella. Proceedings of the 10th International Conference on Permutation Patterns, *Pure Mathematics and Applications* 24(2): 125–142, 2013. [Link to P.U.M.A.]

Research Presentations

Presentations listed under the same title may not have had the same title at time of presentation, but covered roughly the same material.

Invited Research Talks

- A Lifting of the Goulden–Jackson Cluster Method to the Malvenuto–Reutenauer Algebra
 - *Special Session on Algebraic Combinatorics in the Southeast* Nov. 2021
 - AMS Fall Southeastern Sectional Meeting, Online

- *Combinatorics Seminar*, University of Florida (delivered online) Jan. 2021
- Counting Permutations by Peaks, Descents, and Cycle Type
 - *Combinatorics Seminar*, George Washington University, Washington, DC Mar. 2020
 - *Mathematics Colloquium*, Wake Forest University, Winston-Salem, NC Oct. 2019
 - *Algebra and Combinatorics Seminar*, North Carolina State University, Raleigh, NC Oct. 2019
- Shuffle-Compatible Permutation Statistics
 - *Algebra and Discrete Mathematics Seminar*, Clemson University, Clemson, SC Nov. 2018
 - *Combinatorics Seminar*, University of Southern California, Los Angeles, CA Apr. 2018
 - *Combinatorics Seminar*, University of California San Diego, La Jolla, CA Apr. 2018
 - *Combinatorics Seminar*, University of Washington, Seattle, WA Feb. 2018
 - *Algebra and Combinatorics Seminar*, DePaul University, Chicago, IL May 2017
 - *Combinatorics Seminar*, Massachusetts Institute of Technology, Cambridge, MA Apr. 2017
 - *Combinatorics Seminar*, Dartmouth College, Hanover, NH Apr. 2016

Contributed Research Talks

- A Lifting of the Goulden–Jackson Cluster Method to the Malvenuto–Reutenauer Algebra June 2022
20th International Conference on Permutation Patterns
 Valparaiso University, Valparaiso, IN
- New Refinements of a Classical Formula in Consecutive Pattern Avoidance June 2021
19th International Conference on Permutation Patterns
 University of Strathclyde (delivered online)
- Homomorphisms on Noncommutative Symmetric Functions and Permutation Enumeration July 2018
16th International Conference on Permutation Patterns
 Dartmouth College, Hanover, NH
- Shuffle-Compatible Permutation Statistics
 - *AMS Contributed Paper Session on Partitions, Paths, and Permutations* Jan. 2018
 2018 Joint Mathematics Meetings, San Diego, CA
 - *26th British Combinatorial Conference* July 2017
 University of Strathclyde, Glasgow, Scotland, UK
 - *14th International Conference on Permutation Patterns* June 2016
 Howard University, Washington, DC
 - *Graduate Student Combinatorics Conference 2016* Apr. 2016
 Clemson University, Clemson, SC
- Peaks, Descents, and Pattern Avoidance
 - *15th International Conference on Permutation Patterns* June 2017
 Reykjavík University, Reykjavík, Iceland

- *Graduate Student Combinatorics Conference 2017* Apr. 2017
 University of Kansas, Lawrence, KS
- The Goulden–Jackson Cluster Method for Monoid Networks and an Application to Lattice Path Enumeration Aug. 2015
8th International Conference on Lattice Path Combinatorics and Applications
 California State Polytechnic University, Pomona, Pomona, CA
- The VC Dimension of Random Set Systems, Word Sets, and Permutation Sets Jan. 2013
AMS Session on Combinatorics, I
 2013 Joint Mathematics Meetings, San Diego, CA

Research Posters

- Refined Consecutive Pattern Enumeration via a Generalized Cluster Method July 2022
34th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), Indian Institute of Science, Bangalore, India
- Counting Permutations by Peaks, Descents, and Cycle Type
 - *32nd International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC)*, Online July 2020
 - *18th International Conference on Permutation Patterns*, Online July 2020
- Homomorphisms on Noncommutative Symmetric Functions and Permutation Enumeration July 2019
31st International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), University of Ljubljana, Ljubljana, Slovenia
- Shuffle-Compatible Descent Statistics and Quotients of Quasisymmetric Functions July 2018
30th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), Dartmouth College, Hanover, NH

Invited Talks for an Undergraduate Audience

- Counting Permutations Using Valley-Hopping
 - *Math/Stat Colloquium*, Swarthmore College, Swarthmore, PA Feb. 2018
 - *Special Seminar*, University of Hartford, West Hartford, CT Feb. 2018
 - *Math Colloquium*, Hamilton College, Clinton, NY Feb. 2018
 - *Math/CS Coffee*, Davidson College, Davidson, NC Feb. 2018
- Combinatorics, Generating Functions, and a Permutation Counting Problem Sept. 2014
Special Seminar, Goucher College, Baltimore, MD

Local Talks

- 1 *Special Seminar* talk (for an undergraduate audience), Brandeis University Jan. 2018
- 7 talks given at the *Combinatorics Seminar*, Brandeis University 2014–2018
- 6 talks given at the *Graduate Student Seminar*, Brandeis University 2014–2017

Courses Taught

Davidson College

- MAT 108: **Cryptology Through History** Spring 2019
- MAT 112: **Calculus I and Modeling** S '20 ($\times 2$), F '20, S '21 ($\times 2$), S '22 ($\times 2$)
- MAT 255: **Number Theory** Spring 2019, Spring 2021, Spring 2022
- MAT 320: **Combinatorics** Fall 2018
- MAT 340: **Probability** Fall 2018, Fall 2019
- MAT 355: **Abstract Algebra I** Fall 2019, Fall 2020, Fall 2021
- CSC 379: **Cryptology** Spring 2020
- MAT 491: **Independent Study**
 - Advanced Linear Algebra Fall 2021
 - Signed Permutation Statistics Fall 2020
 - Gamma-Positivity in Permutation Enumeration Spring 2019

Brandeis University

- MATH 8a: **Introduction to Probability and Statistics** Summer 2016
- MATH 10a: **Techniques of Calculus (a)** Fall 2015, Spring 2016
- MATH 10b: **Techniques of Calculus (b)** Fall 2014, Spring 2015
- MATH 14b: **Cryptology** Fall 2017
- MATH 298a: **Independent Study**
 - Linear Algebra for Secondary Education Summer 2015

Student Research Mentoring

Davidson College

- Keegan Stump '24 Summer 2022
Supervised research project on shuffle-compatibility. Sponsored by Davidson DRI grant.
- Lindy Bustabad '21 Fall 2020
Supervised research project on signed permutation enumeration.
- Jacob D'Aurizio '20 Summer 2019
Supervised research project on lattice path enumeration. Sponsored by Davidson FS&R grant.

- Crossan Cooper '20 and Will Jones '19 Spring 2019
Supervised research project on permutation enumeration and gamma-positivity. Work published in the *Advances in Applied Mathematics*.

MIT PRIMES

- Richard Zhou (Lexington High School '18) Spring 2017–Fall 2017
Supervised research project on permutation pattern avoidance. Work presented at the *15th International Conference on Permutation Patterns*.

Selected Conferences and Research Workshops

- International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC)
 - Indian Institute of Science, Bangalore, India (attended online) July 2022
 - Bar-Ilan University, Ramat-Gan, Israel (attended online) Jan. 2022
 - Online July 2020
 - University of Ljubljana, Ljubljana, Slovenia July 2019
 - Dartmouth College, Hanover, NH July 2018
 - Queen Mary University of London, London, England, UK July 2017
- International Conference on Permutation Patterns
 - Valparaiso University, Valparaiso, IN June 2022
 - Online (hosted by the University of Strathclyde) June 2021
 - Online June–July 2020
 - Dartmouth College, Hanover, NH July 2018
 - Reykjavík University, Reykjavík, Iceland June–July 2017
 - Howard University, Washington, DC June 2016
 - East Tennessee State University, Johnson City, TN July 2014
- AMS Mathematics Research Community: *Trees in Many Contexts* June 2022
- Joint Mathematics Meetings
 - Online April 2022
 - Baltimore, MD Jan. 2019
 - San Diego, CA Jan. 2018
 - San Diego, CA Jan. 2013
- AMS Fall Southeastern Sectional Meeting Nov. 2021
Online
- International Conference on Lattice Path Combinatorics and Applications
 - Online (hosted by the Centre International de Rencontres Mathématiques) June 2021

- California State Polytechnic University, Pomona, Pomona, CA Aug. 2015
- Triangle Lectures in Combinatorics
 - Online (hosted by the University of North Carolina at Greensboro) Nov. 2020
 - University of North Carolina at Charlotte, Charlotte, NC Feb. 2020
- MAA MathFest
 - Cincinnati, OH July–Aug. 2019
 - Denver, CO Aug. 2018
- 26th British Combinatorial Conference July 2017
University of Strathclyde, Glasgow, Scotland, UK
- Stanley@70 June 2014
Massachusetts Institute of Technology, Cambridge, MA

Selected Professional Development and Teaching Workshops

- **Higher Education Symposium on AP Precalculus** (hosted by College Board) Nov. 2022
Cleveland, OH (upcoming)
- **FIRST** (Journal Clubs, Book Discussions, Inclusive Education Hours, etc.) Jan. 2019–Present
Davidson College, Davidson, NC
- **Digital Learning Institute** July 2020
Davidson College, Davidson, NC
- **Project NExT Workshops** at:
 - MAA MathFest 2019, Cincinnati, OH July–Aug. 2019
 - 2019 Joint Mathematics Meetings, Baltimore, MD Jan. 2019
 - MAA MathFest 2018, Denver, CO July–Aug. 2018
- **ACS FOCUS Institute** June 2019
Hendrix College, Conway, AR
- **Graduate Students with Teaching Responsibilities** (Workshop Series) Jan.–May 2017
Center for Teaching and Learning, Brandeis University, Waltham, MA

Selected Awards, Grants, and Honors

National

- **AMS-Simons Travel Grant** 2021
Awarded \$5,000 for AYs 2021–22 and 2022–23 to support research-related travel.
- **MAA Project NExT Fellow** 2018–2019

Davidson College

- **FIRST RATE** 2020
Awarded a course release for AY 2021–22 to redesign an introductory mathematics course through the lens of inclusive pedagogy.
- **Faculty Study and Research Grant** 2019
Awarded \$4,000 to sponsor a summer research student.

Brandeis University

- **Jerome Levine Thesis Prize** 2018
Awarded annually to a graduate student in the Mathematics Department for an outstanding Ph.D. dissertation.
- **University Prize Instructorship** 2017
Awarded \$6,000 by the Graduate School of Arts and Sciences to design and teach an undergraduate course in cryptology.
- **Outstanding Teaching Fellow Award** 2016
Awarded annually to best graduate student instructors in the Graduate School of Arts and Sciences.
- **Graduate Student Teaching Prize** 2015
Awarded annually to a graduate student in the Mathematics Department for skill and dedication in teaching.

Selected Service and Professional Activities

Profession

- **Co-organizer**, AMS Special Session on *Algebraic and Bijective Methods in Permutation Enumeration*, 2022 Joint Mathematics Meetings April 2022
- **Referee** for the following journals and conference proceedings: 2018–Present
 - *Advances in Applied Mathematics*
 - *Algebraic Combinatorics*
 - *Discrete Mathematics*
 - *Electronic Journal of Combinatorics*
 - *European Journal of Combinatorics*
 - *Journal of Combinatorial Theory, Series A*
 - *Journal of Combinatorics*
 - *Proceedings of the American Mathematical Society*
 - *Proceedings of the International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC)*
 - *Ramanujan Journal*
 - *SIAM Journal on Discrete Mathematics*

- **Reviewer**, *Mathematical Reviews* 2018–Present
- **Co-organizer**, Project NExT Workshop: *Mentoring Undergraduate Research for Beginners*, 2019 Joint Mathematics Meetings Jan. 2019

Davidson College

- **Major Advisor** for 15 students (14 MAT, 1 CSC) 2019–Present
- **Honors Thesis Committee Member** for 7 students 2018–Present
(**Second Reader** for 2 students)
- **Faculty Member**, Phi Beta Kappa (Gamma of North Carolina Chapter) 2019–Present
- **Member**, Faculty of Color Caucus 2018–Present
- **Holistic Advisor** for 9 students 2020–2022
- **Co-organizer**, Math/CS Social Justice Speaker Series 2020–2022
- **Co-organizer**, Math/CS Coffee (departmental colloquium series) 2019–2022
- **Committee Member**, Campus and Religious Life 2019–2022
- **Invited Contributor**, Digital Learning Institute / FIRST Nov. 2020
Contributed a short video for the DLI / FIRST session “Speed Dating with Teaching Tools”, demonstrating the use of collaborative readings and annotations to further inclusivity in a mathematics course.
- **Panelist**, Digital Learning Institute July 2020
Participated in panel discussion on building community, fostering belonging, and lessons learned from teaching remotely in Spring 2020.
- **Speaker**, FIRST Inclusive Education Hour July 2020
Gave an interactive presentation on building community and fostering belonging in the classroom.
- **Faculty Speaker**, Chinese Culture Club Oct. 2019
Spoke about my experiences as an Asian-American and discussed strategies for helping Asian/Asian-American students find belonging at Davidson College.
- **Faculty Speaker**, International Student Pre-Orientation Aug. 2018
Spoke to incoming international students about social identity, belonging, and mental health.

Brandeis University

- **Panelist**, Academic Job Market Alumni Panel April 2021
Participated in panel discussion for graduate students in mathematics about navigating the academic job market in mathematics.
- **Co-organizer**, Combinatorics Seminar 2016–2018

- **Workshop Faciliator**, Mathematics Department Teaching Practicum Nov. 2016
Developed and facilitated a teaching workshop for graduate student instructors on the topic of countering stereotype threat in the classroom.
- **Panelist**, Graduate Student Seminar Sept. '14, '15, '17
Served on introductory panel for first-year graduate students in mathematics.

Community Outreach

- **Volunteer**, Charlotte Mathematics Club Dec. 2018
Assisted in the supervision of mathematical enrichment activities for middle school and high school students.