Mohamed Omar

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Citizenship: CANADA

Professional Experience

Professor Jul 2023 -
Department of Mathematics & Statistics, York University

Associate Chair Jul 2022 - Jul 2023
Department of Mathematics, Harvey Mudd College

Joseph B. Platt Endowed Chair Jul 2019 - Jul 2023
Department of Mathematics, Harvey Mudd College

Associate Professor (with tenure) Jul 2018 - Jul 2023
Department of Mathematics, Harvey Mudd College

Assistant Professor Jul 2013 – Jul 2018
Department of Mathematics, Harvey Mudd College

Harry Bateman Research Instructor (Postdoc) Jul 2011 – Jul 2013
Department of Mathematics, California Institute of Technology

Education

Doctor of Philosophy in Mathematics Sep 2007 – Jun 2011
University of California, Davis, CA, USA
Advisor: Jesús De Loera
Dissertation: Applications of Convex and Algebraic Geometry to Graphs and Polytopes

Master of Mathematics May 2006 – Aug 2007
Combinatorics & Optimization
University of Waterloo
Thesis: Combinatorial Approaches To The Jacobian Conjecture

Bachelor of Mathematics, Cooperative Education Sep 2001 – May 2006
Pure Mathematics, Combinatorics & Optimization
University of Waterloo
Dean's Honour List

Research Interests

Applications of algebra to discrete mathematics, primarily in enumerative combinatorics, graph theory and discrete/convex geometry.

Fellowships

AMS Claytor-Gilmer Fellowship 2021-2022
National Research Fellowship - $50,000

Karen EDGE Fellowship 2020-2023
National Research Fellowship - $24,000

Books/Book Chapters

Graph Theory You Need For Undergrad Research: in 8 Undergrad Lectures
Amazon KDP (2020)

Algebraic and Geometric Methods in Applied Discrete Mathematics
Contemporary Mathematics, Proceedings of the AMS Special Session, Volume 685 (2017)
(with H. Harrington, M. Wright)

Number Theory Toward RSA Cryptography: in 10 undergraduate lectures
Amazon KDP (2017)

On Volumes of Permutation Polytopes
Discrete Geometry and Optimization Fields Institute Communications, Vol 69, pp. 55-77 (2013)
(with K. Burggraf, J. De Loera)

Research Journal Publications

Rédei-Berge Symmetric Functions and their Combinatorial Implications
submitted, 15 pp.
w John Irving

Permutations with a Given X-Descent Set
submitted, 12 pp.

Growth Rates of Permutations with a Given Descent Word
to appear, European Journal of Combinatorics, 18 pp.
w Justin Troyka

Partition Rank and Partition Lattices
Order, 1-18 (2024).

Sets Avoiding Full-Rank Three-Point Patterns in $(\mathbb{F}_q^n)^k$ are Exponentially Small
Australasian Journal of Combinatorics, Vol 85(3), pp. 423-429 (2023)

Burning Graph Classes
Graphs and Combinatorics, Vol 38(4), Article 121 (2022)
(with V. Rohilla)

On Distinct Distances Between a Variety and a Point Set
Electronic Journal of Combinatorics, Vol 29(3), P3.21 (2022)
(with B. McLaughlin)

Factorization Length Distribution For Affine Semigroups III: Modular Equidistribution for Numerical Semigroups with Arbitrarily Many Generators
Journal of the Australian Mathematical Society, Vol 133(1), pp. 21-34 (2021)
(with S. Garcia, C. O'Neill, T. Wesley)

Factorization Length Distribution For Affine Semigroups II: Asymptotic Behavior for Numerical Semigroups with Arbitrarily Many Generators
Journal of Combinatorial Theory Series A, Vol 178, 105358 (2021)
(with S. Garcia, C. O'Neill, S. Yih)

Weighted Means of B-Splines, Positivity of Divided Differences, and Complete Homogeneous Symmetric Polynomials
Linear Algebra and its Applications, Vol 608, pp. 68-83 (2021)
(with A. Bottcher, S. Garcia, C. O'Neill)

Counting Peaks on Graphs
Australasian Journal of Combinatorics, Vol 75, Issue 2, pp. 174-189 (2019)
(with A. Diaz-Lopez, L. Everham, P. Harris, E. Insko, V. Marcantonio)

Descent Polynomials

Discrete Mathematics, Vol 342, pp. 1674-1686 (2019)
(with A. Diaz-Lopez, P. Harris, E. Insko, B. Sagan)

Sparse Neural Codes
Involve, Vol 12, No 5, pp. 737-754 (2019)
(with R. Amzi Jeffs, N. Suaysom, A. Wachtel, N. Youngs)

Lattice Point Visibility on Power Functions
INTEGERS, Vol 18, A90 (2018)
(with P. Harris)

Neural Ideal Preserving Homomorphisms
Journal of Pure and Applied Algebra, Vol 222, Issue 11, pp. 3470-3482 (2018)
(with R. Amzi Jeffs, N. Youngs)

The q-analog of Kostant's Partition Formula on the Highest Root of the Classical Lie Algebras
Australasian Journal Of Combinatorics , Vol 71, Issue 1, pp.68-91 (2018)
(with P. Harris, E. Insko)

A Proof of the Peak Polynomial Positivity Conjecture
Journal of Combinatorial Theory Series A, Vol 149, pp. 21-29 (2017)
(with A. Diaz-Lopez, P. Harris, E. Insko)

What Makes a Neural Code Convex?
SIAM Journal on Applied Algebra and Geometry, Vol 1, Issue 1, pp. 222-238 (2017)
(with C. Curto, E. Gross, J. Jeffries, K. Morrison, Z. Rosen, A. Shiu, N. Youngs)

Low Degree Nullstellensatz Certificates for 3-Colorability
Electronic Journal of Combinatorics, Vol 23, P1.6. (2016)
(with B. Li, B. Lowenstein)

Chromatic Bounds on Orbital Chromatic Roots
Electronic Journal of Combinatorics, Vol 21, P4.17. (2014)
(with D. Kim, A.H. Mun)

Strong Nonnegativity & Sums of Squares on Real Varieties
Journal of Pure and Applied Algebra, Vol 217, Issue 5, pp. 843-850 (2013)
(with B. Osserman)

On the Hardness of Counting and Sampling Center Strings
IEEE/ACM Transactions on Computational Biology and Bioinformatics, Vol 9, Issue 6, pp. 1843-1846 (2012)
(with C. Boucher)

Recognizing Graph Theoretic Properties with Polynomial Ideals
Electronic Journal of Combinatorics, Vol 17, R114. (2010)
(with J. De Loera, C. Hillar, P. Malkin)

Asymptotics of Largest Components in Combinatorial Structures
Algorithmica, Vol. 46, Issue: 3-4. pp.493-503 (2006)
(with D. Panario, B. Richmond, J. Whitely)

Research Conference Publications

New Perspectives on Flexibility in Simple Temporal Planning
ICAPS 2018, Twenty-Eighth International Conference on Automated Planning and Scheduling, 18pp. (2018)
(with J. Boerkoel, A. Huang, L. Lloyd)

A Proof of the Peak Polynomial Positivity Conjecture
FPSAC 2018, Formal Power Series and Algebraic Combinatorics (2018)
(with A. Diaz-Lopez, P. Harris, E. Insko)

On the Hardness of Counting and Sampling Center Strings

SPIRE 2010, String Processing and Information Retrieval pp. 128-135 (2010)
(with C. Boucher)

Distribution of the Number of Encryptions in Revocation Schemes for Stateless Receivers
DMTCS Proceedings, Fifth Colloquium on Mathematics and Computer Science pp. 195-206 (2008)
(with C. Eagle, Z. Gao, D. Panario, B. Richmond)

Expository Articles

I Felt Like A Mathematician: Combining Challenging Theorems with Creative Effort and Metacognition
PRIMUS, Vol 29, Issue 1, pp. 82-102 (2019)
(with E. Cilli-Turner, H. El-Turkey, G. Karakok, M. Savic, G. Tang)

Preparing Students for the GRE Math Subject Test
Math FOCUS, Oct/Nov Issue, pp. 24-25 (2018)
(with I. Ventura)

Pedagogical Practices for Fostering Mathematical Creativity in Proof-Based Courses: Three Case Studies
Proceedings of the 20th Annual Conference on Research in Undergraduate Mathematics Education, pp. 1418-1424 (2017)
(with E. Cilli-Turner, H. El-Turkey, G. Karakok, D. Plaxco, M. Savic, G. Tang)

Pedagogical Practices for Fostering Mathematical Creativity in Tertiary-Level Proof-Based Courses
Proceedings of the 10th Biannual Conference on Mathematical Creativity and Giftedness, pp. 130-135 (2017)
(with E. Cilli-Turner, H. El-Turkey, G. Karakok, D. Plaxco, M. Savic, G. Tang)

Tame the GRE Math Subject Test
Math Horizons, Vol 24, Issue 2, pp. 28-29 (2016)

Distinguished Invited Lectures

Plenary Speaker, Project NExT 2024
"Art & Craft of Problem Design" Aug 2024

Plenary Speaker, FPSAC 2023
"Slice and Partition Rank" Jul 2023

Distinguished Lecture Series, San Diego State University
"Slice and Partition Rank" Nov 2022

University Address, Texas State University
"Creativity Amidst Adversity" Oct 2022

MAA Invited Address, Joint Math Meetings
"Art & Craft of Research Problem Design" Jan 2020

MAA Invited Address, Chan Stanek Lecture @ Mathfest
"The Secrets of Grad School Success" Aug 2019

MAA Invited Address, Henry L. Alder Award @ Mathfest
"Creativity Amidst Adversity" Aug 2018

Honors & Awards

AMS Claytor-Gilmer Fellowship (National Research Award) American Mathematical Society, 2021

Karen EDGE Fellowship (National Research Award) Karen EDGE Foundation, 2020-2023

Henry L. Alder Award (National Teaching Award) Mathematical Association of America, 2018

Dean's Prize, Outstanding Thesis - Division of Mathematical & Physical Sciences UC Davis, 2011

Yueh-Jing Lin Scholarship in Mathematics UC Davis, 2011

Alice Leung Research Scholarship in Mathematics — UC Davis Mathematics, 2010

NSERC Postgraduate Doctoral Scholarship - Tenure Abroad — NSERC 2007-2010

Invited Talks

Rédei-Berge Symmetric Functions via Matrix Algebra

- Canadian Discrete and Algorithmic Mathematics Conference 2025, University of Ottawa 2025

Bounds on Spanning Trees of Bipartite Graphs

- Howard University Mathematics Colloquium 2024
- Colgate University Natural Sciences and Mathematics Colloquium 2024
- Discrete Math Seminar, Toronto Metropolitan University 2023

Slice and Partition Rank

- Toronto Metropolitan University, Mathematics Colloquium 2025
- Carnegie Mellon University, Algebra Combinatorics Optimization Seminar 2023
- University of California, Irvine Algebra Seminar 2022
- University of Milwaukee Mathematics Colloquium 2022
- Claremont Colleges Algebra/Number Theory/Combinatorics Seminar 2022

Burning Graph Classes

- GRASCan, Invited Workshop 2022
- AARMS Graph Searching Online Seminar 2022

Symmetric Functions & Numerical Semigroups

- LGBTQ+ Math Day, Toronto Metropolitan University 2021

Peak Polynomial Positivity Conjecture

- UC Davis Algebra & Discrete Seminar 2021
- USC Combinatorics Seminar 2018
- AMS Fall Sectional Meeting, Buffalo, NY 2017
- Yale-NUS Math Seminar 2017
- UCLA Combinatorics Seminar 2016
- Cal State Northridge Algebra/Number Theory/Combinatorics Seminar 2016
- Claremont Colleges Algebra/Number Theory/Combinatorics Seminar 2016
- MAA Fall 2016 Sectional Meeting, Cal State LA 2016

Convexity Intersections and Algebra

- Occidental College Mathematics Colloquium 2020
- LGBTQ+ STEM Conference, Ryerson University 2020
- Ohio State Combinatorics & Probability Seminar 2019
- University of San Francisco Colloquium 2019
- AMS Special Session on Combinatorics and Geometry, JMM 2018, San Diego, CA 2018
- Williams College Colloquium 2018
- University of New Brunswick Colloquium 2018
- AMS Fall Sectional Meeting, Denton, TX 2017
- Florida Golf Coast University Colloquium 2016
- AMS Spring Sectional Meeting, Fargo, ND 2016

When Algebra Meets Graph Theory

- Ryerson University Math Colloquium 2019
- Morehouse College Colloquium 2016
- Caltech Combinatorics Seminar 2015
- Reed College Colloquium 2015
- United States Military Academy (West Point) Topology & Algebra Research Seminar 2015

- Cal Poly Pomona Colloquium 2014
- SACNAS, Baltimore, MD 2014
- Stauffer Talk Series, Harvey Mudd College 2014
- Invited Faculty Speaker, USTARS, UC Berkeley, Berkeley, CA 2014

Chromatic Bounds on Orbital Chromatic Roots

- Joint Mathematics Meetings, Baltimore, MD 2014
- MAA Fall Sectional Meeting, CSU Dominguez Hills 2013
- Science Seminar, University of La Verne 2013

Vertex Transitive Polytopes

- Claremont Center for Mathematical Sciences Colloquium 2014
- Aalto University Math Colloquium 2013

Strong Nonnegativity and Sums of Squares On Real Varieties

- SACNAS "Algebra: More Than Just Arithmetic!" 2015
- Algebra/Number Theory/Combinatorics Seminar, Claremont Colleges 2011
- AMS Special Session on Comp. and Algorith. Algebraic Geometry, Salt Lake City, Utah 2011
- SIAM Conference on Applied Algebraic Geometry, Raleigh, North Carolina 2011

Permutation Polytopes

- SACNAS International Conferences, Los Angeles, California 2014
- Caltech Combinatorics Seminar 2011
- UC Berkeley Student Seminar in Discrete Math 2011
- AMS 2010 Fall Southeastern Section Meeting, Richmond, Virginia 2010
- Simon Fraser University Colloquium 2010

Iterative Algebraic Algorithms for the Recognition of Combinatorial Properties

- Simon Fraser University Math Seminar 2010
- Goethe-Universitat Institut fur Mathematik Math Seminar 2009
- Technische Universitat Darmstadt, Darmstadt Math Seminar 2009
- Canadian Discrete and Algorithmic Mathematics Conference, Montreal, Quebec, Canada 2009

Teaching Experience

Instructor

Organized entire course, developed content, assembled course materials, delivered lectures, prepared homework and exams, and assigned grades.

- **Discrete Mathematics:** Combinatorics, Graph Theory, Intro to Discrete Math, Topics in Algebraic Graph Theory, Topics in Geometric Combinatorics, Methods in Graph Theory, Convex Geometry
- **Algebra:** Algebraic Geometry, Abstract Algebra, Applied Algebraic Geometry (independent study), Intermediate Linear Algebra, Introductory Linear Algebra
- **Decision Sciences:** Probability & Statistics (R based), Operations Research, Intermediate Probability, Cryptography (independent study)
- **General Mathematics:** Real Analysis, Calculus, Putnam Seminar

Postdoc Advisees + Current Position

- Robert Davis (Colgate University)
- Nora Youngs (Colby College)
- Amanda Ruiz (University of San Diego)

Thesis/Research Advisees + Postgrad Position

- Tomas Aguilar-Fraga (2023, gap year)
- Benjamin Langton (2022, quantitative finance @ Jane Street Capital)
- Vibha Rohilla (2022, software development @ Google)
- Matthew LeMay (2021, grad student @ UT Austin)
- Thomas Martinez (2021, gap year)
- Aria Beaupre (2021, grad student @ John's Hopkins U)
- Bryce McLaughlin (2018, grad student @ Stanford)
- Caitlin Leinkaemper (2017, NSF grad student @ Penn State)
- Samuel Miller (2017, grad student @ UC Santa Cruz)
- Cheng Wai Koo (2016, education in Singapore)
- Robert Amzi Jeffs (2016, NSF grad student @ U Washington)
- Natchanon Suaysom (2016, grad student @ U Washington)
- Aleina Wachtel (2016, software @ Facebook)
- Jazmin Ortiz (2016, software engineer @ Salesforce)
- Bo Li (2016, grad student @ UC Berkeley)
- Maxfield Comstock (2016, grad student @ Georgia Tech)
- Benjamin Lowenstein (2016, software @ Yelp!)
- Lucy Liu (2015, grad student @ Stanford)
- Sorathan Chaturapruek (2014, grad student @ Stanford)

Selected Journal Reviewing

Australasian Journal of Combinatorics
Journal of Combinatorial Theory, Series A
Journal of Algebraic Combinatorics
Electronic Journal of Combinatorics
SIAM Journal of Discrete Mathematics
Discrete Mathematics
Vietnam Journal of Mathematics

National Service

Karen EDGE Fellowship Committee | Karen EDGE Foundation	2024.
Canadian Mathematical Olympiad Committee | Canadian Mathematical Society	2023-pres.
USAMO/USAJMO Subcommittee | Mathematical Association of America	2021-pres.
Euclid Math Contest Committee | CEMC Waterloo	2019-pres.
William Lowell Putnam Grading Commitee	2024-pres.
Special Session Conference Organizer | American Mathematical Society	2024
Claytor-Gilmer Fellowship Committee, Chair | American Mathematical Society	2023-2024
Claytor-Gilmer Fellowship Committee | American Mathematical Society	2022-2023
Board of Directors | Math Foundation of America	2017-2019
AMC 10/12 Subcommittee | Mathematical Association of America	2016-2018

Invited Speakers Committee | MAA/AMS Joint Math Meetings 2016-2017
COMC Problems Committee | Canadian Mathematical Society 2014-2017
Associate Editor | Crux Mathematicorum 2014-2015

Institutional Service Leadership

TA Training - Mathematics | York University 2023-present
Putnam Math Competition | York University 2023-present
Harvey Mudd Faculty Executive Committee | Elected Member 2022
Harvey Mudd Presidential Search Committee 2022
Harvey Mudd Faculty Budget Committee Chair 2021-2022