Alexander Black

aeblack@ucdavis.edu, alexblackmath.com

EDUCATION

UC Davis, Davis, CA, USA — Sep 2019 – Jun 2024 (Expected)

- Ph.D. in Mathematics with applications to Operations Research advised by Jesús De Loera
  - GPA: 4.00

Cornell University, Ithaca, NY, USA — Jul 2017 – May 2019

- B.A. in Mathematics with Distinction in All Subjects
- Summa Cum Laude in Mathematics
  - GPA: 3.90

Hamilton College, Clinton, NY, USA — Aug 2015 - Jul 2017

- GPA: 4.00

Courses: Introduction to Combinatorics, Topics in Topological Combinatorics, Algebraic Geometry I and II, Readings in Representation Theory, Algebraic Combinatorics, Numerical Optimization, Optimization

WORK EXPERIENCE

Mathematics Department UC Davis, Davis, CA, USA

- Graduate Student Researcher — Jun 2020 – Present
  - Code efficient algorithms for experimentation on high dimensional geometric problems
  - Present updates on research to lab of 12 peers once every 9-10 days
- Graduate TA — Sep 2019 – Jun 2021
  - Manage groups of 20-40 students through 2 hours of weekly discussion sections
  - Write lesson plans and review resources for 3-5 exams and 10 discussions
  - Grade and write rubrics for exams given to hundreds of students

Math Support Center Cornell University, Ithaca, NY, USA

- Mathematics Tutor — Jan 2019 – May 2019
  - Assisted Cornell students with homework in mathematics courses 4 hours each week

Upward Bound Cornell University, Ithaca, NY, USA

- Upward Bound Tutor — Aug 2018 – May 2019
  - Helped local high school students 2-4 hours each with math homework
  - Collaborated with a team of tutors to develop new strategies for teaching and motivating students

Mathematics Department Cornell University, Ithaca, NY, USA

- Calculus 1 Course Assistant — Aug 2018 – Dec 2018
  - Hosted office hours 1.5 hours each week
  - Provided students with feedback by grading problem sets

Quantitative and Symbolic Reasoning Center Hamilton College, Clinton, NY, USA

- Mathematics Tutor — Aug 2016 – May 2017
  - Hosted drop-in tutoring 2.5 hours each week in linear algebra and calculus
  - Tutored a high school student online 1.5 hours each week in the Art of Problem Solving calculus course

PUBLICATIONS

1. Sampling Planar Tanglegrams and Pairs of Disjoint Triangulations (Kevin Liu, Alex McDonough, Garrett Nelson, Michael C. Wigal, Youngho Yoo, and Mei Yin), Advances in Applied Mathematics 2023, accessible at arXiv:2304.05318

2. On the Simplex Method for 0/1 Polytopes (with J. De Loera, S. Kafer, and L. Sanità) accepted at Mathematics of Operations Research 2023, accessible at arXiv:2111.14050

3. Small Shadows of Lattice Polytopes, published in the *ACM-SIAM Symposium on Discrete Algorithms (SODA) 2023*, accessible at arXiv:2204.09129

4. The Polyhedral Geometry of Pivot Rules and Monotone Paths (with J. De Loera, N. Lütjeharms, and R. Sanyal) accepted to *SIAM Journal of Applied Algebra and Geometry (SIAGA)* 2023, accessible at arXiv:2201.05134

5. Monotone paths on cross-polytopes (with J. De Loera) accepted to *Discrete and Computational Geometry* 2023, accessible at arXiv:2102.01237

6. Fair splittings by independent sets in sparse graphs (with U. Cetin, F. Frick, A. Pacun, and L. Setiabrata) in *Israel Journal of Mathematics* 2020. accessible at arXiv.1809.03268

UNDER REVIEW

7. Realizable Standard Young Tableaux (with I. Araujo, A. Burcroff, Y. Gao, R. Krueger, and A. McDonough) 2023, accessible at arXiv:2302.09194

8. Short Circuit Walks on Hirsch Counterexamples (with S. Borgwardt and M. Brugger) 2023, accessible at arXiv:2302.03977

9. Flag Polymatroids (with R. Sanyal) 2022, accessible at arXiv:2207.12221

PRESENTATIONS

06/2023: Strict Monotone Diameters of Lattice Polytopes (SIAM Conference on Optimization)
05/2023: On the Circuit Diameter Conjecture for Hirsch Counterexamples (Circuits Workshops at CU Denver)
04/2023: The Polyhedral Geometry of Pivot Rules (UW Seattle Combinatorics Seminar)
01/2023: Small Shadows of Lattice Polytopes (SODA 2023)
12/2022: Smooth Torus Orbit Closures in Flag Varieties (OVGU Magdeburg Algebra Seminar)
12/2022: Monotone Path Polytopes (FU Berlin Student Seminar)
12/2022: Realizable Standard Young Tableaux (FU Berlin Discrete Geometry Seminar)
10/2022: Small Shadows of Lattice Polytopes (Bocconi University, INFORMS 2022)
09/2022: Torus Orbits in Full Flag Varieties (MPI Leipzig)
09/2022: Small Shadows of Lattice Polytopes (TU Munich, ETH Zurich, Cargese Workshop in Combinatorial Optimization)
09/2022: Flag Polymatroids (Geometry meets Combinatorics in Bielefeld)
02/2022: Monotone Paths on Polytopes (University of Nebraska Lincoln Discrete Math Seminar)
01/2022: Small Shadows of 0/1 Polytopes (University of Colorado at Denver Network Flows Seminar)
10/2021: Polyhedral Geometry of Pivot Rules (Frankfurt-Bochum Joint Combinatorics Seminar)
09/2021: Modifications of the Shadow Vertex Pivot Rule (Hausdorff Institute of Mathematics at Bonn - Trimester on Geometry of Linear Programming)
04/2021: Monotone Paths on Cross-Polytopes (Max Planck Institute at Leipzig - (Polytop)ics: Recent advances on polytopes)
02/2021: Monotone Paths on Polyhedral Unit Balls (UC Davis Student Research Seminar)
10/2019: The Square Peg Problem for Two Curves (UC Davis Student Research Seminar)
08/2019: The Square Peg Problem for Two Curves (MAA Mathfest 2019)
05/2019: Ring on a String 2: Group on a Loop (Cornell Undergraduate Math Club)
10/2018: Ring on a String (Cornell Undergraduate Math Club)
10/2017: Inverse Semigroups of Self Similar Graph Actions (Cornell Undergrad Research Symposium)
08/2017: Modeling Relationship Function in Social Networks (MAA Mathfest 2017)

RESEARCH EXPERIENCE

UC Davis

- Graduate Student Researcher, Mathematics Department — Jun 2020 – Present
  - Supervisor: Prof. Jesús de Loera
  - Focus: Geometric and Algorithmic Foundations of Linear Optimization

SPUR Cornell University

- Undergraduate Research Student, Mathematics Department — Jun 2018 – Jul 2018
  - Supervisor: Prof. Florian Frick
  - Focus: Topological Combinatorics

REU University of Texas at Tyler

- Undergraduate Research Student, Mathematics Department — Jun 2017 – Jul 2017
  - Supervisor: Prof. David Milan
  - Focus: Inverse Semigroups, C^*-algebras

AWARDS & SCHOLARSHIPS

- 2023 Alice Siu-Fun Leung Scholarship in Mathematics — Jun 2023

$5,000 Departmental award given annually to a math graduate student at UC Davis for excellence in research

- 2022 George Nicholson Paper Competition Finalist — Sep 2022
  Top 6 of 129 students in competition for the best graduate student operations research paper among students graduating after June 2021 for my paper "Small Shadows of Lattice Polytopes"
- Mixed Integer Programming (MIP) 2022 Workshop Best Poster Award — May 2022
  Best poster among 30 graduate students presenting at MIP 2022
- Yueh-Jing Lin Fund Scholarship — Jun 2021
  $2,000 award given to high-achieving UC Davis math graduate students
- NSF Graduate Research Fellowship — Mar 2021
  Scholarship funds amounting to more than $100,000 to pursue graduate study in applied mathematics
- MAA Mathfest Oustanding Presentation Award — Jul 2017
  Award given to the top 10% of undergraduate presenters at MAA Mathfest

SERVICE

- Organizer of the student/postdoc seminar at ICERM at Brown University for the Spring 2023 semester on discrete optimization
- Reviewer for the SIAM Journal of Discrete Mathematics (SIDMA), Operations Research Letters, and Mathematics of Operations Research
- Co-founder of the student-run algebra and discrete math seminar at UC Davis
- Co-advised research of undergraduate Owen Gao at UC Davis

SKILLS

LaTeX (Advanced), Python (Intermediate), Sage (Beginner), Beamer/TikZ (Intermediate)

INTERESTS

Performing stand up comedy and improv