

Curriculum Vitae

JOSEPH McDONOUGH

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Education

Ph.D. University of Minnesota (expected 2027)
2021–2022 San Diego State University, Mathematics (graduate coursework)
2021 B.S. San Diego State University, Applied Mathematics (Minor: Computer Science)

Employment

2022– Graduate Assistant, UMN
2021–2022 Graduate Student Assistant, SDSU
2019–2021 Instructional Student Assistant, SDSU
2018–2019 Tutor, Mathematics & Statistics Learning Center, SDSU

Awards and Honors

2021 Outstanding Baccalaureate Candidate in Mathematics (SDSU Math Dept.)
2018–2019 Putnam Exam Score: 11 (2018), 10 (2019). Top score at SDSU both years.
2017–2021 Dean’s List, San Diego State University

Research

Publications

5. (with P. Pylyavskyy, S. Wang) *The Stanley-Stembridge conjecture for $2 + 1 + 1$ avoiding unit interval orders: A diagrammatic proof* (submitted) (arXiv:2404.07280)
4. (with C. Brower, C. O’Neill) *Numerical semigroups, polyhedra, and posets IV: Walking the faces of the Kunz cone* (submitted) (arXiv:2401.06025)
3. (with A. Almousa, S. Grate, D. Huang, P. Klein, A. LaClair, Y. Luo) *The MatrixSchubert package for Macaulay2* (submitted) (arXiv:2312.07393)
2. (with C. Brower, S. Chapman, T. Kulhanek, C. O’Neill, V. Pavlyuk, V. Ponomarenko) *Length density and numerical semigroups* CANT 2021 Proceedings (Combinatorial and Additive Number Theory V) (2023) 79–98 (arXiv:2110.10618)
1. (with T. Kulhanek, V. Ponomarenko) *Dilated floor functions that commute sometimes* The PUMP Journal of Undergraduate Research **2** (2019) 107–117

Presentations

2024 Feb. Walking the faces of the Kunz fan, UMN Student Combinatorics and Algebra Seminar
2022 May. Length density and numerical semigroups, AMS Western Sectional (Virtual)
— Apr. Length density and numerical semigroups, SGPs Research Seminar, SDSU
— Mar. A group cone safari II: the rays of doom, SGPs Research Seminar, SDSU
2021 Nov. A group cone safari: finding extremal rays in the group cone, SGPs Research Seminar, SDSU
— Oct. Geometric approaches to studying numerical semigroups, SGPs Research Seminar, SDSU
— Mar. The Kunz polyhedra and delta sets of numerical semigroups, SGPs Research Seminar, SDSU
2020 Dec. The Kunz polyhedra and delta sets of numerical semigroups, SGPs Research Seminar, SDSU
— Sep. Length density of numerical semigroups, SGPs Research Seminar, SDSU
— Aug. Length density of numerical semigroups, REU Presentation

Seminars Organized

2023–2024 Student Combinatorics and Algebra Seminar, UMN (with Miranda Moore, Sylvester Zhang)

2022 Spring Semigroups, Generating Functions, and Polytopes (SGPs) Research Seminar, SDSU

Referee Experience

Involve, A Journal of Mathematics

Teaching and Mentoring Experience

Courses at University of Minnesota, Twin Cities

2024 Spring Sequences, Series, and Foundations (Math 3283W) (Discussion TA)

2023 Fall Sequences, Series, and Foundations (Math 3283W) (Discussion TA)

2023 Spring Calculus I (Math 1271) (Discussion TA)

2022 Fall Calculus I (Math 1271) (Discussion TA)

Courses at San Diego State University

2022 Spring Discrete Math (Math 245) (Lead TA)

2021 Fall Discrete Math (Math 245) (Lead TA)

2021 Spring Discrete Math (Math 245) (TA)

2020 Fall Discrete Math (Math 245) (TA)

2020 Spring Discrete Math (Math 245) (TA)

2019 Fall Combinatorics (Math 579) (Grader)

Computing Experience

Languages: `sage`, `Macaulay2`, `python` (`NumPy`, `SciPy`), `C++`, `Go`, `Java`

General: `git`, Unix terminal, Jupyter notebooks, \LaTeX

Software (mostly on Github @jmcdonough98)

MatrixSchubert: Macaulay2 package for studying matrix Schubert varieties (with A. Almousa et. al)

numsgps-kunz-functions: Functions for investigating Kunz polyhedra and numerical semigroups

Euler: Solutions to (roughly 100) computational math puzzles posted on project Euler

hsvfilter: Object detector using hsv color filtering

aoc: Solutions to Advent of Code

md5collisions: Implementation of the MD5 cryptographic hash algorithm for a cryptography class project

pendulumSim: Simulation of an inverted pendulum on a cart, including an optimal control system