JONATHAN PARLETT

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EDUCATION

Drexel University *Expected Graduation 2025*
B.S. in Mathematics
B.S. in Computer Science. Concentrations: Algorithms and Theory, Numeric and Symbolic Computation.
Current GPA: 3.77

RESEARCH INTERESTS

Number theory (analytic, algebraic, arithmetic geometry), combinatorics (algebraic, enumerative).

RESEARCH EXPERIENCE

Towson University

Number Theory REU: Long Paths in Polynomial Divisor Graphs, June - July 2024
A divisor graph, $D(n)$ contains vertices $\{1, 2, ..., n\}$ and an edge between two vertices, u and v, if $u|v$ or $v|u$. Previous work by Pollington, Pomerance, Tenenbaum, and Saias has studied the length of the longestest path in $D(n)$ establishing upper and lower bounds of order $\frac{n}{\log n}$. We developed an analogous result for a function field $\mathbb{F}_q[x]$. For the length of the longest path in the divisor graph of polynomials in $\mathbb{F}_q[x]$ with degree at most n, we established upper and lower bounds of order $\frac{q^n}{n}$. See presentation given at YMC 2024. Preprint coming soon. This work was joint with Jay Calkins, Nicole Froitzheim, and Kayla Traxler, and advised by Professor Nathan McNew, and Professor Angel Kumchev.

Drexel University

Fixed Point Homing Shuffles: Research Internship, March - May, August-Sept 2024
Studied a family of maps on the symmetric group we call fixed point homing shuffles. These maps generalize a few known problems such as Conway's Topswops, and a card shuffling process studied by Gweneth McKinley. We showed that the iterates of these homing shuffles always converge, and characterize the set U_n of permutations that no homing shuffle sorts. We also study a homing shuffle that sorts anything not in U_n, and find how many iterations it takes to converge in the worst case. See preprint available on arxiv here. This research was advised by Professor Darij Grinberg.

Subnet Communicability: Structure Function Coupling in the Human Connectome, June 2022 - March 2023
Communication models attempt to explain the dynamics of signal propagation in the brain. In this work we proposed a novel communication model, Subnet Communicability, and performed computational experiments showing it explained dynamics better than the current state of the art model. This research was advised by Dr. Yusuf Osmanlioglu, and supported by a mini-grant from Drexel University. See below, a poster presented at the Week of Undergraduate Excellence at Drexel University, and a paper presented at CDMRI 2023, a MICCAI workshop.

MCMC Algorithms: Research Internship, March - September 2023
In this work various Markov Chain Monte Carlo (MCMC) algorithms were applied to the problem of inferring a function describing the force acting on the well studied Lorenz system. Various MCMC algorithms were considered, to include, Metropolis Hastings, Preconditioned Crank-Nicholson (pCN) , multi-proposal pCN, and Hamiltonian Monte Carlo. Utilizing previous results in the field concerning convergence rates of these algorithms we show a geometric rate of convergence in our studied problem.

Mathematical analysis was supported by computational experiments. This research was advised by Dr. Cecilia Mondaini, and supported by her grant pertaining to research of MCMC algorithms.

TEACHING EXPERIENCE

Drexel University

Course Assistant June 2022 - Jan 2024
Data Structures: Created presentations on memory semantics and C programming to prepare students to implement data Structures in C. Graded all written and programming assignments which covered implementations, and introductory algorithmic problem solving, and analysis. Held offices hours, and recitations to assist students in understanding course material

Programming Language Concepts: Created scripts to automate grading of students programming assignments. Held offices hours to assist students in understanding course material, to include, functional programming in haskell, scheme interpreter implementation, and program testing

Algorithmic Number Theory & Cryptography: Held offices hours to assist students in understanding course material, as well as, administer make up quizzes. Graded all assignments which covered analysis, implementation, and breaking of various cryptosystems

Math Tutor Jan 2024 - March 2024
Held offices hours to assist students with problem solving in 1st year math courses, and to help students develop good learning, strategies, and habits.

Math Grader Sept 2024 - Mar 2025
Abstract Algebra I (Fall 2024): Covers the theory of groups, rings, and fields.

Abstract Algebra II (Winter 2025): Covers rings, fields, modules, and algebras, with applications to number theory.

Linear Algebra II (Winter 2025): A second course in linear algebra, covers vector spaces over arbitrary fields, linear maps, Jordan cononical form, spectral theorem, inner product, and normed spaces.

PROFESSIONAL EXPERIENCE

SRI International March - September 2022
Intern, Data Analysis and Software Engineering *Princeton, NJ*

Worked under Principal Research Engineer Norman Hurst, to develop a technology to allow for recovery of time from video streams, robust against framerate conversions.
Conducted statistical analysis of system performance to facilitate improvement and validation of functionality, as well as develop methods to further improve accuracy of this system. Contributions lead to inclusion as co-inventor on patent.
Worked primarily in the C programming language, with performance analysis through python and pandas.

United States Marine Corp October 2015 - February 2020
Data Systems Administrator *Camp Pendleton, CA*

Configured and maintained information systems networks to facilitate communication between military units in remote locales.
Provided services such as voice, video, email, file sharing, and internet, through a combination of Cisco, and Microsoft software and hardware solutions.
Trained peers and subordinates in occupational skills.

PUBLICATIONS

2024 Fixed Point Homing Shuffles. Preprint, available on arxiv.

2023 Subnet Communicability: Diffusive Communication Across the Brain Through a Backbone Subnetwork, joint with Abhishek Jeyapratap, Ali Shokoufandeh, Birkan Tunc, and Yusuf Osmanlioglu

PRESENTATIONS/TALKS

2025 At the 2025 Joint Mathematics Meetings, poster on Long Paths in Polynomial Divisor Graphs, joint with Nicole Froitzheim.

2024 At YMC 2024 hosted by Ohio State University, on Long Paths in Polynomial Divisor Graphs, joint with Kayla Traxler.

2023 At CDMRI 2023 Subnet Communicability: Diffusive Communication Across the Brain Through a Backbone Subnetwork, joint with Abhishek Jeyapratap.

2023 At Drexel week of undergraduate excellence Subnet Communicability: Diffusive Communication Across the Brain Through a Backbone Subnetwork.

AWARDS

Outstanding Undergraduate Teaching Assistant Award, Spring 2024

Yilin Yang Outstanding Undergraduate Math Research Award, Spring 2024

Undergraduate Research Mini-Grant, Winter 2023

Deans list, Drexel University

Navy, and Marine Corp Achievement Medal, United States Marine Corp 2018,2020

MEMBERSHIPS

Computer Science Theory Reading Group (2022-Present)

Institute of Electrical and Electronics Engineers (IEEE) (2020-Present)

Mathematics Student Organization (2022 - Present)