Luke Hawranick

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Education

West Virginia University, Morgantown, WV Expected: *May 2025*
Honors B.S. in Mathematics, Honors B.S. in Computer Science
Minors: Statistics, Music Performance
GPA: 4.0

Research Experience

Mathematics Capstone, West Virginia University *December 2023 -*

- Studying extremal problems involving monochromatic matchings in an ordered, 2-edge-colored complete graph G.
- Improved a published linear upper bound by a constant on the number of vertices required to realize a monochromatic nest-free matching of fixed size in G.
- Analyzing the chromatic number of the line graph of G with adjacency adjusted according to specific types of matchings.

Computer Science Capstone, West Virginia University *August 2021 - May 2022, February 2024 -*

- Implemented four published approximation algorithms and an exact linear program for the unweighted Tree Augmentation Problem.
- Designed and implemented a randomized algorithm. Studying average case analysis.
- Testing all algorithms across six classes of trees of at most $10,000$ vertices and contrasting metrics of space, time, and solution quality.

Iowa State Math REU, Iowa State University *June 2024 - August 2024*
Ames, IA

- Introduced a framework to approach sophisticated enumeration of maximal independent sets (MIS's) in a grid-like graph class with walks along a digraph.
- Compared the per-vertex growth rate of the set of MIS's across subclasses of grid-like graphs.
- Studied statistics of the set of MIS's within our graph class, such as the number of non-isomorphic MIS's and the average size of an MIS.

Summer Undergraduate Research Fellowship *May 2023 - August 2023*
National Institute of Standards and Technology
Gathersburg, MD

- Contrasted two methods of buffering messages for IPC using MPI (Message Passing Interface) for highly parallel programs that are used for large-scale simulations.
- Modeled the behavior of message passing in an existing simulator in C and wrote runtime tests to run on an HPC cluster; varied MPI libraries, compilers, and message sizes for each buffering protocol, contrasting runtimes.
- Presented findings to the research group and program coordinators, emphasizing more diverse future testing as a priority.

Summer Undergraduate Research Experience, West Virginia University *June 2022 - August 2022*

- Designed a randomized MST verification algorithm to simplify a deterministic linear time algorithm that heavily relied on preprocessing.
- The algorithm was a one-sided error, false-based, Monte Carlo randomized algorithm, which utilized random sampling of edges.

Presentations

"An Empirical Evaluation of Algorithms for Simple Stochastic Games", The 17th Multi-Disciplinary International Conference on Artificial Intelligence, via zoom.	November 2024
"Inter-node Communication Performance Tuning", 2023 National Institute of Standards and Technology SURF Colloquium, Gaithersburg, MD	August 2023
"A Randomized Minimum Spanning Tree Verification Algorithm for Dense Graphs", 15th Annual Summer Symposium at West Virginia University, Morgantown, WV	July 2022
"An Empirical Analysis of Approximation Algorithms for the Unweighted Tree Augmentation Problem", 6th Annual Spring Symposium at West Virginia University, Morgantown, WV	April 2022

Technical Skills

Programming Languages: C, Python, Java, MATLAB, JavaScript, TypeScript.

Miscellaneous: LaTeX, SageMath, Git, HPC, HTML, CSS.

Mentoring

Mathematics Tutor, West Virginia University *January 2021 -*

- Tutoring 50+ different students every semester in courses from College Algebra to Differential Equations in both an in-person and virtual medium.
- Developing students' academic performance by providing personalized explanations, which has led to improved grades and deeper understanding of key concepts.
- Building academic relationships to foster students' learning and understanding of mathematical concepts.

MATH 104**,** 122 **Learning Assistant**, West Virginia University *Spring 2022, Fall 2023*

- Facilitated classes of 30 students' learning during lab sections of College Algebra and Quantitative Reasoning.
- Assisted students using pedagogical and traditional techniques with questions and problems during class.

Professional Development

2024 WVU Conference on Discrete Mathematics and Applications, Morgantown, WV (attendee)	April 2024
9th Annual Lake Michigan Workshop on Combinatorics and Graph Theory, Western Michigan University, Kalamazoo, MI (attendee)	April 2024
2024 Graduate Student Combinatorics Conference, Cargenie Mellon University, Pittsburgh, PA (attendee)	March 2024