Hannah E. Pieper

Boston University, Department of Mathematics
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EDUCATION

Boston University, Boston MA
Ph.D. in Mathematics **(December 2023)**
M.A. in Mathematics **May 2020**

Oberlin College, Oberlin OH **May 2018**
B.A. with High Honors in Mathematics

Budapest Semesters in Mathematics, Budapest HU **Fall 2016**
Intensive semester in mathematics taught by faculty from the Renyi Institute.

RESEARCH EXPERIENCE

Boston University, Boston MA

Doctoral Student Under Dr. Margaret Beck **June 2020 - present**
· Proved the existence of a pulse solution to the Swift-Hohenberg equation by implementing a computer assisted proof in Matlab.
· Discovered new applications of the Maslov index in stability analysis by extending a computational technique.
· Extending the framework for computing invariant vector bundles using computer assisted proofs (in progress).

Research Assistant Under Dr. M. Kon and J. Castrillón-Candaś **June 2021 - October 2021**
· Classified cancerous gene data by using a novel functional data analysis approach that outperformed the benchmark metrics.
· Measured the effect of limited data on predictions by running simulations on the BU supercomputer (heterogenous Linux cluster).

Oberlin College Mathematics Department, Oberlin OH

Honors Student Under Dr. Elizabeth Wilmer **September 2017 - May 2018**
· Compared the spectral and geometric properties of two thickened cycles in an effort to propose a simplification to the Watts-Strogatz random graph model
· Generalized known spectral inequalities for simple connected graphs to any arbitrary graph (not necessarily connected) with weighted edges and self loops
· Thesis: *Comparing Two Thickened Cycles: A Generalization of Spectral Inequalities*

Mathematics Research Group **January 2017**
· Used spectral graph theory to study synchronization in complex networks
· Compared theoretical measures of synchronizability with observed synchronized behavior in corticocortical networks

Mathematics Research Group **January 2016**
· Studied combinatorial game theory with game trees
· Analyzed and classified winning strategies of dynamic one-pile Nim

Grand Valley State University, Allendale MI

Student Researcher Under Dr. Shelly Smith **June 2017 - August 2017**
· Generalized previously known 2-Catalan sets into new k-Catalan sets
· Contributed 23 combinatorial objects to the collection of 33 previously known k-Catalan sets

· Modified previously known combinatorial objects to create new sets counted by the Raney numbers
· Contributed 19 combinatorial objects to the collection of 3 previously known Raney Sets
· Presented research at 3 conferences

Oberlin College Physics Department, Oberlin OH

Research Assistant Under Dr. Stephen Fitzgerald **January 2015**
· Used infrared spectroscopy to study selective hydrogen absorption in metal-organic frameworks

INDUSTRY EXPERIENCE

Dyno Therapeutics, Watertown MA

Data Science Intern **January 2022 - May 2022**
· Worked on a team of engineers and computational biologists to optimize AAV capsid engineering for better gene therapy vectors with machine learning.
· Performed a literature review, implemented and tested dynamic ensembling models and productionized code for company use.

TEACHING AND MENTORING EXPERIENCE

Boston University, Boston MA

Teaching Fellow
· MA 113: Elementary Statistics **Fall 2020**
· MA 226: Differential Equations **Spring 2020**
· MA 541: Modern Algebra I **Fall 2019**
· MA 122: Calculus for the Life and Social Sciences II **Fall 2019**
· MA 225: Multivariable Calculus **Spring 2019**
· MA 115: Statistics I **Fall 2018**

Facilitator
· MA 226: Differential Equations **Summer II 2020**

Instructor of Record
· MA 225: Multivariable Calculus **Summer I 2020**
· MA 225: Multivariable Calculus **Summer I & II 2019**

Mentoring
GirlsGetMath@BU **(August 2022)**
· Teaching fellow for a five day nonresidential program for high schoolers that seeks to motivate young adults to consider careers in mathematics in an affirming environment.
Directed Reading Program Mentor **Fall 2019 - present**
· Paired with one undergraduate student per semester. Met weekly to explore a chosen topic and helped student prepare a culminating presentation.
Graduate Mentor **Fall 2019 - present**
· Paired with one undergraduate student per semester. Served as a general resource and connection in the department.

Oberlin College, Oberlin OH

Quantitative Skills Center Tutor **January 2018 - May 2018**
· Designated tutor for discrete mathemathics
· Held weekly office hours to discuss lecture material and provide homework assistance
Peer Tutor **January 2017 - May 2018**
· One-on-one tutor for discrete math, statistics, and mathematics of social choice
· Met weekly with tutees to review lecture notes and assist with problem sets

Supplementary Instruction Leader (OWLS Program) **September 2015-May 2016**
· Prepared and taught three hours of supplementary instruction sessions weekly for multivariable calculus
· Created and used original exercises and worksheets

CONFERENCES, PRESENTATIONS AND PUBLICATIONS

Presentations

Pieper, H. (2022, August). *Spectral stability via the Maslov index and validated numerics.* Invited talk presented at the SIAM Conference on Nonlinear Waves and Coherent Structures in Bremen, Germany.

Pieper, H. (2022, January). *Spectral stability via the Maslov index and validated numerics.* Contributed talk presented at Dynamics Days hosted virtually by Georgia Institute of Technology.

Pieper, H. (2018, April). *Comparing two thickened cycles.* Lecture presented in the annual Honors Lecture Series, Oberlin, OH.

Dautenhahn, E., & Pieper, H. *Generalized k-Catalan objects.*
· Paper session presented at the annual Undergraduate Mathematics Day, Dayton OH (2017, November)
· Paper session presented at the annual SUMMR Conference, Allendale, MI (2017, July)

Dautenhahn, E., & Pieper, H. (2017, July). *Raney objects: a generalization of Catalan sets.* Paper session presented at the annual Mathematical Assocation of America MathFest, Chicago, IL.
· Recognized for an outstanding presentation in the student paper sessions

Publications

Pieper, H. (2018). *Comparing Two Thickened Cycles: A Generalization of Spectral Inequalities.* Electronic Thesis or Dissertation. Oberlin College, 2018. OhioLINK Electronic Theses and Dissertations Center.

Dautenhahn, E., & Pieper, H. (2017). *Generalized Catalan Numbers and Objects: X, Y Equivalence Classes and Polyominoes.* Proceedings of Undergraduate Mathematics Day, Vol. 5. 25 - 35.

HONORS, AWARDS & GRANTS

Boston University, Boston MA

SIAM Student Travel Award **August 2022**
· Awarded by SIAM to attend the SIAM Conference on Nonlinear Waves and Coherent Structures (NWCS22).
Teaching Fellow **Fall 2018 - Fall 2020**

Oberlin College, Oberlin OH

Rebecca Cary Orr Memorial Prize **May 2018**
· Awarded to a graduating senior mathematics student on the basis of outstanding achievement in undergraduate mathematics and promise of future professional accomplishment.
Sigma Xi **Inducted May 2018**
Mathematics Honors student **Fall 2017 - Spring 2018**
John F. Oberlin Merit Scholarship **Fall 2014 - Spring 2018**

SKILLS

Programming Languages
Proficient in Python, Java, Matlab, R

Software
Mathematica, Git, Latex, Jupyter Notebook, RStudio

PROFESSIONAL MEMBERSHIPS

American Mathematical Society
Associaton for Women in Mathematics
Mathematical Association of America
SIAM