Benjamin J. Clark

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Education

Ph.D. in Mathematics **September 2022–Present**
Washington State University

Bachelor of Science in Mathematics **January 2020–June 2022**
University of Washington Bothell

Bachelor of Science in Computer Science and Software Engineering **September 2015–June 2019**
University of Washington Bothell

Work Experience

Teaching Assistant **August 2022–Present**
Washington State University *Pullman, Washington*

- Run labs and lecture for entry level math classes.
- Tutor at the math learning center covering all undergrad math subjects.

Site Reliability Engineer / Software Engineer **June 2019–August 2022**
Google *Kirkland, Washington*

- Reduced the complexity of a large scale distributed file storage system.
- As an SRE, I was the service owner for Chrome Webstore; this entailed leading dev syncs, providing production expertise, and being the point of contact for the developers.
- Designed and implemented monitoring metrics, graphs, and alerts for Chrome Webstore. Identified the critical user journeys for their service and wrote alerts to best serve those journeys.
- Improved the efficiency of a large caching service saving resources and improving startup time.

Lead CSSE tutor **January 2017–March 2019**
University of Washington Bothell *Bothell, Washington*

- Tutored computer science concepts to students in Java, C/C++, and Python.
- Tutored math concepts from calculus to intro proof classes.
- Trained tutors in communication, structure, and various approaches for tutoring.
- Interviewed and hired new tutors.

Publications

[1] B. J. Clark and P. Paparella. Polynomials that preserve nonnegative matrices. *Linear Algebra and its Applications*, 637:110–118, 2022.

[2] B. J. Clark and P. Paparella. Polynomials that preserve nonnegative matrices of order two. *Mathematics Exchange*, 16:58–65, 2022.

[3] B. J. Clark and P. Paparella. Polynomials that preserve nonnegative monomial matrices. 2024.

[4] N. Fiebelkorn, B. Clark, and K. Sung. Would gamers collaborate given the opportunity? In *Proceedings of the 13th International Conference on the Foundations of Digital Games*, FDG '18, New York, NY, USA, 2018. Association for Computing Machinery.

Conference Presentations

- Joint mathematics meeting, talk titled: An experimental approach to the nonnegative inverse eigenvalue problem 2025
- Western Canadian Linear Algebra Meeting, talk titled: The nonnegative inverse eigenvalue problem is solvable and the algorithm to solve it exists. So why is the problem unsolved? 2024
- Joint mathematics meeting, talk titled: Polynomials that preserve nonnegative matrices 2024
- Pacific Northwest Section of the Mathematical Association of America, talk titled: Polynomials that preserve nonnegative matrices 2023
- Northwest Undergraduate Mathematics Symposium, talk titled: Problems in nonnegative matrix analysis 2018
- Foundations of Digital Games, talk titled: Would Gamers Collaborate given the Opportunity? 2018

Local/Department Presentations

WSU Department Presentations

- An experimental approach to the S-SNIEP using algebraic geometry 2025
- NIEP, SNIEP, RNIEP, and other problems in spectral nonnegative matrix theory 2024
- The cone of polynomials that preserve nonnegative matrices 2023
- Polynomials that preserve nonnegative matrices 2022

UW Presentations

- CSSE Capstone, talk titled: Optimizations in BrainGrid simulations 2019
- UW Undergraduate Research Symposium, talk titled: Early results on polynomials that preserve nonnegative matrices 2018

Teaching Experience

- Abstract algebra - Instructor of record Spring 2024
- Discrete Mathematics - Instructor of record Fall 2024
- Calculus 2 - Teaching assistant Spring 2024
- Discrete Mathematics - Instructor of record, Fall 2023
- Calculus 2 - Teaching assistant Spring 2023
- Calculus 1 - Teaching assistant Fall 2022

Awards

- Sam C. And Ruth Ann Saunders Graduate Fellowship in Mathematics, 2024
- UWB Founder Fellow, 2018

Projects

Nonnegative matrix boundary optimizer | github.com/Thrinador/niep | *Python, Differential evolution, Numpy, Scipy*

- One of the difficult things about the nonnegative inverse eigenvalue problem (NIEP), is trying to reason about the matrices that lie on the boundary. This project aims to numerically solve for these matrices using a series of optimization steps. The idea is that once these matrices are found we can build conjectures on what the boundary of the NIEP looks like.
- The optimization is done by running differential evolution on the coefficients of the characteristic polynomial of matrices. Once a given coefficient has been solved for, that is we have a feasible range, it is used as a constraint for the next coefficient. This process will produce a grid search like output of the feasible region for the coefficients. The matrices on the boundary of this region are then the matrices on the boundary of the NIEP.
- This project gave me a deeper understanding of the inner workings of python and the numpy, scipy libraries.

Matrix polynomial analysis | github.com/Thrinador/matrix_polynomial_analysis | *Rust, Optimization, Thread pools*

- The goal of the project was to get a picture of what the space of polynomials that preserve the nonnegativity of matrices of a given size looks like.
- This is being done as a followup investigation into the research I did on polynomials that preserve nonnegative matrices.
- The main process is to generate a set of polynomials, then try and minimize their coefficients. Since there is no know test to see if a polynomial preserves nonnegative matrices after a minimization action is preformed the polynomial must be tested against a large set of matrices. This led to several performance optimization problems including thread pools, generating a large amount of random numbers, and race conditions.
- I did this project in rust because it is a very performant language and as a way of learning the language better.

Brain Grid | github.com/UWB-Biocomputing/BrainGrid | *C++, Cuda, Optimization*

- BrainGrid is an open-source spiking neural network simulator that is intended to aid scientists and researchers by providing pre-built code that can be easily modified to fit different models.
- Worked on optimizing the performance of the Cuda code through profiling different aspects of the kernel.
- Found and fixed a bug that reduced the number of memory allocations from 6 million to 10 thousand.
- Tuned the micro kernels and reduced the branching paths to give a 2 times speed up.

Chess | github.com/thrinador/Chess | *Java, JavaFX, Networking*

- Wrote a GUI chess application in JavaFX using event driven programming.
- Improved the project as part of my networking class by adding server code and allowing clients to make lobbies and join games.

CSSE Technical Skills

Languages: C/C++, Java, Rust, Python, Matlab
Developer Tools: VSCode, Visual Studio, Netbeans, Git, Jupyter notebook
Technologies/Frameworks: Linux, Cuda, Actix web, JavaFX