Peter E. **Francis**

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Summary

I am completing a PhD in Mathematics, studying probability and combinatorics, with papers published in Math and AI journals. I'm passionate about quantitative research and development. Programming is a core part of who I am and what I do: I code for my research and for other side projects, with 2.5M lines of code public in GitHub. I am looking forward to using my extensive experience for impactful, real-world projects.

Education

PhD in Mathematics (In progress)   *Stony Brook University*
- Advisor: Evita Nestoridi
- Thesis: Limit Profiles in Separation Distance for Markov Chains   *Sept. 2021 - May 2026 (Expected)*

B.A. in Mathematics, Valedictorian, Summa cum laude   *Gettysburg College*
- Major in Mathematics and Minor in Physics
- GPA: 4.25/4.33, Selected Course Work: Linear Algebra, Numerical Metohds, Research in Combinatorics   *Sept. 2017 - May 2021*

Skills

Programming	Python (NumPy, SciPy, Pandas, Matplotlib, PIL, Cython, SymPy), LaTeX, Java, MatLab, R, Sage
Web & Network	Python (Flask, Gunicorn, SQLAlchemy), nginx, Javascript, HTML/CSS
Mathematical	Combinatorics, Probability, Statistics, Calculus

Selected Programming Projects

Each of these entries is a tool or app that I made. Click on any blue text for more information.

AddComb	JS	Extensive library for optimized additive combinatorics computation, currently used by several researchers
IFS Fractals	Python+JS	Web tool and python-module to efficiently generate IFS fractals, used by 100+ students and instructors
graphPlot	Python	Python module that uses physics to find ideal plotting coordinates for nodes of graphs
Sedario	Python+JS	Strategy game of my own invetion with real-time online multiplayer and 5 AI opponents
Online-Poker	Python+JS	Real-time multiplayer interface for games of Texas Holdem' and Omaha
Canvas Games	JS	Collection of games using <canvas>, some with AI opponents or generation (used in a Numberphile)
Complex Functions	JS	Web app that plots complex functions, uses dynamic color schemes for better data visualization
Custom Julia Sets	JS	Web tool for generating Julia sets with custom parameters
Table Editor	JS	Web tool for editing and converting between various data formats (TSV, CSV, Markdown, HTML, etc.)
Autostereograms	JS	Web tool for generating autorstereograms (magic eyes)
Bingo	Python+JS	Real-time multiplayer interface for generating and playing bingo games, used by 300+ people
Quadegories	Python+JS	The official web app for the trivia game invented by Brook Zelcer

Selected Publications & In-Progress Work

- Nearest Neighbors in a Poisson Point Process   *In Progress*   *Mar. 2025*
- Leading All the Way: Comparability in Vector Posets   *In Progress*   *Mar. 2025*
- Calculus: An Introductory Textbook   *Unpublished (Free Online Access)*   *Dec. 2024*
- Secrets and Quantifiers   *Math Horizons, MAA*   *May 2021*
- Opponent Hand Estimation in the Game of Gin Rummy   *Proceedings of the AAAI, 35(17)*   *Feb. 2021*

Experience

- Teaching Assistant   *Department of Mathematics, Stony Brook University*   *Fall 2021 - PRESENT*
- Peer Learning Associate, Calculus and Linear Algebra   *Department of Mathematics, Gettysburg College*   *Jan 2018 - May 2021*
- Advanced Technician   *College Life Office, Gettysburg College*   *Sept. 2017 - May 2021*
- Photographer   *Office of Communications and Marketing, Gettysburg College*   *Jan. 2018 - May 2021*
- Eagle Scout   *Harrington Park, NJ*   *Sept. 2017*
- Advanced SCUBA Diver   *PADI*   *Feb 2025*
- 3rd Degree Black Belt in Tae Kwon Do   *World TaeKwonDo Federation*   *2016*
- Camping/Outdoors Dept. Coordinator   *Nature Place Day Camp*   *Summers 2016 - 2021*