

Peter E. Francis

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Education

Gettysburg College

B.A. IN MATHEMATICS

- Major in Mathematics and Minor in Physics
- GPA: 4.23/4.333
- Received the four-year Lincoln Scholarship, the highest merit-based scholarship.

Gettysburg, PA

Sept. 2017 - PRESENT

Publications

Secrets and Quantifiers

LOGIC

- There is a discrepancy between the sometimes deceiving and confusing use of quantifiers in the English language and the rigidly fundamental role that quantification plays in mathematical writing. So the question is: how do we translate?

Math Horizons, MAA

To Appear Feb. 2021

Opponent Hand Estimation in the Game of Gin Rummy

ARTIFICIAL INTELLIGENCE

- ABSTRACT: In this article, we describe various approaches to opponent hand estimation in the card game Gin Rummy. We use an application of Bayes' rule, as well as both simple and convolutional neural networks, to recognize patterns in simulated game play and predict the opponent's hand. We also present a new minimal-sized construction for using arrays to pre-populate hand representation images. Finally, we define various metrics for evaluating estimations, and evaluate the strengths of our different estimations at different stages of the game.

Association for the Advancement of
Artificial Intelligence

Nov. 2020 (Submitted)

Maximal Sizes of Weak $(2, 1)$ -Sum-Free Sets in Finite Abelian Groups

ADDITIVE COMBINATORICS

- ABSTRACT: The finite abelian group G is type I if $|G|$ has a prime divisor congruent to $2 \pmod 3$, type II if $|G|$ is divisible by 3 but has no divisors congruent to $2 \pmod 3$, and type III if all divisors of $|G|$ are congruent to $1 \pmod 3$. A subset $A \subset G$ is weakly $(2, 1)$ -sum-free if the set of all sums of 2 distinct elements of A is disjoint from A . We are interested in finding the size $\mu^{\wedge}(G, \{2, 1\})$ of the largest weak $(2, 1)$ -sum-free subset of G . Here, we determine $\mu^{\wedge}(G, \{2, 1\})$ for G of type I and some G of type II. We also present new constructions for weak $(2, 1)$ -sum-free sets for G of type III, and so find a new lower bound for $\mu^{\wedge}(G, \{2, 1\})$.

Research Papers in Mathematics,
Gettysburg College

May 2020

The Maximum Size of Weak (k, l) -Sum-Free Sets

ADDITIVE COMBINATORICS

- ABSTRACT: A subset A of a given finite abelian group G is called weakly (k, l) -sum-free if the set of all sums of k distinct elements of A is disjoint with set of all sums of l distinct elements of A . We are interested in finding the size $\mu^{\wedge}(G, \{k, l\})$ of the largest weak (k, l) -sum-free subset in G . Here, we provide a new upper bound for $\mu^{\wedge}(G, \{k, l\})$ as well as present new constructions for weak $(2, 1)$ -sum-free sets in some noncyclic groups.

Research Papers in Mathematics,
Gettysburg College

May 2019

Presentations

Gettysburg Math Department Colloquium

- Opponent Hand Estimation in the Game of Gin Rummy

Gettysburg, PA

October, 2020

Gettysburg Math Research Symposium

- Maximal Sizes of Weak $(2, 1)$ -Sum-Free Sets in Finite Abelian Groups

Gettysburg, PA

May, 2020

Gettysburg Math Research Symposium

- The Maximum Size of Weak (k, l) -Sum-Free Sets

Gettysburg, PA

May, 2019

Teaching Experience

Department of Mathematics, Gettysburg College

Gettysburg, PA

LINEAR ALGEBRA PEER LEARNING ASSOCIATE

Jan. 2020 - PRESENT

- Wrote various Python projects.
- Assist in teaching course material.

CALCULUS PEER LEARNING ASSOCIATE

Feb. 2018 - PRESENT

- Assist Calculus II students in understanding concepts and course material.
- Teach regular class sessions once a week using my own prepared material.

CALCAID TUTOR

Spring 2018, Fall 2018, Spring 2020

- Assist students in understanding concepts and course material at weekly review sessions.

Other Projects

graphPlot

Python

- Python module that uses a time-step simulation of charged particles and springs to find ideal plotting coordinated for nodes of planar and nonplanar graphs.

Jan 2020 - PRESENT

ifsFractals

Python

- Python module to generate fast fractals that are fixed points of iterated function systems.

Jan 2019 - PRESENT

Complex Function Plot

Javascript

- A web app that plots colorful complex function transformations.

Jan 2019 - PRESENT

Skills

Programming

Python, \LaTeX , Java, MatLab, R, Sage

Web

Flask with Python, Javascript, HTML/CSS

Design

Photography, Photoshop, Lightroom

Outdoors

Backpacking, Canoeing, Wilderness Skills, PADI SCUBA Certified Open Water Diver

Honors & Awards

2020 **Recipient**, Earl E. Ziegler Junior Mathematics Award

Gettysburg, PA

2019 **President**, Pi Mu Epsilon, Mathematics Honor Society

Gettysburg, PA

2019 **Recipient**, Paul Mugabi Problem-Solving Award in Mathematics

Gettysburg, PA

2018 **Recipient**, Dr. George R. Miller '19 and Dr. Richard T. Mara '46 First Year Student Prize in Physics

Gettysburg, PA

2017-20 **Recipient**, Dean's List

Gettysburg, PA

2017 **Member**, National Honor Society

Old Tappan, NJ

Extracurricular Activity

College Life Office, Gettysburg College

Gettysburg, PA

ADVANCED TECHNICIAN

Sept. 2017 - PRESENT

- Assisted in instruction of technicians.
- Operate and organize audio, lighting and other production equipment for large and small events.

Office of Communications and Marketing, Gettysburg College

Gettysburg, PA

PHOTOGRAPHY INTERN

Jan. 2018 - PRESENT

- Shoot and edit portraits and pictures for a wide variety of events.