Axel Brandt

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Academic Appointments

Assistant Professor, Northern Kentucky University 2018-Present

Teaching Postdoctoral Fellow, Davidson College 2016-2018

Education

University of Colorado Denver, Denver, Colorado USA May 2016
– Ph.D. Applied Mathematics, Advisor: Florian Pfender

Miami University, Oxford, Ohio USA Aug 2012
– M.S. Mathematics, Advisor: Tao Jiang

Ohio Northern University, Ada, Ohio USA May 2010
– B.S. Mathematics, Applied Statistics minor, Senior Capstone Advisor: Donald Hunt

Publications

Antimagic Labelings of Weighted and Oriented Graphs (with Z. Berikkyzy, S. Jahanbekam, V. Larsen and D. Rorabaugh) Discrete Math. Theor. Comput. Sci, **23**(3), 2021.

"Tic-Tac-Whoa!" In M. Capaldi, *Teaching Mathematics Through Games.* AMS/MAA Press Classroom Resource Materials, Vol 65, 1-7, 2021.

Additive List Coloring of Planar Graphs with Given Girth (with J. Diemunsch and S. Jahanbekam) Discuss. Math. Graph Theory **40 3**, 855-873, 2020

Planar Graphs with Girth 20 are Additively 3-Choosable (with N. Tenpas[1] and C. Yerger) Discrete Appl. Math. 277, 14-21, 2020.

An Alternative Approach for Bounding the Additive Choice Number of Planar Graphs (with N. Tenpas and C. Yerger), Congr. Numer. 231, 157-163, 2018.

A Robber Locating Strategy for Trees (with J. Diemunsch, C. Erbes, J. LeGrande and C. Moffatt), Discrete Appl. Math. **232C**, 99-106, 2017.

Stability and Turán numbers of a class of hypergraphs via Lagrangians (with D. Irwin and T. Jiang), Comb. Probab. Comp. **26**(3), 367-405, 2017.

I,F-partitions of Sparse Graphs (with M. Ferrara, M. Kumbhat, S. Loeb, D. Stolee and M. Yancee), European J. Combin. **57**, 1-12, 2016.

Local Gap Colorings from Edge Labelings (with B. Moran, K. Nepal, F. Pfender and D. Sigler), Australas. J. Combin. **65**(3), 200-211, 2016.

Teaching Fellowships

Project NExT Fellow, Mathematical Association of America 2017-2018
– An ongoing early-career teaching-oriented professional development program

NSF GK–12 Fellowship, Grant DGE-0742434, University of Colorado Denver 2013–2014
– 1-year assistantships competitively awarded to CU Denver graduate students in STEM

[1] indicates co-author was an undergraduate student at time of research

Research Projects with Undergraduate Students

Northern Kentucky University

- Rachael Lerch, Bijay Rimal, Jack Shannon, *Pursuit-Evasion on Graphs* Summer 2020
- Kola Akinrele, Patrick O'Doherty, Weston Rainer, *Pursuit-Evasion Games on Graphs* 2019-2020
- Jacob Adkins, Elise Bezold, Abigail Leonard, Aryan Shrestha, *Coasters Done Quick* Summer 2019
- Patrick O'Doherty, Weston Rainer, *Optimal Strategy in Combinatorial Games* Spring 2019

Davidson College

- Nathan Tenpas, *Additive 3-Choosability of Planar Graphs* (Senior Thesis) 2017-2018
- Savannah Williams, *Additive List Coloring Even Cycles* Summer 2017
- Savannah Williams, *Mathematical Persistence in K-8 Students* Summer 2017

University of Colorado Denver

- Brent Moran, *Local Gap Colorings from Edge Labelings* 2014
- Ben Hoffman, Matt Mowrey, Rudy Ybarra, *Math for Peace: Rule of Law* Fall 2013

Mathematical Consulting

Kroger Corporation Nov 2021

- Contribute in optimizing the design of a logic network used to validate user input on online forms

Neaton Auto Products Manufacturing Aug 2019

- Provide conceptual framework for modeling assembly line process toward developing algorithm to minimize number of test parts

Lockheed Martin Space Systems Company Apr 2017

- Contribute in optimizing the onboard flight computer calibration calcuations of NASA's Orion Spacecraft in an effort to maximize CPU performance

Pace Aug 2016

- Model various apartment packing problems for a marketing infographic

Teaching with Full Course Responsibility

Northern Kentucky University 2018-Present

- Graph Theory & Combinatorics, Discrete Mathematics, Introduction to Proofs, Calculus 1, 2, & 3, Precalculus, Mathematics for Liberal Arts

Davidson College 2018-Present

- Number Theory, Sets & Proofs, Linear Algebra, Calculus 1 & 3

University of Colorado Denver 2012-2013

- Problem Solving Tools (with MATLAB lab), Polynomial Calculus

Miami University 2011-2012

- Calculus 1, Precalculus

External Funding

STEM Ready, Improving Undergraduate STEM Education, National Science Foundation 2019-2022

- improving mathematics preparation for STEM students, PI Bethany Bowling (*$299,999*)

Minigrant, Center for Undergraduate Research in Mathematics 2019-2020

- Lead undergraduate research group for academic year working in coordination with similar research group at Hiram College *($16,700)*

Internal Funding

Student Summer Fellowship, NKU Institute for Student Research and Creative Activity 2020
– Support student summer research *($3,500)*

Scholarship and Engagement, NKU Scripps Howard Center for Civic Engagement 2019-2020
– Support expansion of mathematical outreach activities/programs *($2,000)*

Collaborative Faculty Student Project Award, College of Arts and Sciences 2020
– Funding for student in CURM project on "Pursuit-Evasion Games on Graphs" that included outreach component *($2,000)*

Faculty Summer Fellowship, Academic Affairs 2020
– Funding to extend dissertation research *($6,000)*

Equity, Diversity, and Inclusion Fellowship, College of Arts and Sciences 2019-2020
– Co-Lead year-long project working with students on "Student Access and Completion through Engaging Feedback in Online Homework," Co-PI Dan McGee *($11,004.35)*

Research Grant, Center for Integrative Natural Science and Mathematics Spring 2019
– Lead semester-long research project with undergraduate students on "Optimal Strategy in Combinatorial Games" *($10,567.64)*

Curriculum Development Grant, Davidson College Spring 2018
– Develop math-oriented street performance acts with students at local schools and community events *($1,700)*

Curriculum Development Grant, Davidson College Summer 2017
– Develop mathematics enrichment activities for K-8 summer program through Center for Civic Engagement *($1,000)*

Scholarly Presentations

Upcoming Talks

Research with First-Year Students SIAM ED22, Jul 2022

Invited Talks

Fixing Congressional Dysfunction Using Polynomials S.F. Austin State, Oct 2020

Efficiently Binge Watching a Series Ohio Wesleyan, Feb 2020

An Introduction to the Method of Flag Algebras Vanderbilt, Mar 2019

Maths for Funsies (and learning) Kentucky Wesleyan, Mar 2019

Mathematical Networks: an introduction to graph theory Ohio Northern, Oct 2018

Entire Colorability for a Class of Planar Graphs JMM AMS Special Session, Jan 2018

Purposeful Polynomials: Committee Scheduling and Non-Attacking Rooks Winthrop, Nov 2017

Extremal Graph Theory with Flag Algebras Discrete Seminar, USC Nov 2017

Flag Algebras: A Graph Theory/Computational Optimization Translator Seminar, VCU Oct 2017

Optimization, Probability, and Modeling as a tool in Extremal Graph Theory Kennesaw State, Sep 2017

Additive Coloring of Some Planar Graphs AMS E Special Session, Sep 2017

I, F-Partitions of Sparse Graphs AMS SE Special Session, Nov 2016

Antimagic Labelings of Weighted and Oriented Graphs JMM AMS Special Session, Jan 2016

Short Cycles in Graphs — Discrete Seminar, Nebraska-Lincoln, Dec 2015

Short Cycles in Graphs — Discrete Seminar, Iowa State, Oct 2015

Combinatorial Nullstellensatz and Choosability — Discrete Seminar, Miami (Ohio), Feb 2014

Contributed Talks

Implementation of an Online Summer Bridge Program Designed to Accelerate Mathematics Preparation for STEM Programs — KAS Annual Meeting, Nov 2020

Maths for Funsies: Playful Classroom Activities for Mathematical Exploration — KCM, Mar 2020

Tic-Tac-Toe: A Mathematical Nostalgia — KAS Annual Meeting, Nov 2019

Tic-Tac-Whoa! — NKU Spotlight on Scholarship, Oct 2019

Winning in a Quantitative Literacy Course — MAA MathFest, Aug 2019

Additive 3-Choosability of Planar Graphs with Girth 20 — KAS Annual, Nov 2018

Polynomial peacemakers: avoiding scheduling conflicts — MAA Indy Section, Oct 2018

Taking Math to the Streets — MathFest, Aug 2018

Entire Colorability for a Class of Plane Graphs — JMM, Jan 2018

Avoiding Conflict through Zeros of Polynomials — MathFest, Jul 2017

Entire Colorability for a Class of Planar Graphs — Cumberland Conference, May 2017

Additive Coloring Planar Graphs with Girth at least 5 — Cumberland Conference, May 2017

Fixing Congressional Dysfunction with Polynomials — MAA SE Section, Mar 2017

Entire Colorability for a Class of Planar Graphs — Boca Conference, Mar 2017

Posters

Taking Math to the Streets — MathFest, Aug 2018

IBL Mathematics Enrichment with Middle School Students — IBL Conference, Jul 2017

Mathematical Persistence in K-8 Summer Enrichment: A Preliminary Report — Mathfest, Jul 2017

Community Outreach and Mathematical Enrichment

Visits and Small Events

120 sessions in K-12 schools and community — 2012-Present

- Mathematical modeling explored in "*Surface Area, Volume, and Mammalian Heartrates*" and "*Will the Zombie Virus get you?*" by predicting student resting heart rates and population growth rates
- Mathematical thinking analyzed through games including "*Finding Fifteen*," "*Chomp*," and "*Mastermind*"
- Mathematical skills reinforced in games (ex. "*Kakuro*," "*Towers of Hanoi*") or advanced mathematical ideas introduced in puzzles (ex. "*Drawing on Donuts*," "*Extreme Relationships*")

Programs and Large Events

- Welcoming Address for Davidson College Hackathon — Feb 2017
- Leader for Freedom Schools Program Afternoon Activity Session — Summer 2017
  Implement mathematical enrichment activities for K-8 summer program
- Facilitator for Charlotte Math Club — 2016-2018

Facilitate competition preparation and mathematical enrichment at monthly meetings

– Co-organizer and Math Wrangle Director for Julia Robinson Math Festival — Sep 2015
Facilitate, select problems, and train judges for 14-team tournament-style competition and assist with logistics for one-day event hosting over 300 middle school students

Teacher Professional Development

Sessions

Superpermuations — Western Massachusetts Math Circle, Apr 2019

The Blind Professor — Rocky Mountain Math Teacher Circle, Nov 2015

Professional Service

Conferences

– Co-planner of student activities at Kentucky MAA Conference — Apr 2020
– Judge for student competition at Kentucky Academy of Science Conference — 2018, 2019, 2021
– Coordinator for Project NExT Special Session at JMM — Jan 2018
– Co-Organizer of AMS Special Session at JMM — Jan 2018
– Session Chair for MAA SE Section — Mar 2017
– Member of Treasure Hunt Organizing Team for MAA SE Section — Spring 2017

MAA

– KY Section Newsletter Editor — 2021-Present
– Mentor for Great Talks for a General Audience — MathFest 2018, 2019
– Participant for MAA Focus Group on Instructional Practices Guide — JMM 2017

Other

– Referee for the Journal of Discrete Mathematics, Journal of Discrete Applied Mathematics, Australasian Journal of Combinatorics, International Journal of Mathematics and Statistics, and the College Mathematics Journal
– Reviewer for AMS Mathematical Reviews
– Volunteer to pilot questions for AP Calculus Test