

Education

Iowa State University , Ph.D. in Mathematics <i>Advisor: Leslie Hogben. Dissertation title: Sign patterns that require eventual exponential nonnegativity</i>	Ames, IA 2009–2014
Minnesota State University , M.A. in Mathematics <i>Advisor: In-Jae Kim. Thesis Title: On nilpotence indices of sign patterns</i>	Mankato, MN 2007–2009
Drake University , B.S., Major: Mathematics, Minor: Music	Des Moines, IA 2004–2007

Employment

Amazon <i>Research Scientist</i>	Alexa AI – Web Information <i>August 2022–present</i>
Hamline University <i>Visiting Lecturer, Computational Data Science and Mathematics</i>	Department of Mathematics <i>September 2018–August 2022</i>
Grand View University <i>Assistant Professor of Mathematics</i>	Department of Mathematics & Computer Science <i>August 2014–May 2018</i>
Drake University <i>Adjunct Instructor</i>	Department of Mathematics & Computer Science <i>Fall 2012, Spring 2014</i>

Research Interests

Combinatorial Matrix Theory, Nonnegative Matrix Theory, Graph Theory, Computational Mathematics, Data Analysis

Courses taught

As instructor (with full responsibilities)

Hamline University: Intro. to Programming ($\times 5$); Intro. to Computer Science ($\times 2$); Programming in MATLAB; Intro. to Computational Data Science; Calculus I ($\times 4$); Statistics ($\times 14$); Elements of Statistical Learning ($\times 3$); Multivariable and Vector Calculus; Discrete Mathematics; Topics in Advanced Mathematics (Topics in Graph Theory); First Year Seminar (Uses and Misuses of Algorithms) ($\times 2$); Computational Data Science Capstone ($\times 2$); *Guided Independent Studies:* Programming and Modeling in R; Elements of Statistical Learning; Tensorflow Computer Vision

Grand View University: Intro. to Algebra ($\times 7$); Intermediate Algebra; Intro. & Intermediate Algebra ($\times 2$); Finite Mathematics ($\times 12$); Intro. to Discrete Structures; Applied Calculus; Applied Statistics; Intro. to Mathematical Reasoning; Intro. to Mathematical Modeling ($\times 3$); Intro. to Differential Equations; Discrete Computational Structures ($\times 2$); Intro. to Numerical Analysis; Senior Seminar ($\times 2$)

Drake University: Calculus I; Calculus II

Iowa State University: High School Algebra; College Algebra; Calculus I; Calculus II ($\times 2$); Elementary Differential Equations & Laplace Transforms

Minnesota State University – Mankato: College Algebra ($\times 4$)

As recitation leader

Iowa State University: Discrete Math for Business & Social Sciences ($\times 2$); Calculus for Business & Social Sciences; Calculus II ($\times 2$); Calculus III ($\times 2$)

Other teaching experience

Iowa State University: Grader for graduate Linear Algebra; REU Grad Student Mentor/Research Assistant

Honors and Awards

- Received internal mini-grant from Hamline University's MacCorkle fund to purchase hardware to build a self-driving robotic car, Spring 2021.
- Corecipient of internal mini-grant for weekly prep sessions for the ACM contest, Grand View University, Fall 2016.
- Received \$1000 additional professional development funds from the Provost (competitive internal grant) to speak at the 20th ILAS Conference in Leuven, Belgium, Grand View University, July 2016.
- Graduate College Teaching Excellence Award, Iowa State University, Fall 2013.
- Graduate and Professional Student Senate Professional Advancement Grant to present at the 2-day workshop "Theoretical and Applied Aspects of Nonnegative Matrices" at BIRS, 2012.
- SIAM Student Travel Award to present at the SIAM Annual Meeting, 2012.
- J.J.L. Hinrichsen Pure Mathematics Award (excellence in research), Iowa State University, 2012.
- AMS Graduate Student Travel Grant to present at the AMS Central Section Meeting at the University of Nebraska–Lincoln, NE, 2011.
- ILAS Travel Award to present at the 17th ILAS Conference in Braunschweig, Germany, 2011.
- Graduate and Professional Student Senate Professional Advancement Grant to present at the 17th ILAS Conference in Braunschweig, Germany, 2011.
- Graduate College travel grant to attend the Focused Research Group "Eventually Nonnegative Matrices and their Sign Patterns" at BIRS, 2011.
- 1st place (tie) in the Basil E. Gillam Freshman Mathematics Contest, Drake University, 2004.

Publications

In Preparation.....

- [12] (With S. Allred, K. Grace, H.T. Hall, A. Jensen) **A combinatorial bound on the number of distinct eigenvalues of a graph.**

Submitted publications.....

- [11] (With L. Gan, J. Krietschgau, J. C.-H. Lin, S. Spiro) **Complementary vanishing graphs.**

Publications appeared/accepted.....

- [10] (With S. Butler, S. Fallat, H.T. Hall, B. Kroschel, J. C.-H. Lin, B. Shader, N. Warnberg, B. Yang) **Properties of a q -analogue for zero forcing**, *Graphs Combin.*, **36**(5):1401–1419, 2020.
- [9] (With C. Bozeman, B. Brimkov, D. Ferrero, M. Flagg, L. Hogben) **Restricted power domination and zero forcing problems**, *J. Comb. Optim.*, **37**(3):935–956, 2019.
- [8] (With S. Butler, L. Hogben, K. Hogenson, L. Kramer, R.L. Kramer, J.C.-H. Lin, R.R. Martin, D. Stolee, N. Warnberg, M. Young) **Rainbow arithmetic progressions**, *J. Comb.*, **7**(4):595–626, 2016.
- [7] **Sign patterns that require eventual exponential nonnegativity**, *Electron. J. Linear Algebra*, **30**:171–195, 2015.
- [6] (With M. Archer, M. Catral, R. Haber, L. Hogben, X. Martinez-Rivera, and A. Ochoa) **Potentially eventually exponentially positive sign patterns**, *Involve*, **6**(3):261–271, 2013.
- [5] (With J. Ekstrand, H.T. Hall, D. Hay, L. Hogben, R. Johnson, N. Kingsley, S. Osborne, T. Peters, J. Roat, A. Ross, D.D. Row, N. Warnberg, and M. Young) **Positive semidefinite zero forcing**, *Linear Algebra Appl.*, **439**:1862–1874, 2013.
- [4] (With J. Ekstrand, D. Hay, L. Hogben, and J. Roat) **Note on positive semidefinite maximum nullity and positive semidefinite zero forcing number of partial 2-trees**, *Electron. J. Linear Algebra*, **23**:79–87, 2012.
- [3] (With M. Catral, L. Hogben, D.D. Olesky, and P. van den Driessche) **Sign patterns that allow strong eventual**

nonnegativity, *Electron. J. Linear Algebra*, **23**:1–10, 2012.

- [2] (With M. Archer, M. Catral, R. Haber, L. Hogben, X. Martinez-Rivera, and A. Ochoa) **Constructions of potentially eventually positive sign patterns with reducible positive part**, *Involve*, **4**(4):405–410, 2011.
- [1] (With I.-J. Kim) **On nilpotence indices of sign patterns**, *Commun. Korean Math. Soc.*, **25**(1):11–18, 2010.

Conferences and Talks

Invited Talks.....

- “Restricted power domination,” Special Session on The Inverse Eigenvalue Problem of a Graph and Zero Forcing, 52nd Southeastern International Conference on Combinatorics, Graph Theory & Computing, Virtual, March 9, 2021.
- “Zero forcing and other games on graphs,” Mathematics & Statistics Department Colloquium, Carleton College, Northfield, MN, April 17, 2018.
- “Upper triangular sign patterns that require eventual exponential nonnegativity,” Special Session on Combinatorial Matrix Theory, AMS Central Section Meeting, Minneapolis, Oct. 30, 2016.
- “Upper triangular sign patterns that require eventual exponential nonnegativity,” Minisymposium on Combinatorial Matrix Theory, 20th ILAS Conference, Leuven, Belgium, July 15, 2016.
- “Sign patterns that require eventual exponential nonnegativity,” Minisymposium on Sign Pattern Matrices, 18th ILAS Conference, Providence, June 6, 2013.
- “Sign patterns that require eventual exponential nonnegativity,” Special Session on Generalizations of Nonnegative Matrices and Their Sign Patterns, AMS Central Section Meeting, Ames, IA, April 27, 2013.
- “Sign Patterns That Allow Strong Eventual Nonnegativity,” Minisymposium on Matrices and Graphs, 2012 SIAM Annual Meeting, Minneapolis, July 12, 2012.
- “Positive semidefinite maximum nullity is equal to positive semidefinite zero forcing number for partial 2-trees,” Special Session on Matrices and Graphs, AMS Central Section Meeting, Lincoln, NE, Oct. 14, 2011.
- “Potentially eventually positive and potentially eventually exponentially positive sign patterns,” Young Researchers Minisymposium on Combinatorial Matrix Theory, 17th ILAS Conference, Braunschweig, Germany, Aug. 23, 2011.
- “Strongly Eventually Nonnegative Matrices,” Special Session on Matrices and Graphs, AMS Central Section Meeting, Saint Paul, April 11, 2010.

Contributed Talks.....

- “Matrix sign patterns that require eventual exponential nonnegativity,” MAA–Iowa Sectional Meeting, Waverly, IA, Oct. 19, 2013.
- “Sign patterns that allow strong eventual nonnegativity,” Theoretical and Applied Aspects of Nonnegative Matrices, Banff International Research Station (BIRS), Banff, Canada, July 28, 2012.
- “On Potentially Nilpotent Sign Patterns,” MAA–North Central Sectional Meeting, St. Paul, MN, April 25, 2009.
- “On Potentially Nilpotent Sign Patterns,” Minnesota State University–Mankato Graduate Research Conference, Mankato, MN, April 7, 2009.

Seminar Talks.....

- “Zero forcing and other games on graphs,” Math Department Seminar, Hamline University, Oct. 16, 2018.
- “Sign patterns that require eventual exponential nonnegativity,” ISU Discrete Math Seminar, March 26, 2013.
- “On sign patterns that require eventual exponential nonnegativity,” ISU Discrete Math Seminar, Nov. 27, 2012.
- “Sign patterns that allow strong eventual nonnegativity,” ISU Discrete Math Seminar, Sep. 4, 2012.
- “Positive semidefinite maximum nullity is equal to positive semidefinite zero forcing number for partial 2-trees,” ISU Discrete Math Seminar, Oct. 4, 2011.
- “On maximum positive semidefinite nullity and positive semidefinite zero forcing number of partial 2-trees,” with D. Hay and J. Roat. ISU Discrete Math Seminar, April 12, 2011.
- “Potentially eventually exponentially positive sign patterns,” ISU Discrete Math Seminar, Oct. 26, 2010.
- “On Nilpotence Indices of Sign Patterns,” ISU Discrete Math Seminar, Sep. 22, 2009.

Posters Presented.....

- “Eventually nonnegative matrices and related classes,” 2010 NSF-CBMS Regional Conference: The Mutually Beneficial Relationship of Matrices and Graphs, Ames, IA, July 14, 2010.

Funded Workshop Participant.....

- Mathematics Research Community: Finding Needles in Haystacks: Approaches to Inverse Problems using Combinatorics and Linear Algebra, American Mathematical Society, Virtual, June 6–11, 2021.
- The 2020 Uncoast Unconference R developer workshop, Minneapolis. Cancelled due to COVID-19.
- Zero forcing and its applications, American Institute of Mathematics, San Jose, Jan. 30–Feb. 3, 2017.
- Theoretical and Applied Aspects of Nonnegative Matrices, BIRS, Banff, Canada, July 27–29, 2012.
- Eventually Nonnegative Matrices and their Sign Patterns, focused research group, BIRS, Banff, Canada, May 15–22, 2011. (One of 5 co-organizers and attendees.)

Other Conferences Attended.....

- Minnesota Peacebuilding Leadership Institute training: Intro to Strategies for Trauma Awareness and Resilience for Cultural Competence, Racial Healing and Equity; Intro to Restorative Justice; Intro to Resilience; January 2022.
- Institute for Research on Statistics and its Applications (IRSA) Conference: Questions About Reproducibility in an Age of Big Data, Virtual, May 6–8, 2021.
- Joint Mathematics Meetings, Jan. 6–9, 2021.
- AMS Short Course Mathematical and Computational Methods for Complex Social Systems, Jan. 3–5, 2021.
- IRSA Conference: Causal Inference and Data Science, Minneapolis, May 2–3, 2019.
- Midwest Sports Analytics Meeting (MSAM), Pella, IA, Nov. 18, 2017.
- 21st International Linear Algebra Society (ILAS) Conference, Ames, IA, July 24–28, 2017.
- MAA–Iowa Section Meeting at Grand View University, Des Moines, IA, Oct. 7–8, 2016.
- Midwestern Graph Theory (MIGHTY) LIII Conference, Ames, IA, Sep. 21–22, 2012.
- NSF-CBMS Regional Conference: The Mutually Beneficial Relationship of Matrices and Graphs, Ames, IA, July 12–16, 2010.
- MAA–North Central Section Meeting at Concordia College, Moorhead, MN, Oct. 17–18, 2008.

Service

Professional Service.....

- Session Chair for contributed session at 21st ILAS Conference, Ames, IA, July 25, 2017.
- Session Chair for MAA–Iowa Section Meeting at Grand View University, Des Moines, IA, Oct. 7, 2016.
- Co-organizer (with A. Berliner and L. Deaett) of the minisymposium “Combinatorial Matrix Theory” at the 20th ILAS Conference, Leuven, Belgium, July 11–15, 2016.
- Reviewer for Mathematical Reviews® (MathSciNet®), 2015–present.
- Referee: *Discrete Mathematics*, *Electronic Journal of Linear Algebra*, *Filomat* ($\times 2$), *Journal of Algebra Combinatorics Discrete Structures and Applications*, *Linear Algebra and its Applications* ($\times 3$), *Linear and Multilinear Algebra*, *Operators and Matrices*, *Special Matrices*.
- Planning Committee Member: First ISU Graduate and Professional Student Research Conference, 2013–2014.
- Session Chair for Midwestern Graph Theory (MIGHTY) LIII Conference, Ames, IA, Sep. 22, 2012.
- Session Chair for Iowa Summer Research Symposium, Ames, IA, July 29, 2010.

University Service.....

- Contributed to curriculum revitalization resulting from program review, Hamline University, 2021–2022.
- Contributed to expedited program reviews of Computational Data Science Major and Mathematics Major, Hamline University, Spring 2021.

- Faculty supervisor of student internships, Hamline University, Spring 2020–present. (10 students)
- Academic Advisor, Hamline University, Fall 2019–present. (currently about 30 advisees)
- Developed three new courses and redesigned two existing courses for launch of Hamline University’s Computational Data Science major, Fall 2019–present.
- Involved in development of Hamline University’s Computational Data Science major, Spring 2019.
- Member of Mathematics Visiting Lecturer search committee, Hamline University, Spring 2019.
- Involved in development of Grand View University’s Business Analytics major, Fall 2017–Spring 2018.
- Co-organizer: Machine Learning reading group (of faculty and students) at Grand View, Fall 2017–Spring 2018.
- Member of the Student Success Collaborative (SSC) software implementation Leadership Team, Spring 2017–Spring 2018, including:
 - Chair of the “Success Marker Development” Group.
 - Member of the SSC software “Workflow Development” Group.
 - Member of the SSC software Training Team.
- Appointed by the university president to be involved in Institutional Planning Initiative, Spring 2017, including:
 - One of eight faculty member participants in a “Direction Setting” retreat with the GV Board of Trustees.
- Co-organizer of the Math & Computer Science Department Game Night, Spring 2017.
- Co-advisor of weekly prep sessions for the ACM programming contest, Fall 2016.
- Member of the Student Success Integration Team Task Force, 2016–2017.
- Academic Advising and Progression Committee, 2015–2017 (Chair: 2016–2017).
- Member of committee to choose new developmental math textbook, Spring 2016.
- Volunteer for ACM North Central North America Regional Programming Contest hosted at Grand View, 2014–2015.
- First-year graduate student peer mentor: Jephian C.-H. Lin (2013–2014), Xavier Martinez-Rivera (2011–2012).
- Supervising TA for Math 150, web-based course. Trained, scheduled, monitored instruction of other TAs, Fall 2010.

Professional Memberships

- Association for Women in Mathematics (AWM), 2016–present.
- International Linear Algebra Society (ILAS), 2010–present.
- American Mathematical Society (AMS), 2008–2014; 2019–present.
- Mathematical Association of America, 2015–2020.
- Iowa Section NExT (New Experiences in Teaching) Fellow, 2013–2018.
- Society for Industrial and Applied Mathematics (SIAM), 2013–2014.
- Associate member of Sigma Xi, The Scientific Research Society, 2012–2014.

Computer skills

Programming Languages and Software: Mathematica, MATLAB, Python, R, SageMath, SQL

Homework Systems: MyMathLab, MyProgrammingLab, WebAssign, WileyPLUS, Blackboard, Canvas

Markup Languages: \LaTeX , Beamer, HTML, R Markdown

References

Dr. Luke Bennett	Professor of Mathematics	Grand View University	LBennett@grandview.edu
Dr. Bruce Bolon	Professor of Physics	Hamline University	bbolon@hamline.edu
Dr. Art Guetter	Professor of Mathematics	Hamline University	aguetter@hamline.edu
Dr. Eric Hart	Professor of Mathematics	Grand View University	ehart@grandview.edu
Dr. Leslie Hogben	Professor of Mathematics	Iowa State University	hogben@aimath.org