JOHN S. CAUGHMAN IV

Professor of Mathematics
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PRESENT POSITION:

Professor of Mathematics and Statistics. Portland State University. 2010-present.

PAST POSITIONS:

Associate Professor of Mathematics and Statistics. Portland State University. 2005-2010.

Assistant Professor of Mathematical Sciences. Portland State University. 2000-2005.

Visiting Research Instructor in Mathematics. Michigan State University. 1998-2000.

EDUCATION:

Ph.D. in Mathematics, University of Wisconsin, Madison. May 1998.
  Thesis: "Bipartite P- and Q-Polynomial Association Schemes".
  Minor: Philosophy of Education.
  Advisor: Paul M. Terwilliger.

M.A. in Mathematics, University of Wisconsin, Madison. May 1995.

B.S. in Mathematics, Purdue University, W. Lafayette, IN. July 1992.

B.A. with Honors in Philosophy, Purdue University, W. Lafayette, IN. May 1992.

RESEARCH:

My primary area of research is Algebraic Combinatorics. In this field, algebraic techniques are applied to the study of combinatorial objects such as graphs or association schemes. Association schemes are very general combinatorial objects; for example, any finite group, building, or distance regular graph can be viewed as an association scheme. Recently association schemes have found applications to coding theory, design theory, and by work of V. Jones, to the construction of knot and link invariants.

Much of my work concerns bipartite P-and Q-polynomial association schemes. These include incidence graphs of symmetric block designs, the bipartite dual polar spaces $D_D(q)$, the hypercubes $H(D, 2)$, and the Hemmeter graphs $\text{Hem}_D(q)$, as well as a number of examples related to sporadic simple groups and link invariants. My results include a computation of the possible Q-polynomial structures, a complete description of the associated Terwilliger algebra, and several new restrictions on the intersection numbers. Another result shows how the last subconstituent supports an association scheme structure which is again P- and Q-polynomial. These are used to classify all bipartite P- and Q-polynomial schemes with sufficiently large diameter.

In present work, I am pursuing extensions of these results to the non-bipartite case. This line of inquiry is likely to produce a classification of the distance-regular graphs that support a spin model. Another project, in a different direction, is to investigate the Norton algebra of a scheme. This is a non-associative algebra that has played a key role in the study of sporadic simple groups and can be constructed in all the known examples of bipartite P- and Q-polynomial schemes. The Terwilliger algebra sheds light on the structure of these Norton algebras, making them a natural object of study. Other directions of interest include the extension of my results to the case of symmetric block designs, and an attempt to find a geometric characterization of the Hemmeter graphs.

Finally, ongoing research involves the application of graph theory and combinatorics to such diverse problems as: the use of graph laplacians to stabilize formations of independently controlled vehicles, the use of hypergeometric functions to count lattice chains related to king's walks and the Delannoy numbers, and the use of combinatorial methods to the study of 1-factorizations of the complete graph.

PUBLICATIONS:

Refereed Journal Articles

[1] P. Banda, J. Caughman, M. Cenek, and C. Teuscher. "Shift-symmetric configurations in two-dimensional cellular automata: irreversibility, insolvability, and enumeration," *Chaos*, **29** (2019), no. 6, pp. 1-19.

[2] L. Agong, C. Amarra, J. Caughman, A. Herman, and T. Terada. "On the girth and diameter of generalized Johnson graphs," *Discrete Mathematics*, **341** (2018), no. 1, pp. 138-142.

[3] J. Caughman, J. Krussel, and J. Mahoney. "Spanning tree decompositions of K_{2n} orthogonal to rotational 1-factorizations," *Graphs and Combinatorics*, **33** (2017), no. 2, pp. 321-333.

[4] E. Lockwood, Z. Reed, and J. Caughman. "An analysis of statements of the multiplication principle in combinatorics, discrete, and finite mathematics textbooks," *International Journal of Research in Undergraduate Mathematics Education*, **3** (2017), no. 3, pp. 381-416.

[5] N. Schimanski and J. Caughman. "Cycle structures of orthomorphisms extending partial orthomorphisms of $\mathbb{Z}_2^n$," *Electronic Journal of Combinatorics*, **23** (2016), no. 3, Research Papers #P3.41 pp. 1-17.

[6] E. Lockwood and J.S. Caughman. "Set partitions and the multiplication principle," *Problems, Resources, and Issues in Mathematics Undergraduate Studies*, **26** (2016), no. 2, pp. 143-157.

[7] P. Banda, J. Caughman, and J. Pospichal. "Configuration symmetry and performance upper bound of one-dimensional cellular automata for the leader election problem," *Journal of Cellular Automata*, **10** (2015), no. 1-2, pp. 1-21.

[8] E. Lockwood, C. Swinyard, and J.S. Caughman. "Patterns, sets of outcomes, and combinatorial justification: two students' reinvention of counting formulas," *International Journal of Research in Undergraduate Mathematics Education,* **1** (2015), no. 1, pp. 1-36.

[9] E. Johnson, J. Caughman, J. Fredericks, and L. Gibson. "Implementing inquiry-oriented curriculum: from the mathematicians perspective," *Journal of Mathematical Behavior*, **32** (2013), no. 4, pp. 743-760.

[10] J.S. Caughman IV, C. Dunn, N. Neudauer, and C. Starr. "Counting lattice chains and Delannoy paths in higher dimensions," *Discrete Mathematics*, **311** (2011), no. 16, pp. 1803-1812.

[11] J.S. Caughman IV, C. Haithcock, and J.J.P. Veerman. "A note on lattice chains and Delannoy numbers," *Discrete Mathematics*, **308** (2008), no. 12, pp. 2623-2628.

[12] J.S. Caughman IV, E.J. Hart, and J. Ma. "The last subconstituent of the Hemmeter graph," *Discrete Mathematics*, **308** (2008), no. 14, pp. 3056-3036.

[13] H.A. Lewis and J.S. Caughman IV. "Tips for the Job Search: Applying for Academic and Postdoctoral Positions," *Notices of the Amer. Math. Soc.*, **53** (2006), no. 9, pp. 1021-1026.

[14] J.S. Caughman IV and J.J.P. Veerman. "Kernels of directed graph Laplacians," *Electron. J. Combin.*, **13** (2006), no. 1, Research Papers #39, pp. 1-8.

[15] J.J.P. Veerman, G. Lafferriere, J.S. Caughman IV, and A. Williams. "Flocks and Formations," *J. Stat. Phys.* **121** (2005), no. 5-6, pp.901-936.

[16] G. Lafferriere, A. Williams, J.S. Caughman IV, and J.J.P. Veerman. "Decentralized control of vehicle formations," *Systems Control Lett.* **54** (2005), no. 9, pp. 899-910.

[17] J.S. Caughman IV, M.S. Maclean, and P. Terwilliger. "The Terwilliger algebra of an almost bipartite P- and Q-polynomial association scheme," *Discrete Mathematics*, **292** (2005), no. 1-3, pp. 17-44.

[18] J.S. Caughman IV and N. Wolff. "The Terwilliger algebra of a distance-regular graph that supports a spin model," *J. of Algebraic Combin.*, **21** (2005), no. 3, pp. 289-310.

[19] J.S. Caughman IV. "Bipartite Q-polynomial distance-regular graphs," *Graphs and Combinatorics*, **20** (2004), no. 1, pp.47-57.

[20] J.S. Caughman IV. "The last subconstituent of a bipartite P- and Q-polynomial association scheme," *European Journal of Combinatorics*, **24** (2003), no. 5, pp.459-470.

[21] J.S. Caughman IV. "The parameters of bipartite Q-polynomial distance-regular graphs," *Journal of Algebraic Combinatorics*, **15** (2002), no. 3, pp.223-229.

[22] J.S. Caughman IV and B. E. Sagan. "The multiplicities of a dual-thin Q-polynomial association scheme," *Electronic Journal of Combinatorics*, **8** (2001), no. 1, Notes 4.

[23] J.S. Caughman IV. "Bipartite Q-polynomial quotients of antipodal distance-regular graphs," *J. Combin. Theory Ser. B*, **76** (1999), pp.291-296.

[24] J.S. Caughman IV. "The Terwilliger algebras of bipartite P- and Q-polynomial association schemes," *Discrete Math.*, **196** (1999), pp.65-95.

[25] J.S. Caughman IV. "Spectra of bipartite P- and Q-polynomial association schemes," *Graphs Combin.*, **14** (1998), pp.321-343.

[26] J.S. Caughman IV. "Intersection numbers of bipartite distance-regular graphs," *Discrete Math.*, **163** (1997), pp.235-241.

Refereed Book Chapters

[27] S. Larsen, E. Glover, A.M. Bergman, J. Caughman. "What kind of opportunities do abstract algebra courses provide for strengthening future teachers mathematical knowledge for teaching?" In: Wasserman N. (eds) *Connecting Abstract Algebra to Secondary Mathematics, for Secondary Mathematics Teachers* (pp. 71-84). Research in Mathematics Education (2018), Springer.

Refereed Conference Proceedings

[28] E. Lockwood, J. Caughman, and K. Weber. "Multiple semantic representation systems in binomial identities: An exploration of proofs that explain and proofs that only convince," *22nd Annual Conference on Research in Undergraduate Mathematics Education*, Oklahoma City, OK: Oklahoma State University (2019), in press.

[29] R. Dhal, G. Lafferriere, and J. Caughman. "Towards a complete characterization of vulnerability of networked synchronization processes," *55th IEEE Conference on Decision and Control* (2016), pp. 5207-5212.

[30] L. Tran, A. Gronquist, M. Perkowski, and J. Caughman. "An improved factorization approach to reversible circuit synthesis based on EXORs of products of EXORs," to appear in the *Proceedings of the IEEE 46th International Symposium on Multiple-Valued Logic*, Sapporo, Japan: Hokkaido University (2016).

[31] E. Lockwood, Z. Reed, and J. Caughman. "Categorizing statements of the multiplication principle," In *Proceedings of the 37th Annual Meeting of the North American Chapter of the Psychology of Mathematics Education,* East Lansing, Michigan: Michigan State University. (2015).

[32] E. Lockwood, C. Swinyard, and J. Caughman. "Modeling outcomes in combinatorial problem solving: the case of combinations," In T. Fukawa-Connelly, N. Infante, K. Keene, and M. Zandieh (Eds.), *Proceedings for the Eighteenth Special Interest Group of the MAA on Research on Undergraduate Mathematics Education,* Pittsburgh, PA: West Virginia University. (2015), pp. 690-696.

[33] J. Caughman, C. Dunn, J. Laison, N. Neudauer, and C. Starr. "Minimum representations of rectangle visibility graphs," *Graph Drawing: 22nd International Symposium*, (2014).

[34] E. Lockwood, C. Swinyard, and J. Caughman. "Examining students' combinatorial thinking through reinvention of basic counting formulas," In T. Fukawa-Connelly, G. Karakok, K. Keene, and M. Zandieh (Eds.), *Proceedings for the Seventeenth Special Interest Group of the MAA on Research on Undergraduate Mathematics Education,* Denver, CO: Northern Colorado University. (2014), pp. 169-184.

[35] M. Hawash, M. Perkowski, S. Bleiler, J. Caughman, and A. Hawash. "Reversible function synthesis of large reversible functions with no ancillary bits using covering set partitions," *Proceedings of ITNG Eighth International Conference*, (2011), no. 16, pp. 1008-1013.

[36] G. Lafferriere, J.S. Caughman IV, and A. Williams. "Graph theoretic methods in the stability of vehicle formations," *ACC2004*, 2004.

[37] J.S. Caughman IV and N. Wolff. "Parameter constraints for a distance-regular graph that supports a spin model," *Proceedings of Com2MaC Workshop*, (2004), Busan, Korea, pp.125-132.

[38] J.S. Caughman IV. "The Terwilliger algebra for bipartite P- and Q-polynomial association schemes (extended abstract)," Group Theory and Combinatorial Mathematics (Japanese). *Surikaisekikenkyusho Kokyuroku*, No. 991, pp.108-109, 1997.

WORKS IN PROGRESS:

[1] E. Lockwood, J. Caughman, and K. Weber. "Multiple representation systems in binomial identities: Exploring proofs that explain," Submitted.

[2] J.S. Caughman IV. "The classification of distance-regular graphs that support a spin model," in preparation.

[3] J.S. Caughman IV and E. Lockwood. "On the existence of certain lowering maps in polynomial rings," in preparation.

[**4**] J.S. Caughman IV. "A hypergeometric identity that resolves a nonnegativity conjecture related to the parameters of a distance-regular graph," in preparation.

[**5**] E. Lockwood, C. Swinyard, and J. Caughman. "Encoding outcomes in counting problems: the case of combinations," submitted.

[**6**] J. Caughman, S. Bleiler, and E. Kummel. "An upper bound on the number of linear extensions of product posets," submitted.

HONORS/AWARDS:

John Eliot Allen Outstanding Teacher (5th). Awarded by the College of Liberal Arts and Sciences. Portland State University. June 2017.

John Eliot Allen Outstanding Teacher (4th). Awarded by the College of Liberal Arts and Sciences. Portland State University. June 2014.

John Eliot Allen Outstanding Teacher (3rd). Awarded by the College of Liberal Arts and Sciences. Portland State University. June 2011.

John Eliot Allen Outstanding Teacher (2nd). Awarded by the College of Liberal Arts and Sciences. Portland State University. June 2005.

CECS Outstanding Teacher. Awarded by the College of Engineering and Computer Science. Portland State University. May 2003.

John Eliot Allen Outstanding Teacher (1st). Awarded by the College of Liberal Arts and Sciences. Portland State University. June 2002.

Frame Teaching Award Nominee in Mathematics. Nominated by students. Mathematics Department, Michigan State University. May 1999.

Sustained Excellence in Teaching and Service in Mathematics. Awarded by the faculty of the Mathematics Department, University of Wisconsin, Madison. May 1998.

Outstanding Teaching Award in Mathematics. Awarded by the faculty of the Mathematics Department, University of Wisconsin, Madison. May 1995.

GRANT ACTIVITIES:

Advisory board for grant. Lockwood, Elise (Principal), "Developing Undergraduate Combinatorial Curriculum in Computational Settings," Sponsored by NSF - National Science Foundation, Federal, $800,000. 2017 - 2022. Funded.

Advisory board for grant. Ellis, Amy (Principal), Lockwood, Elise (Co-Principal), Moore, Kevin (Co-Principal), Tillema, Eric (Co-Principal), Caughman, John (Supporting), "Generalization Among Multiple Mathematical Areas (GAMMA)," Sponsored by NSF - National Science Foundation, Federal, $1,499,908. 2014 - 2017. Funded.

Co-PI for grant. Terwilliger, Paul M (Co-Principal), Miklavic, Stefko (Co-Principal), Caughman, John (Co-Principal), "Bipartite Distance-Regular Graphs (BDRG2)," Sponsored by Slovenian Research Agency – International Collaboration, Other, $15,000.00. (September 2009 - September 2012). Funded.

Senior personnel for grant. Larsen, Sean (Co-Principal), Thanheiser, Eva (Co-Principal), Staples, Megan (Co-Principal), Newton, J (Co-Principal), Caughman, John (Supporting), "Justification and Argumentation: Growing Understanding of Algebraic Reasoning (JAGUAR)," Sponsored by NSF - National Science Foundation, Federal, $446,759.00. (January 2009 - January 2012). Funded.

Co-PI for grant. Larsen, Sean (Principal), Caughman, John (Co-Principal), Yannotta, Mark (Co-Principal), "Teaching Abstract Algebra for Understanding," Sponsored by NSF - National Science Foundation, Award Number DUE-0737299, $200,001.00. (July 1, 2008 - December 31, 2011). Funded.

Senior personnel for grant. Larsen, Sean (Co-Principal), Noll, Jennifer (Co-Principal), Swinyard, Craig A (Co-Principal), Yanotta, Mark (Co-Principal), Caughman, John (Supporting), "Teaching Advanced Calculus for Understanding (CCLI Project)," Sponsored by NSF - National Science Foundation, Federal, $249,908.00. (May 2009). Not funded.

Senior personnel for grant. Marrongelle, Karen (Co-Principal), Dick, Tom (Co-Principal), Foreman, Linda (Co-Principal), Higgins, Karen (Co-Principal), Young, T (Co-Principal), Caughman, John (Supporting), "Oregon Mathematics Leadership Institute Partnership (OMLI)," Sponsored by NSF - National Science Foundation, Federal, $5,000,000.00. (January 2005 - September 2008). Funded.

Co-PI for grant. Terwilliger, Paul M (Co-Principal), Miklavic, Stefko (Co-Principal), Caughman, John (Co-Principal), "Bipartite Distance-Regular Graphs (BDRG1)," Sponsored by Slovenian Research Agency – International Collaboration, Other, $15,000.00. (September 2007). Not funded.

Senior personnel for grant. Brown, Cynthia (Co-Principal), Chrzanowska-Jeske, Malgorzata (Co-Principal), Palmiter, Jeanette (Co-Principal), Patton, Judith (Co-Principal), Fant, Karla (Co-Principal), Caughman, John (Supporting), "Improving STEM Retention through Community Building (STEM)," Sponsored by NSF - National Science Foundation, Federal, $1,997,698.00. (October 2004). Not funded.

Co-PI for grant. Caughman, John (Co-Principal), Becker, William (Co-Principal), Montag, Susan (Co-Principal), Clark, Andy (Co-Principal), Cameron, Bill (Co-Principal), "Portland Science/Math Connect: A Partnership to Transform Teaching and Learning in Under-Achieving Schools (CONNECT)," Sponsored by NSF - National Science Foundation, Federal, $2,500,000.00. (December 2003). Not funded.

Co-PI for grant. Lendaris, George (Co-Principal), Lafferriere, Gerardo (Co-Principal), Caughman, John (Co-Principal), "Graph Theoretic Methods in Control and Neural Networks (FRG)," Sponsored by NSF - National Science Foundation, Federal, $1,029,328.00. (September 2003). Not funded.

PI for grant. Caughman, John (Principal), "Association Schemes, Terwilliger Algebras, and Spin Models (IRFAP)," Sponsored by NSF - National Science Foundation, Federal, $47,700.00. (October 1998). Not funded.

U. S. Department of Education Fellowship. Awarded by the faculty of the Mathematics Department, University of Wisconsin, Madison. Spring 1997.

Graduate Summer Research Funding. Awarded by the Graduate School, University of Wisconsin, Madison. Summer 1996.

OTHER ACTIVITIES:

Special Session Organizer. Discrete Mathematics in the Undergraduate Curriculum Ideas and Innovations for Teaching, with E. Lockwood of Oregon State University, part of the Joint Mathematics Meetings of the Americal Mathematical Society to be held in Atlanta, GA. January 2017, 2018, 2019.

Referee for Professional Journals. European Journal of Combinatorics, Graphs and Combinatorics, Journal of Algebraic Combinatorics, Journal of Combinatorial Theory, Combinatorica, and Discrete Mathematics. 1998-present.

Curricular Design and Course Creation. Redesigned upper-level Combinatorics offerings, revising MTH 4/587 and creating new MTH 4/556. Redesigned Calculus/Linear Algebra sequence, MTH 261 and MTH 343. Developed new curriculum for MTH 344 and MTH 356. Reinstituted Advanced Number Theory, MTH 4/549. Created 2-term Graph Theory sequence, MTH 4/561-4/562. Created 3-term Algebraic Graph Theory sequence, MTH 661,662,663. Portland State University. 2005-present.

Translator. *Topics in Mathematics for the 10th Grade.* Mathematics resource book for Waldorf teachers. Originally in German. Spring 2008.

Combinatorics Conference (Potlatch). Principal organizer. Hosted at Portland State, Fall 2006.

Special Session Organizer. Association Schemes and Distance-regular Graphs, with Paul Terwilliger of University of Wisconsin, part of the Western Sectional meeting of the AMS. June 2002.

Portland Area Seminar for Graph Theory and Combinatorics. Organizer, with Nancy Neudauer of Pacific University. 2001-2011.

CONFERENCE TALKS AND OTHER PRESENTATIONS:

"Pursuing a math career and counting lattice chains". Invited colloquium lecture, presented at Clackamas Community College. March 2016.

"Deconstruction and reconstruction of the multiplication principle". Contributed talk, presented at Pacific Northwest meetings of the MAA, March 2016.

"How many ways through the maze?". Invited colloquium lecture, presented at Mt. Hood Community College. February 2016.

"Rainbow spanning trees: two ways to decompose a complete graph ". Kieval Lecture Series, presented at Southern Oregon University. 2013.

"Setting the bar low for rectangle visibility graphs". Kieval Lecture Series, presented at Southern Oregon University. 2013.

"Counting lattice chains and Delannoy numbers". Kieval Lecture Series, presented at Southern Oregon University. 2013.

"Lattice Chains and Delannoy Paths". Reed College Colloquium, Reed College. March 2010.

"Lattice Chains and Delannoy Paths: A Triumph of Pencil & Paper". Portland State University, presented at Maseeh Colloquium, Department of Mathematics & Statistics. October 2009.

"The Friendship Theorem & Graph Theory". University of Portland, Colloquium, Department of Mathematics & Statistics. September 2009.

"My Experience Using an Innovative Algebra Curriculum". Lecture, Mathematical Association of America, presented at MathFest 2009, Portland, OR. August 2009.

"Higher Order Lattice Chains and Delannoy Numbers: The Enumeration". Lecture, Mathematical Association of America, presented at MathFest 2009, Portland, OR. August 2009.

"An Inequality for Leonard Systems". Lecture at the annual meeting of the Mathematical Association of America, Worcester Polytechnic Institute. April 2009.

"Research in Distance-regular Graphs". Mathematics Department, University of Hamburg, Germany. February 2008.

"Stabilizing of Vehicle Formations". Mathematics Department, University of Hamburg, Germany. June 2008.

"Graph Theoretic Methods in the Stability of Vehicle Formations". Colloquium, Mathematics Department, Helmut Schmidt University, Hamburg, Germany. June 2008.

"The Friendship Theorem". Colloquium, Mathematics Department, Clackamas Community College. November 2007.

"Graphs and Matrices". Colloquium, Mathematics Department, Pacific University. December 2005.

"Laplacians of Directed Graphs". Portland Area Lecture Series for Graph Theory, Portland State University. Spring 2005.

"Spin Models and Distance-regular graphs". Combinatorics Potlatch, Mathematics Department, Seattle University. Fall 2005.

"Terwilliger algebras, spin models, and distance-regular graphs". Com2MaC Workshop on Distance-regular Graphs and Finite Geometry, invited plenary speaker, Busan, Korea. July 2004.

"The last subconstituent of Hemmeter's graph". Com2MaC Conference on Association Schemes, Codes and Designs, Busan, Korea. July 2004.

"Spin Models and Distance-regular graphs". Combinatorics seminar, Mathematics Department, University of Wisconsin. March 2003.

Organized special session of AMS meetings, "Association Schemes and Distance-regular graphs". Portland State University, July 2002.

"An introduction to distance-regular graphs", Colloquium, Portland State University Department of Mathematics and Statistics, April 2002.

"Classical parameters and bipartite distance-regular graphs", Lecture given at the EuroWorkshop on Algebraic Graph Theory, University of Edinburgh, Scotland, July 9 - 13, 2001.

"The Algebraic Study of Distance-regular Graphs", Lecture at the annual meeting of the Pacific Northwest section of the Mathematical Association of America, Seattle Pacific University. April 2001.

"Parameterizations of Bipartite Distance-regular Graphs", Lecture at the Conference for Algebraic Combinatorics and Vertex Operator Algebras, University of California, Santa Cruz. July 2000.

"Parameters of Bipartite Q-Polynomial Distance-regular Graphs", Lecture at the Conference for Geometric and Algebraic Combinatorics, Oisterwijk, Netherlands. August 1999.

"Parameter Restrictions for Bipartite Q-Polynomial Distance-regular Graphs", Lecture, MIGHTY-XXXI, Oakland, Michigan. March 1999.

"The Terwilliger Algebras of Bipartite P- and Q-Polynomial Association Schemes", Lecture, FPSAC Conference, Fields Institute, Toronto, Canada. June 1998.

"The Terwilliger Algebras of Bipartite P- and Q-Polynomial Association Schemes", Poster session, ESF Conference for Algebra and Discrete Mathematics, San Feliu de Guixols, Spain, October 1997.

"The Subconstituent Algebras of Bipartite P- and Q-Polynomial Association Schemes", Invited speaker, RIMS Conference, Kyoto, Japan, December 1996.

"A New Inequality for Bipartite Distance-regular Graphs", Invited speaker, Workshop on the Terwilliger Algebra, Kyoto University, Japan, December 1996.

"Q-Polynomial Structures for Bipartite Distance-regular Graphs", Lecture given at the Workshop on Distance-regular Graphs, Centre de Research Mathematique, University of Montreal, Canada, November 1996.

"Eigenvalue Orderings for Bipartite P- and Q-Polynomial Association Schemes", Poster session, FPSAC Conference, University of Minnesota, June 1996.

Other: Lectures given in AMS Special Sessions: Baltimore (January 1998), Louisville (March 1998), and Chicago (September 1998), Portland (June 2002).

STUDENTS SUPERVISED:

PhD Students

[1] **Taiyo Terada**, Ph.D. in Mathematical Sciences, Portland State University.
Project: "Graph Coloring and Independence in Generalized Johnson Graphs" in progress.

[2] **Ewan Kummel**, Ph.D. in Mathematical Sciences, Portland State University.
Project: "Linear Extensions of Partial Orders" in progress.

[3] **Nichole Schimanski**, Ph.D. in Mathematical Sciences, Portland State University.
Project: "Orthomorphisms in Groups" Summer 2016.

[4] **James Mahoney**, Ph.D. in Mathematical Sciences, Portland State University.
Project: "Tree Graphs and Orthogonal Spanning Tree Decompositions" Spring 2016.

Master's Students

[5] **Brittany Carter**, M.S. in Mathematical Sciences, Portland State University.
Project: "Proving Eulerian triangulations are 3-colorable" in progress.

[6] **Ari Herman**, M.S. in Mathematical Sciences, Portland State University.
Project: "Distance, Diameter, Girth, and Odd Girth in Generalized Johnson Graphs" 2019.

[7] **Kyle Oddson**, M.S. in Mathematical Sciences, Portland State University.
Project: "Counting and Coloring Sudoku Graphs" 2019.

[8]   **Levi Casey**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Reidemeister-Schreier Rewriting Process for Group Presentations" 2017.

[9]   **Melanie Hoffman**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Two-Toned Tilings and Compositions of Integers" 2017.

[10] **Taiyo Terada**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Computing Total Dominator Chromatic Numbers of Some Graphs" 2017.

[11] **Karl Wallulis**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Permutation Polynomials over Finite Fields" 2017.

[12] **Gabriel Stauth**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Coherent Configurations and the Graph Isomorphism Problem" 2017.

[13] **Jason Kincaid**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Total Dominator Chromatic Numbers of Graphs" in progress.

[14] **Katherine Rock**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Properties of the Towers of Hanoi Graphs" 2016.

[15] **Dan Vaughn**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Rainbow Connection Numbers in Graphs" 2014.

[16] **Nate Gildersleeve**, M.S.T. in Mathematics Education,, Portland State University.
      Project: "The Gossip Problem" 2013.

[17] **Damon Hochnadel**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Cycles, Chords, and Planarity in Graphs" 2013.

[18] **Wil Langford**, M.S. in Mathematical Sciences, Portland State University.
      Project: "On the Extremal Cases of the Identifying Code Problem" 2013.

[19] **Matthew Ridge**, M.S. in Mathematical Sciences, Portland State University.
      Project: "On (Kq:k)-stable Graphs" 2013.

[20] **Shelley Welke**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Electrical Resistances in Products of Graphs" 2012.

[21] **Jaime Bushi**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Optimal Strategies for Hat Games" 2012.

[22] **Ewan Kummel**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Linear Extensions and LYM Posets" 2012.

[23] **Aaron Spindel**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Hypergraphs with a Unique Perfect Matching" 2012.

[24] **Tom Roidt**, M.S.T. in Mathematics Education, Portland State University.
      Project: "Cycloids and Paths" 2011.

[25] **Cynthia Schneider**, M.S.T. in Mathematics Education, Portland State University.
      Project: "Complex Numbers and the Theorem of DeMoivre" 2011.

[26] **Nichole Schimanski**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Fractional Colorings and Zykov Products of Graphs" 2011.

[27] **Tomohiro Kawasaki**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Sharp Upper Bounds for the Largest Laplacian Eigenvalue of a Tree" 2011.

[28] **Joseph Richards**, M.S. in Mathematical Sciences, Portland State University.
      Project: "Graphic Realizations of Sequences" 2011.

[29] **Ian Walker**, M.S.T. in Mathematics Education, Portland State University.
      Project: "Explorations in Recursion with John Pell and the Pell Sequence" 2011.

[30] **Timothy Meagher**, M.S. in Mathematical Sciences, Portland State University.
Project: "Multi-coloring and Mycielski's construction" 2010.

[31] **Clifford Smith**, M.S.T. in Mathematics Education, Portland State University.
Project: "EFibonacci Solitaire and Its Use in the Classroom" 2010.

[32] **Valerie Tillia**, M.S. in Mathematical Sciences, Portland State University.
Project: "Determinants of Distance Matrices of Trees" 2010.

[33] **Robert Benim**, M.S. in Mathematical Sciences, Portland State University.
Project: "Enumerating Cyclic Quasiplatonic Groups For a Given Signature" 2010.

[34] **Troy Parkinson**, M.S. in Mathematical Sciences, Portland State University.
Project: "The Golden Root of Chromatic Polynomials" 2009.

[35] **Kalei Titcomb**, M.S. in Mathematical Sciences, Portland State University.
Project: "The Problem of the 36 Officers" 2009.

[36] **Amy Winston**, M.S.T. in Mathematics Education, Portland State University.
Project: "A Finite History of Infinity" 2009.

[37] **Carly Vollet**, M.S. in Mathematical Sciences, Portland State University.
Project: "The Structure of Maximum Independent Sets in Fullerenes" 2007.

[38] **Nathan Lazar**, M.S. in Mathematical Sciences, Portland State University.
Project: "Destroying Automorphisms in Trees" 2007.

[39] **Charles DeGrasse**, M.S. in Mathematical Sciences, Portland State University.
Project: "Weighted Forms of Euler's Theorem" 2007.

[40] **Nickolas Chura**, M.S. in Mathematical Sciences, Portland State University.
Project:"Alternating Sign Matrices and Symmetry" 2007.

[41] **Brad Benjamin**, M.S. in Mathematical Sciences, Portland State University.
Project: "The Algebra of the 2x2x2 Rubik's Cube" 2007.

[42] **Ander Erickson**, M.S. in Mathematical Sciences, Portland State University.
Project: "Representing Permutations with Tableaux" 2007.

[43] **Becky Ross**, M.S. in Mathematical Sciences, Portland State University.
Project: "Clausen's Formula and Nonnegativity" 2007.

[44] **Tony Jacobs**, M.S. in Mathematical Sciences, Portland State University.
Project: "Fractional Chromatic Numbers and Clique Numbers" 2006.

[45] **Elise Lockwood**, M.S.T. in Mathematical Sciences, Portland State University.
Project: "The Combinatorics and Pedagogy of Matchings and Rook Polynomials " 2006.

[46] **Shelley Lopresti**, M.S.T. in Mathematical Sciences, Portland State University.
Project: "Desargues' Theorem and the Mathematics of Perspective" 2006.

[47] **Ross Cottrell**, M.S.T. in Mathematical Sciences, Portland State University.
Project: "A Historical Approach to Limits, Sequences, and Series " 2006.

[48] **Gabe Daleson**, M.S. in Mathematical Sciences, Portland State University.
Project: "Deterministic Primality Testing in Polynomial Time " 2006.

[49] **Louis Kaskowitz**, M.S. in Mathematical Sciences, Portland State University.
Project: "The Independence Fractal of a Graph " 2006.

[50] **Kylee Bracher**, M.S. in Mathematical Sciences, Portland State University.
Project: "The Law of Quadratic Reciprocity: Proof by Wilson's Theorem " 2005.

[51] **Clifford Haithcock**, M.S. in Mathematical Sciences, Portland State University.
Project: "Hamiltonicity and Fault Tolerance in the k-ary n-cube" 2005.

[52] **Katie Leonard**, M.S. in Mathematical Sciences, Portland State University.
Project: "The Friendship Theorem and Projective Planes " 2005.

[53] **Laura Smoyer**, M.S.T. in Mathematical Sciences, Portland State University.
Project: "Musical Mathematics: The Mathematics of Equal Temperament " 2005.

[54] **Joanna Taylor**, M.S.T. in Mathematical Sciences, Portland State University.
Project: "Polynomial Multiplication and the Role of Variables " 2005.

[55] **Kelsey Knode**, M.S. in Mathematical Sciences, Portland State University.
Project: "Fibonacci Solitaire and Motzkin Paths" 2005.

[56] **Sky McKinley**, M.S. in Mathematical Sciences, Portland State University.
Project: "The Hamming Codes and Delsartes Linear Progamming Bound" 2003.

[57] **Elizabeth Hart**, M.S. in Mathematical Sciences, Portland State University.
Project: "Bilinear Forms, Dual Polar Spaces, and the Hemmeter Graph" 2002.

[58] **Craig Swinyard**, M.S.T. in Mathematics Education, Portland State University.
Project: "An Introductory Graph Theory Curriculum" 2002.

[59] **Nadine Wolff**, M.S. in Mathematical Sciences, Portland State University.
Project: "Spin Models and Bose-Mesner Algebras" 2001.

Senior Honor's Theses

[60] **Kyle Oddson**, Senior honors thesis in Mathematical Sciences, Portland State University.
Project: "Math and Sudoku: Exploring Sudoku boards through graph theory, group theory, and combinatorics" Winter 2016.

[61] **Kaelyn Flowerday**, Senior honors thesis in Mathematical Sciences, Portland State University.
Project: "Unfolding trees and symmetrically-associated graphs" 2015.

[62] **Kevin Samuels**, Senior Honors Thesis in Mathematical Sciences, Portland State University.
Project: "A Dynamic Survey of Cages" 2009.

FURTHER INFORMATION:

Languages: English and German. Reading knowledge of French.

Computing Skills: Sage, Python, Unix, HTML, Fortran, Basic, Emacs, VI and PICO editors, X-Windows environment, Maple, Matlab, Mathematica, X-fig, TeX, and LaTeX.

Hobbies: Poetry, genealogy, philosophy, hiking, running, spending time with my family.

Country of Citizenship: United States.