Nathan C. Carter

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Wilder Teaching Professor
Director, Center for Analytics and Data Science
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Bentley University
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Positions

2019–present	Professor, Mathematical Sciences	Bentley University
	Director, Center for Analytics and Data Science, 2022–present	
	Wilder Teaching Professorship, 2020–2025	
2018–2019	Research Associate	University of St Andrews
	mathematical software development, GAP team	(during sabbatical)
2010–2019	Associate Professor, Mathematical Sciences	Bentley University
	Department Chair during 2014–2018	
2009–2010	Game development consultant	self-employed
	clients included Spiral Galaxy and Mattel, Inc.	(during sabbatical)
2004–2010	Assistant Professor, Mathematical Sciences	Bentley University

Education

Indiana University, Bloomington, Indiana

Ph.D. Mathematics, July 2004, Advisor: Prof. David Charles McCarty
Thesis: *Reflexive Logics—Intermediate logics that can prove their own completeness*

M.S. Computer Science, May 2004, Advisor: Prof. Douglas R. Hofstadter
Masters Software Project: *Group Explorer* (group theory visualization software)

M.S. Mathematics, April 2001

University of Scranton, Scranton, Pennsylvania

B.S. Mathematics and Computer Science, *magna cum laude* with Mathematics Award, May, 1999

Awards

National

Distinguished Lecture Series, Mathematical Association of America, March 2022

Beckenbach Book Prize, Mathematical Association of America, January 2021

Trevor Evans Award, Mathematical Association of America, August 2012

Beckenbach Book Prize, Mathematical Association of America, January 2012

Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member, Mathematical Association of America, 2010

National Science Foundation Division of Undergraduate Education: Course, Curriculum, and Laboratory Improvement Grant #0736644, Phase I ($130,552), PI (with Dr. Kenneth Monks, Co-PI), 2008–2011

Institutional

Outstanding Scholarly Contribution, Bentley University, September 2012
Three Innovation in Teaching Awards, Bentley University, 2007, 2014, 2016

Books

Data Science for Mathematicians (editor). Taylor and Francis, September 2020, ISBN 978-0-36702-705-6 (hardback), 978-0-42939-829-2 (ebook).

Introduction to the Mathematics of Computer Graphics. Mathematical Association of America Press, September 2016, ISBN 978-1-61444-122-9. Website and resources at `http://nathancarter.github.io/mocg`.

forallχ in Lurch. Based on work by P.D. Magnus, August 2012. An Open Educational Resource, a logic textbook integrating the software system *Lurch* throughout. On the web at `https://nathancarter.github.io/faxil/`.

Visual Group Theory. Mathematical Association of America Press, May 2009, ISBN 987-0-88385-757-1. My website for this book is at `http://web.bentley.edu/empl/c/ncarter/vgt`.

Chinese translation, 群论彩图版, from China Machine Press, October 2019, ISBN 978-7-111-62485-1.

Refereed Publications

N. Carter, A. Iyengar, M. Lanham, S. Nestler, D. Schrader, A. Zadeh. "Clustering algorithms to increase fairness in collegiate wrestling," Journal of Quantitative Analysis in Sports, Volume 18, Issue 2, 2022.

M. Agarwal, N. Carter, D. Oury. "Machine Learning," chapter in *Data Science for Mathematicians,* September 2020.

N. Carter. "Circuits in RGB Express," *Mathematics Magazine,* Vol. 92 (2019), pp. 323–388. `https://doi.org/10.1080/0025570X.2019.1614418`

N. Carter, D. Oury. "Classroom Management with RStudio Server Professional," Technology Innovations in Statistics Education, Volume 11, Issue 1, 2018.

N. Carter, K. G. Monks. "A Web-Based Toolkit for Mathematical Word Processing Applications with Semantics," Proceedings of CICM 2017, eds. Herman Geuvers and Jacques Fleuriot (2017).

N. Carter, K. G. Monks. "From Formal to Expository: Using the Proof-Checking Word Processor *Lurch* to Teach Proof Writing," chapter in "Beyond Lecture: Techniques to Improve Student Proof-Writing Across the Curriculum," eds. Schwell, Steurer, and Vasquez, MAA Notes (2016).

N. Carter, K. G. Monks. "*Lurch:* A word processor that can grade students' proofs," *Workshops and Work in Progress at CICM,* Christoph Lange et al., editors. CEUR Workshop Proceedings Vol-1010, Aachen, Germany (2013). Online at `http://ceur-ws.org/Vol-1010/`.

N. Carter, K. G. Monks, "*Lurch:* A word processor built on OpenMath that can check mathematical reasoning," *Workshops and Work in Progress at CICM,* Christoph Lange et al., editors. CEUR Workshop Proceedings Vol-1010, Aachen, Germany (2013). Online at `http://ceur-ws.org/Vol-1010/`.

N. Carter, M. Predescu. "A Study of the Effect of Density Dependence in a Matrix Population Model," *The Australian Journal of Mathematical Analysis and Applications,* Vol. 7, Issue 1 (2010).

N. Carter, C. Hadlock, D. Haughton. "Generating Random Networks from a Given Distribution," *Computational Statistics and Data Analysis,* Vol. 52, No. 8 (April 2008), pp. 3928–3938.

N. Carter. "Reflexive Intermediate First-Order Logics," *Notre Dame J. Formal Logic,* Vol. 49, No. 1 (2008), pp. 75–95.

S. Adams, N. Carter, C. Hadlock, D. Haughton, G. Sirbu. "Change in Connectivity in a Social Network over Time: A Bayesian Perspective," *Connections,* Vol. 28, Issue 2 (2008).

S. Adams, N. Carter, C. Hadlock, D. Haughton, G. Sirbu. "Proactive Encouragement of Interdisciplinary Research Teams in a Business School Environment: Strategy and Results," *Journal of Higher Education Policy and Management,* Vol. 30, No. 2 (2008).

N. Carter. "Reflexive Intermediate Propositional Logics," *Notre Dame J. Formal Logic,* Vol. 47, No. 1 (2006), pp. 39–62

N. Carter, B. Emmons. "Group Theory Visualization with Group Explorer," *J. Online Mathematics and its Applications,* online at `http://www.joma.org`, published Dec. 2005

N. Carter, R. Eagles, S. Grimes, A. Hahn, C. Reiter. "Chaotic Attractors with Discrete Planar Symmetries," *Chaos, Solitons & Fractals,* Vol. 9, No. 12 (1998), pp. 2031–3054

N. Carter, S. Grimes, C. Reiter. "Frieze and Wallpaper Chaotic Attractors with a Polar Spin," *Computers and Graphics,* Vol. 22, No. 6 (1998), pp. 765–779

Publications in Progress

N. Carter. "*How to Data:* A free resource for data science students," *Scatterplot,* revise and resubmit.

N. Carter, G. Friedman, O. Tavakoli. "Can AI Grade Mathematical Proofs?" In progress, to submit in summer 2025.

Expository Publications

N. Carter. "ChatGPT Gets All the Attention," *Math Horizons,* November 2024.

N. Carter. "AfterMath: Don't Skip the Code," *Math Horizons,* April 2017, p.34.

N. Carter, D. Kalman. "It's a Wonderful Log," *Math Horizons,* November 2014, p.18.

N. Carter, D. Kalman. "Haunted by Pythagoras," *Math Horizons,* November 2012, p.20.

N. Carter, E. Farrington. "A Quick Tour of Manjul Bhargava's 2011 Hedrick Lectures on Elliptic Curves," *Math Horizons,* November 2011, p.6.

N. Carter, D. Kalman. "Harvey Plotter and the Circle of Irrationality," *Math Horizons,* November 2011, p.10.

N. Carter. "AfterMath: Thinking Inside the Box," *Math Horizons,* February 2010, p.34.

N. Carter. Review of *Five Minute Mathematics,* Erhard Behrends. *Math Horizons,* February 2009, p. 26.

S. Adams, N. Carter, C. Hadlock, D. Haughton, G. Sirbu. "A Recipe for Collaborative Research," *BizEd,* Sept/Oct (2006), pp. 30–34

Teaching Experience at Bentley University

Electives

Actuarial Practicum with Advanced Excel Modeling (3 sections, in partnership with actuaries from Liberty Mutual Insurance)
Data Science (MA705, 3 sections)
Data Science (MA346, 5 sections)
Discrete Mathematics (7 sections)
Mathematical Logic for Honors Students (6 sections)
Mathematical Modeling with VBA in Excel (3 sections)
Mathematics of Computer Graphics, MA 307 (10 sections)

Directed Study

Honors Capstone projects (5 semesters)
iPhone Application Development (2 semesters)
Mathematical Software Development (1 semester)

Service Courses

Calculus I, II, and III (MA 126, 131, 139, 233) (several sections in different semesters)
Calculus review for graduate students (GR 526) (3 semesters)

Software

See my full list of software publications, including desktop and web applications, GAP packages, and teaching aids, on my GitHub profile, `http://github.com/nathancarter`.

Other Professional Experience

Center for Analytics and Data Science (CADS), Bentley University: Director, 2022–present
Strategical Plan Implementation Team, Bentley University: 2022–present
Wilder Teaching Professor, Bentley University, endowed position, 2020–present
Core Curriculum Revision Task Forces, Bentley University: 2019–2021
School of Computer Science, University of St Andrews: Principal Research Fellow, sabbatical 2018–2019
Department of Mathematical Sciences, Bentley University: Chair, 2014–2018
Shared Governance Task Force, Bentley University: 2016–2018
Chauvenet Prize Committee, Mathematical Association of America: 2014–2017
Honors Program, Bentley University: Associate Director, 2012–2014
Math Horizons: Editorial board member, 2009–2019
National Science Foundation: Proposal Reviewer, as needed, beginning 2008

Talks

Functions are All You Need
Applied Math in Statistics and Data Science Education, ICERM, Providence, RI, May 20, 2025
`https://icerm.brown.edu/video_archive/4151`

Using AI in Python through HuggingFace Transformers (workshop)
Analytics Without Borders Conference, Bentley University, April 4, 2025
`https://videos.bentley.edu/media/t/1_mfzy88lh`

Workshop on Lurch (proof checking software)
Conference on Intelligent Computer Mathematics, Montreal, QC, August 5, 2024, with K. G. Monks

Introduction to Lurch (proof checking software)
American Institute of Mathematics, Pasadena, CA, December 5, 2023, with K. G. Monks

Large Language Models: Construction, Use, and New Discoveries
New England Statistical Society Data Science Day, University of Connecticut, October 21, 2023.
`https://www.youtube.com/watch?v=RNJrHWY9Onc`

Mathematics in Data Science
Mathematical Association of America Distinguished Lecture Series, online, March 23, 2022.
`https://www.youtube.com/watch?v=lK5LcwmMn9Y`

The Surprising Pedagogical Value and Versatility of Cayley Graphs
Illustrating Number Theory and Algebra Workshop, ICERM, Brown University, October 21, 2019.

Cayley Graphs for Building Intuition in Group Theory
American Mathematical Society Fall Southeastern Section Meeting, Gainesville, FL, November 3, 2019.

Lurch: software for immediate feedback for students in a first proof course
School of Computer Science seminar, University of St Andrews, Scotland, September 25, 2018

Clustering with Genetic Algorithms in Division III Collegiate Wrestling
Analytics Without Borders Conference, Bentley University, Waltham, MA, March 23, 2018

A Web-Based Toolkit for Mathematical Word Processing Applications with Semantics
Conference on Intelligent Computer Mathematics, Edinburgh, UK, July 2017

Teaching an Introduction to the Mathematics of Computer Graphics
MAA Minicourse, Joint Mathematics Meetings, Atlanta, GA, January 5 and 7, 2017

Teaching an Introduction to the Mathematics of Computer Graphics
MAA Workshop, MathFest, Columbus, OH, August 4, 2016

Panel on Assessment Facilitated by Technology, Invited Panelist
Digital Open Mathematics Education Conference, University of Toronto, June 19, 2016

Lurch: A Word Processor that can Grade Students' Proofs
MathFest, Portland, OR, August 8, 2014

The Value of Visualization in Group Theory
Evening lecture, Indiana University, Bloomington, IN, April 9, 2014

Lurch: A Word Processor that can Grade Students' Proofs
Logic Seminar, Indiana University, Bloomington, IN, April 9, 2014

What does Rubik's Cube have to do with Quintic Polynomials?
Keynote address at the 63rd Annual Western Illinois University Mathematics Teachers Conference, Macomb, IL, March 21, 2014

Introduction to the Mathematics of Computer Graphics
Mathematics Department Colloquium, Western Illinois University, Macomb, IL, March 20, 2014

Using Lurch in an Introduction to Proofs Course
MathFest, national meeting of the Mathematical Association of America, Hartford, CT, August 3, 2013

Three talks on various aspects of the software system *Lurch*
Conference on Intelligent Computer Mathematics, Bath, UK, July 2013

Lurch: A word processor that checks students' mathematical reasoning
Joint Meetings of the AMS and MAA, San Diego, CA, January 9, 2013

Introduction to the Mathematics of Computer Graphics,
Bentley University Mathematics Department Seminar, Waltham, MA, October 31, 2012

The Lurch Project: A word processor that checks your math
Joint Meetings of the AMS and MAA, Boston, MA, January 4, 2012

The Lurch Project: A word processor that checks your math
Joint Meetings of the AMS and MAA, New Orleans, LA, January 6, 2011

Visualizing Group Theory: From Zero to Galois Theory in 50 Minutes
Gordon College, November 11, 2010

The Lurch Project: A word processor that checks your math
MathFest, national meeting of the Mathematical Association of America, in a session for recipients of the Henry L. Alder Award, Pittsburgh, PA, August 6, 2010

Using Lurch in the Classroom
Maryland/D.C./Virginia Section Meeting of the Mathematical Association of America, Virginia State University, Petersburg, MD, April 16, 2010

Visualization Lessons from Visual Group Theory
Joint Meetings of the AMS and MAA, San Francisco, California, January 16, 2010

Lurch: Software for Teaching Mathematical Proofs
Sage Education Day 1, Clay Math Institute, Cambridge, MA, December 6, 2009

Visual Group Theory
MathFest, national meeting of the Mathematical Association of America, Portland, OR, August 6, 2009

Lurch: Software for Teaching and Writing Mathematical Proofs
MathFest, national meeting of the Mathematical Association of America, in a session on Getting Students Involved in Writing Proofs, Portland, OR, August 7, 2009

Workshop on Lurch: Software for Teaching Mathematical Proofs
Northeast Section of the MAA Fall 2008 meeting, November 21, 2008, Bentley University

A Talk Without Words: Visualizing Group Theory
Joint Meetings of the AMS and MAA, San Diego, California, January 7, 2008

Metal and Money: A Logical Video Game
Bentley University Wilder Workshop for Innovation in Teaching Award Winners, April 23, 2008

Visualizing Group Theory with Group Explorer
Joint Meetings of the AMS and MAA, New Orleans, Louisiana, January 5, 2007, MAA Session on Use of Technology in Abstract Algebra and Number Theory

Visualizing Group Theory: From Zero to Galois Theory in 50 Minutes
Marywood University, November 17, 2006

Visualizing Group Theory: From Zero to Galois Theory in 50 Minutes
Wellesley College Mathematics Department Colloquium, September 26, 2006

Using Software to Explore Upper-Division Mathematics Classes, with a Focus on Abstract Algebra
Council on Undergraduate Research National Conference, DePauw University, June 24, 2006, with Allen Hibbard and Ellen Maycock

Reflexive Intermediate Propositional Logics
Association for Symbolic Logic Winter meeting, January 15, 2006

Reflexive Intermediate Logics
Massachusetts Institute of Technology logic seminar, September 28, 2005

Group Explorer—Visualization Software in the Abstract Algebra Classroom
Northeast Section meeting of the MAA, Worcester, Massachusetts, November 20, 2004

Group Explorer—Visualization Software in the Abstract Algebra Classroom
Joint Meetings of the AMS and MAA, Phoenix, Arizona, January 8, 2004, with Brad Emmons MAA Contributed Papers Session on Mathlets for Teaching and Learning Mathematics

Reflexive Intermediate Logics
Graduate Student Seminar, Indiana University, December 2003

Group Explorer—Visualization Software in the Abstract Algebra Classroom
Indiana University, in two abstract algebra courses, Sept. and Oct. 2003

Chaotic Attractors with Discrete Planar Symmetries
MAA Eastern Pennsylvania and Delaware section meeting, Shippensburg University, Shippensburg, Pennsylvania, April 1998

Chaotic Attractors with Discrete Planar Symmetries
Joint Meetings of the AMS and MAA, Baltimore, Maryland, January 1998, with Richard Eagles and Steven Grimes

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