# Nicholas A. Scoville

## Curriculum Vitae


101K Pfahler
Ursinus College
Collegeville, PA

Phone: 610-409-3118
E-Mail: nscoville@ursinus.edu
URL: http://webpages.ursinus.edu/nscoville/


## POSITIONS HELD

**Ursinus College**

| | |
|---|---|
| Full Professor | fall 2021- present |
| Joseph Beardwood III Chair of Mathematics | fall 2017-present |
| Associate Professor | fall 2016- spring 2021 |
| Chair of Mathematics and Computer Science | spring 2016-present |
| Assistant Professor | fall 2010-spring 2016 |

**Faulkner University**

| | |
|---|---|
| Adjunct Professor | 2015 |

## EDUCATION

**Dartmouth College**

| | |
|---|---|
| Ph.D., Mathematics | June 2010 |
| Masters of Arts, Mathematics | June 2007 |

**Western Michigan University**

| | |
|---|---|
| Masters of Science, Mathematics | June 2005 |
| Bachelors of Science, Mathematics | August 2003 |

**Grand Rapids Community College**

| | |
|---|---|
| Associates, Architectural Drafting | May 2001 |

## TEACHING EXPERIENCE

**Ursinus College,**

*Math 335: Abstract Algebra*
*Math 491: Algebraic Topology*
*Math 451: Discrete Morse Theory*
*Math 361: Graph Theory*
*CIE 100: Common Intellectual Experience*
*Math 421: Topology*
*Math 211: Multivariable calculus*
*Math 235: Linear Algebra*
*Math 10: Problem Solving*
*Math 322: Geometry*
*Math 341: Probability*
*Math 236W: Discrete Mathematics*
*Stat 141Q: Statistics I*
*Math 111: Calculus I*
*Math 112: Calculus II*

**Adjunct Professor,** Faulkner University

*Math 1312: Mathematics* Spring 2015

**Other teaching experience,**

| | |
|---|---|
| *Teaching Assistant: Dartmouth College* | Summer 2009 |
| *Instructor: Dartmouth College* | 2007-2009 |
| *Teaching Assistant: Dartmouth College* | 2005-2007 |
| *Instructor: Western Michigan University* | 2003-2005 |
| *Undergraduate Teaching Assistant: Western Michigan University* | 2002-2003 |

## INDEPENDENT STUDIES

**Ursinus College,**

| | |
|---|---|
| Discrete Morse theory and knots, Connor Donovan | Spring 2021 |
| Discrete Morse theory, Elvi Sopiqoti | Spring 2020 |
| Discrete plates and Olives, Matthew Furgele | Spring 2020 |
| Analyzing heart data, Ben Minardi | Spring 2019 |
| Algebraic topology, Nick Tulio | Spring 2019 |
| Strong collapsibility and the Morse complex, Max Lin | Spring 2019 |
| Group of strong self-homotopy equivalences, Vince Sergi, Ryan Quick | Spring 2019 |
| Boolean functions, Ryan Quick | Fall 2018 |
| Algebraic topology, Jason Bennett | Fall 2018 |
| Generating Discrete Morse Functions from Point Data, Ashlyn Welch | Spring 2018 |
| Random discrete Morse theory, Nikolai Peralta | Spring 2018 |
| Homotopy theory, Karthik Yegnesh | Fall 2016 Spring 2017, Fall 2017, Spring 2018 |
| Topology, Ian Rand | Spring 2017 |
| Discrete Morse theory and Persistent homology, Yuqing Liu | Spring 2017 |
| Random discrete Morse theory, Nikolai Peralta, Chase Babrich | Fall 2016, Spring 2017 |
| Algebraic topology, Matan Peleg | Fall 2016, Spring 2017 |
| Category theory, Michael Vennettilli | Spring 2015 |
| Multiplication in discrete Morse theory, Rose Blanchard | Spring 2015 |
| Number theoretic notions in discrete Morse theory, Ian Rand | Spring 2015 |

| | |
|---|---|
| Discrete Morse theory, Tyler Helms | Fall 2014 |
| Estimating the discrete LS category, Brian Green | Fall 2013 |
| Homology and Cohomology, Seth Aaronson, Brian Green, Michelle Tanco | Spring 2013 |
| Discrete LS category, Seth Aaronson | Spring 2013 |
| Counting discrete Morse functions, Seth Aaronson | Spring 2012 |
| Lie Groups, Brian Green | Spring 2012 |
| Discrete Morse Theory, Mike Agiorgousis | Spring 2012 |
| Markov Chains, Jayant Velagala | Spring 2012 |
| Probability, Jayant Velagala | Fall 2011 |
| Knot Theory, Will Molden | Fall 2011 |
| Discrete Morse Theory, Seth Aaronson | Spring 2011 |

## STUDENT POSTERS AND PRESENTATIONS

Benjamin Johnson *"Merge trees in discrete Morse theory,*
Mathfest, Cincinnati, Ohio August 2019

Yuqing Liu *"Persistence equivalence of discrete Morse functions on trees,*
Mathfest, Denver, Colorado August 2018

Karthik Yegnesh *"Families of Objects in Categories and Elementary Topoi,*
AMS/MAA Joint Math Meetings, Atlanta, Georgia January 2017

Karthik Yegnesh *Cosheaf theoretical constructions in networks and persistent homology,*
$68^{th}$ annual Delaware Valley Science Fair, Oaks, Pennsylvania (won "first place" in Mathematics) March 2016

Karthik Yegnesh *Cosheaf theoretical constructions in networks and persistent homology,*
$59^{th}$ annual Montgomery County Science Research Competition, Collegeville, Pennsylvania
(won "first place" in math category) March 2016

Matt Belle *Arboricity,*
AMS/MAA Joint Math Meetings, Baltimore, Maryland January 2014

Brian Green *Estimating the discrete Lusternik–Schnirelmann category,*
AMS/MAA Joint Math Meetings, Baltimore, Maryland January 2014

Seth Aaronson *Lusternik–Schnirelmann category for cell complexes,*
AMS/MAA Joint Math Meetings, San Diego, California January 2013

Mike Agiorgousis, Brian Green, and Alex Onderdonk *Discrete Morse Functions and Homology,*
AMS/MAA Joint Math Meetings, San Diego, California (won "Outstanding Presentation" award) January 2013

Mike Agiorgousis, Brian Green, and Alex Onderdonk *Discrete Morse Functions and Homology,*
Undergraduate Science Research Symposium, Haverford College September 2012

Mike Agiorgousis, Brian Green, and Alex Onderdonk *Discrete Morse Functions and Homology,*
Mathfest, Madison, Wisconsin August 2012

Mike Agiorgousis, Brian Green, Alex Onderdonk,and Kim Rich *Discrete Morse Functions and Homology,*
*Disappearing Boundaries Summer Research Meeting, Lebanon Valley College* July 2012

Seth Aaronson and Marie Meyer, *"Graph Isomorphisms in Discrete Morse Theory", AMS/MAA Joint Meetings, Boston, MA* January 2012

## PUBLICATIONS

Benjamin Johnson and Nicholas A. Scoville, "Merge trees in discrete Morse theory," *submitted*

Nicholas A. Scoville and Matthew C. B. Zaremsky, "Higher connectivity of the Morse complex," *submitted*

Desamparados Fernandez-Ternero, Enrique Macias-Virgos, David Mosquera-Lois, Nicholas A. Scoville, and Jose-Antonio Vilches, "Fundamental Theorems of Morse theory on posets," *submitted*

Gregory Lupton, John Oprea, and Nicholas A. Scoville, "The digital Hopf construction," *submitted*

Gregory Lupton and Nicholas A. Scoville, "Digital Fundamental Groups and Edge Groups of Clique Complexes," *submitted*

Connor Donovan, Maxwell Lin, and Nicholas A. Scoville, "On the homotopy and strong homotopy type of complexes of discrete Morse functions, *submitted*

Gregory Lupton, John Oprea, and Nicholas A. Scoville, "Subdivision of Maps of Digital Images," *submitted*

Dominic Klyve and Nicholas A. Scoville, "Summation graphs and discrete Morse theory," *submitted*

Maxwell Lin and Nicholas A. Scoville, "On the automorphism group of the Morse complex," *Advances in Applied Mathematics*, Volume 131, October 2021, 102250

Gregory Lupton, John Oprea, and Nicholas A. Scoville, "Homotopy Theory in Digital Topology," *Discrete and Computational geometry*, (to appear)

Gregory Lupton, John Oprea, and Nicholas A. Scoville, "A Fundamental Group for Digital Images," *Journal of Applied and Computational Topology*, 5 (2021), no. 2, 249311.

Nicholas A. Scoville, "Topology from Analysis: A Mini-Primary Source Project for Topology Students," *Convergence* (June 2020)

Desamparados Fernandez-Ternero, Enrique Macias-Virgos, Nicholas A. Scoville, and Jose-Antonio Vilches, "Strong discrete Morse theory and simplicial LusternikSchnirelmann category: A discrete version of the Lusternik-Schnirelmann Theorem," *Discrete and Computational Geometry*, 63 (2020), no. 3, 607623.

Ian Rand and Nicholas A. Scoville, "Discrete Morse functions, vector fields, and homological sequences on trees," *Involve, A Journal of Mathematics* Involve, a Journal of Mathematics 13-2 (2020), 219–229. DOI 10.2140/involve.2020.13.219

Yuqing Liu and Nicholas A. Scoville, "The realization problem for discrete Morse functions on trees," *Algebra Colloquium*, **27** : 3 (2020) 455–468 DOI: 10.1142/S1005386720000371

Nicholas A. Scoville, "The Cantor Set Before Cantor: A Mini-Primary Source Project for Analysis and Topology Students," *Convergence* (May 2019)

Mike Agiorgousis, Brian Green, Alex Onderdonk, Nicholas A. Scoville, and Kim Rich, "Homological sequences in discrete Morse theory," *Topology Proceedings*, 54 (2019) 283–294

Colin Adams, Allison Henrich, Kate Kearney and Nicholas A. Scoville, "Knots Related by Knotoids," *American Mathematical Monthly* Volume 126, 2019 - Issue 6, 483–490

Nicholas A. Scoville and Karthik Yegnesh "A Persistent Homological Analysis of Network Data Flow Malfunctions," *Journal of Complex Networks*, Issue 6, 1 December 2017, Pages 884-892

Nicholas A. Scoville, "Connecting Connectedness: A Mini-Primary Source Project for Topology Students," *Convergence* (October 2017)

Nicholas A. Scoville and Willie Swei "On the Lusternik–Schnirelmann category of a simplicial map," *Topology and its applications* 216 (2017), 116-128

Brian Green, Nicholas A. Scoville, and Mimi Tsuruga, "Estimating the discrete Lusternik–Schnirelmann category," *Topological Methods in Nonlinear Analysis*, 45, No. 1 (2015), 103–116

Akshaye Dhawan, Michelle Tanco, and Nicholas A. Scoville, "A Distributed Greedy Algorithm for Constructing Connected Dominating Sets in Wireless Sensor Networks," SENSORNETS, Lisbon, Portugal January 2014

Nicholas A. Scoville, "Metric Structures for CW Complexes," *Topology Proceedings*, 44 (2014) 117–131

Seth Aaronson, Marie Meyer, Nicholas A. Scoville, Mitchell T. Smith, and Laura Stibich, "Graph Isomorphisms in discrete Morse theory," *AKCE Int. J. Graphs Comb.,* 11, No. 2 (2014), 163–176

Seth Aaronson and Nicholas A. Scoville, "Lusternik–Schnirelmann category for cell complexes," *Illinois J. of Mathematics*, 57, No. 3 (2013), 743–753

Nicholas A. Scoville, "Georg Cantor at the Dawn of Point-Set Topology," *Loci*, (March 2012), DOI: 10.4169/loci003861

Nicholas A. Scoville, "Lusternik–Schnirelmann Category and the Connectivity of $X$," *Algebraic & Geometric Topology*, 12 (2012) 435-448

Nicholas A. Scoville, "Mapping Cone Sequences and a Generalized Notion of Cone Length," *JP Journal of Geo. and Top.*, 11(2011), Issue 3, 209-233

Nicholas A. Scoville, "A Metric for Homotopy Types," Ph.D. Thesis, Dartmouth College, Spring 2010

Rob Nendorf, Nicholas A. Scoville, Jeff Strom, "Categorical Sequences," *Algebraic & Geometric Topology*, 6 (2006) 809–838

## BOOKS

*Discrete Morse theory*, AMS/MAA Press, 2019

## BOOK CHAPTERS

Nicholas A. Scoville, "Sometimes when your hopes have all been shattered," *Living Proof: Stories of resilience along the mathematical journey*, Edited by Henrich et al., AMS/MAA Press, 2019

## BOOK REVIEWS

Nicholas A. Scoville, "Never a dull moment: Hassler Whitney, Mathematics Pioneer" by Keith Kendig, *The American Mathematical Monthly* Volume 126, 2019 - Issue 9

## PRESENTATIONS (past 4 years only)

*Higher connectivity of the Morse complex* January, 2021
Virtual AMS/MAA Joint Meetings (invited talk)

*Discrete Morse theory as an introduction to topology* March, 2020
Juniata College math colloquium (invited talk)

*Towards a new digital homotopy theory* February, 2020
University of Albany Geometry/Topology seminar (invited talk)

*Digital topology: A smooth introduction* November, 2019
Westminster College, Fulton Missouri (invited talk)

*Towards a new digital homotopy theory* November, 2019
University of Missouri Geometry/Topology seminar (invited talk)

*Strong discrete Morse theory and an application to simplicial Lusternik–Schnirelmann category* November, 2019
Topological Complexity and Related topics, AMS Southeastern
Sectional Meeting, University of Florida (invited talk)

*On the automorphism group of the Morse complex* November, 2019
General Contributed Paper Session, AMS Southeastern Sectional Meeting, University of Florida

*A new digital homotopy theory* June, 2019
Lehigh Geometry/Topology Conference

*Towards a new digital homotopy theory* May, 2019
Lehigh University Algebraic Topology seminar (invited talk)

*Build your own topology* January, 2019
General Contributed Paper Session on Research in Topology, Joint Math Meetings, Baltimore

*Digital Topology: A smooth introduction* October, 2018
Western Michigan University (invited talk)

*Strong discrete Morse theory* July, 2018
ICART 2018, Rabat Morocco

*Digital Topology: A smooth introduction* March, 2018
Colloquium, Elon University (invited talk)

*$S^1$ and $S^2$ and $S^3$, oh fy! A digital Hopf fibration* January, 2018
Math Colloquium, Montana State University (invited talk)

*$S^1$ and $S^2$ and $S^3$, oh fy! A digital Hopf fibration* November, 2017
Colloquium, Catholic University of America (invited talk)

*Digital Topology: A smooth introduction* November, 2017
Colloquium, Bard College (invited talk)

*$S^1$ and $S^2$ and $S^3$, oh fy! A digital Hopf fibration* November, 2017
Colloquium, Dartmouth College (invited talk)

*Digital Topology: A smooth introduction* October, 2017
Colloquium, Seattle University (invited talk)

*Digital Topology: A smooth introduction* October, 2017
Colloquium, Central Washington University (invited talk)

*Simplicial Lusternik–Schnirelmann category and strong discrete Morse theory* October. 2017
Topology Seminar, University of Florida (invited talk)

*$S^1$ and $S^2$ and $S^3$, oh fy! A digital Hopf fibration* October, 2017
Colloquium, University of Florida Colloquium (invited talk)

*Digital Topology: A smooth introduction* September, 2017
Math Club, Cleveland State University (invited talk)

*A Persistent Homological Analysis of Network Data Flow Malfunctions* August, 2017
Applied Algebraic Topology in Sapporo, Sapporo Japan

*A Persistent Homological Analysis of Network Data Flow Malfunctions* June, 2017
Applied Topology in Bedlewo, Bedlwo Poland

*A Simplicial Lusternik–Schnirelmann Theorem (poster)* June, 2017
Topological Data Analysis: Theory and Applications, Macalester College

*Towards a new digital homotopy theory* April 2017
Colloquium, Cleveland State University (invited talk)

*Collaborative Research: Transforming Instruction in Undergraduate Mathematics via Primary Historical (TRIUMPHS)* January, 2017

MAA Invited Paper Session on Research in Improving
Undergraduate Mathematical Sciences Education
Program, AMS/MAA Joint Meetings, Atlanta (invited talk)

## WORKSHOPS RUN

*MAA Workshop: Teaching Undergraduate Mathematics via Primary Source Projects.* January, 2020
AMS/MAA Joint Math Meetings, Denver Colorado

*TRIUMPHS Graduate student training Workshop* July 19-20, 2019
New Mexico State University

*TRIUMPHS Training Workshop* September 13-15, 2018
University of Colorado Denver

*Teaching Undergraduate Mathematics via Primary Source Projects* January 2018
AMS/MAA Joint Math Meetings, San Diego CA

*Teaching Mathematics with Primary Historical Sources* April 1, 2017
MAA EPADEL sectional meeting, Kutztown PA

*TRIUMPHS Training Workshop* September 8-10, 2016
University of Colorado Denver

*Connecting Past to Present: An approach to teaching topology via original resources* July, 2016
HPM 2016, Montpelier France

## PROFESSIONAL AFFILIATIONS

*Council on Undergraduate Research* 2013-2017

*History of Mathematics Special Interest Group*
*of the Mathematical Association of America (HOMSIGMAA)* 2012-Present

*Association of Christians in the Mathematical Sciences* 2011-Present

*Mathematical Association of America* 2009-Present

*American Mathematical Society* 2005-Present

*Pi Mu Epsilon Mathematics Honors Society* Fall 2002-Spring 2005

## HONORS AND AWARDS

Paul R. Halmos-Lester R. Ford Award
for article of expository excellence published in The American Mathematical Monthly August 2020

**REU SITE: Exploration and Professional Excellence in the Mathematical Sciences**
NSF Grant 1851948 (April 2020- March 2023) $225,469

Western Michigan University
Department of Mathematics Alumni Achievement Award October 2018

**Collaborative Research: RUI: Transforming Instruction in Undergraduate Mathematics via Primary History Sources**
NSF IUSE Grant 1524065 (Aug. 2015- Sept. 2020) PIs at Colorado State, Central Washington, NMSU, Xavier, U Colorado, Denver, U Florida $71,002

Best oral presentation at HTCA conference in Genoa, Italy
sponsored by Gruppo Italiano Ricercatori in Pattern Recognition. February 2015

Mellon travel grant July 2013

Mellon travel grant May 2012

Project NExT Fellow Aug. 2010 – Aug. 2011

## ADDITIONAL SKILLS

Mathematical Software: LATEX, MATLAB, Maple, BlackBoard, WeBWork, HTML, Minitab, Derive, Java.

## MATHEMATICAL ACTIVITIES

Served on MA math thesis committee for Marwa Mosallam
"On cup-products of cofibers of maps between Moore spaces, Hopf invariant, and Lusternik–Schnirelmann category"
Western Michigan University, July 2021

Served on virtual panel "Teaching and the Liberal Arts"
University of Tennessee, Knoxville April 2020

Referee for several journals (available upon request) 2013-present

Member of NSFs College of Reviewers for Undergraduate Education 2018-2021

Scientific Committee, ESU8, Oslo Norway July 2018

| | |
|---|---|
| Scientific Committee, ICART 2018, Rabat Morocco | July 2018 |
| Organized Special Session "AMS Special Session on Open & Accessible Problems for Undergraduate Research, " with Allison Henrich and Michael Dorff at AMS/MAA Joint Math Meetings | January 2018 |
| Focus Magazine, editorial board | November 2017-present |
| Served on NSF panel review | 2016, 2017, 2018 |
| Served on MAA Basic Library List Committee | January 2017-January 2020 |
| Organized Special Session "AMS Special Session on Open & Accessible Problems for Undergraduate Research, " with Allison Henrich and Michael Dorff at AMS/MAA Joint Math Meetings | January 2017 |
| Served on panel "The Research and Teaching Pendulum: January 2017 Finding a Stable Equilibrium" at AMS/MAA Joint Math Meetings | January 2017 |
| Organized Special Session "Applied and Computational Topology, " with Matthew Wright and Paweł Dłotko at AMS/MAA Joint Math Meetings | January 2016 |
| Organized panel "Finding a thesis topic and advisor, " at AMS/MAA Joint Math Meetings | January 2016 |
| Reviewed applications for Posters on the Hill | Fall 2015 |
| Reviewer for MathSciNet Mathematical Reviews | February 2015-present |
| Organized panel "Graduate school: Choosing one, getting in, staying in, " at AMS/MAA Joint Math Meetings | January 2015 |
| Reviewed applications for Posters on the Hill | Fall 2014 |
| Book reviewer for online MAA book reviews | 2014-Present |
| Faculty representative for Ursinus MAA student chapter | 2014-Present |
| CUR Councilor in the Mathematics and Computer Sciences Division | 2014-Present |
| Served on panel "You published your dissertation: now what?" at AMS/MAA Joint Math Meetings | January 2013 |

| | |
|---|---|
| Organized panel "The on-campus interview survival guide" at AMS/MAA Joint Math Meetings | January 2013 |
| Reviewer for mathematical publication database Zentralblatt | August 2012-present |
| Senior Personal, Ursinus College REU (NSF Grant No. DMS-1003972) | June 2012-August 2012 |
| Organized Panel "Hit the Ground Running! Interview like a Pro and land the job" at AMS/MAA Joint Math Meetings | January 2012 |
| Senior Personal, Ursinus College REU (NSF Grant No. DMS-1003972) | June 2011-August 2011 |
| Judge for MAA Student Paper Session 3, MathFest | August 2011 |
| Judge of research abstracts for Young Mathematicians Network Conference applicants | July 2011 |
| Judge for MAA Student Poster Session, Joint Mathematics Meetings | January 2011 |
| Calculus Committee, Ursinus College; Member | August 2010-present |
| Statistics Committee, Ursinus College; Member | August 2010-present |
| Organizer for Ursinus College $\epsilon$-talks | Fall 2010-Fall 2016 |
| Treasurer for YMN (Young Mathematicians Network) | 2010-2015 |
| Judge for MAA Student Paper Session 11, MathFest | August 2010 |
| Reader/Reviwer for "Introduction to Homotopy Theory" by Martin Arkowitz | 2007-2008 |
| Student Seminar Organizer | 2004-2005 |
| WMU Pi Mu Epsilon Graduate Representative | 2003-2005 |
| Grader | Summer 2004, Summer 2003 |