

Professional Appointments

Assistant Professor	University of Windsor	Current
Adjunct Research Professor	Carleton University	Current
Adjunct Assistant Professor	University of Windsor	2020
Postdoctoral Researcher	Carleton University	2020
Postdoctoral Researcher	University of Waterloo	2019
Visiting Postdoctoral Researcher	Wilfrid Laurier University	2019
Research Intern	Maplesoft	2018

Education

PhD, Computer Science	University of Waterloo	2017
MMath, Computational Mathematics	University of Waterloo	2009
BMath, Computational Mathematics	University of Waterloo	2008

Research Interests

Computer-assisted proofs, automated reasoning, satisfiability solving, symbolic computation, experimental mathematics, and discrete mathematics.

Grants

NSERC Discovery Grant (\$157.5K)	2021
Startup Grant, University of Windsor (\$70K)	2021
NSERC Postdoctoral Fellowship (\$90K)	2020
Co-authored the research proposal “Amazon AWS for Automated Reasoning” that was awarded \$145K USD in Amazon AWS Credits. (PI: Vijay Ganesh)	2019

Journal Publications

C. Bright, I. Kotsireas, V. Ganesh. The Science of Less-Than-Brute Force: When Satisfiability Solving Meets Symbolic Computation. To appear in Communications of the ACM, 2022.

C. Bright, I. Kotsireas, A. Heinle, V. Ganesh. Complex Golay Pairs up to Length 28: A Search via Computer Algebra and Programmatic SAT. Journal of Symbolic Computation, 2021.

C. Bright, I. Kotsireas, V. Ganesh. New Infinite Families of Perfect Quaternion Sequences and Williamson Sequences. IEEE Transactions on Information Theory, 2020.

C. Bright, K. Cheung, B. Stevens, D. Roy, I. Kotsireas, V. Ganesh. A Nonexistence Certificate for Projective Planes of Order Ten with Weight 15 Codewords. Applicable Algebra in Engineering, Communication and Computing, 2020. **AAECC 2020 best paper award.**

C. Bright, I. Kotsireas, V. Ganesh. Applying Computer Algebra Systems with SAT Solvers to the Williamson Conjecture. Journal of Symbolic Computation, 2020.

C. Bright, D. Đoković, I. Kotsireas, V. Ganesh. The SAT+CAS Method for Combinatorial Search with Applications to Best Matrices. *Annals of Mathematics and Artificial Intelligence*, 2019.

E. Zulkoski, C. Bright, A. Heinle, I. Kotsireas, K. Czarnecki, V. Ganesh. Combining SAT Solvers with Computer Algebra Systems to Verify Combinatorial Conjectures. *Journal of Automated Reasoning*, 2017.

C. Bright, R. Devillers, J. Shallit. Minimal Elements for the Prime Numbers. *Journal of Experimental Mathematics*, 2016.

Conference Publications

N. Rubin, C. Bright, B. Stevens, K. Cheung. Integer and Constraint Programming Revisited for Mutually Orthogonal Latin Squares. To appear in Student Abstract Proceedings of the 36th AAI Conference on Artificial Intelligence, 2022.

N. Rubin, C. Bright, K. Cheung, B. Stevens. Improving Integer and Constraint Programming for Graeco-Latin Squares. *Proceedings of the 32nd IEEE International Conference on Tools with Artificial Intelligence*, 2021.

C. Bright, K. Cheung, B. Stevens, I. Kotsireas, V. Ganesh. A SAT-based Resolution of Lam's Problem. *Proceedings of the 35th AAI Conference on Artificial Intelligence*, 2021.

C. Bright, K. Cheung, B. Stevens, I. Kotsireas, V. Ganesh. Unsatisfiability Proofs for Weight 16 Codewords in Lam's Problem. *Proceedings of the 29th International Joint Conference on Artificial Intelligence*, 2020.

C. Bright, K. Cheung, B. Stevens, I. Kotsireas, V. Ganesh. Nonexistence Certificates for Ovals in a Projective Plane of Order Ten. *Proceedings of the 31st International Workshop on Combinatorial Algorithms*, 2020.

C. Bright, I. Kotsireas, V. Ganesh. SAT Solvers and Computer Algebra Systems: A Powerful Combination for Mathematics. *Proceedings of the 29th International Conference on Computer Science and Software Engineering*, 2019.

C. Bright, J. Gerhard, I. Kotsireas, V. Ganesh. Effective Problem Solving Using SAT Solvers. *Maple in Mathematics Education and Research, Third Maple Conference Proceedings*, 2019.

C. Bright, D. Đoković, I. Kotsireas, V. Ganesh. A SAT+CAS Approach to Finding Good Matrices: New Examples and Counterexamples. *Proceedings of the 33rd AAI Conference on Artificial Intelligence*, 2019.

C. Bright, I. Kotsireas, V. Ganesh. A SAT+CAS Method for Enumerating Williamson Matrices of Even Order. *Proceedings of the 32nd AAI Conference on Artificial Intelligence*, 2018.

C. Bright, I. Kotsireas, A. Heinle, V. Ganesh. Enumeration of Complex Golay Pairs via Programmatic SAT. *Proceedings of the 43rd International Symposium on Symbolic and Algebraic Computation*, 2018.

C. Bright, V. Ganesh, A. Heinle, I. Kotsireas, S. Nejati, K. Czarnecki. MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. *Proceedings of the 18th International Workshop on Computer Algebra in Scientific Computing and the 1st SC² Workshop*, 2016.

C. Bright, A. Storjohann. Vector Rational Number Reconstruction. *Proceedings of the 36th*

International Symposium on Symbolic and Algebraic Computation, 2011.

Other Publications

D. Dallaire, *C. Bright*. Enumerating Projective Planes of Order Nine with Proof Verification. To appear in the 7th International Workshop on Satisfiability Checking and Symbolic Computation.

Z. Li, *C. Bright*, V. Ganesh. An SC-Square Approach to the Minimum Kochen–Specker Problem. To appear in the 7th International Workshop on Satisfiability Checking and Symbolic Computation.

C. Bright, K. Cheung, B. Stevens, I. Kotsireas, V. Ganesh. Solving Lam’s Problem via SAT and Isomorph-Free Exhaustive Generation (Extended Abstract). To appear in the Recently Published Research Track of the 19th International Conference on Principles of Knowledge Representation and Reasoning, 2022.

B. Lee, *C. Bright*. Hadamard 160 in Cool Tones. Maple Conference Mathematical Art Gallery, 2021. **Judges’ choice award.**

C. Bright, I. Kotsireas, V. Ganesh. The SAT+CAS Paradigm and the Williamson Conjecture (Extended Abstract). ACM Communications in Computer Algebra, 2018.

Invited Tutorials

Isomorph-Free Exhaustive Generation in SAT Solving. New Perspectives in Symbolic Computation and Satisfiability Checking, Dagstuhl Seminar, Wadern, Germany, February 17, 2022.

Invited Talks

Searching for Kochen–Specker Systems With Orderly Generation and Satisfiability Solving. Applications of Computer Algebra, Gebze Technical University, Istanbul, Turkey, August 15, 2022.

Searching for Kochen–Specker Systems With Orderly Generation and Satisfiability Solving. Satisfiability: Theory, Practice, and Beyond Reunion, Simons Institute, Berkeley, USA, June 16, 2022.

SAT Solving with Computer Algebra for Combinatorics. Tutte Colloquium, University of Waterloo, Waterloo, Canada, April 1, 2022.

When Computer Algebra Meets Satisfiability: A New Approach to Combinatorial Mathematics. New Technologies in Mathematics Seminar Series, Harvard University, Cambridge, USA (with Vijay Ganesh), November 3, 2021.

Satisfiability Checking + Symbolic Computation: A New Approach to Combinatorial Mathematics. LAPIS Meeting, Rice University, Houston, USA (with Vijay Ganesh), July 12, 2021.

SAT Solvers for Combinatorics Problems. CanaDAM 2021 (Held Online), May 25, 2021.

Computational Algebra and Logic for Mathematical Search. University of Windsor Department of Mathematics and Statistics Colloquium, Windsor, Canada (Held Online), May 6, 2021.

Computer Algebra and SAT for Mathematical Search. Theoretical Foundations of SAT/SMT Solving, Simons Institute, Berkeley, USA (Held Online), April 21, 2021.

A Resolution of Lam's Problem via Satisfiability Solvers. Canadian Mathematical Society Winter Meeting, Montréal, Canada (Held Online), December 4, 2020.

SAT Solving with Computer Algebra for Fast, Verified Mathematical Search. University of Windsor School of Computer Science Seminar, Windsor, Canada, March 12, 2020.

SAT Solving with Computer Algebra and its Application to Graph Theory and Geometry. Computational Geometry Lab Seminar, Ottawa, Canada, February 28, 2020.

SAT Solving with Computer Algebra: A Powerful Combinatorial Search Method. UBC Discrete Mathematics Seminar, Vancouver, Canada, September 10, 2019.

SAT Solving with Computer Algebra: A Powerful Combinatorial Search Method. University of Victoria Discrete Mathematics Seminar, Victoria, Canada, September 6, 2019.

SAT Solving with Computer Algebra: A Powerful Combinatorial Search Method. SFU Discrete Mathematics Seminar, Vancouver, Canada, September 3, 2019.

SAT+CAS: A Powerful New Combinatorial Search Method. Ottawa–Carleton Combinatorics & Optimization Seminar Series, Ottawa, Canada, October 5, 2018.

Faster SAT Solving with Applications to Sudoku. Maplesoft, Waterloo, Canada, August 31, 2018.

Improvements to Satisfy and ChromaticNumber. Maplesoft, Waterloo, Canada, March 23, 2018.

Conference and Workshop Talks

Solving Lam's Problem via SAT and Isomorph-Free Exhaustive Generation. Principles of Knowledge Representation and Reasoning, Haifa, Israel, August 3, 2022.

A SAT-Based Resolution of Lam's Problem. AAAI Conference on Artificial Intelligence, Vancouver, Canada (Held Online), February 3, 2021.

Unsatisfiability Proofs for Weight 16 Codewords in Lam's Problem. International Joint Conference on Artificial Intelligence, Yokohama, Japan (Held Online), January 14, 2021.

Nonexistence Certificates for Ovals in a Projective Plane of Order Ten. International Workshop on Combinatorial Algorithms, Bordeaux, France (Held Online), June 8, 2020.

SAT Solvers and Computer Algebra Systems: A Powerful Combination for Mathematics. International Conference on Computer Science and Software Engineering, Markham, Canada, November 4, 2019.

Effective Problem Solving using SAT Solvers. Maple Conference 2019, Waterloo, Canada, October 17, 2019.

Searching for Projective Planes with Computer Algebra and SAT Solvers. Applications of Computer Algebra, Montréal, Canada, July 19, 2019.

A SAT+CAS Approach to Finding Good Matrices: New Examples and Counterexamples. AAAI Conference on Artificial Intelligence, Honolulu, USA, January 30, 2019.

MathCheck: A SAT+CAS Mathematical Conjecture Verifier. International Congress on Mathematical Software, Notre Dame, USA, July 26, 2018.

Enumeration of Complex Golay Pairs via Programmatic SAT. International Symposium on

Symbolic and Algebraic Computation, New York, USA, July 17, 2018.

A SAT+CAS Method for Enumerating Williamson Matrices of Even Order. AAAI Conference on Artificial Intelligence, New Orleans, USA, February 4, 2018.

A SAT+CAS Method for Enumerating Williamson Matrices of Even Order. International Workshop on Satisfiability Checking and Symbolic Computation, Kaiserslautern, Germany, July 29, 2017.

MathCheck2: Combining Learning-based Search (SAT) with Symbolic Computation (CAS). International Workshop on Satisfiability Checking and Symbolic Computation, Timișoara, Romania, September 24, 2016.

MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. Computer Algebra in Scientific Computing, Bucharest, Romania, September 20, 2016.

MathCheck: A Math Assistant Combining SAT with Computer Algebra Systems. International Joint Conference on Artificial Intelligence, New York, USA, July 12, 2016.

MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. International Workshop on Satisfiability Modulo Theories, Coimbra, Portugal, July 2, 2016.

MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. Computationally Assisted Mathematical Discovery and Experimental Mathematics, London, Canada, May 13, 2016.

Vector Rational Number Reconstruction. International Symposium on Symbolic and Algebraic Computation, San Jose, USA, June 9, 2011.

Poster Presentations

A SAT-Based Resolution of Lam's Problem. AAAI Conference on Artificial Intelligence, Vancouver, Canada (Held Online), February 3, 2021.

Unsatisfiability Proofs for Weight 16 Codewords in Lam's Problem. International Joint Conference on Artificial Intelligence, Yokohama, Japan (Held Online), January 14, 2021.

A SAT+CAS Approach to Finding Good Matrices. AAAI Conference on Artificial Intelligence, Honolulu, USA, January 30, 2019.

The SAT+CAS Paradigm and the Williamson Conjecture. International Symposium on Symbolic and Algebraic Computation, New York, USA, July 17, 2018.

A SAT+CAS Method for Enumerating Williamson Matrices of Even Order. AAAI Conference on Artificial Intelligence, New Orleans, USA, February 4, 2018.

Vector Rational Number Reconstruction. East Coast Computer Algebra Day, Waterloo, Canada, April 9, 2011.

Teaching Experience

University of Windsor

Introduction to Algorithms and Programming II	70 students	Fall 2022
Computational Mathematics	8 students	Fall 2022
Introduction to Algorithms and Programming II	80 students	Summer 2022
Key Concepts in Computer Science	48 students	Summer 2022

Introduction to Algorithms and Programming II	167 students	Winter 2022
Key Concepts in Computer Science	93 students	Winter 2022
Computational Discrete Mathematics	2 students	Fall 2021
Introduction to Algorithms and Programming II	111 students	Winter 2021
<i>University of Waterloo</i>		
Elementary Algorithm Design and Data Abstraction	88 students	Fall 2015
Introduction to Computer Science 1	145 students	Spring 2015
Designing Functional Programs	103 students	Fall 2014

Awards

Applications of Computer Algebra Early Researcher Award	2022
Judges' Choice Award at the 2021 Maple Conference Mathematical Art Gallery.	2021
Recipient of the €4,000 Jacques Calmet award for the best paper appearing in the journal <i>Applicable Algebra in Engineering, Communication and Computing</i> in the year of 2020.	2021
Recipient of a Maple Application Center Editor's Choice award for developing an interactive Maple worksheet demonstrating how to solve Sudoku using a SAT solver.	2018
Invited paper in the Journal of Automated Reasoning.	2017
Received a 0x\$1.20 reward check from Donald Knuth for pointing out an error in <i>The Art of Computer Programming</i> .	2017
Invited paper in the SC ² track at Computer Algebra in Scientific Computing.	2016
Recipient of the Morgan Deters award, a \$1200 USD travel grant awarded to select graduate students in the field of Satisfiability Modulo Theories.	2016
Recipient of a TA performance award, receiving \$500 for outstanding performance as a teaching assistant.	2013
Recipient of a University of Waterloo Computer Science special graduate scholarship, receiving \$1000 for my academic standing.	2011

Peer Reviewed and Deployed Programming

Main developer of the SAT+CAS system MathCheck for verifying or finding counterexamples to combinatorial conjectures.	Current
Contributor to the computer algebra system Maple 2018 and 2019. My research led to a dramatic improvement in the performance of graph theory and logic commands.	2018
Contributor to the open source number theory library FLINT. Oversaw the implementation of a fast lattice basis reduction algorithm.	2014

Student Supervision

Amadou Keita (PhD Mathematics, University of Windsor). Starting a project to search for strongly regular graphs using SAT solvers and computer algebra (with Ilya Shapiro).	2022
Muhammad Usaid Rehman (MSc Computer Science, University of Windsor). Starting a project to apply SAT solvers to the discrete logarithm problem.	2022

Sahar Heidariasl (MSc Computer Science, University of Windsor). Starting a project to apply SAT solvers to problems in circuit complexity. 2022

Nahiyam Alamgir (MSc Computer Science, University of Windsor). Starting a project to perform cryptanalysis of hash functions using SAT solvers. 2022

Yameen Ajani (MSc Computer Science, University of Windsor). Starting a project to factor integers with known bits using SAT solvers. 2022

Pratyush Agarwal (Indian Institute of Technology Bombay). Mentoring a project to combine SAT and more expressive solvers to search for circuits computing mathematical operations like matrix multiplication (with Vijay Ganesh and Supratik Chakraborty). 2022

Shreyash Mutyalwar (BTech Electronics and Communications, College of Engineering, Pune). Starting a project to experimentally test Schnorr’s algorithm for factoring integers using Diofantine approximation as a part of the 2022 Mitacs Globalink Research Internship program. 2022

Vidyanshu Mishra (BSc Mathematics and Computing Engineering, Delhi Technological University). Starting a project to experimentally test an algorithm for factoring integers with known bits using SAT solvers as a part of the 2022 Mitacs Globalink Research Internship program. 2022

Daniel Dallaire (BSc Mathematics and Computer Science, University of Windsor). Mentoring a project to certify the classification of the projective planes of order nine (paper accepted to the SC² workshop 2022). 2021

Zhengyu Li (BSc Computer Science, University of Toronto). Mentoring a project to apply SAT solvers and computer algebra to problems in physics (with Vijay Ganesh). The project resulted in the first improvement on the best known lower bound of the size of a Kochen–Specker system since 2016 (paper accepted to the SC² workshop 2022). 2021

Abinaya Venkatesan (MAsc Electrical and Computer Engineering, University of Waterloo). Mentored a project to apply SAT solvers to problems in circuit complexity (with Vijay Ganesh and Supratik Chakraborty). 2020

Madhur Kumar Sharma (BAsc Electrical and Computer Engineering, University of Waterloo). Mentored a project to find new complementary sequences using SAT solvers. 2020

Noah Rubin (BMath Mathematics, Carleton University). Mentored a Research Training Award project for combining integer and constraint programming to search for combinatorial designs (with Kevin Cheung and Brett Stevens). The project resulted in a paper at ICTAI 2021 and a student abstract at AAAI 2022. 2020

Abhinav Baid (BEng Computer Science, Birla Institute of Technology and Science). Mentored during Google’s Summer of Code program (with William Hart). The project resulted in a high performance implementation of a lattice basis reduction algorithm in the number theory library FLINT. 2014

Service

On the program committee for the 2022 *International Workshop on Satisfiability Checking and Symbolic Computation*. 2022

Organizer (with Ahmad Biniiaz) of the School of Computer Science Colloquium at the Univer-

sity of Windsor.	2022
Member of the CS appointments committee.	2022
Associate editor of the journal <i>Maple Transactions</i> .	2021
Co-chair of the <i>2021 International Workshop on Satisfiability Checking and Symbolic Computation</i> .	2021
Member of the student Abdulrauf Gidado's PhD committee.	2020
On the program committee for the <i>2021 AAAI Conference on Artificial Intelligence</i> .	2020
On the program committee for the <i>2020 Maple Conference</i> .	2020
On the program committee for the <i>2020 International Workshop on Satisfiability Checking and Symbolic Computation</i> .	2020
Administered the webpage of the Computer Science Graduate Student Association at the University of Waterloo for several years, starting in 2014.	
Have been an executive member and volunteer instructor of three university clubs: Mambo Club at the University of Waterloo, KW Salseros at Wilfrid Laurier University, and UOSalsa at the University of Ottawa.	

Paper Reviewing

Journal of Automated Reasoning	2022
Graphs and Combinatorics	2022
International Conference on Tools and Algorithms for the Construction and Analysis of Systems	2021
IEEE Access	2021
IEEE Transactions on Information Theory	2021
Cryptography and Communications: Discrete Structures, Boolean Functions and Sequences	2021
Maple Conference (3)	2021
AAAI Conference on Artificial Intelligence	2020
Computer Algebra in Scientific Computing	2020
International Workshop on Satisfiability Checking and Symbolic Computation	2020
International Conference on Tools with Artificial Intelligence (2)	2019
IEEE Access	2019
International Symposium on Symbolic and Algebraic Computation	2019
Notes on Number Theory and Discrete Mathematics	2018
International Conference on Formal Structures for Computation and Deduction (2)	2018
International Workshop on Satisfiability Checking and Symbolic Computation	2017
International Symposium on Symbolic and Numeric Algorithms for Scientific Computing	2017
International Conference on Principles and Practice of Constraint Programming	2017

International Workshop on Satisfiability Checking and Symbolic Computation	2016
International Symposium on Formal Methods	2016
Computer Algebra in Scientific Computing	2016
International Symposium on Artificial Intelligence and Mathematics	2015
Journal of Integer Sequences	2014

References

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