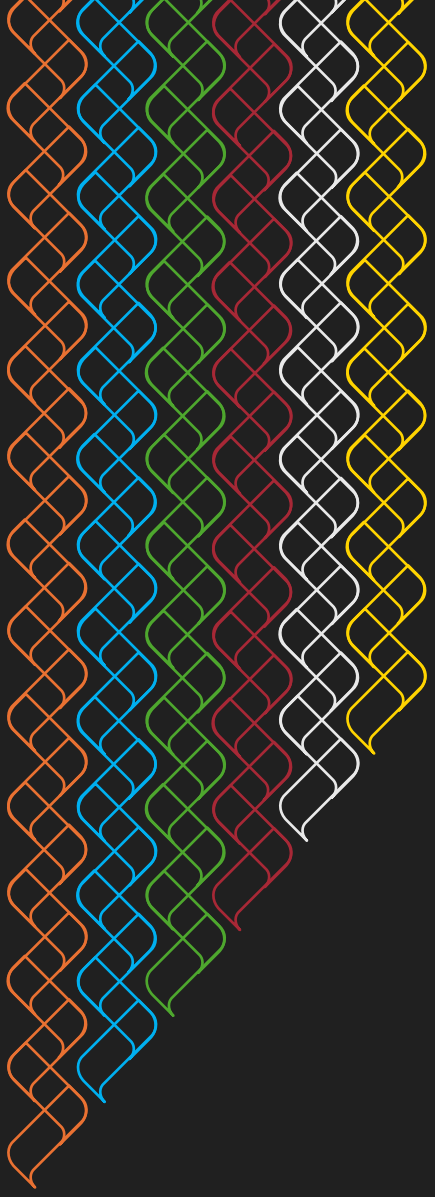
CHASE **ANNUAL REPORT** 2025



DALHOUSIE UNIVERSITY

DEPARTMENT OF MATHEMATICS AND STATISTICS

Land Acknowledgement

The Department of Mathematics and Statistics, at Dalhousie University operates in the unceded territories of the Mi’kmaw, Wolastoqey, and Peskotomuhkati Peoples.

These sovereign nations hold inherent rights as the original peoples of these lands, and we each carry collective obligations under the Peace and Friendship Treaties.

Section 35 of the *Constitution Act, 1982* recognizes and affirms Aboriginal and Treaty rights in Canada.

African Nova Scotian Acknowledgement

We recognize that African Nova Scotians are a distinct people whose histories, legacies and contributions have enriched that part of Mi'kma'ki known as Nova Scotia for over 400 years.

DALHOUSIE UNIVERSITY

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MESSAGE FROM THE DEPARTMENT CHAIR

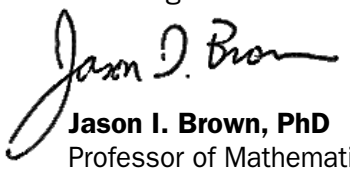
"How does it feel to be one of the beautiful people?
Now that you know who you are, what do you want to be?"
– Baby You're a Rich Man (Lennon and McCartney)

Look how far you've come. You started out, fresh out of high school, likely not knowing what you want to study at Dalhousie University. Now here you are, years later, with a degree in Mathematics, Statistics or Actuarial Sciences, and the world is awaiting. Of course, you've had help along the way – family, friends, faculty and teaching assistants – but it's been *you* and the work you've put in that bring you to this point. Kudos on a job well done!

Myself, I am almost at the end of my duties as chair of the Department of Mathematics and Statistics. I've relied on many colleagues along the way. Thank you, Mark, Jeanne, Nora, Balagopal, Angela, and most of all, Anna Marie, the department's administrator. It's been a pleasure and an honour to serve students and faculty over the last three years, and I wish my successor, Sarah Chisholm, all the best. The department is in very good hands.

To all who are graduating, and to our award winners, I extend my congratulations. Getting your degree is indeed beautiful – enjoy the view from the top of the hill you've climbed! And be rest assured that there are bigger and more awesome mountains to scale. It'll be hard work, but aren't the best things in life worth it?

Have a great summer!



Jason I. Brown, PhD
Professor of Mathematics
Department Chair

IN RECOGNITION

GRADUATES & NEWEST ALUMNI

Congratulations to all our graduates from the fall of 2024 and spring of 2025!

We look forward to hearing from you. Please feel welcome to either drop us a line when you have a chance or stop in to say hello next time you are on campus. And here, we are pleased to present the names of each person who convocated this academic year, a total of seventy-seven (77).

Graduates, who are now members of our alumni family, are listed alphabetically by surname.

SPRING 2025

Name	Program(s)
Wasi Alavi	Bachelor of Science, in Statistics
Samir Ali	Bachelor of Science, Major in Statistics and Actuarial Science
Simone Alim	Bachelor of Science, Major Co-operative in Statistics and Economics
Andrew Allen	Bachelor of Science, Honours in Mathematics
Kyle Allie	Bachelor of Science, Major in Statistics; Undergraduate Certificate in Data Analytics
Deanna Ames	Bachelor of Science, Major in Mathematics; Undergraduate Certificate in Data Analytics
Yuetong Bao	Bachelor of Science, Major in Statistics; Undergraduate Certificate in Actuarial and Financial Mathematics; Undergraduate Certificate in Data Analytics
Joseph Barss	Master of Science, Statistics
Lucas Thaddeus Ben	Bachelor of Science, Major in Statistics
Ava Benedict	Bachelor of Science, Major in Mathematics; Undergraduate Certificate in Actuarial and Financial Mathematics
Jenna Bentley	Bachelor of Science, Major in Statistics; Undergraduate Certificate in Data Analytics
Kanav Bhardwaj	Undergraduate Certificate in Data Analytics
Jiaoyang Chen	Bachelor of Science, Major in Biology and Statistics
Zijin Cheng	Master of Science, Statistics
Lucien d'Eon	Diploma in Actuarial Science
Suchintha Divakaram	Bachelor of Science, in Statistics
Eleanor Friddell	Bachelor of Science, Honours with double major in Math and Classics
Erin Gilfoy	Bachelor of Science, Major in Actuarial Science; Undergraduate Certificate in Data Analytics
Haoyi Gu	Bachelor of Science, Major in Actuarial Science and Statistics
Rachael Hayward	Bachelor of Science, Major in Statistics and Gender & Women's Studies
Zizo Hengel	Undergraduate Certificate in Data Analytics
Huu Tram Anh Huynh	Undergraduate Certificate in Data Analytics
Anna Jericho	Bachelor of Science, Major in Neuroscience and Statistics
Ananya Jeyakumar Jeyakumar	Bachelor of Science, Major Co-op in Actuarial Science and Economics
Tyler Kaugi	Bachelor of Science, in Statistics
Nicholas Layden	Doctor of Philosophy, Mathematics

Victoria LeBlanc	Bachelor of Science, Major in Mathematics
Ray Li	Bachelor of Science, Honours in Statistics and Economics
Xueying Liu	Bachelor of Science, Major in Statistics
Zilin Liu	Bachelor of Science, in Statistics
Parth Maheta	Bachelor of Science, Honours Co-operative in Physics and Mathematics
Ben Moorehead	Undergraduate Certificate in Data Analytics
Liam Morrison	Bachelor of Science, Honours in Physics and Mathematics
Alex Needler	Bachelor of Science, Major in Mathematics; Undergraduate Certificate in Actuarial and Financial Mathematics; Undergraduate Certificate in Data Analytics
Yiqun Nie	Bachelor of Science, Major in Statistics
Aleksander Olsroed	Bachelor of Science, Major in Mathematics and Statistics
Marzieh Palizdar	Master of Science, Mathematics
Dylan Pearson	Master of Science, Mathematics
Kristen Ross	Bachelor of Science, Major in Statistics; Undergraduate Certificate in Actuarial and Financial Mathematics; Undergraduate Certificate in Data Analytics
Ethan Saunders	Bachelor of Science, Honours in Mathematics
Rory Schepp	Bachelor of Science, Honours in Mathematics
Christopher Smith	Bachelor of Science, Major in Statistics
Victoria Somerton	Bachelor of Science, in Mathematics
Kacey Straub	Bachelor of Science, Major in Mathematics
Zehra Surmeli	Bachelor of Science, Major in Statistics
Matthew Taylor	Bachelor of Science, Major in Statistics
Fatemeh Tofighi Khelejan	Master of Science, Statistics
Boyong Wang	Bachelor of Science, Major in Statistics
Chao Wang	Bachelor of Science, Honours in Mathematics
Jingbo Wang	Bachelor of Science, Major in Statistics
Owen Winters	Bachelor of Science, Major in Actuarial Science and Statistics
Wanxin Wu	Bachelor of Science, Major in Statistics
Xiaoyu Xiao	Bachelor of Science, Major in Statistics
Weiyang Yan	Bachelor of Science, Honours in Statistics
Xihan Yan	Bachelor of Science, Major in Statistics
Jiarui Yang	Bachelor of Science, in Statistics
Matthew Young	Bachelor of Science, Major in Statistics; Undergraduate Certificate in Data Analytics
Qijie Yue	Bachelor of Science, Major in Statistics
Guorui Zhang	Bachelor of Science, in Statistics
Tianyi Zhang	Bachelor of Science, in Statistics
Wensha Zhang	Doctor of Philosophy, Statistics
Hongren Zhu	Bachelor of Science, Honours in Statistics

FALL 2024

Name	Program(s)
Ali Abdulrahman	Bachelor of Science, Major in Statistics
Marissa Assam Andrecyk	Bachelor of Science, Major in Mathematics
Chadya Bhatia	Bachelor of Science, Major in Actuarial Science and Mathematics
Claire Boteler	Doctor of Philosophy, Statistics
Louis Bu	Master of Science, Mathematics
Junrui Chen	Bachelor of Science, Major in Statistics
Haokun Dong	Bachelor of Science, Major in Statistics
Yanjie Fang	Bachelor of Science, Major in Economics and Statistics
Joyce Jiao	Bachelor of Science, Major in Mathematics and Computer Science
Xiangfeng Jing	Bachelor of Science, in Statistics
Marcello Lanfranchi	Doctor of Philosophy, Mathematics
Ruizhi Liu	Master of Science, Mathematics
Timothy Power	Bachelor of Science, Major in Mathematics
Chang Su	Bachelor of Science, Major in Economics and Statistics
Yihui Yu	Bachelor of Science, Major in Statistics

DEPARTMENT AWARDS

This spring we have awarded several medals, scholarships, and a prize. Congratulations to our award earners! The names of this year's recipients are presented below along with a brief description of each award.

SIR WILLIAM YOUNG GOLD MEDAL IN MATHEMATICS

This medal is awarded at convocation to the student who stands first among those taking First class honours in Mathematics. It is also known as the University Medal in Mathematics. **Recipient – Andrew Allen.**

UNIVERSITY MEDAL IN STATISTICS

This medal is awarded at convocation to the student who stands first among those taking First class honours in Statistics. **Recipient – Weiyang Yan.**

UNIVERSITY MEDAL IN ACTUARIAL SCIENCE

This medal is awarded at convocation to the student who stands first among those taking First class honours in Actuarial Science. **No Award.**

HELLER-SMITH FOUNDATION GRADUATE SCHOLARSHIP

This scholarship is awarded based on academic achievement. The scholarship was established to provide financial support and recognition to a graduate student. **Recipient – Thu Thi Minh Nguyen.**

PROFESSOR MICHAEL EDELSTEIN MEMORIAL GRADUATE PRIZE

This prize is awarded to a graduate student who shows great promise in the mathematical sciences. **Recipient – Aaron Fairbanks.**

THE PETER AND ANNE-ELLEN FILLMORE SCHOLARSHIP

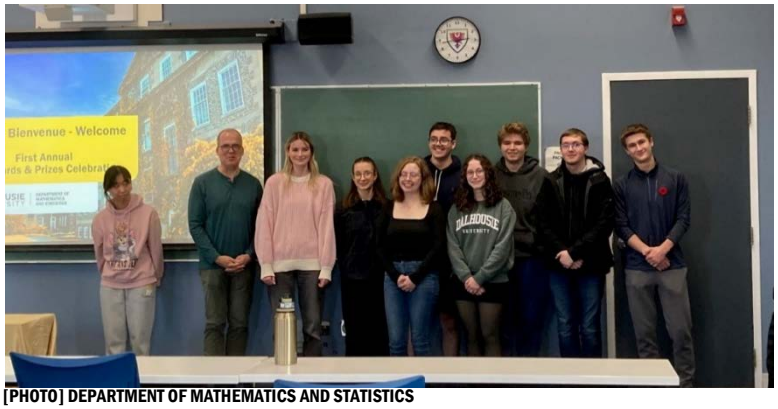
This scholarship is awarded to a graduating math honours or major student from the Maritimes who plans to become a high school math teacher. **Recipient (Fall 2024) – Emily Dennis; Recipient (Spring 2025) – Victoria LeBlanc.**

THE RALPH AND FRANCES LEWIS JEFFERY SCHOLARSHIP

This scholarship is awarded to two students who have each completed an honours degree in Mathematics, and who have maintained at least second class standing during the first three years. **Recipients – Eleanor Friddell and Ethan Saunders.**

FIRST ANNUAL FALL IN-PROGRAM AWARDS

In the fall of 2024, the Department held its First Annual Fall In-Program Awards ceremony & reception on Thursday, November 7, 2024. Faculty, staff, award winners and their supporters filled the Colloquium Room to celebrate some of our top students. We are looking forward to hosting this event again this upcoming fall.



[PHOTO] DEPARTMENT OF MATHEMATICS AND STATISTICS

ARNOLD AND BEATRICE TINGLEY MEMORIAL SCHOLARSHIP

The Tingley Scholarship commemorates the lives of Arnold and Beatrice Tingley. The scholarship was established by their son Daryl and his family Maureen, Peter, and Martin. This scholarship is awarded to an undergraduate student from Atlantic Canada entering the third year of a four-year BA or BSc program. Candidates will have high academic standing and will have shown enthusiasm and talent for mathematics (by having taken at least five mathematics or statistics courses over their first two years of study and being enrolled in any mathematics program). **Recipient (2024) – Nicholas Czapalay; Recipient (2025) – Emma van de Wiel.**

BARRY WARD FAWCETT MEMORIAL PRIZE

This monetary award goes to the student who has achieved the highest grade in MATH/CSCI 2113 (Discrete Structures II). **Recipient – Jonah Barrington.**

BERNOULLI PRIZE

This monetary award goes to the student registered in the Co-op Mathematics Program who has the best cumulative academic record, subject to the restrictions that the prize can be awarded only once to a given individual, and that the winner must have performed acceptably in all work term assignments. **Recipient – Julia Moroney.**

ERMA GEDDES FILLMORE MEMORIAL SCHOLARSHIP

This scholarship is in memory of Erma Geddes Fillmore (BA'24) and was established by her family. This scholarship is awarded in the fall term – to a full-time BSc undergraduate student with the highest grade-point average entering the second year of their degree with a declared major in either Mathematics or Statistics. **Recipient – Carly Munro.**

FIELD PRIZE IN STATISTICS

This monetary prize is awarded to the student with the highest academic standing who has completed their third year of studies in Statistics. This award was endowed by Dr. Christopher Field and Mrs. Harriet Field. **Recipient – Owen Winters.**

JONATHAN BORWEIN MEMORIAL SCHOLARSHIP

This scholarship is in the memory of the late Jonathan (Jon) Borwein (1951—2016) who began his academic career as a post-doc in our department and then spent a substantial part of his career here at Dalhousie. This cash prize is awarded to a student who has shown promise, as demonstrated by academic achievement and/or successful involvement, in one or more of the following areas: experimental mathematics, optimization, classical number theory, special functions, scientific computation, or in an area related to these, as determined by the Awards Committee. **Recipient – Jonah Barrington.**

KEN DUNN MEMORIAL PRIZE

This cash prize is awarded to a student who has completed the third year of an Honours program in Mathematics or Statistics, or a combined Honours program in Mathematics and Statistics. **Recipient – Ethan Saunders.**

R.P. & KAMLA GUPTA SCHOLARSHIP IN STATISTICS

This scholarship is to recognize excellence in Statistics by providing one or more scholarships to undergraduate students enrolled in Honours Statistics. **Recipient – Weihang Yan.**

THE DR. EMIL AND MRS. STELLA BLUM PRIZE IN MATHEMATICS

This monetary prize is awarded to an Advanced Major or Honours Mathematics student who achieves the highest grade in second year Calculus. **Recipient – Sofia Gabriele.**

THE ELLEN MCCAUGHIN MCFARLANE PRIZE

This award is in the memory of Ellen McCaughin McFarlane (BA or BSc'27) and goes to the student who has achieved the highest standing after completing year one of the honours program. This prize is a monetary award. **Recipient – Hewson MacDonald.**

THE KATHERINE M. BUTTENSHAW PRIZE

This monetary prize is awarded to the student standing highest in the advanced Mathematics courses. **Recipient – Deanna Ames.**

WAVERLEY PRIZE

This award goes to the student with the highest standing in MATH 1010 (Differential and Integral Calculus II). **Recipient – Sofia Mereshuk.**

CHINESE EDUCATION PROMOTION ASSOCIATION OF NS (2+2 JOINT PROGRAM SCHOLARSHIP)

This scholarship is awarded to two students who are enrolled in the Dalhousie and Shangdong University of Finance and Economics Joint undergraduate program of study in statistics, for their outstanding achievements in their program at Dalhousie University. **Recipients – Yiqun Nie and Boyong Wang.**

EARLY CAREER FACULTY AWARD OF EXCELLENCE FOR TEACHING

Dr. Sarah Chisholm, Department of Mathematics and Statistics and coordinator of the Mathematics and Statistics Learning Centre

[PHOTO] DEPARTMENT OF MATHEMATICS AND STATISTICS

Dr. Sarah Chisholm demonstrates exceptional commitment to inclusive, student-centered teaching and educational leadership. In testimonials, students spoke about Dr. Chisholm's empowering and supportive teaching style. Her outstanding coordination and mentorship of teaching assistants, along with her leadership in the Math/Stat Learning Centre and multiple SoTL (scholarship of teaching and learning)-STEM (science, technology, engineering, and math) inclusive initiatives, further demonstrates her commitment to student success and educational leadership.

Dr. Chisolm excels in teaching introductory level mathematics, particularly calculus. She creates a learning environment that is both welcoming and productive for all, particularly students from historically underrepresented communities. She strives to help students enhance their problem-solving skills more broadly and mentors early career academics preparing for their own teaching pathways.

DR. JOANNA MILLS FLEMMING RECOGNIZED BY THE STATISTICAL SOCIETY OF CANADA

The Statistical Society of Canada (SSC) announced several awards at its annual conference last June in St. John's, NL. The awards were the **Gold Medal**, the **Honorary Membership Award**, the **Distinguished Service Award**, the **SSC Early Career Educator Award,** the **Lise Manchester Award,** and the **Award for Impact of Applied and Collaborative Work.**

Dr. Joanna Mills Flemming earned the **Award for Impact of Applied and Collaborative Work**. This award *"…recognizes outstanding contributions by SSC members in collaborative research and applied work, the importance of which derives primarily from its relatively recent impact on a subject area outside of the statistical sciences, on an area of application, or on an organization*." A complete bio and citation can be found **here** at the Societe statistique du Canada/Statistical Society of Canada (SSC) website.

[PHOTO] DEPARTMENT OF MATHEMATICS AND STATISTICS

REPORTS & NOTES

UNDERGRADUATE PROGRAM

HONOURS STUDENTS

DORETTE PRONK, JULIEN ROSS, ED SUSKO

This year we had seven honours students in Mathematics and three listed in the Statistics Division:

MATHEMATICS

- **Rory Schepp,** supervisors: Christopher Dean and Peter Selinger, ***Title: Methods to Improve Lattice Surgery Compilation.***
- **Ethan Saunders,** supervisor: Peter Selinger, ***Title: Paintbucket on Graphs is PSPACE complete.***
- **Chao Wang,** Supervisor: Theodore Kolokolnikov, ***Title: Separation of Singularities in Green's Functions for rectangular Domains and Solving Mean First Passage Time Problems with Multiple Traps.***
- **Eleanor Friddell,** Supervisor: Theodore Johnson-Freyd, ***Title: Visualizing Spherical and Hyperbolic Symmetry Groups via 3D Modelling and Printing.***
- **Andrew Allen,** Supervisor: Peter Selinger, ***Title: The Quantum Ramsey Number QR(2,k) is 3k-2.***
- **Abdelaziz Elherbawy,** Supervisor: Jeannette Janssen, ***Title: The Zero Forcing Number of the Hypercube.***
- **Jonah Barrington,** Supervisor: Karl Dilcher, ***Title: Distinct Reisudes of the Gauss Factorial Modulo a Composite.***

STATISTICS

- **Ray Li,** Supervisor: Orla Murphy.
- **Weiyang Yan,** Supervisor: Ed Susko.
- **Hongren Zhu,** Supervisor: Lam Ho.

MATHEMATICS DIVISION

PETER SELINGER

Like the famous novel "A Void" (from French: *"La Disparition"*), the following paragraphs do not use the letter "E":

Our math division has again had a good annual turn. Most of us taught or took a class (or two, or many!), for a total of 63 from Fall to April. That is a lot!

Our faculty did a lot of additional things too. J. Ross was math and honours advisor; and D. Pronk and Karl D. did it during his hiatus - thanks! As always, Sarah Chisholm ran our first-floor support room, and did lots of training too, of TAs and so on. And Sarah also won an FoS Award for Outstanding Classroom Instruction. Wow, bravo! Good job! David Iron again saw to it that our grad program could stay afloat, also with Sara Faridi's aid. Amazing! As always, Rob Milson did good work as our coop advisor - thanks! Roman Smirnov was as an AIO for our Faculty, which is always a lot of work too! Difficult but important work. And T. Kolokolnikov was colloquium chair. Many good talks! D. Pronk ran our math clubs for young kids again, an activity that is always a hit. Jason Brown was Chair, as you know. Many thanks, that is a hard job too! And last but not unimportantly: Gord Hamilton is now our coordinator for (how can I say this?) math circular things. I'm so glad that Gord was found and is now doing this for us! It is so good that schools can run math clubs again, yay! Thanks also to all of you facilitators who go out to schools and throughout Nova Scotia and run such programs on a day-to-day basis. It is satisfying to know that you do this.

As part of this annual summary of our activity, I will also point out, as always, that nothing would work without all that support from our amazing math and stats admin support staff. Many thanks to all of you!

Did I miss anybody? Probably. Sorry if I did!

Now what additional thing can I say? And how can I say it? May I point out that writing in this way is hard? You know, I miss that most important symbol from our ABC. Without it, it's surprisingly difficult to say anything without sounding a bit off. You should try it occasionally! Also, you might find this thought comforting: writing in this way is an ability that AIs, such as ChatGPT, still lacks. So you could ask your class to turn in all individual work using a similar constraint to what I am using now. That is, without using that all-important fifth symbol. That would miraculously stamp out plagiarism right away! Just don't try to talk about natural logarithms.

Finally, to all our folks who study at Dal, and most of all to our graduating class, I want to say this: you did an amazing job. I am proud of all of you! You found out things, you did good work, and now you will go on to amazing jobs, grad school, or anything you want. I wish you much productivity and fun in all that you do from now on! Congratulations, you did all of us proud! And may you visit us again, in a bit!

STATISTICS DIVISION

BRUCE SMITH

Andrew Irwin is the AARMS Director, appointment to start on July 1, 2024.

Claire Boteler graduated in October 2024 with her PhD in Statistics. She is now working as a Research Scientist at the National Oceanographic Centre in Southampton, UK.

In April 2025, Mike Dowd was part of a team of researchers from Simon Fraser University, University of Victoria and Dalhousie that was awarded an NSERC CREATE grant entitled: "WHALES: Whale Habitat and Acoustic Learning for Ecosystem Sustainability". Congratulations, Mike!

Joanna Mills Flemming has led an initiative in which the Strategic Training for Advanced Genetic Epidemiology (STAGE) Network, which is at the forefront of innovation in molecular and genetic epidemiology and statistical–omics, will be partnering with CANSSI Atlantic to establish a STAGE Atlantic Canada node. This initiative will bring an internationally recognized training program to graduate students in Dalhousie's Faculties of Science and Medicine. It aligns well with several ongoing programs at Dalhousie, including the Centre for Genomics Enhanced Medicine (CGEM), which includes over 50 members across the University working in the field of Human Genetics. The roll out of the program will begin in September. Congratulations, Joanna!

Congratulations to the following students who have received graduate degrees in Statistics this year:

Joseph Barss. Degree: M.Sc. Thesis title: Spatiotemporal Modelling of Lobster Abundance Supervisors: Joanna Mills-Flemming, Théo Michelot. Joseph is currently working at Fisheries and Oceans Canada and will begin his Ph.D. at Dalhousie this fall. He has received a Dalhousie Research Excellence Scholarship to support his PhD research.

Claire Boteler. Degree: Ph.D. Thesis title: Estimating the Carbonate System and its Anthropogenic Spatiotemporal Variability Supervisor: Michael Dowd. Claire is now working as a Research Scientist at the National Oceanographic Centre in Southampton, UK.

Janet Cheng. Degree: M.Sc. Thesis title: A Critical Review and Comparison of Methods to Predict Mortality in People with Cystic Fibrosis. Supervisors: Orla Murphy, Sanja Stanojevic.

Fatemeh Tofighi Khelejan. Degree: M.Sc. Thesis title: Testing Adequacy of Codon Substitution Models. Supervisor: Hong Gu, Toby Kenney.

Wensha Zhang. Degree: Ph.D. Thesis title: Evolutionary Shift Detection with Variable Selection Method Supervisors: Dr. Toby Kenny, Dr. Lam Ho.

ACTUARIAL SCIENCE

TOBY KENNEY

There were five major graduates from the Actuarial Science program this year. There is continued interest in our program from local employers with two employers - TELUS Health and Manulife - providing student information sessions to recruit students from our program. There was also a student information session from the Canadian Institute of Actuaries.

We are saddened by the departure of Catie Foley, who has been teaching for this program for the past 3 years. During that time, she has taught a number of courses in the program and been an enthusiastic advocate for program development. Her experience working as an actuary and connections in the industry have been invaluable to students. We are very grateful to Catie for everything she has done for the program and wish her the best for all her future endeavours. We are pleased that Philippe Fullsack has agreed to teach the Life Contingencies courses next year.

I will be on sabbatical for the whole year. Bruce Smith will be teaching the Actuarial Models courses.

DALHOUSIE UNDERGRAD MATHEMATICS AND STATISTICS STUDENT SOCIETY

NICHOLAS REILLY - PRESIDENT

The Dalhousie Undergraduate Mathematics and Statistics Society was revived this year after a temporary hiatus. The Society would especially like to thank Nabil Abi Daoud for his work in organizing, leading, and rebuilding the undergraduate math society here at Dalhousie.

We kicked off the year with our AGM where we enjoyed some pizza and elected the official executive team. Over the course of the year we hosted board game events, a LaTeX workshop, a course selection information session, study socials, and collaborated with other societies like the Theoretical Physics Undergrad and Grad Society.

However, the highlight of the year was certainly our Pi Day event (March 14), which we hosted in collaboration with the Dalhousie Math and Stats Graduate Society. At the event members of both the Undergraduate and Graduate societies got “pied” by fellow students, which was a fun time for all (besides the clean-up perhaps). Students and faculty alike also enjoyed the pizza lunch provided.

We would like to thank every student and faculty member who came to our events and made them a resounding success. We’d also like to thank the outgoing members of the executive team and welcome the new 2025-2026 executive team:

President – Nicholas Reilly; **Vice President Internal –** Noah Wayne; **Co-Vice Presidents External –** Nabil Abi Daoud and Aaron Carey; **Co-Treasurers –** Ana Mastnak and James Murphy; **Director of Communications –** Bram Ogus; **Social Media Coordinator –** Zach Fay.

BOOKS WANTED FOR SALE

KARL DILCHER

As I mention every year in the Chase Report, I'm taking care of a large number of surplus books that have been donated over the years by current and retired faculty members, alumni and departing students. This time I want to thank in particular Kathy Baker, Ed Barbeau, Ilya Blum, the family of the late Karen Chandler, Keith Johnson, Michael Lamoureux, and Tom Potter, who since last Summer donated hundreds of high-quality books.

Over the last few years, altogether several thousand volumes were sold to mathematicians all across Canada and hundreds more around the world. Earlier this year I shipped a large number of books (at a steep discount) to Iraq, with another large order just in. Once a year I can donate the sizeable income from these sales in equal part to scholarship funds in our department and to the Canadian Math Society (CMS).

Countless volumes (perhaps some 1,500) still remain; they are catalogued at:

mathstat.dal.ca/~dilcher/oldbooks.html

As always, I welcome further donations of mathematics, statistics and related books, including textbooks of any kind. In my experience, eventually most of the books find a good home and as an extra bonus, two good causes will be supported. I thank all those who have donated their books.

A related initiative is what I informally call the Calculus Textbook Preservation Project. I'm keeping one copy of each edition of each calculus textbook that I can get my hands on; they are hidden in the basement. Quite surprisingly, without much effort on my part, this collection has grown to about 500 volumes. For this initiative too, I welcome further books. Duplicates are given away to students, along with other elementary mathematics and statistics textbooks.

[CHASE BUILDING FACING WEST]

BOB PARÉ AND CATEGORY THEORY AT DALHOUSIE

ALAN COLEY, ROBERT DAWSON, DORETTE PRONK, PETER SELINGER AND RICHARD WOOD

Our friend and colleague, Bob Paré, recently turned 80 years old. It therefore seems appropriate at this time to review Bob's contributions to Category theory at Dalhousie, which has been and currently remains a world center for the field. A partial biography and list of his collaborators are included below.

After completing his PhD, in 1969, on "Absolute Colimits" at McGill with Lambek, Bob joined F.W. Lawvere's Category Theory group at Dalhousie as a postdoctoral fellow. For a year during the two years that group existed, Chris Howlett, a PhD student at McMaster, was also part of the group. When Howlett returned to McMaster in 1972, Richard Wood was looking for a place and supervisor to do a PhD, and he recommended Bob as follows: "He understands hom functors! Richard – consider what this means!" That might sound like an odd sort of recommendation but within a few months Richard was sitting in Bob's office while he showed him on his blackboard what was soon to be one of Bob's most famous papers. He proved, for an elementary topos $\mathbb{E}$, with sub object classifier Ω, the hom functor $\mathbb{E}(-, \Omega) : \mathbb{E}^{op} \to \mathbb{E}$ is monadic. Amongst other things, Bob's result showed that existence of finite colimits in an elementary topos followed from the other axioms. Bob called his paper "Colimits in Topoi". A few weeks later, Peter Freyd contacted Bob to ask if he could have the paper to be published in JPAA.

[PHOTO] DALHOUSIE UNIVERSITY

That was an exciting year. Bob and Dietmar Schumacher from Acadia started the Category Theory Seminar at Dalhousie. Luzius Grunenfelder was a faculty attendee. There were several graduate students other than Richard including Vipin Sehgal, Ioana Schiopu and David Lever (before he went to Stony Brook for a year) who were part of the group, and the Seminar was also attended by several talented undergraduate students and some non-category-theory graduate students. Peter Schotch of Philosophy also often showed up. In the years 1972-1973 there were many, many talks on "Indexed Categories". The idea was that, for any object I in a topos $\mathbb{E}$, the Category $\mathbb{E}/I$, whose objects are arrows $\int : X \to I$ in $\mathbb{E}$, with codomain I, can serve as the category of I -indexed families of objects of $\mathbb{E}$. It was known that $\mathbb{E}/I$ is also an elementary topos and that fact had already been dubbed the 'The Fundamental Theorem of Topos Theory.' But the work of Bob and Schumacher contributed enormously to a deeper understanding of $\mathbb{E}/I$.

In 1973-74 Bob Rosebrugh became a graduate student of Bob and, soon after him, David Lever returned as a student and Javad Tavakoli joined too. Bob had a number of research visitors and postdoctoral fellows, and Dalhousie for the second time became a world center for Category Theory. In addition, many of Bob's students found positions in the Atlantic region and soon there were researchers in cognate disciplines such as Hopf Algebras too. Grunenfelder was a Hopf algebraist, and he was joined by Margaret Beattie at Mount Allison and Mitja Mastnak at Saint Mary's. Some years earlier, Robert Dawson, who had been a Dalhousie undergraduate, obtained his PhD at Cambridge and secured a position at Saint Mary's. Bob's influence had already been felt throughout the Atlantic region by the mid-1980s and many other researchers passed through. Around 1988, motivated by his work with Michael Makkai on accessible categories, Bob developed an interest in double categories, a concept that had been introduced by Charles Ehresmann in 1963, and had both an algebraic and geometric appeal, but had not been studied in much detail for their own sake. (Double groupoids had been used in homotopy theory in the seventies by Ronnie Brown.) In the late 1980s graphical representations for composing/pasting 2-cells, so called pasting diagrams or pasting schemes, were introduced to category theory, and it would be natural to ask whether this type of representation could also work for double categories, especially since the double cells with their rectangular forms naturally gave rise to tilings. Bob had thought about it and realized that there was an obstruction in the form of what is now known as the pinwheel diagram. During an international category theory conference in Como in 1990, Bob told Robert about this, and this led to the paper "General associativity and general composition for double categories", published in Cahiers in 1993.

Dorette Pronk, learned about their work through two presentations at the International Category Theory Conference in 1992 (her first exposure to category theory). Dorette was intrigued, but one of her fellow graduate students told her not to work on that, because it is going to be “way too popular”. Bob spent the next 30 years on showing the category theory community various aspects of the beauty of double categories, but there were not many ”early adopters”. He worked with Marco Grandis on a series of papers that can be viewed as foundational for the theory of double categories, developing the notions of adjunctions and limits. Susan Niefield, who had been a postdoctoral fellow in the department and continued to return as a regular visitor, worked on gluing constructions and tabulators, Bob developed many examples, coming mostly from algebra, and established various ways in which double categories can be used to better understand 2-categories, most notably showing that weighted limits can be better understood as double limits.

Dorette’s interest in Bob’s work, as well as his welcoming demeanor, led her as a new graduate student to apply for a postdoctoral fellowship at Dalhousie. Bob was very interested in her work on orbifolds, represented by internal groupoids in topological spaces, so during her postdoctoral fellowship she did not work on double categories. However, when she returned as a faculty member, she developed an interest in using double categories to better understand localizations of categories. This led to a series of papers (with Bob and Robert) that used bicategories and double categories to freely add adjoints to the arrows in a category, and further explorations of the span construction. Related work was done by Michael Shulman on what he called framed bicategories and then on virtual double categories, also with Geoff Cruttwell, a former Dalhousie graduate student.

Double categories gained increased traction when John Baez and others at the Topos Institute started to use them successfully in applied category theory, specifically in networking theory and categorical logic. This was partially made possible by Bob’s work on the Yoneda theory for double categories. Bob also continued to inspire young category theorists at the International Category Theory conferences: he met with Raould Koudenburg, a new category theorist interested in double categories, after CT 2016 (which had been held in Nova Scotia), and inspired David Jaz Myers through conversations during CT 2017 in Vancouver. More recently, Bob’s ideas on using certain double categories as double Lawvere theories have been picked up by students in Japan and in Halifax. Double categories and related work developed at Dalhousie in terms of equipment, have also been picked up by the infinity category theory community and play an important role in the development of a framework for formal category theory.

In 2022 the interest in research on double categories had grown so far that the first ‘Virtual Double Category Workshop’ was held, followed by a second one in 2024. There are now so many double category talks at the International CT meetings that there is no need to introduce the notion of double category anymore. The field has indeed finally become “popular” and this is in large part due to Bob’s contributions and encouragement of new graduate students.

Throughout his working years at Dalhousie Bob adhered to “a vow of 2-dimensionality,” perhaps in part inspired by observations he and Robert made in their paper on what a free double category is like. Some of the nice features taken for granted in the graphical representations in two dimensions do not apply in three dimensions. Since Bob’s retirement he has worked on inter-categories, a 3-dimensional generalization of double categories (which are triple categories that satisfy a number of constraints). He continues to attend seminars at Dalhousie and interact with the algebra group.

More recently Peter Selinger, and thereafter his graduate student Julien Ross, joined Dalhousie faculty, partially overlapping with Bob. Peter and Julien work on programming languages for quantum computing and quantum circuit theory. Some of this work involves type systems that can be modeled in indexed categories, which is a field in which Bob has made crucial contributions. Continuing the tradition established by Bob, there are currently students and postdoctoral fellows working on type theory (other than for quantum computing) and on the theory of double categories, another area that was pioneered by Bob. Theo Johnson-Freyd, who recently joined Dalhousie, works on higher categorical algebra, especially as it relates to mathematical physics. Higher categories is another area that Bob has contributed to.

In summary, throughout Bob’s career he has made an enormous contribution to category theory at Dalhousie, not only through his own work but by also creating a flourishing research culture through the beauty he uncovers and through the questions he asks. It should also be said that Bob’s contributions to the Department are very much appreciated by all of his colleagues and friends.

FROM THE CHASE REPORT OF TEN YEARS AGO

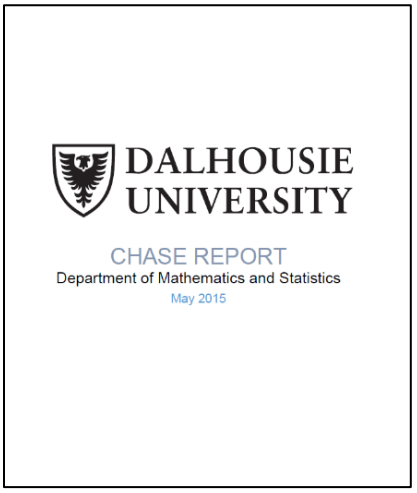
(DUG UP BY KARL DILCHER)

3.14... AND ALL THAT

While Pi as a number remains constant (in the Euclidean metric at least), the annual Pi Day event keeps growing. Pi Day 2015 was dubbed "Super Pi Day" because of the inclusion of two more digits, 3.1415 represented by March 14/15. In keeping with the growth trend of this event, we were invited by the Lord Nelson to hold our festivities in their Georgian Lounge.

The Lord Nelson went all out for us with lots of gourmet pies, refreshments, contests and door prizes, even a pie-in-the-face for some key members of the Department.

Marie–Andree B Langlois, President of DMSGA, worked with Michelle Burgess at the Lord Nelson and promoted the event on campus as well as inviting the Mathematics Departments from Saint Mary's University and Mount St. Vincent University. It was a wonderful success with a variety of attendees from students to faculty to upper-level administration, 140 RSVPs and several additional drop-ins. – *Originally submitted by former Administrator, Queena Crooker-Smith*



[PHOTO] DEPARTMENT OF MATHEMATICS AND STATISTICS

FROM THE CHASE REPORT OF FIFTEEN YEARS AGO

A DOUBLE ANNIVERSARY

As the caption on the front page indicates, this coming Fall and Winter mark a double anniversary for our department: The construction of the Provincial Archives Building (now the Chase Building) was completed 80 years ago, in 1930, and the formal opening took place on January 14, 1931. Secondly, the then Department of Mathematics, Statistics and Computing Science moved into the newly renovated (but not quite finished) building for the Fall term of 1985. The careful planning that preceded the move was chaired by Tony Thompson, in collaboration with the University Architect at the time, and with the help of many staff and faculty.

This double anniversary should be a reason for a celebration. Ideas are most welcome, as are volunteers to help organize some festivities – academic, social, or both. - *-Dr. Karl Dilcher*

THE BALCONY SCENE

As every department member knows, one of the nicest features of the Chase Building is our balcony. In fact, last year it served as the backdrop for wedding photos for at least two couples who had connections with our department.

But now the balcony has also been discovered by the Dalhousie Theatre Department. On March 31st a group of three theatre students asked for permission to use our balcony as a stage for a class project. Obviously, permission was granted, and rehearsals began immediately. On that day and the next, April 1st, our balcony presented quite a spectacle, and occasionally it got rather loud.

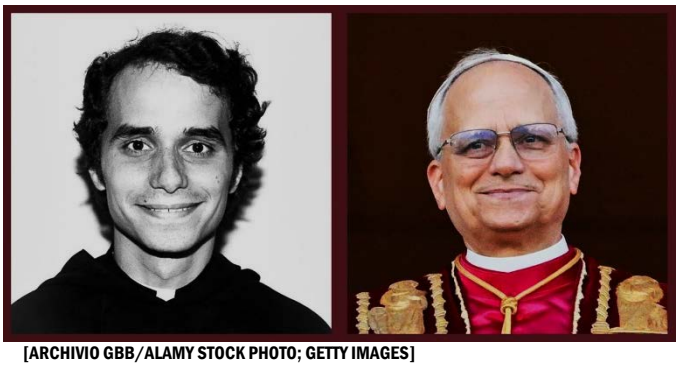
And no, it was NOT Romeo and Juliet, nor was this an April Fool's joke, as at least one department member of little faith had conjectured. *–Dr. Karl Dilcher*

JOHNSON'S LAW

Mathematics is full of rules and laws, such as Cramer's Rule, Pythagoras' Law, and many others. Perhaps a little less known is *Johnson's Law*, named after Professor Keith Johnson of this department who postulated more than 20 years ago that *there has to be snow on the day of the Calculus exam in April*. This can take the form of significant accumulation, or just a few flakes in the air, but year after year this law proved to be correct. Until finally this year, when we had an unusually mild early Spring and the law appeared to be broken at last. However, on the day of the big exam, Thursday, April 16, the temperature started to drop, and finally, when your law-abiding department chair went outside at around 11 p.m., there was indeed a wet snow shower. So, Johnson's Law remained valid for yet another year. *-Dr. Karl Dilcher*

A NEW CAREER OPTION FOR MATHEMATICIANS?

PETER SELINGER



[ARCHIVIO GBB/ALAMY STOCK PHOTO; GETTY IMAGES]

What can you do with a degree in mathematics? This is a question we often get asked at open houses and academic program fairs. Today, we can add a new profession to the list: Pope. The new pontiff Leo XIV, formerly known as Robert F. Prevost, received a BSc in mathematics from Villanova University in 1977 [BOTH PICTURED, AT RIGHT].

There is much we do not yet know about the new pope. Does he believe in the axiom of choice? I hope so. It might help with the selection of cardinals, especially large ones. Can we expect a papal bulletin on the continuum hypothesis? That might finally settle the matter. At the very least, it is reassuring to have a pope who knows how to count his flock. God once told Adam and Eve to go forth and multiply. Maybe we can finally expect commandments to also add, subtract, and take multiplicative inverses.

All joking aside, being trained in logic, rigorous proof, and problem solving prepares you for many professions. Your education has you covered, whether you go into finance, academia, software, or the papacy.

SUMMARY OF COLLOQUIA AND SEMINARS

Everyone who is interested is welcome to attend our discussions and seminars:

- Departmental Colloquium – Mathematics
- Departmental Colloquium – Statistics
- Honours Seminar (Mathematics)
- Number Theory Seminar
- Atlantic Category Theory & Algebra Seminar (ATCAT)
- Dalhousie-AARMS Analysis-Applied Math-Physics Seminar
- Graph Theory Seminar
- Relativity Seminar

Additional information on the colloquia and seminars is available on the Department website: **dal.ca/faculty/science/math-stats/news-events/colloquium.html**

We would like to highlight the two colloquia series. The Mathematics Colloquia Series is organized by Theo Kolokolnikov. The 2024-2025 colloquium schedule included these presenters:

- Hansol Park (September 23) ***Topic:*** *Emergent behavior of mathematical models on manifolds*
- Pawel Pralat (November 7) ***Topic****: Asynchronous Majority Dynamics on Binomial Random Graphs*
- Adam Clay (February 21) ***Topic:*** *Orderable groups and the L-space conjecture*
- Carolyn Zhang (February 24) ***Topic:*** *Math in physics: from palindromes to UMTCs*
- Takayuki Hibi (March 24) ***Topic:*** *Pick's formula and Castelnuovo polytopes*
- Kevin O'Keefe (March 27) ***Topic:*** *Collective dynamics of swarmalators*
- Andrew Irwin (April 7) ***Topic:*** *An Ocean of Data*

The Statistics Seminars are organized by Théo Michelot and Orla Murphy. Once again, this year the seminar series moved to a hybrid setting, with several in-person presenters with most of the event still being held online. The list of the talks is located here:

- Juliana Schulz (September 12) ***Topic:*** A new multivariate Poisson model **[VIRTUAL]**
- Connie Stewart (September 19) ***Topic:*** Estimating the Diet of Predators: Bridging Statistical Methods and Biological Insights **[IN-PERSON]**

- Xi Zhang (October 3) ***Topic:*** Multivariate longitudinal data clustering with a dynamic copula kernel mixture model **[IN-PERSON]**
- Graduate student speakers: Joseph Barss, Claire Cui, Ethan O'Connell, Jingyu Li, Fatma Sarhan (October 10) ***Topic:*** Five graduate students will be introducing their research area and project(s) in short presentations **[IN-PERSON]**
- Mike Noonan (October 24) ***Topic:*** Predicting The Unpredictable: Integrating Environmental Stochasticity Into Wildlife Conservation **[IN-PERSON]**
- Nick Beck (October 31) ***Topic:*** Spatio-temporal modeling in sports: Building an industry leading sports intelligence platform **[IN-PERSON]**
- Paul Sheridan (November 28) ***Topic:*** A Fisher's Exact Test Interpretation of the TF-IDF Term-Weighting Scheme **[IN-PERSON]**
- Brian Reich (January 23) ***Topic:*** Spatial causal inference in the presence of preferential sampling to study the impacts of marine protected areas **[VIRTUAL]**
- Richard Wilkinson (February 6) ***Topic:*** Statistical challenges in creating cardiac digital twins **[VIRTUAL]**
- Kevin Granville (February 28) ***Topic:*** Investigating Trends in Ontario's Fire Regime: Fire Season Length and Monthly Ignition Frequencies **[IN-PERSON]**
- Owen Ward (March 13) ***Topic:*** Scalable Bayesian computation for networks utilising Aggregated Relational Data **[VIRTUAL]**
- Simon Bonner (March 20) ***Topic:*** A conditional approach to estimate and account dependence formed by long-term pairs in mark-recapture studies **[VIRTUAL]**
- Amy Hurford (March 31) ***Topic:*** Pandemic preparedness needs modelling preparedness: highlighting the role of mechanistic models and the gap in supporting Canadian small jurisdictions **[IN-PERSON]**

AFFILIATED ORGANIZATIONS & SOCIETIES

AARMS

ANDREW IRWIN, AARMS DIRECTOR

The Atlantic Association for Research in Mathematical Sciences (AARMS) supports research and education in the mathematical sciences in Atlantic Canada, primarily through activities organized at its eleven member universities.

We congratulate our four new post-doctoral fellowship recipients: Yuri Salmaniw (Cape Breton), Sebastiano Argenti (Memorial), Seth K. Asante (UNB), and Denys Bulavka (Dalhousie). We have several programs to support the work of junior researchers: graduate scholarships, an annual thesis prize, Undergraduate Student Research Awards, and support for conference and collaborative travel. This year scholarships were awarded to Thiago de Holleben, Logan Pipes, thesis prizes to Jonathan Babyn, Marcello Lanfranchi, and travel support to more than two dozen junior researchers.

AARMS supports a small number of collaborative research groups. Proposals are invited for awards of up to $50,000/year for two years. The primary purpose of this program is to support research activities in Atlantic Canada. We are soliciting submissions from groups of researchers who have common research interests and wish to work collaboratively. The primary applicant must be a faculty member at an AARMS member university. Proposals involving multiple researchers from Atlantic Canada, researchers from outside Atlantic Canada, and researchers from multiple fields are encouraged.

AARMS a supports a wide range of workshops, conferences, and outreach activities organized by Atlantic Canadian researchers. Applications are evaluated three times a year in September, January and May. Please see our annual report for much more information on AARMS' activities and "How to apply" (**aarms.math.ca/onlinesystemnotice**) for details on getting AARMS support for your work.

CANSSI ATLANTIC

JOANNA MILLS FLEMMING/MARK MONK

CANSSI Atlantic embarked on the inaugural 'Atlantic Canada Data Science Tour' kicking things off right here in the Chase Building, making its debut on September 27, 2024. Presenters included:

[CANSSI PHOTO]

September (Dalhousie University)

- *"Spatiotemporal Modelling of Lobster Abundance"* **Joseph Barss**, MSc student in statistics, Dalhousie University.
- *"Statistics and Fish: How Our Expertise Can Benefit Ecology and Fisheries Science"* **Raphaël McDonald**, PhD student in statistics, Dalhousie University.
- *"Coastal Flooding and Extreme Value Analysis"* **Fatma Sarhan**, MSc student in statistics, Dalhousie University.

October (St. Francis Xavier University)

- *"Incorporating Data-driven Models towards Actuarial Problems"* **Kyran Cupido**, PhD; Associate Professor in mathematics and statistics, St. Francis Xavier University.

November (University of Prince Edward Island)

- *"Using Machine Learning to Forecast Changes in Canada's Food Prices"* **Kristina Kupferschmidt,** PhD; Assistant Professor, School of Mathematical and Computational Sciences, University of Prince Edward Island.

December

- (no event held)

January/February (University New Brunswick – Saint John)

- *"Your Data Are a Fingerprint: Why Anonymization Is Not Anonymous and How Statistics Can Protect You"* **Dylan Spicker,** PhD; Assistant Professor, Mathematics and Statistics, University of New Brunswick – Saint John.

March (Memorial University)

- *"Mediation Analysis of Recurrent Events"* **Shenita Pramij,** PhD candidate in the Department of Mathematics and Statistics at Memorial University of Newfoundland.

April (Acadia University)

- *"MURPH: Generating Reproducible Ecological Research Through Accessible Data Management and Communication Practices"* **Paige Levangie,** MSc candidate in the Department of Biology at Acadia University.

COMMUNITY OUTREACH AND BEYOND

DALHOUSIE MATH CHALLENGE CLUB

DORETTE PRONK

During the fall of 2024, we only offered the junior math club, for students in grades 5-8 (although some younger students joined who wanted to be challenged beyond what they had learned in school). Iresha Madhushika, one of our graduate students, led the club with the help of Owen Winters, one of our undergraduate students. The students in the club also participated in the Canada Jay Math Competition from the Canadian Math Society and Ethan Saunders assisted in invigilating the contest.

During the winter term an energetic team of undergraduate and graduate students offered to run both the junior and the senior club. The junior club was especially well attended and was primarily led by Jeremiah Hockaday, one of our graduate students, with undergraduate students Nabil Abi Daoud, Owen Winters, and Ethan Saunders as additional teachers and teaching assistants. The senior club was primarily led by Bram Ogus, one of our undergraduate students, with Asher Millett, James Murphy and Dulguun Norjinbat as additional teachers and teaching assistants. Dr. Pronk served as general advisor for the clubs. We thank all the students for their efforts and enthusiasm in leading the clubs. Both the students and their parents have expressed their appreciation and gratitude and are looking forward to the continuation of the club this fall.

CAMPS BASED IN THE DEPARTMENT

Black Educators' Association (BEA)/Dalhousie Math Camp; The annual BEA and Dalhousie Math Camp took place from July 7-12, in 2024, and will return in Summer 2025. **CMS/Dalhousie Senior High Math Camp;** After a period of hiatus due to the COVID-19 Pandemic, the Senior High Math Camp returned and ran from July 21 to 25, 2024 and is slated to return in Summer 2025.

["WALK AROUND THE CHASE": WALLACE MCCAIN LEARNING COMMONS, (L); SOUTH FACING WALL OF THE CHASE BUILDING, (R)]

DALHOUSIE INDIGENOUS MATH CAMP

ORIGINAL ARTICLE APPEARED IN DAL NEWS, BY KEN CONROD – SUMMER 2024

SUMMER CAMP BRINGS INDIGENOUS YOUTH TO DAL FOR MATH AND COMPUTER SCIENCE FUN

[DANNY ABRIEL/DALHOUSIE UNIVERSITY]

If you heard a wailing electric guitar echoing through the halls of the Chase Building this week, it was, in fact, for educational purposes.

A session led by Dr. Jason Brown [PICTURED, AT RIGHT], known for his **research combining math and music**, where participants played percussion instruments and "felt" the mathematics in the rhythm was one of the activities in the inaugural Indigenous Math Camp, which saw 14 youth from Mi'kmaw communities throughout Nova Scotia arrive at Dalhousie shortly after the National Indigenous Peoples' Day on June 21.

Led by co-directors Dr. Brown of the Department of Mathematics and Statistics and Dr. Nauzer Kalyaniwalla of the Faculty of Computer Science, the five-day camp showcased the fun side of math and programming concepts and provided a taste of the campus experience. It built on the foundation established by the long-running Black Educators' Association (BEA) – Dalhousie Math Camp, which has brought African Nova Scotian youth to Dal for summer math and coding sessions for the past 30 years.

BEA camp founder Dr. Chelluri Sastri, a retired Dal math professor, was also eager to establish a camp for Indigenous students, but it took until a partnership with **Mi'kmaw Kina'matnewey**, the organization which represents the educational interests of 12 Mi'kmaw communities in Nova Scotia, to get it up and running.

"Indigenous students represent a completely underserved segment," Dr. Kalyaniwalla says, estimating he has taught only a handful of Indigenous students in his computer science classes over the years.

Experiencing life on campus

After checking into their LeMarchant Place residence rooms on Saturday with their chaperones, the students, aged 12-14, were welcomed to campus with an introduction from Elder Tom Christmas.

[BELOW: INSTRUCTOR DR. JULIEN ROSS LEADS CAMPERS THROUGH A WORKSHOP.]

During the camp, which ran from June 22-26, the students cycled through different workshops and activities led by faculty and grad student volunteers in the computer labs and classrooms of Dal's Studley Campus. Dr. Brown led the math portion of the camp's sessions, with Dr. Kalyaniwalla overseeing the computer science side of things, namely the introduction of Scratch, a programming language mainly used as an educational tool for young people.

"All the activities are very visual, very hands-on," says Dr. Brown. "They're designed to get into the creative part of mathematics."

Outside of the classroom, students made the most of their time on campus, taking in the **Alan Syliboy exhibition** at the Dalhousie Art Gallery, enjoying an evening of karaoke in the Ko'jua Okuom space in the Killam Library, and visiting the Indigenous Student Centre.

With a focus on fun, Dr. Brown hopes the inaugural group of campers enjoyed sampling the first-year university experience, living in residence and meeting peers from across the province, as well as gaining a further appreciation of math and computer science.

"I think they're going to see that there is more math in their lives than they expected."

The Indigenous Math Camp was sponsored by Mi'kmaw Kina'matnewey, the Atlantic Association for Research in the Mathematical Sciences (AARMS), Chairs for Inclusion in Science and Engineering (CISE Atlantic), the Canadian Mathematical Society, the Faculty of Science, and the Dalhousie University President's Office.

[BELOW: DR. NAUZER KALYANIWALLA INSTRUCTS CAMPERS ON HOW TO USE THE SCRATCH PROGRAMMING LANGUAGE.]

[BELOW: DR. THERESA RAJACK-TALLEY, VICE-PROVOST, EQUITY AND INCLUSION, WELCOMES CAMPERS.]

NOVA SCOTIA MATH CIRCLES

GORDON HAMILTON

Nova Scotia Math Circles took a break as its former director, Tom Potter, took on a senior lectureship position at Cape Breton University. David Iron remained the faculty advisor as Nova Scotia Math Circles pivoted to a new director, Gordon Hamilton, who joined us in February.

The Team

Nineteen talented undergraduate and graduate students are working with Nova Scotia Math Circles: Aaron Yip, Anh Tran, Bram Ogus, Cian Comighod, Danella Calina, Daniel Teixeira, David Zeidler, Fateme Gholami, Fatemeh Tofighi Khelejan, Gregory Whalen-Edwards, Hasan Mahmood, Jeremiah Hockaday, Leila Mohammadi Valehzaghard, Linh Dinh, Margo Paris, Marzieh Palizdar, Sahil Talwar, and Timothy Power.

Our Impact

Since starting in February 2025, we have visited 151 classrooms in Bridgewater, Bedford, Dartmouth, Halifax, Hubbards, Sydney, Truro, Wolfville, and Yarmouth. We've also hosted three events at the Halifax Central Library, 3 events on the Dalhousie University campus, and put on 1 family board game event.

New Activities

Nova Scotia Math Circles is designing and classroom-testing new activities. We iterate on pedagogy and puzzle design to improve our classes over time.

One example of an exciting new activity was a grade 2+ puzzle introduced by Jeremiah Hockaday: Six people want 3,3,3,3,2, and 1 friends respectively. Can they make it work among themselves? Mathematicians would call this a degree sequence for a graph. Impossible problems like this are given with a straight face and students are urged to solve them. This type of failure is built into most of our puzzles because failure can be made more humorous and emotionally engaging than a success. The puzzles have some easy-to-understand proofs that are accessible to grade two children. For example, can the degree sequence of a huge number of 2s be solved? What about a degree sequence of consecutive numbers like 5,4,3,2,1?

Beauty

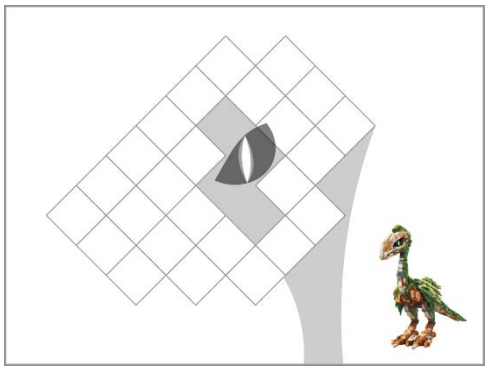
Nova Scotia Math Circles is also committed to creating beautiful new activities and upgrading old activities. This work is well worth the effort because once an activity is beautified, it attracts artsy children who would otherwise be unimpressed by math class.

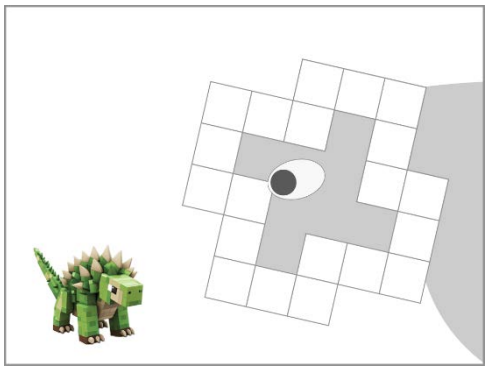
There is no permanent place in the world for ugly mathematics. [G.H. Hardy, 1941]

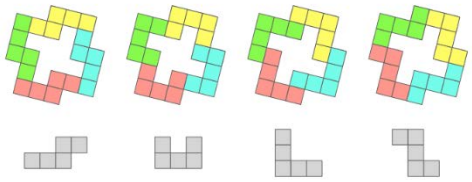
We add a little:

There is no permanent place in the world for ugly mathematics, especially in elementary school!

One of the puzzles being upgraded in this way is a pentomino tiling puzzle. The old activity asked P-2 students to tile specific areas using specific pentominoes. The new activity asks them to use identical pentominoes to tile Minecraft-style dinosaurs.







FOUR COPIES OF FOUR PENTOMINOES TILE THE DINOSAUR ON THE RIGHT. CAN YOU MAKE A DINOSAUR THAT CAN BE TILED BY A DIFFERENT SET OF FOUR?

Unsolved

One way we keep outreach interesting for our undergraduate and graduate students is to present unsolved curricular puzzles. This includes some classics, like Henry Dudeney's No-three-in-a-line puzzle from 1900, the Collatz Conjecture from 1937, and the Graceful Tree Conjecture from 1967. We also add to this list with original puzzles.

Many of these unsolved problems are essential for every child to experience sometime in elementary school. That's because they are deep but also pedagogically strong. Top students can always be deflected into problem solving (never a waste of time) while the rest of the class works on skill acquisition.

Board Games

One of our goals is to bring together the worlds of math education and board games. Why put such an emphasis on board games? The #1 thing we want out of elementary school math classrooms is not arithmetic skills (that's #2) but rigorous thinking and problem solving. Board games are the most joyous excuse to problem solve — that's why we promote their adoption in the classroom and at home.

Working with schools

We no longer go to a school for just a few classes—instead, we require that our schedule be filled. Full days are more efficient.

We now have a working relationship with the Halifax Regional Centre for Education, which has actively recommended us to select schools.

As of April 2025, we have gotten approval to use the logo [SEE BELOW] of the Nova Scotia Mathematics Teachers Association. This adds credibility when we deal with schools across the province. We'll use the logo when producing classroom materials and videos demonstrating classroom pedagogy and puzzles.

[SOURCE} NOVA SCOTIA TEACHERS UNION (NSTU)

SCIENCE ATLANTIC

PETER SELINGER & ORLA MURPHY

The Science Atlantic undergraduate conference on Mathematics, Statistics, and Computer Science took place October 4 and 5, 2024, at Acadia University. We took a group of twenty-one students **[GROUP PHOTO, BOTTOM CENTRE]** to Wolfville to attend the conference. Many of our students gave talks and/or participated in the math competition.

Owen Winters and Dulguun Norjinbat **[BOTH, NOT PICTURED]** – won an honourable mention in the math competition. Joseph Barss **[BELOW LEFT]** won the first-place graduate student research award in Statistics. Scott Wesley **[BELOW RIGHT]** won the second-place graduate student research award in Mathematics. Eleanor Friddell and Joyce Jiao **[BELOW CENTRE]** each won an undergraduate research communication award in Mathematics. Congratulations to the award winners and thank you to everyone for participating!

[PHOTOS] PETER SELINGER/ORLA MURPHY

ATLANTIC TOPOLOGICAL QUANTUM FIELD THEORY (TQFT) SPRING SCHOOL

THEO JOHNSON-FREYD

[PHOTOS] THEO JOHNSON-FREYD

About thirty-five participants gathered the week of May 19-23 at UNB Fredericton for the annual Atlantic TQFT Spring School. Dalhousie had a strong showing: in addition to the organizers Theo Johnson-Freyd and Luuk Stehouwer, the School included Dalhousie PhD students Adrien DeLazzer Meunier, Ruizhi Liu, and Scott Wesley, undergraduate Asher Millett, and incoming MSc student Tanner Altenkirk. Other students came from far and wide to join us in New Brunswick: University of Waterloo, University of Western Ontario, Florida State University, University of California Berkeley, Università di Milano, Hebrew University of Jerusalem, The Chinese University of Hong Kong, … just to name a few of the participants' home universities.

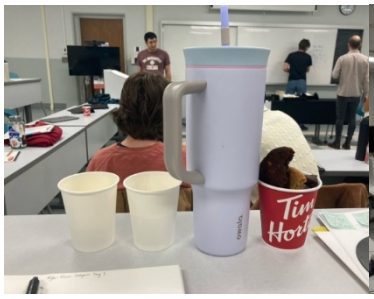
The weather was cold, grey, and rainy, and the lectures and problem sets were top notch. The instructors and courses at the school were:

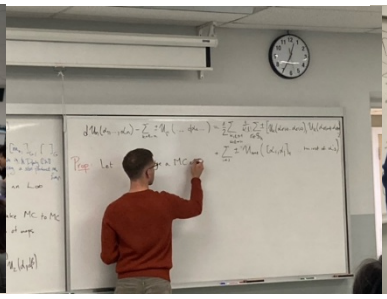
- Kyle Kawagoe (The Ohio State University), *Fusion categories and condensed matter*
- Ján Pulmann (Charles University, Prague), *Deformation quantization*
- Paula Verdugo (Max Planck Institute for Mathematics, Bonn), *Introduction to algebraic K-theory*

Rounding out the teaching and organizing teams were our excellent TAs, who ran daily problem sessions — Salvatore Pace (Massachusetts Institute of Technology) and Alice Rolf (University of Toronto) — and local organizer Branimir Ćaćić (UNB Fredericton).

This was our third annual TQFT Spring School. A few participants have attended every year; they report that they look forward every year to the chance to see friends at this Canadian retreat. Other highlights of the week, according to an informal poll of students: lively and engaged discussion after every lecture; the opportunity to connect with new people and learn cutting-edge mathematical physics; walking in a big group across the Saint John/Wolastaq River to Picaroons Brewery; and the too-brief moment of sunshine on Thursday.

The School was supported by AARMS, NSERC, and the Simons Collaboration for Global Categorical Symmetries. We also particularly thank UNB staff member Brendon Gibson for taking such good care of us during our stay.





CHASE ANNUAL REPORT **2025**

The **Chase Annual Report 2025** is published for students, alumni, and friends of the Department of Mathematics and Statistics, Dalhousie University. Your suggestions and comments are welcomed for future issues (email **mathstat@dal.ca**).

This year's edition of the Chase Annual Report was produced and designed by **Mark Monk.**

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