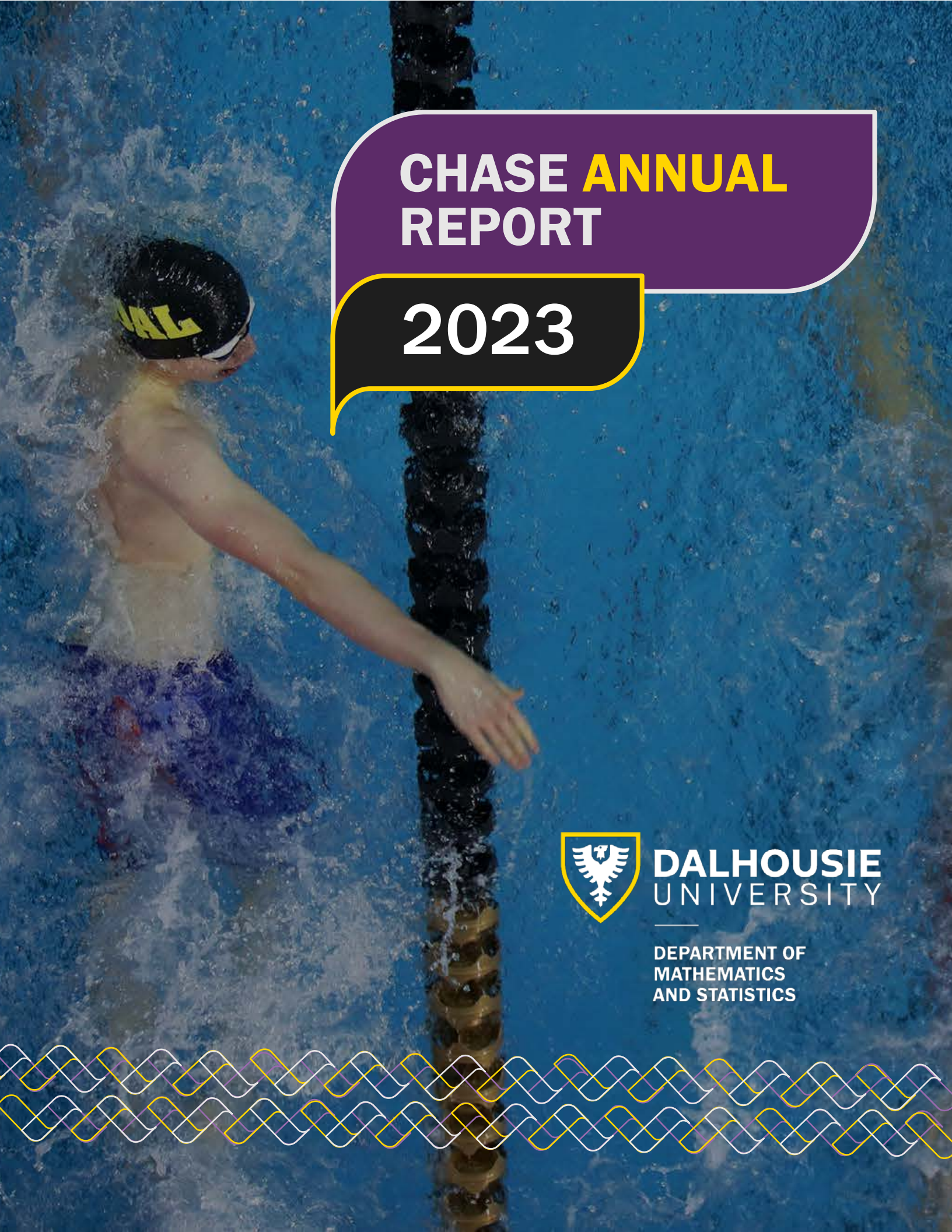

CHASE ANNUAL REPORT

2023

DALHOUSIE UNIVERSITY

DEPARTMENT OF MATHEMATICS AND STATISTICS

DALHOUSIE
UNIVERSITY

MATHEMATICS
AND STATISTICS

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HONOURS & AWARDS

Congratulations to all our graduates from the fall of 2022 and spring of 2023! You are now members of our alumni family and 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. **[Editor's note: the official list of graduates was unavailable in time for this print edition. The online version of the 2023 Chase Report will be published with each graduate's name and program once all graduate names are available from the Registrar's Office. Thank you.]**

DEPARTMENT AWARDS

The names of this year's recipients are presented below along with a description about each of the **19** awards. Congratulations to our 2022 – 2023 award earners!

SIR WILLIAM YOUNG GOLD MEDAL IN MATHEMATICS

This medal is awarded at convocation to the student who stands first among those taking 1st class honours in Mathematics. It is also known as the University Medal in Mathematics.
Recipient: Linh T. Dinh

UNIVERSITY MEDAL IN STATISTICS

This medal is awarded at convocation to the student who stands first among those taking 1st class honours in Statistics.
Recipient: Dul Norovsambuu

UNIVERSITY MEDAL IN ACTUARIAL SCIENCE

This medal is awarded at convocation to the student who stands first among those taking 1st class honours in Actuarial Science.
Recipient: *No Actuarial Science honours students*

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. Arnold joined the faculty at Dalhousie University in 1953. With the support of his wife Bea, Arnold served Dalhousie, in turn, as mathematics professor, Chair of the Department of Mathematics, Registrar, Secretary of Senate, Secretary of the Board of Governors and Assistant to the President, until his retirement in 1986. He was appointed Professor Emeritus in 1988. 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 two first years of study and being enrolled in any mathematics program).
Recipient: Nicholas Lynden Czapalay

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: Owen Winters

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: Chadya Bhatia

ERMA GEDDES FILMORE MEMORIAL SCHOLARSHIP

This scholarship is in memory of Erma Geddes Fillmore (Dalhousie BA, 1924), 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: *To be awarded fall 2023*

FIELD PRIZE IN STATISTICS

This monetary prize is awarded to the student with the highest academic standing who has completed their 3rd year of studies in Statistics. This award was endowed by Dr. Christopher Field and Mrs. Harriet Field.
Recipient: Noah Winter

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: Nathan Hebert

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 postdoc in our department, and then spent a substantial part of his career here at Dalhousie: First from 1974 to 1980, and then again from 1982 to 1991 in this department, and later, from 2004 to 2009 as a CRC in the Faculty of Computer Science, but still with close connections to our department. Dr. Borwein completed an Honours Mathematics degree in 1971 at the University of Western Ontario (now Western University). He received his DPhil from Oxford in 1974, as an Ontario Rhodes Scholar. Dr. Borwein held faculty positions at Dalhousie, Carnegie-Mellon, Waterloo and Simon Fraser, including named professorships and Canada Research Chairs. Most recently he was Laureate Professor at the University of Newcastle (NSW, Australia). Throughout most of his career he founded and directed successful research centers, and he maintained his connection with Dalhousie through an adjunct appointment. Among numerous other honours, Dr. Borwein was elected a Fellow of the Royal Society of Canada in 1994, and he became a fellow of various prestigious mathematical and scientific associations around the world. An obituary for Jon Borwein can be found on p. 14 of the 2017 Chase Report, **cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/math-stats/ChaseReport2017.pdf** .

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: *A first award will be made at a later date*

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: Andrew Allen

PROFESSOR MICHAEL EDELSTEIN MEMORIAL GRADUATE PRIZE

This prize is awarded to a graduate student who shows great promise in the mathematical sciences.
Recipient: Thiago de Holleben

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: Jingyi Wang

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: Oscar Rodney

THE ELLEN MCCAUGHIN MCFARLANE PRIZE

This award is in the memory of Ellen McCaughin McFarlane, class of 1927 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: Ethan Saunders

THE KATHERINE M. BUTTENSHAW PRIZE
This monetary prize is awarded to the student standing highest in the advanced Mathematics courses.
Recipient: Eleanor Friddell

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: Ethan Merlin

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 2nd class standing during the first three years.
Recipients: Linh T. Dinh and Peilin Li

WAVERLEY PRIZE
This award goes to the student with the highest standing in MATH 1010 (Differential and Integral Calculus II).
Recipient: Veronika Karas

REPORTS & NOTES

MESSAGE FROM THE DEPARTMENT CHAIR
JASON BROWN

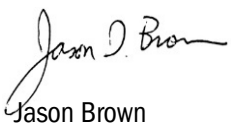
"The long and winding road..."- John Lennon/Paul McCartney

Completing a university degree is no small achievement – it requires years of hard work and perseverance, not only from you, but from your friends and family who support you. Achieving a degree in Mathematics, Statistics or Actuarial Sciences is testament to your perseverance, but also your love for both the utility and beauty of the subject. It doesn't seem so long ago (although it was!) that I was sitting in anticipation at convocation. This time is special and momentous, so take it all in and be in the moment. There is much to be proud of – not only of the degree, but even more so the journey that has taken you here.

This year we have slowly taken down our masks and returned, for the most part, to normal life. I also want to thank you for your consideration of others in protecting everyone – especially, your fellow students and your instructors – these past two years. Getting your degree through a pandemic has been challenging, and I thank you for not only your academic dedication but also your generosity and maturity as caring citizens.

Much goes on behind the scenes to ensure that the teaching and mentoring that we provide goes on as seamlessly as possible. We have had, over the last year, almost a complete turnover of staff in the main office, and the wheels might have fallen off if not for the dedication and competency of our new staff members, Mark Monk and Susan Enta. I appreciate the continuing excellent work of Balagopal Pillai in IT and to Angela Myers for maintaining the Chase building. I also extend special thanks to Anna Davis, the department's Administrator whose all-encompassing knowledge and dedication to both faculty and students has helped me make it through my first year as Chair.

To our majors, to our honours students, to those who won scholarships and to our award winners, I extend my congratulations. Whether you are proceeding onto graduate work or heading out into the workforce, take time today to take stock of what you have just accomplished. The end of this long and winding road is just the start of a new one.



Jason Brown
Department Chair

HONOURS PROGRAM

JULIEN ROSS AND ED SUSKO

This year we had a total of **eleven** honours students in our Mathematics and Statistics programs. Each student, their project and their supervisor are noted below.

MATHEMATICS:

- **Louis Bu,** thesis title: Hybrid Search Trajectory Finding as an Application of Zermelo's Navigation Problem, Supervisor: Robert Milson
- **Linh T. Dinh,** thesis title: Quaternionic Methods in Exact Synthesis, Supervisor: Neil J. Ross
- **Ruoyan Fang,** thesis title: Stern's Diatomic Sequence and its Analogue in $Z[\sqrt{2}]$, Supervisor: Karl Dilcher
- **Peilin Li,** thesis title: Building Monomial Ideals with Fixed Betti Numbers, Supervisor: Sara Faridi
- **Jan O. Schrader,** thesis title: Seasonally Forced Endemic Models using Method of Matched Asymptotics, Supervisor: Theodore Kolokolnikov and John Rumsey
- **Can S. Sozuer,** thesis title: Methods to Learn Graphs of Functional Brain Networks, Supervisor: Jeannette Janssen
- **Balkar Yildirim,** thesis title: The Connection between Cosmological Inflation and Dark Energy, Supervisor: Alan Coley

STATISTICS

- **Munkhdul Norovsambuu,** The Effect of Chromosomes on the Glucose Level of Potatoes, Supervisor: Hong Gu
- **Wenhui Wang,** Survival Analysis Method with R using Breast Cancer Dataset, Supervisor: Lam Ho
- **Yihang Xing,** Influencing Factors of Cyanotoxins Based on Spatio-Temporal Statistics, Supervisor: Hong Gu
- **Weifan Yan,** Using Superlearner to Predict Remission from Childhood Epilepsy, Supervisor: Bruce Smith

MATHEMATICS DIVISION

PETER SELINGER, DIRECTOR

This has been another good year for the mathematics division. With most pandemic restrictions lifted, it was nice to have what felt like our first "normal" year in a while.

I would like to congratulate all our graduating students. You have done extensive research, learned to be a scholar, and wrote and defended your Honours theses, Masters' theses, and PhD theses.

Much of the exciting work that goes on in the division is invisible to those walking around the Chase Building, as many hours are spent doing research, writing publications, publishing them in journals and conferences, and travelling and giving talks at conferences and seminars. In addition to our academic accomplishments, the Mathematics Division is involved in many visible and community-oriented activities such as courses, student support in office hours and the Learning Centre, advising, math summer camps, the annual Science Atlantic conference, and the many Math Circles events given by graduate students and other members of our department in Halifax and around the province.

Our dedicated faculty and staff have played a significant role in our success this year. Julien Ross expertly guided our undergraduate students as the mathematics advisor and honours coordinator. The graduate coordinators, David Iron (Fall) and Theo Johnson-Freyd (Winter), have done an excellent job admitting graduate students and looked after their funding and well-being. Rob Milson took over the position of coop advisor from Jason Brown, who became department chair this year. Our curriculum is in the capable hands of Theo Kolokolnikov, who returned to his role as the chair of the curriculum committee. Suresh Eswarathasan never fails to amaze me in his role as the colloquium chair, attracting an impressive roster of speakers. Tom Potter continues to do a fantastic job as the Math Circles coordinator. As always, Sarah Chisholm is in charge of the Learning Centre, as well as all of the hiring and training of teaching assistants, graduate student instructors, and other Part-Time Academics (PTAs), and handling everything with aplomb and kindness.

I would also like to thank our amazing staff, Anna, Mark, Susan, and Balagopal, without whom none of the division's business would get done. Maria, our graduate secretary, retired this year after many years of service, and we wish her a wonderful retirement. We are looking forward to welcoming a new graduate secretary soon.

Our graduates are off to an exciting future, and we are so proud of them! The rest of us will hopefully enjoy a few quiet summer months, and then we'll be ready for another exciting school year.

STATISTICS DIVISION

ANDREW IRWIN, DIRECTOR

Hong Gu *(below)*, and delegation, meets with representatives of the Shandong University of Finance and Economics (SDUFE)

Congratulations to all our graduates including Yun Cai, Shen Ling, Chaoyue Liu who completed their PhD this year. Prof. Lam Ho was awarded tenure and promoted to Associate Professor.

Hong Gu visited Shandong University of Finance and Economics (SDUFE) in April. She met with students, parents, faculty, and administrators to discuss the joint 2+2-degree program offered by our two universities. We had our first class of students from SDUFE at Dalhousie this year and are looking forward to further developing the partnership.

Division members continue to be successful competitors for external funds to support their research. Lam Ho's Canada Research Chair in Stochastic Modelling was renewed for another 5 years. Hong Gu and Toby Kenney were awarded NSERC Discovery grants. Joanna Mills Flemming was awarded a Natural Sciences and Engineering Research Council of Canada (NSERC) Alliance Grant entitled "Advancing spatiotemporal stock assessment models to integrate high-resolution seafloor mapping data in order to achieve sustainable harvest strategies for Canadian shellfish", with Fisheries and Oceans Canada and Clearwater Seafood Limited Partnership. Toby Kenney received a Mitacs Accelerate award to support student internships. Joanna Mills Flemming is now an Associate Editor for *Environmetrics*.

In May 2023, Ethan O'Connell started an MSc working on a project to improve validation of earth systems models, funded by a grant from Environment and Climate Change Canada. Interdisciplinary PhD student Fabio Frazao began working with Mike Dowd on developing machine learning for automated whale detection from underwater acoustic data streams. This work was funded by a grant from Fisheries & Ocean Canada (DFO) through their Canadian Nature Fund for Aquatic Species at Risk.

Joanna Mills Flemming organized a 4-day workshop at Dal from May 15-18, co-sponsored by the Canadian Statistical Sciences Institute (CANSSI) and the Ocean Frontier Institute (OFI), titled "Advancing Best Practice in State Space Assessment Modeling of Complex Fisheries and Biological Data, with a Focus on the Canadian Context". Andrew Irwin and research associate Niall McGinty organized a workshop at Massachusetts Institute of Technology (MIT) in April sponsored by the Simons Foundation on Modelling and Data Analysis of Zooplankton Biogeography.

ACTUARIAL SCIENCE

TOBY KENNEY

We are delighted to welcome Catie Foley to the department as a 3-year part-time instructor in Actuarial Science starting in September 2022. Catie has worked as an Actuarial Consultant at LifeWorks since 2015. She received a Bachelor of Mathematics from Carleton University in 2009 and a Bachelor of Education from Memorial University in 2013. She attained her Associateship of the Society of Actuaries (SOA) and the Canadian Institute of Actuaries (CIA) in 2018, then went on to complete her Fellowship of the SOA and the CIA in 2020. She also has previous experience teaching university level courses in Actuarial Science at the University of New Brunswick.

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. Over the last few years, a few thousand volumes were sold to mathematicians all across Canada and hundreds more around the world. 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).

More than 1,500 volumes 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. Anything that is deemed suitable for the library will be placed there. 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.

THE FIBONACCI QUARTERLY

KARL DILCHER

It doesn't seem to be widely known that the electronic version of the *Fibonacci Quarterly* has been hosted on our servers since 2010. The *Fibonacci Quarterly* is the oldest journal specializing on numerical and polynomial sequences, and not just Fibonacci numbers. It was founded in 1963 in California, and is still going strong as a journal that has both a paper and an electronic version. The *Quarterly* therefore predates by several decades its excellent (and online-only) sister-journals, the *Journal of Integer Sequences* and *INTEGERS*.

The *Fibonacci Quarterly* can be found at **fq.math.ca/**. All issues are freely accessible on campus or through the proxy server, and any volumes 6 years or more in the past are freely accessible anyway. All older issues and articles, right back to 1963, have been retro-digitized. Please take some time to browse!

REFLECTIONS

FROM THE CHASE REPORT OF FIFTEEN YEARS AGO

AS DUG UP BY KARL DILCHER


Dalhousie University

CHASE REPORT

NEWSLETTER OF THE DEPARTMENT OF MATHEMATICS AND STATISTICS

Faculty of Science MAY 2008

A MOVING STORY – It was reported that the Department Chair [K.D.] was proud of at last being a mover and shaker, if only for fifteen minutes. During the early stages of renovations to create the new student space, several file cabinets needed to be moved.

However, safety regulations did not allow the two burly movers to do the job. So, two scrawny academics had to jump in and remove the very heavy drawers so that the empty cabinets could then be moved professionally and completely legally. After this moving experience the Chair, who had been joined by Alan Surovell, returned to his office still shaking from the exertion, but happy and duly praised by [Administrator] Gretchen Smith.

To relive this issue of the Chase Report, or other past issues, please visit **dal.ca/faculty/science/math-stats/alumni-friends/chase-report.html** .

WE REMEMBER

Dr. Keith Richard Thompson *(originally published in the Chronicle Herald, July 22, 2022)*

(PHOTO CREDIT AND TEXT SOURCE: SALTWIRE.COM)

With much sadness, we announce that Dr. Keith Richard Thompson died peacefully on July 11, 2022, in the Hospice Halifax. Keith was a professor emeritus at Dalhousie University and held a joint appointment in the Departments of Mathematics & Statistics and Oceanography.

Born in Southeast London, England on May 9, 1951, Keith was the proud son of Eric Thompson, who was a talented musician, highly skilled on violin and oboe, and Margaret Thompson, who had strong Kent farming roots. Keith obtained a B.Sc. in Mathematics in 1973 and an M.Sc. in Fluid Mechanics in 1974 at the University of Manchester in the UK, and a Ph.D. in Oceanography in 1979 at the University of Liverpool.

He arrived at Dalhousie University as a post-doc in the early 1980s, and then became a faculty member. His work focused on coastal forecasting for Canadian waters, including a storm surge prediction model that is now being used operationally. He held a Tier I Canada Research Chair in 'Marine Prediction and Environmental Statistics' and sat on international committees including the Coastal Ocean Observations Panel of the Global Ocean Observing System. He was a recipient of the J.P. Tully Medal in Oceanography from the Canadian Meteorological and Oceanographic Society in 2016, and three of his PhD students went on to become faculty members at Dalhousie.

Like his father, Keith was very passionate about playing music. He learned to play classical guitar in his early years, and in recent years he turned to the bass guitar, playing with the Halifax Music Co-op, as well as with small groups and friends. He also enjoyed watercolour painting, and in the last year, he was becoming skilled in the art of stained glass.

He is survived by his wife, Ingrid Peterson; his son, Peter Thompson; and his brothers, David Thompson and Graham Thompson. The family is very grateful to the medical and nursing staff at the Halifax Infirmary and Victoria General Hospital, as well as the care staff at Hospice Halifax. Donations in Keith's memory can be made to QEII Health Sciences Centre Foundation. A celebration of Keith's life will be held in the Steele Ocean Sciences Atrium at Dalhousie University on August 20th, 11-1 p.m. Entrance to the Steel Ocean Sciences building is on 1355 Oxford St, Halifax. Take the stairs or elevator up one level to the Atrium.

The First Killam Professor of Mathematics has died

RICHARD J. WOOD, former Faculty Member

F. William (Bill) Lawvere, who was the Killam Professor of Mathematics from 1969 to 1971, died at home in North Carolina on January 23, 2023, seventeen days before his 86th birthday. While his time at Dalhousie was short, the Mathematics he and his colleagues accomplished during those months has become legendary in the subdiscipline of Category Theory.

Bill was born in Muncie, Indiana and obtained his undergraduate degree from Indiana University, Bloomington. He completed his PhD at Columbia in 1963, officially under the supervision of Samuel Eilenberg, who with Saunders Mac Lane had discovered and founded Category Theory in 1945. But it is generally understood that Bill was equally a student of Mac Lane, who was at Chicago. Bill's PhD thesis, "Functorial Semantics of Algebraic Theories", was revolutionary. Before then categories were, for the most part, seen as ways of organizing large collections of mathematical structures, typified by the category of all topological spaces, the category of all groups, and so on. For any kind of algebra, given by operations subject to equations, Bill made the operations and equations into a category in its own right, called an *algebraic theory*. A single algebra became a functor defined on the algebraic theory. The category in which the functor took its values could be the category of sets, but just as easily it could be a category of spaces, a category of algebras, . . . , and this was just the beginning.

By the time he reached Dalhousie, Bill was the undisputed leader of his field and had given first order categorical axioms to capture the elementary aspects of set theory itself. At Dalhousie, with Myles Tierney, he turned his hand to the relaxation of such axioms so as to include the categories of sheaves of sets, toposes, that were under close scrutiny by Alexander Grothendieck and the French school. Bill and Myles saw the possibility of treating such categories as models of theories of *variable sets* and concentrated on the elementary aspects of toposes, in particular on exponentiation (function spaces) and the subobject classifier, the latter sometimes called the (Heyting algebra) object of truth values and denoted by Ω. Grothendieck would later say that he had missed Ω. in his study and refered to it as the "Lawvere element".

During Bill's months at Dalhousie a steady stream of categorical visitors from around the world arrived at Dalhousie to participate in the development of Elementary Toposes. Before he left he had sown the seeds of what was to become a very active research group in Category Theory at Dalhousie, whose seminar persists after more than 50 years. Bill returned to visit Dalhousie, for seminars and international Category Theory meetings a number of times during his life.

Bill's leadership in the field was not short-lived. He went on to introduce many more ideas and remains the most influential category theorist to date. Along with his mathematical ability, Bill carried an enormous generosity, showered particularly on younger mathematicians, that manifested itself with hours of his time. He was always approachable and listened patiently when young people told him their ideas. Without fail, he would offer suggestions for further development and, also without fail, his suggestions led to deeper and more general theorems. His passing is mourned by a large biological family and many mathematicians.

SUMMARY OF COLLOQUIA & 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 are organized by Suresh Eswarathasan. The 2022-2023 colloquium schedule is online at: **mathstat.dal.ca/~sureshe/Colloquium.html.**

The Statistics Seminars are organized by Théo Michelot and Orla Murphy. This year the seminar series moved to being held online. The list of the talks is located here: **dal.ca/faculty/science/math-stats/news-events/colloquium/deparmental-colloquia-statistics.html#contentPar_text**

AFFILIATED ORGANIZATIONS & SOCIETIES UPDATES

The Department participates in five organizations related to mathematics and statistics:

- Canadian Mathematical Society (CMS)
- Atlantic Association for Research in the Mathematical Sciences (AARMS)
- Canadian Statistical Sciences Institute (CANSSI)
- Statistical Society of Canada (SSC)
- American Mathematical Society (AMS)

We are pleased to share updates from some of these organizations.

ATLANTIC ASSOCIATION FOR RESEARCH IN THE MATHEMATICAL SCIENCES (AARMS)

DAVID LANGSTROTH

The Atlantic Association for Research In the Mathematical Sciences (AARMS) is pleased to report that, after a hiatus of 3 years, due to the pandemic, we will be, this year, hosting our annual graduate level Summer School on the topic of Emerging Infectious Diseases Modelling, to be held at Memorial University August 19-31. Further information can be found on our website.

We are sad to say that we are entering the last year of the successful Directorship of Dr. Sanjeev Seahra, and a process is now underway to select the next Director of AARMS. If you, or anyone you know, might be a good candidate for this position please consult our website for further information or contact the AARMS Executive Administrator, David Langstroth (dll@cs.dal.ca).

We would also like to remind everyone about the Junior Researcher Travel Support program which still has funds to spare for this year. If your students or postdocs are traveling to conferences there may be some funding available. The application process is not difficult.

AARMS newest committee, on Equity, Diversity and Inclusion has also had a busy first year. There will be an open call during the summer term for volunteers for the second year. If this is an area you are interested in, watch for the announcement.

Finally, a reminder of our full suite of programs which are all up and running. We look forward to seeing applications from researchers at our member universities for support in the following areas:

- Postdoctoral fellowships
- Collaborative Research Groups
- Workshops and Conferences
- Outreach
- Graduate Scholarships
- Doctoral Thesis Award
- Junior Researcher Travel Support
- Industrial Problem-Solving Workshop
- MSRI Summer Schools
- Distinguished Lecturer

Watch your email for announcements, or check out our programs on our website: aarms.math.ca

COMMUNITY OUTREACH AND BEYOND

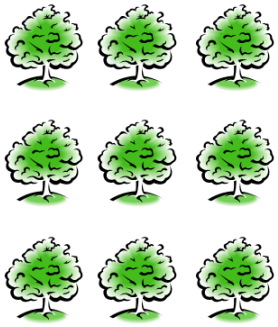
FUN MATH PROBLEMS

TOM POTTER

THE TREE PROBLEM:

If one plants 9 trees in a square, as pictured (on next page), then one can draw 8 straight lines, each going through three trees (how?) Can you reposition the trees in such a way that you can find more than 8 straight lines, each going through three trees? What's the maximum number of such lines?

Solution is at the end of the Chase Report.



BEA ANNUAL MATH CAMP

The 2022 BEA Math Camp resumed its week-long residential camp from July 4 to 8, 2022. The camp returns this summer starting on July 3 to 7.

CMS MATH CAMP

The 2022 CMS Math Camp didn't take place last summer and is postponed for 2023. We anticipate the return of the program in the summer of 2024.

NS MATH CIRCLES

TOM POTTER

"Mathemagic" Presentation in Yarmouth in Bian and Tom.

It has been another year of successful outreach activities for NS Math Circles. The activities of NS Math Circles are twofold: travelling to schools around the province to do interactive math workshops—doing mathematics and in way that promotes engagement and builds confidence—and hosting monthly interactive presentations aimed at the junior to senior high level, which are free to attend.

This year Tom Potter continued as program director of Math Circles, and Dr. David Iron continued as faculty advisor. A number of presenters and content developers from last year continued to work with Math Circles this year; these included: Arvin Vaziry, Cali Park, Carmen Graves, Dario Brooks, Joey Latta, Joyce Jiao, Louis Bu, Scott Wesley, and Xiaoning Bian. We also recruited a large number of presenters in order to keep up with the growing demand for Math Circles presentations; these included Anaam Choudhury, Baorui Jia, Daniel Teixeira, Dulguun Norjinbat, Fangda Cui, Iresha Madduwe Hewalage, Neil Kelley, Razy Shafiee, Shapour Heidarkhani, Thiago de Holleben, Usman Shehu, and Vivienne Kwan.

The fall started off very busy for NS Math Circles. In October we began school visits and monthly events and attended the Math Teachers Association Conference at CP Allen High in Bedford. There, we gave presentations to groups of teachers from around the province to promote our program.

In November we did a special presentation at Dalhousie for a group of students from Duc d'Anville Elementary, organized together with Phillip Jackson, an African Nova Scotian Student Support Worker. Dario Brooks gave a presentation for this, which was very well-received. Together with Mr. Jackson, we organized another presentation in January for Clayton Park Jr High students of African Ancestry. We are currently planning to bring both groups back in June.

We also visited Yarmouth in November and did four days of presentations there. This was the first multi-day trip that Math Circles has done since 2019. We completed another week-long trip to Antigonish and Cape Breton in May.

In February we did two special evening presentations, one with a group of Embers and another with a group of Sparks. The presenters were Carmen Graves and Vivienne Kwan, and the topic was Pentominoes. In addition, Math Circles participated in the first Mount Family STEAM Day at MSVU, in February. Math Circles set up several tables of different activities on a Saturday morning: families could drop in, participate in some fun math challenges, and learn about our program. It was a great time and a great opportunity to promote our work, and we look forward to doing it again.

In March we hosted the 2023 Canadian Math Kangaroo Contest at Dalhousie. Dalhousie was the only Kangaroo contest site in Nova Scotia, with 111 registrants. Tom Potter and Dr. Dorette Pronk were the site coordinators, who also had help from several members of the Math Circles team. In March we also did 6 breakout sessions for grades 6-12 at the South Shore Science Fair in Bridgewater.

Dario presenting to a group in Clayton Park.

The Dal Discovery Days resumed in April, for the first time since before the pandemic, and NS Math Circles provided the activities for the Math Department. Over two days we hosted three large groups and one small group in the Learning Centre. We did activities such as cutting Mobius Strips, Fold and Cut Theorem, Tangrams, Cryptography, and Card Tricks, and included a refreshment break for each group. We also hosted a homeschool group at Dalhousie in April, which was very well-received.

As of the second week of May, we have done 88 school visits, for a total of 360 classes, in addition to the special outreach presentations mentioned above. We visited schools all over the Halifax Regional Municipality, as well as in Canning, Valley, Lantz, Yarmouth, Antigonish, Inverness, and Port Hawkesbury. We have visits planned to Liverpool and Truro in May and June. Moreover, we did two online class visits this year: one for a school in Halifax, and one for a school in London, Ontario. The latter group was very excited about our visit and wants to do another!

Anaam giving presentation at Dalhousie Discovery Days.

Our Monthly events this year have attracted a mix of participants from students, parents, and teachers. We've continued to host these events in a blended format, meaning that students can attend in person or online. These events were given by presenters from our team, enthusiastic graduate students, department alumni, and post-doctoral researchers in our department. Over 200 students joined us so far this year. We had pizza and pop for those who attended in person. Our presenters so far this year were Tom Potter, Cali Park, Sarah Meng Li, Dr. Hector Baños Cervantes, Dr. Dongho Lee, and Erick Lee. In May we will have a presentation from Dr. Danielle Cox and Dr. Karyn McLellan. We are very grateful to our volunteers for giving these workshops.

Math Circles is also working toward doing more for under-served groups in mathematics. We have been very fortunate to collaborate with Phillip Jackson to give special presentations with role model presenters for groups of African Nova Scotian students. We are also working toward collaborating more with Imhotep's Legacy Academy. In addition, our director is working with Dr. Dorette Pronk to initiate a pilot project working with Indigenous students at Ridgecliff Middle School. This would involve trying to help Indigenous students in achieving their goals in a supportive environment. The administration and support staff at Ridgecliff school have been very eager and supportive in this endeavor. The Math Circles program will be able to provide presenter support and materials to help with this initiative, and we hope that some of the Math Circles activities will help the students to engage with math, while boosting their confidence.

Neil, Joey, and Dulguun presenting to Heather Collins' Grade 6 Class (From Twitter).

Thanks to everyone who helped make this year a great success, including presenters, teachers, and math consultants and support workers in the community. We would also like to thank the office staff in the Math and Stats Department: Anna Marie Davis, Susan Enta, and Mark Monk, for their time and support, especially Susan for help with all pay-related work. Thank you to Dr. David Iron for overseeing all contracts and expenses. And thank you to Dr. Dorette Pronk for being interested and involved in the program's success and for collaborating on diversity work.

This year, Math Circles celebrates its ninth year of funding with Eastlink. We are extremely grateful to Eastlink for their generous support, which makes our program possible!

Keep up to date with our events at www.nsmathcircles.ca. We are also on **Twitter (@NSMathCircles)** and **Facebook (NSMathCircles1).**

MIDWINTER SOCIAL

MARK MONK; PHOTOS BY SUSAN ENTA

Just before the Winter Reading Week, the Admin Team, under the leadership of Anna Marie Davis (Administrator), put together a "Mid-Winter Social," which took place in the Grawood Lounge in the Dalhousie Student Union Building - on the evening of Thursday, February 16 – right in the middle of a February Thaw. The evening saw members of faculty, staff, and grad students on hand to spend some time socializing and playing catch-up after being apart for almost three years due to the COVID-19 Pandemic and the gradual return to campus and for our newer students me more people from around the department. Here are some photos from the event.


Born
Wild

ATLANTIC TOPOLOGICAL QUANTUM FIELD THEORY (TQFT) SPRING SCHOOL

GEOFF VOOYS

During the first week of May, over 20 graduate students from various Canadian and American institutions (including Dalhousie University, UCLA Berkeley, Caltech, Yale, and more) gathered in the cozy Old Orchard Inn (in Wolfville, Nova Scotia) where they attended the first Atlantic TQFT Spring School, organized by Theo Johnson-Freyd and Geoff Vooys. The school provided an introduction to some aspects of Topological Quantum Field Theory (TQFT), a powerful organizing framework for many areas of mathematics and physics. There were three lecture series in the mornings:

A group photo of conference attendees.

- Factorization algebras by Araminta Amabel (UT Austin)
- Spectral sequences by Arun Debray (Purdue)
- Fusion categories by Colleen Delaney (UC Berkeley)

In the evenings, students worked together in problem sets tailored specifically for the event, with the aid of the TAs Eilind Karlsson (TU Munich), Will Stewart (UT Austin), and Matthew Yu (Perimeter Institute).

The unusual schedule, which had busy mornings and late evenings but had completely open afternoons, allowed for the participants to spend their afternoons exploring their surroundings in the Annapolis Valley, before returning to the Old Orchard to practice what they learned during the morning lectures. Wolfville itself is a small town near the southern edge of the Bay of Fundy. It is home to Acadia University and so, despite its small size, there are many amenities. These include your usual pubs and restaurants (complete with locally brewed beers and ciders), cute cafés and crêperies, and a home-made ice cream shop. Being remotely located meant easy access to many hiking trails, including a trail leading to the scenic vistas along Cape Split.

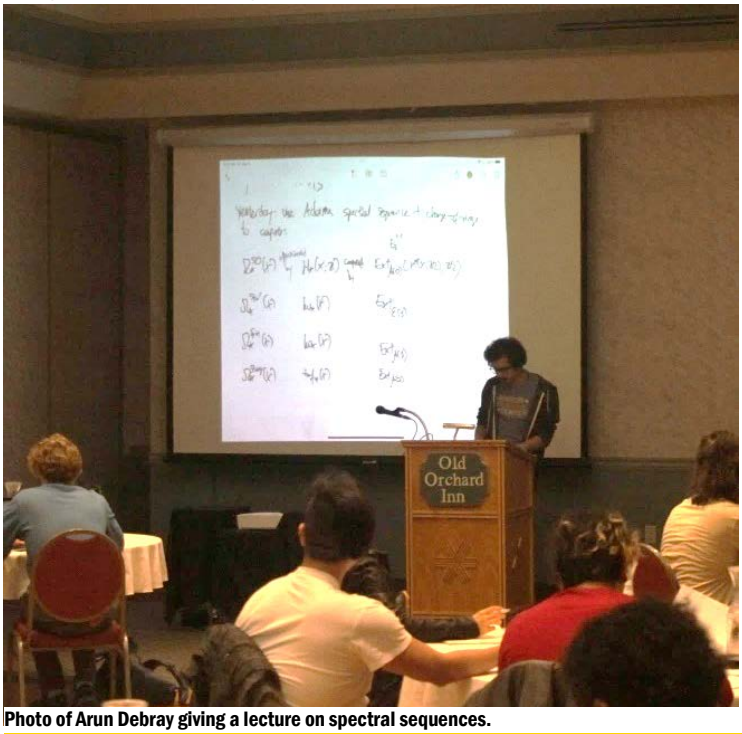


Photo of Arun Debray giving a lecture on spectral sequences.

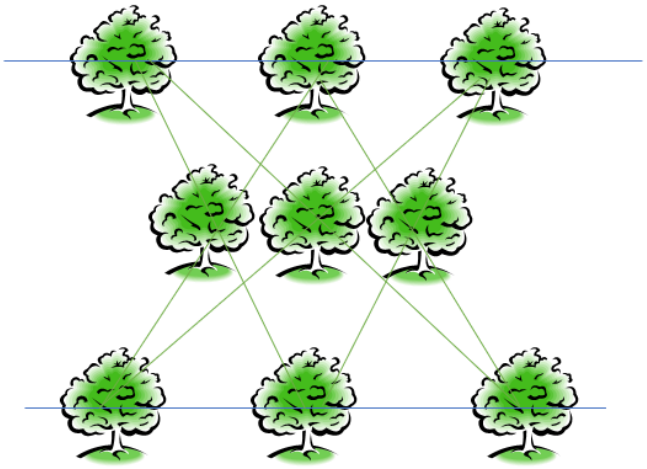
As this event was aimed at graduate students, it was a great first opportunity for many of the participants to meet other people with similar research interests. It also gave them great exposure to different perspectives on important topics that they have encountered throughout their studies.

We thank the staff of the Old Orchard Inn for their hospitality, the lecturers and TAs for sharing their knowledge, and the students for their participation. We would also like to acknowledge and thank AARMS, NSERC, and the Simons Foundation for their generous support and help in funding this event.

Hopefully this is the first of many Atlantic TQFT Spring Schools to come.

Photo of a problem-solving session at the end of the day.

SOLUTION TO FUN MATH PROBLEMS



Answer: The maximum is 10.
See https://en.wikipedia.org/wiki/Orchard-planting_problem

CHASE ANNUAL REPORT | 2023

The **Chase Annual Report** 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.**

This year's theme of the Dalhousie Swim Team members is meant to embody our continued perseverance to the end of the race or struggle that was the COVID-19 pandemic and to parallel the Chair's Report, "the long and winding road." The colours chosen are from the University's colour palette and if you look in the skies over the Chase Building, at any point throughout the day or night and the year, you will find these colours.

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