DALHOUSIE UNIVERSITY

CHASE REPORT

Department of Mathematics and Statistics

June 2018

CONGRATULATIONS

2017-18 AWARD WINNERS

Sir William Young Gold Medal in Mathematics

Finlay Rankin

University Medal in Statistics

Yannick MacMillan

Ralph & Frances Lewis Jeffery Scholarship

Amir Farrag
Finlay Rankin

Barry Ward Fawcett Memorial Prize

Charlie Gerrie

Ken Dunn Memorial Prize

Jeremy Peters

Katherine M. Buttenshaw Prize

Alex Christie

Waverly Prize

Kieran Bhaskara

Emil and Stella Blum Award in Mathematics

Christy Zacharia

Ellen McCaughin McFarlane Prize

Liam Orovec

Professor Michael Edelstein Memorial Graduate Prize

Asmita Sodhi

Heller-Smith Scholarship

Emma Carline

Field Prize in Statistics

Renny Doig

Undergraduate Research Awards

Alex Christie (Peter Selinger)
Charlie Gerrie (Jeannette Janssen and Jordan Barrett)
Adam Lucas (Jeannette Janssen and Jordan Barrett)
Mason Maxwell (Karl Dilcher)
Zoe McIntyre (Rob Milson)

HONOURS STUDENTS

October 2017 Convocation:

<u>**Honours in Mathematics**</u>

Josh Feldman

<u>**Honours in Statistics**</u>

Xinyue Zhang
Keyi Zhao

May 2018 Convocation:

<u>**Honours in Mathematics**</u>

Jiaye Chen
James Eckstein
Luke MacLean
Finlay Rankin
Amir Farrag (with Computer Science)
Taylor Gray (with Physics)
Alex Hare (with Chemistry)
Naveen Khanduri (with Physics)
Ravi Rai (with Physics)
Yi Shi (with Economics)

<u>**Honours in Statistics**</u>

Ying Chi
Jiaxin Luo
James Thomson
Jingyang Xu
Wade Zhang
Meng Zhu Jia (with Economics)
Quentin Kerr (with Biology)
Yannick MacMillan (Multidisciplinary)
Mia Parenteau (with Psychology)

NSERC AWARD WINNERS

CGS-M Rebecca Ryan

NEW KILLAM SCHOLARSHIPS

Ethan Lawler

KILLAM RENEWALS

Melissa Huggan
Kim Whoriskey

VANIER CANADA GRADUATE SCHOLARSHIP

Ethan Lawler

PRESIDENT'S AWARD

Ethan Lawler

GRADUATE STUDENTS

October 2017 Convocation:

<u>**Mathematics**</u>

Iain Beaton, MSc
Amitabh Halder, MSc
Kyle MacKeigan, MSc
Darien DeWolf, PhD
Alanod Sibih, PhD
Shuangquan Xie, PhD

<u>**Statistics**</u>

Esmail Furjani, MSc
Tianshu Huang, MSc

May 2018 Convocation:

<u>**Mathematics**</u>

Michelle Bouthillier, MSc
Adam Forget, MSc

<u>**Statistics**</u>

Jonathan Babyn, MSc

CHAIR'S MESSAGE
By Jeannette Janssen

On June 1, we will celebrate our newly minted graduates and prize winners. A group of talented students will cross the stage to receive their degrees in mathematics, statistics or actuarial science and will go off to apply their acquired knowledge in "the real world". During our Awards Day ceremony, we will have the opportunity to say goodbye, wish them good luck, and also to shine a light on those graduating students that received exceptional honours and scholarships. We will also hand out awards to current students that excelled in some specific way; as always, it was hard to choose between many deserving candidates. I am happy to see such a great group of students. Congratulations on your achievements!

This academic year brought quite a bit of change in our department. **Lam Ho** took up his position as Canada Research Chair (Tier II) in the Statistics division. **Neil Julien Ross** joined the Mathematics division as a (tenure track) assistant professor. Julien is a graduate of this department; he did his PhD studies under the supervision of Peter Selinger and is now joining Peter's research group. **Svenja Huntemann** became an instructor, as well as manager of the Learning Centre, taking over from Pierre Stevens after his retirement last summer. Svenja has been a member of this department for a few years already; she is a PhD student supervised by Richard Nowakowski and Sara Faridi, and she is well-known through her involvement in Math Circles and many other activities. Svenja is graduating this summer and her position will be taken over by **Sarah Chisholm**, another graduate of this department. There also have been some changes in our office. **Jenny Edison** joined us in the summer on a temporary basis. Jenny helped put together the self-study document for our unit review and she has been busy updating our website, putting this Chase report together, and generally helping out. In August, our administrator Queena Crooker-Smith left our department to start a position in the Faculty of Agriculture. **Tanya Timmins** took over her position in September (on secondment from Physics). Tanya joined us at the busiest time of the year, after three nail-biting weeks without an administrator in the office. She has brought a number of good ideas to the department, and a lot of good cheer.

Congratulations to **Theo Kolokolnikov**, who was awarded a Killam professorship this year. Theo is a leading researcher in the area of non-linear dynamics. His work applies to swarm dynamics, pattern formation, and even can be used to model wealth distribution in societies. Congratulations also to **Rob Noble** and **Ammar Sarhan**, who were promoted to Senior Instructor. Finally, kudos to **Joanna Mills-Flemming**, who will be heading a Collaborative Research Team of the Canadian Statistical Sciences Institute (CANSSI), titled "Towards Sustainable Fisheries: State Space Assessment Models for Complex Fisheries and Biological Data." This is the second CANSSI CRT in recent years that is being led by Joanna. In addition, Joanna is heading a research collaboration with the Ocean Frontier Institute at Dalhousie, also focusing on the statistics of fisheries.

This year, the Faculty of Science held a **Unit Review** of our department. As part of this process, we first documented our activities over the last seven years in a sizeable report. The most enjoyable part of preparing this report was to trace our former students and find out where they

are now. It was heartening to see that so many had landed great quantitative jobs, or continued in academia. It was useful and enlightening to take stock of everything going on in teaching, research, outreach and administration, and to look to the future. I thank everyone that contributed to the report. The report submission was followed by an internal review by a committee of faculty members from other departments in the Faculty of Science and another review by an external committee consisting of a mathematician and a statistician from other Canadian universities. I have just received their reports: both committees gave helpful suggestions for improvement, but both started with a glowing endorsement of our department.

Finally, thanks to Maria, Ellen, Tanya and Jenny for their work in keeping the office running, and thanks to Angela for keeping the building clean. Thanks to Balagopal for managing our computing equipment, and congratulations on his added new responsibility of managing computing resources for the Ocean Frontier Institute. Thanks to Mike and Roman, the directors of the Stats and Math divisions, and to all other faculty members who have helped with various administrative tasks and made the Chair's job easier.

MATHEMATICS DIVISION
By Roman Smirnov

We have almost come to the closure of the academic year 2017-18 and this is the time to reflect on what we have achieved during the year and also to acknowledge faculty, staff, students and friends of the Mathematics Division who have contributed to its success, yet again.

This year has been special for the Division in many ways, most notably being the year of the latest unit review for the Department. Unit reviews are conducted on a seven year cycle and are aimed to assess the objectives, priorities, activities and achievements of the Department. All members of the Division participated in the unit review by providing the necessary information about their teaching and research achievements, strategic goals and priorities, as well as meeting with the members of the internal and external unit review committees and participating in various discussions about our plans and ways to further develop and improve the quality of our undergraduate and graduate programs.

Much work has been done to improve the course offerings available to our students. In particular, one of our most popular courses - MATH2030 (Matrix Theory and Linear Algebra I) will be offered as a first-year course listed in the calendar as MATH1030 starting next year. This decision will afford more flexibility and variety for the students interested in taking first-year courses in Mathematics and will affect the course requirements for our programs accordingly. The course has also been substantially revamped (kudos to the members of the linear algebra committee) to offer online assignments, tutorials and a designated "in-house" (free of charge) set of notes which is a revised and extended (by Peter Selinger) version of an open-source textbook. This set of notes will also serve as a textbook for MATH2040 (Matrix Theory and Linear Algebra II).

Also, starting next year, Dalhousie University will no longer offer X/Y courses, which will eliminate two of our calculus courses, namely MATH1000X/Y and MATH1500X/Y. The departmental decision to retire MATH1500X/Y (at least for now) preceded that of the university concerning

the X/Y courses. These two calculus courses were originally introduced to serve very different purposes. The former course was aimed at students who benefited from more time and a slower pace, while the latter course named "The Calculus" was conceived as an enrichment calculus course. MATH1000X/Y will be replaced by a specially designed course "MATH1215 with tutorials." As for MATH1500X/Y, well, we will most certainly introduce a new calculus enrichment course soon enough. The discussions about why we should/should not have an enrichment calculus course enjoy a predictable periodicity with the period of about 7-8 years. For example, here is an extract from the Mathematics Division meeting held on the 15 of June 1995: *"MATH1500: [Discussion only.] Several members have expressed the view that we should re-institute MATH1500. [It is too late to do anything for the next semester but a discussion seems in order.]"* So, stay tuned.

Next year we are bringing back MATH3210 (Introduction to Numerical Analysis) which will further enhance our course offerings in Applied Mathematics.

The Division members, as always, performed strongly in research. Most notably, for the second year in a row, a Division member was awarded a prestigious Faculty of Science Killam Professorship. Last year the award went to Peter Selinger. This year it is Theo Kolokolnikov's turn. This award is a highly competitive mark of distinction, recognizing outstanding contributions to one's field of study.

The Mathematics Colloquium under the leadership of its Chair, Sara Faridi, has been especially active this year, attracting many well-known speakers from around the world. The Division also hosts the

AtCAT, General Relativity and Cosmology, Number Theory and other seminars that are relevant and interesting to people engaged in mathematics research.

We are very excited about welcoming new faculty and staff and working with them. Julien Ross joined the Division this year as a member of the Quantum Computing group. Andrew Irwin will be joining us next year; he is a well-established scholar with broad research interests in Applied Mathematics, Statistics, Oceanography, and Biomathematics. Sara Chisholm will also be joining us next year as the Learning Centre Coordinator whose teaching duties will be mostly in Mathematics. Tanya Timmins joined us last summer as the new Departmental Administrator- she has already established herself as an indispensable member of the team. We also welcome our new part-time office staff member Jenny Edison who has actually edited the document you are reading now. *{True! ☺ JE}*

Keith Johnson and Keith Taylor, two of our most valued and esteemed colleagues have reached the age of retirement and have decided to take this opportunity to continue personal growth starting next year. We will miss them greatly. Dorette Pronk and David Iron will continue working as the Mathematics Honours Coordinator, and the Mathematics Graduate Coordinator respectively next year.

I wish to thank, once again, all of the Division members and our fantastic staff for their continuous help and unfailing support.

STATISTICS DIVISION
By Mike Dowd

The Statistics division had a very successful year! Some of the highlights are as follows:

Dr. Lam Ho, Assistant Professor, received a Canada Research Chair (Tier II) award. *(From the CRC website: **Tier II Chairs**, tenable for five years and renewable once, are for exceptional emerging researchers, acknowledged by their peers as having the potential to lead in their field. For each Tier II Chair, the institution receives {a sum} annually for five years.)*

Dr. Joanna Mills Flemming, Professor, recently received three years of funding for a CANSSI Collaborative Research Team project titled "Towards Sustainable Fisheries: State Space Assessment Models for Complex Fisheries and Biological Data" for which she is the project lead. The inaugural meeting of this CRT will be held in Montreal at CRM just after the SSC Meetings. Joanna has also received three years of funding as project lead for HQP from the Ocean Frontier Institute, as well as an NSERC Engage Plus grant. She was also the team lead for a NSERC Engage Grant project that just finished with Picomole. Grad student Jonathan Babyn was involved with both of these grant projects. Dr. Mills Flemming has been invited to speak at the upcoming SSC Meetings, the CAIMS Meetings and the IBC Conference.

Master's degrees in Statistics were conferred upon Jonathan Babyn, Esmail Furjani, and Tianshu Huang.

New grad students admitted to our MSc program in 2018 were Paul Bjorndahl, Junqiu Gao, Molly Hayes, Ziwei Jin, and Lauren McLennan.

Incoming PhD student Claire Boteler received an NSGS scholarship.
Recent post-doctoral fellows in the department, Marie Auger-Methe and William Aeberhard, have both obtained faculty positions in 2018 (Assistant Professorships) at UBC and Stevens Institute of Technology, respectively.

KILLAM PROFESSORSHIP

Theodore Kolokolnikov

For the second year in a row, a member of the Mathematics Division has been awarded a Faculty of Science Killam Professorship. This year the recipient of this very prestigious award is Dr. Theodore Kolokolnikov. The following is a citation from the nomination letter, prepared by our prize nomination committee, chaired by Alan Coley:

Dr. Kolokolnikov is a leading researcher in the area of nonlinear dynamics, and his research has been both prolific and of the highest level. His papers all appear in the best journals, including 'Proceeding of the Royal Society A'. His achievements have been recognized with research grants. He

was the principal investigator for an AARMS Collaborative Research Group in 2011-13. He won the CAIMS early career award in 2012. Most recently he was awarded an NSERC Accelerator award in 2014.

Congratulations to Theo for this well-deserved distinction!

ACTUARIAL SCIENCE
By Toby Kenney

The Atlantic Students Actuarial Conference was organized by the Dalhousie Actuarial Science Society in Halifax on Saturday, the 24th of March, in particular by students Dave Iruegas and Francis Laing. It was attended by a total of 80 individuals, including 41 students from six different universities, and 11 employers from five companies. It featured talks by prominent local actuaries, the president of the Canadian Institute of Actuaries, and the Manager of Government Relations from the Insurance Bureau of Canada. The main event sponsors were the Canadian Institute of Actuaries, the Society of Actuaries, the Casualty Actuarial Society, the Insurance Bureau of Canada, Eckler, Mercer, Morneau-Shepell, and Sun Life.

Meanwhile, our Actuarial Science program continues to develop in its third year. This year there were two graduates from our program. There are also several students planning to graduate with honours in Actuarial Science in 2019, so we are expecting the program to continue to thrive.

AWARDS DAY SPEAKER
Dr. Angela Siegel

This year's Awards Day speaker is Angela Siegel- a former Dalhousie Math graduate (Ph.D. 2011) who was the Math Circles Director for six years and who also spent time as a sessional instructor teaching second and third year mathematics courses. Dr. Siegel was also a freelance writer for several sailing magazines for just over a year as she crossed the ocean from Washington, D.C. to New Zealand with her family. We thank her very much for coming back to share her experiences with us on Awards Day.

RETIREMENT
Richard Nowakowski

Since retiring in the spring of 2017, Richard Nowakowski has immersed himself in his hobbies, mathematics, dancing and gardening. In August, Mike Fisher (USA) and Carlos Santos (Portugal) visited to work on games. Mathematics also took him to: Calgary in September to visit with Richard Guy; Lyon in October as an Invited Speaker and to work with Eric Duchene and the Lyon CGT group; and New Zealand in February to visit Michael Albert and complete the second edition of their book, "Lessons in Play". Upcoming are trips to Fredericton and Augusta, plus getting his garden in shape for a charity Garden Tour in July.

SCIENCE ATLANTIC REPORT
By Dorette Pronk

Science Atlantic is an organization that provides undergraduate students in Atlantic Canada with opportunities to get together, present their work, and meet faculty from other Atlantic universities.

Each fall there is a math, stats and computer science conference held at one of the Atlantic universities. The conference starts with a math competition and a coding competition. Friday evening features a public lecture and Saturday is filled with research presentations, mostly given by students. It is an excellent opportunity for students to present their summer research and introduce themselves to faculty from other universities. The best presentations are honoured with various awards.

This year, the conference was at UNB, Fredericton, from October 13th-15th. Our department was represented by a large number of both undergraduate and graduate students, as well as a postdoc and some faculty. Jordan Barrett won the Communication Award with his talk on *A Link between Music Theory and Graph Theory*, which was about analyzing various rhythm structures and illustrating his findings with examples from popular music. Marzieh Bayeh's talk on quantum computing was also highly ranked and would have received an award, if she had been a student. Other students from our department that gave talks were Finlay Rankin and James Eckstein.

One of our teams, featuring James Eckstein and Howe Simpson, won second place in the math competition. In this regard, I also want to express a special thanks to Marzieh Bayeh for inviting all students to sit in on her MATH 3790 course to receive competition training.

CAIMS CONFERENCE
By T. Kolokolnikov

The Canadian Applied and Industrial Math Society (CAIMS) conference took place in beautiful Halifax, Nova Scotia, Canada on July 17–21st, 2017. There were around 150 participants, mostly from Canada, but also with a strong international representation, especially from the US (about 20%). The meeting had five themes: data science, industry, fluids, differential equations, and numerical methods. In addition, there were sessions on collective behaviour and stochastics.

The conference featured plenary talks by award winners, including winners of prizes for best PhD thesis, the CAIMS/PIMS early-career research prize (for researchers within 10 years of their PhD), the CAIMS/FIELDS Industrial prize, and the CAIMS research prize. The CAIMS research prize was awarded to James J. Feng. In his prize lecture, he discussed collective motion of cells inside a thin channel. A central question is the following: how can unidirectional motion be initiated and maintained in the absence of any chemical gradients or inertia? Feng and his

students showed, using direct numerical simulations, that such anisotropic motion can be a result of isotropic cell-to-cell interactions as well as interactions with a channel wall, and is initiated spontaneously when there is sufficient cell density.

A highlight of the conference was a public lecture, supported by both CAIMS and AARMS (Atlantic Association for Research in Mathematical Sciences), featuring Chad Topaz, who discussed swarming. It was a very entertaining and lively affair, with public participation in swarming experiments. One of the experiments involved changing the frequency of synchronized clapping by having a select group of participants accelerate the clapping rhythm. That particular experiment was judged "inconclusive", so I hope Chad will have a chance to make further such experiments in the future and report the results here! The lecture was very well received, and it was well attended by the public at large, at least judging by the questions at the end, many with a philosophical bent.

One of the largest themes of the conference was numerical methods, with over 40 talks, although many of them overlapped significantly with other themes, such as DEs and fluids.

Dynamical systems had a particularly large presence, and it also overlapped with multiple themes of the conference. There were many talks on related topics, such as stability and bifurcation of nonlinear waves, dynamics of fluids, asymptotic methods for PDEs, "classical" dynamical systems, nonlinear PDEs, numerical methods for DEs, reaction–diffusion systems, collective behaviour, and stochastics.

The fluid dynamics sessions focused on two areas: the dynamics of thin fluids and geophysical fluid dynamics. Through these two extreme scales of fluids, the talks discussed a wide range of research methods: laboratory experiments, theoretical analysis, and numerical simulations. The research also ranged from fundamental mathematics of understanding singularities in dynamics to the applied problems of particle separation. The sessions came from a range of universities, with speakers from California, Oxford, Edinburgh, and Western Canada.

It was interesting to note that the industry session was dominated by topics related to data science and statistics. At past CAIMS conferences, most of the industrial talks revolved around questions of manufacturing. This year, however, while manufacturing was still one of the main themes, there was a clear trend towards talks on data science. While this may be partly a reflection of the organizers' tastes, the trend towards data science is also a reflection of the trends in society as a whole.

To conclude, CAIMS conference showcased Canada's strengths in applied math, showing its evolution and growth in Canada.

10 YEARS AGO…
(An excerpt from Chase Report 2008)
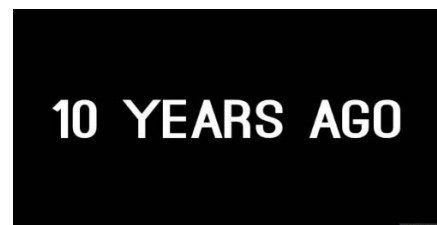
PICTURE THIS! One fine day at the very end of March, our valued colleague, Emeritus Chris Field, came into the office to report the theft of his photograph from

his office door. While this alone would be serious enough to merit a mention in this publication, it is truly puzzling that the thief left behind the (at least!) equally attractive picture of Chris's office mate, Professor Dick Sutherland. Whether it was due to this snub, or rather the Nova Scotia weather, Dick spent the following weeks in Arizona. Meanwhile, office staff are reportedly monitoring e-Bay on a regular basis to see whether Chris' portrait appears for sale, and more interestingly, what the going price will be.

2018 Update: According to Dr. Field, the photo was never located. He'd like to think that an admirer took it as a keepsake, but he rather suspects that it was an unhappy student who wanted it for dart practice!

POSTDOCTORAL FELLOWS

Postdoctoral fellows contribute greatly to the Department's profile by adding their strengths both in research and in teaching. Many return later on to become tenured faculty members in our department.

Here are the postdoctoral fellows of 2017/18.

Marzieh Bayeh:
Marzieh Bayeh just finished a 2-year AARMS postdoc under the supervision of Dorette Pronk. She has been working on equivariant topological complexity. Topological complexity measures the complexity of a space as related to motion planning related questions. Marzieh is extending the theory and constructions for spaces with known symmetry.
She is now starting another postdoc working with Peter Selinger on quantum programming languages. Marzieh is also involved in many departmental activities, including the math club for school age children.
For her Ph.D. work at the University of Regina, Marzieh received the Governor General's Academic Gold Medal for most outstanding academic performance of a graduate student in any discipline.

Lin Jiu:
Lin Jiu joined our department at the end of August of 2017 as a Killam PDF, and has been working with Karl Dilcher. After completing his Ph.D. at Tulane University, he had previous postdoctoral positions in Linz, Austria. Lin has been the organizer of a very active Number Theory Seminar, which will continue throughout the summer and into the following year.

Frank Fu:
Frank Fu is a type theorist who is working with Peter Selinger on dependent type systems for quantum programming. He received his Ph.D. from the University of Iowa and held a previous postdoc position at Heriot-Watt University in Scotland.

Viraj Sanghai:
Viraj Sanghai is an AARMS postdoctoral fellow currently working with Alan Coley in cosmology. Together with Robert van den Hoogen (St.FX) he is helping to organize the upcoming AARMS workshop and Atlantic GR conference in Antigonish.

Kohei Kishida:
Kohei Kishida has been a mathematician, computer scientist, and philosopher. He came to us from the University of Oxford and is currently working with Peter Selinger on modal logics for quantum computing.

Huaichun Wang:
Huaichun Wang has been working with Ed Susko and Andrew Roger (Biochemistry & Molecular Biology) on statistical models for genomic sequence evolution. Huaichun also continues in his role as the statistical consultant for the department.

Alexis Bernadet:
Alexis Bernadet recently finished a 2-year postdoc with Peter Selinger, working on non-idempotent intersection type systems.

Mayada Shahada:
Mayada has been directing the math circles program and otherwise intensively looking at homology of lattices, trying to prove a subadditivity conjecture on the homological degrees.

VISITORS

In addition to our postdoctoral fellows, research visitors also contribute to the department's overall research climate. Once again this year we've had several medium- to long-term visitors from several different countries.

Christophe Vignat of the Université Orsay (France) and Tulane University has been visiting the department since May 8, 2018. He is here to work with Karl Dilcher and Lin Jiu, and will stay until July of this year. This is Christophe's fourth visit to Dalhousie.

Dr. Carlos Santos, Portugal, August 3-9, 2017- Collaboration with Dr. Richard Nowakowski on the analysis of scoring games;

Dr. Michael Fisher, USA, August 9-13, 2017- Collaboration with Dr. Richard Nowakowski on the analysis of the subversion game.

Mina Bigdeli was here twice (June/July and Nov/Dec 2017) to work with Dr. Sara Faridi.

Imran Anwar was here March/April 2018 to work with Dr. Sara Faridi.

Edward Ewing-Wilson (UNB), **David McNutt** (Stavanger) and **David Weir** (Nottingham) visited with Dr. Alan Coley.

MATH KANGAROO CONTEST
By Dr. Lois Murray
(Halifax Regional Representative, Canadian Math Kangaroo)

The 2018 Canadian Math Kangaroo Contest was hosted in classrooms at the Chase Building on March 18th, 2018. In Canada this year, the contest has grown such that there were 50 contest sites across the country at which a total of 6,450 students, enrolled in grades 1 through 12 competed. Here at Dalhousie University there were 88 competitors, representing grades 1 through 11.

I would like to thank **Asmita Sodhi** for her excellent organizational skills, and **Asmita, Fahemeh Bayeh, Fatima Bayeh and Ian MacIntosh** for their generous effort in helping set up the rooms with contest papers and invigilating the students.

The results of the contest are in. Here in Halifax, one Grade 5 student placed third in Canada; four students won National Gold medals; two won National Bronze medals; and 26 other students scored high enough to receive Regional ribbons.

There will be a ceremony for the award-winning students and their supporters early in June to celebrate their successes. Dr. Dorette Pronk has generously offered to present the awards to these students.

THE MATH CHALLENGE CLUBS
By Dorette Pronk

By the end of the 2016-2017 school year, we saw an increase of interest in the Math Challenge Club by younger students who needed a different style of interaction and who needed to be taught about different topics from those students in the higher grades.

So, this fall we decided to have two Math Clubs. The senior club, for grades 7 and up, meets on Mondays from 5 until 7 PM and the junior club, for grades 1-6, meets on Tuesdays from 4:15 till 5:15 PM. Attendance in both clubs has increased significantly over the school year thus far and we currently have 49 students registered for the junior club (although on average about 20 attend each week) and we have 33 students registered for the senior club (with about 25 attending on average).

Both clubs work on problems coming from various math competitions and go over the ways we approach these types of problems. Each week there is a particular technique or topic that is discussed and then there are problems at various levels that the students work on depending on their age and background. Working

together, explaining solutions to each other and encouraging each other, are important goals for both clubs. We emphasize that any student with an interest in mathematics is welcome. We are grateful to acknowledge that a large part of the funding that makes this possible comes from AARMS (the Atlantic Association for Research in the Mathematical Sciences).

Students from both of the math challenge clubs participated in the Math Kangaroo Contest which was held in the Chase Building on Sunday, March 18th. We are grateful to Dr. Lois Murray from the Department of Microbiology and Immunology for organizing this once again! Each year, this contest is one of the highlights for our students and some of the assistants from the math clubs volunteered their time to make sure that it ran smoothly.

Students from the senior club participated in several other contests this year as well. A number of them wrote the Canadian Open Math Contest. Two of our students received a bronze award as Nova Scotia champions. They also received three gold awards and three silver awards for being best in their grade in Nova Scotia. They also participated in a couple of the AMC competitions- winning an award for our region- and they are looking forward to the upcoming team competitions: the Purple Comet Math Contest and the Waterloo Canadian Team Competition. Team competitions bring out the best in our students when they brainstorm together to solve the challenging problems.

Both challenge clubs can only run because of the wonderful group of volunteers that help out each week. For the senior club, our dedicated graduate students were Asmita Sodhi, Fatemeh Bayeh, and Fahimeh Bayeh. Since January, we have also been grateful for the presence and

help of two undergraduate students: Andrew Haydar and Maddie Torres. Because I have been on compassionate leave since January 2018, Asmita has done an excellent job at taking on the leadership of the senior club, teaching the students and facilitating their participation in several contests. Thank you, Asmita! The junior club has received fantastic help from Dr. Mayada Shahada- the Math Circles Director, and Fatemeh and Fahimeh Bayeh. For this winter semester I am very grateful to my colleagues, Jeannette Janssen and Roman Smirnov for taking over the leadership of the club.

Both clubs have also benefited from the work done by our postdoc Dr. Marzieh Bayeh and her MATH 3790 class. This is a class on problem solving, and our first math course to become part of the Science Leadership and Communication Program, hosted by the faculty of science. Students were required to attend the math clubs a couple of times as assistants and lead the club twice. After receiving feedback and giving feedback on each other's presentations, it was clear that both the MATH 3790 students and the students attending the club were learning a lot. All second presentations were really connecting with the students' interests and abilities. Our MATH 3790 students developed both leadership and communication skills through their participation in the math clubs.

I want to take this opportunity to express a heartfelt thank you to all who have helped out with the math clubs this year and especially to the faithful volunteers who have been there every week to engage the students and spark their interest in challenging math problems.

UNDERGRADUATE MATH CONFERENCE

The 2017 Canadian Undergraduate Math Conference was hosted by McGill University in Montreal. Dalhousie's Math and Stats chair, Jeannette Janssen, was a plenary speaker. Her talk was entitled, "The virtual space hidden behind a social network".

Dalhousie students Amir Farrag and Jordan Barrett attended the conference.

This year's Canadian Undergraduate Math Conference will be held at the University of Saskatchewan in July. For more details on the conference, visit **https://cumc.math.ca/2018/**

COMPUTING RESOURCES
By Balagopal Pillai

Several old servers and storage units were retired over the past year. They were virtualized and consolidated to two new servers. This saved on UPS capacity, rack space and cooling.
More courses are now using our webwork assignment server.
The machine room operated without any issues the past year.

STATISTICAL CONSULTING SERVICES
By Huaichun Wang

The Statistical Consulting Service provides professional consultation to researchers and graduate students. The consulting service serves clients both within and outside Dalhousie, including government, hospitals, business and scientific communities.

Over the past year approximately thirty substantial consulting projects were carried out. Example projects include:

1) Analytics of opioid drug misuse in Nova Scotia. Logistic regression models were applied to identify main predictor variables that are strongly associated with opioid misuse (Nova Scotia Department of Health and Wellness)
2) Maximum likelihood inference of forest bird density from observed point count data for (Dr. Cindy Staicer and students, Dept. of Biology)
3) Comparison of different methods that quantify genetic and environmental influences on retinopathy of prematurity (work with Dr. Johane Robitaille, Dept. of Ophthalmology and Visual Sciences, on
4) Linear mixed effects modeling to analyze the effects of gestational weight gain on their child body mass (Emily Burke, Dept. of Medicine);
5) Exploratory and confirmatory factor analyses of nursing surveys (Dr. Evelyn Kennedy, Cape Breton University).

Dr. Huaichun Wang is the current statistical consultant and works under the supervision of Dr. Edward Susko. The consulting office is located on the first floor of the Chase building in Room 115. To make an appointment, call (902) 494-8850 or send an email to scs@mathstat.dal.ca.

BOOKS FOR SALE
By Karl Dilcher
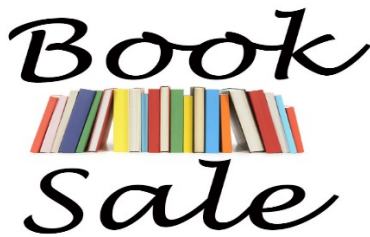
As many department members know, I keep, and have catalogued, a large number of surplus books that have been donated over the years by current and retired faculty members, alumni and departing students. Over the last two years, well over 1000 volumes were sold to mathematicians around the country and dozens more around the world. I was able to donate the sizeable income from these sales back to our department and to the CMS.

About two months ago, another sale was advertised through the CMS, and it was once again quite successful; a couple hundred more volumes were sold to mainly Canadian mathematicians, among them many graduate students. Also, earlier this year, I received two more sizeable donations, and currently about 1500 volumes still remain; they are catalogued at:
http://www.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.

THE CALCULUS OF BOOKS
By Karl Dilcher

Department members will have seen large numbers of elementary textbooks in open shelves around the department- mainly in Room 107, the Learning Centre, and in two packed bookshelves at the north side of the 3rd floor. They are for sale at $3 each and they do sell, slowly but regularly,

adding several hundred dollars a year to the book fund described above.

What is not generally known, and what I announce here for the first time, is that over time I've set aside and catalogued one copy of each edition of each calculus textbook, keeping them hidden in the former library space in the basement of the Chase Building. Without much effort on my part, this collection has grown to about 450 volumes.

Many of them are, of course, different editions of well-known franchises such as Stewart, or Thomas & Finney. But there are also many single-edition textbooks that probably never made a break-through on the textbook market. One can also observe certain trends, for instance the "Reform Calculus" movement, or the use of technology in Calculus, or the emergence of "early transcendental" editions. One can also observe the rapid growth in size and weight of textbooks over the years.

The oldest textbook in the collection, by about 70 years, was published in 1849 (Thomas Tate, "The Principles of the Differential and Integral Calculus. Similified."). One classic in the collection is "Calculus Made Easy" by Sylvanus P. Thompson, originally published in 1910 (we have a reprint of the 3rd edition of 1946). The late Ralph Jeffery, of Queen's and Acadia Universities, after whom the Ralph and Frances Lewis Jeffery Scholarship is named, also wrote a Calculus textbook, published in 1960 (reprinted 1970) with the U of T Press.

Some quirky book titles include "Calculus: It's the Limit", "Calculus. A Search for Meaning", "How to Ace Calculus: The Streetwise Guide", and "Prof. E. McSquared's Original, Fantastic & Highly Edifying Calculus Primer". However,

"The Calculus of Murder" by Erik Rosenthal (St. Martin's Press, 1986) is not part of the collection.

Please let me know if you wish to see the collection. A list of its contents will eventually be posted on the web. Finally, a request: If you have old (or not-so-old) Calculus or any other textbooks, please don't throw them away! Also, please don't put them on the bookshelves or in the Learning Centre, but give them to me first, so I can sort them and possibly add more volumes to the collection.

AARMS REPORT
By David Langstroth

The past year has seen a number of AARMS activities at Dalhousie, including support for the postdoctoral fellowships of Marzieh Bayeh (supervised by Dorette Pronk) and Virag Sanghai (supervised by Alan Coley). We have appointed a new outreach postdoc, Daniele Turchetti, to join us this summer, to be supervised by Sara Faridi. We are very excited to be organizing the first AARMS Industrial Problem Solving Workshop, to be hosted at Dalhousie in July, and workshops in Mathematical Foundations of Programming Semantics, and Quantum Physics and Logic to take place in June. We continue to support local outreach initiatives such as the Dalhousie Math Camp and we are also very pleased, in the last year to have appointed Jeannette Janssen to the position of Chair of the AARMS Board.

THE EUROPEAN GIRLS MATHEMATICAL OLYMPIAD

By Dorette Pronk
(With excerpts of text from
https://cms.math.ca/MediaReleases/2018/
EGMO2018Results)

April 15, 2018: Canada's first-ever team to compete in the European Girls Mathematical Olympiad returned from Italy, medals in hand. EGMO Math Team Canada earned one Silver medal, two Bronze medals and one Honourable Mention.

EGMO Team Canada 2018
(Photo courtesy of Sarah Sun)

The two-day competition got its start in 2012 when it was first written in Cambridge, UK and has since grown to include more than 50 countries. Participation in the EGMO is by invitation only and Team Leader Professor Dorette Pronk (Dalhousie) says the solutions submitted by the Canadian Team were *"The most beautiful' she has seen… that the students were encountering interesting problems with enough time to solve them and really appreciate the beauty in the ideas, fitting, in the environment of beauty and art in Florence."*
Although the EGMO was certainly a competition, it had a different focus than on just medals and placement. The focus was on creating a community of female mathematicians that the participants could draw on in the future. Contestant Anna Krokhine says the competition was *"About community rather than being hostile or competitive, you could really think about interesting mathematics during the week."* The team agreed that although challenging, the competition was also inspiring as they were encountering interesting problems.
Deputy Team Leader Sarah Sun (TD Bank, Data Strategy) says she was encouraged by the performance of the team noting: *"I get the uncanny feeling that I am seeing tomorrow's global leaders today".*
Canada's presence at the European Girls' Mathematical Olympiad was made possible in large part due to the financial support of the University of Waterloo's Faculty of Mathematics for which the Society is very grateful. The Society would also like to acknowledge the Leaders and organizers of the Winter Training Camp who assisted in identifying and training the members of the team. Canada's Team consisted of:

Elnaz Hessami Pilehrood - Silver Medalist - Marc Garneau C. I., North York, ON

Anna Krokhine - Bronze Medalist - University of Toronto Schools, Toronto, ON

Jingzhi Liang - Bronze Medalist - Marc Garneau C. I., North York, ON

Karen Situ - Honourable Mention - University Hill Secondary School, Vancouver, BC

About the European Girls' Mathematical Olympiad (EGMO)

The European Girls' Mathematical Olympiad is an international mathematics competition similar in style to the International Mathematical Olympiad, with two papers taken on consecutive days. Participating countries send teams of four female mathematicians of school age. EGMO 2019 will take place in Kyiv, Ukraine.

About the Canadian Mathematical Society (CMS)

Founded in 1945, the Canadian Mathematical Society (CMS) promotes the advancement, discovery, learning and application of mathematics. The CMS promotes mathematics through a rich array of activities including scientific meetings, publications, awards, prizes, grants, camps and competitions.

Students qualify themselves for placement on Math Team Canada for the EGMO or IMO through their performance on a number of competitions, starting with the COMC, the Canadian Open Math Challenge, which is held each year in November. Students in the Halifax area that are interested in being part of a community of problem solvers and preparing for competitions are welcome at the Dalhousie Math Clubs.

To learn more, please contact Dorette Pronk: Dorette.Pronk@Dal.Ca.

EAST COAST COMBINATORICS CONFERENCE

The 13th ECCC (East Coast Combinatorics Conference) was held May 7-9, 2018 in the Chase Building. There were two plenary speakers, Gary Gordon and Elizabeth McMahon (Lafayette College). Both are highly esteemed researchers in areas of combinatorics. Dr. Gordon gave the plenary talk and Dr. McMahon gave a public lecture on recreational mathematics.

The conference featured contributed talks by faculty, graduate students, and post-docs. The talks filled two and a half full days, with approximately 35-50 attendees. One new aspect this year was two afternoon sessions where the conference participants broke into small groups to work on open problems. The open problems were solicited in advance and disseminated at the start of the conference.

FIBONACCI CONFERENCE
By Karl Dilcher

A joke circulating on the internet states that "This year's Fibonacci conference will be as large as the last two combined". While this is unlikely to be achieved, we do expect about 80 mathematicians from around the world to attend the 18th International Conference on Fibonacci Numbers and Their Applications, which will take place here on campus this summer, from July 1 to July 7.

The scope of the conference is wider than the name indicates; it will be mainly about recurrent sequences of numbers and polynomials, and other special sequences. The Fibonacci conferences have taken

place every second year since 1984, alternating between North America and Europe. This year's conference will continue its egalitarian tradition: There are (almost) no invited talks, and everybody, from student to senior researcher, will have the same amount of time for their talks. Based on past conferences, we expect about 50-60 contributed talks.

The one exception is the "Lucas Lecture", a one-hour special lecture that will be open to the public. This year's Lucas Lecturer is Dr. Hugh Williams, a well-known Canadian researcher on recurrence sequences and their applications in Cryptography. Dr. Williams is also a specialist on the life and work of Edouard Lucas who was most influential in the development of this field of research.

For further information, see https://www.fq.math.ca/fibonacci18/.

The conference is organized by Karl Dilcher and supported by Keith Johnson. The photo shown above is neither of these gentlemen, but is the head of a statue of Fibonacci (a.k.a. Leonardo Pisano) in Pisa, Italy.

NOVA SCOTIA MATH CIRCLES
By Mayada Shahada

Math Circles has continued its success during the 2017/2018 year.
Thanks to the fourth year of funding by Eastlink, we have been able to go on even more trips and create several new presentations for preschool and elementary school levels.
There were a few changes in our team this year. While Dorette Pronk continued as faculty advisor, Mayada Shahada joined the team as director and postdoctoral fellow. Melissa Huggan continued to be the

assistant director. With partial support from the department, Abdullah Al-Shaghay, Evangelia Aleiferi and Iain Beaton were full year teaching assistants while Maryam Ehya and Ethan Lawler held a partial teaching assistantship in the fall. Our casual presenters for this year were Ben Cameron, Curran Cameron, Corey DeGagne, Maryam Ehya, Marie B.Langlois and Asmita Sodhi.

As it is every year, our fall term was very busy. We had our usual week-long trips to the Tri-County Regional School Board and Cape Breton along with an average of three local trips per week as well. We were lucky this year to have a reasonably nice winter that kept us busy during the winter term as well.

As of early May, we have outreached nearly 6500 students and given 241 presentations at 42 different schools in five different school districts. We still have three trips per week planned for the rest of May and June.

In addition to school trips, we visited the homeschooling group in Dartmouth and the Generation 1 Leadership Initiative group. In October, we had a table at the annual NS Math Teacher Association Conference to advertise our program.

Dalhousie Math Discovery Days were held in the Learning Centre on April 25th, 26th and 27th. We ran six sessions during these days and over 200 students solved mysteries, learned some card tricks, created artwork and enjoyed a snack break.

Our ten monthly events this year attracted between 40 and 60 participants including students, parents, and teachers. At these events, faculty members from our department (Dorette Pronk, Richard

Nowakowski and Robert Milson) volunteered to give very engaging talks. We also had/will have guest presenters, namely Danielle Cox, David Wolfe and Erick Lee. The other months were filled with activities organized by presenters from our team and by our graduate students (Asmita Sodhi, Svenja Huntemann, Marie B. Langlois, Ben Cameron and Mayada Shahada). This year, the director gave/will give a hands-on presentation in Truro Campus. We aim to extend this next year and schedule similar events at the Dalhousie Campus in Truro.

Math Circles also participated in the AARMS Girl Guides Outreach event in UNB at Fredericton over May 12th and 13th. The program director, Mayada Shahada and the program faculty advisor Dorette Pronk ran three sessions for 73 girl guides, pathfinders and rangers. On May 12th, Mayada Shahada participated in the evening panel at the event. She introduced and talked about the Math Circles program at Dalhousie.

For the summer, we are planning to hold the first Math Circles Camp Day in July. We are also creating new hands-on presentations for preschool and elementary school levels covering curriculum outcomes as well as general mathematical skills. Besides these presentations, we are planning to design university preparation presentations for grade 12 students to help them understand what to expect in a first year mathematics course.

MATH CIRCLES EVENTS
Organizer: Svenja Huntemann

Jun 8, 2017: Svenja Huntemann
Topic: Numeral Systems

Sept 27, 2017: Asmita Sodhi
Topic: A Mathematical Mystery Tour

Nov 16, 2017: Dr. Danielle Cox
Topic: Ready, SET, go!

Dec 13, 2017: Dr. Dorette Pronk
Topic: A Mathematical Art Show

Jan 31, 2018: Dr. Richard Nowakowski
Topic: Mathemagic

Feb 21, 2018: Dr. David Wolfe
Topic: Top-Down Induction

Mar 21, 2018: Dr. Robert Milson
Topic: Proportional Games and Magic Numbers

Apr 11, 2018: Marie B.Langlois and Ben Cameron
Topic: Radical Relay 2018

May 10th, 2018: Mayada Shahada (Dalhousie Agriculture Campus-Truro)
Topic: Algebra is a Powerful Tool

May 16, 2018: Erick Lee (HRSB)
Topic: Math Party!

MATH CAMP 2017 REPORT
By Dr. R.P. Gupta

The Dal-BEA Math camp for Black Students was held July 9-15, 2017. Twenty Nine campers from junior high schools all over Nova Scotia attended the camp.

On Sunday, July 9, 2017, parents brought their campers to Shirref Hall, where registration and a reception outlining expectations and responsibilities were held. The campers stayed all week in Shirref Hall under the supervision of four

chaperones- Kyiasha Benton, Nzingha Millar, Cody Higgins and Joshua Lunda.

Weekday mornings and two afternoons were devoted to academic teaching. The instructors were: Gerry Clarke, Sunita Pinet, Preman Edward and Jordan Barrett. The instructors of the Math classroom and the Computer Science classroom worked together to create the curriculum. In the Mathematics classroom students were taught via lectures, student-led discussions/activities/partner work, group work, games and independent discovery.

Throughout the week the students were introduced to new topics as well as building on topics and ideas that they had been introduced to throughout the school year. In the Computer Science classroom, we introduced the students to topics that they will later use to program and subsequently simulate or graph. These topics included playing the games 10 and NIM, where students discussed strategies on winning and looked at the mathematics behind the simple games that they play. Also, students were introduced to the Fibonacci sequence via a hands-on activity using the mating rituals of enclosed rabbits, thus allowing them to think about when they use mathematics in their everyday life and how use of mathematics is important when thinking logically and solving problems. The teachers also enhanced the educational experience by giving the students information that would help them in the upcoming school year.

On the Monday afternoon, the campers visited the Museum of Natural History and, in the evening, a career night presentation was given by Kaya Sparks- a CBC reporter, Ms. Cinera States- a graduate from Dalhousie Medical School and Tundy Belogun- a Kings College student studying journalism. They discussed the importance of education and the vital role mathematics plays in the business world. The campers were very focused and engaged at the presentation and the Q&A session was amazing. On Tuesday, Campers went to the Black Cultural Centre. The highlight of this outing was a historical presentation of the arrival of Blacks to Nova Scotia by Mr. Ken Fells. On Wednesday afternoon, they went bowling. On Thursday night, the students were given a tour of the Discovery Centre where they engaged in several science experiment activities. On Friday, the closing ceremony took place and prizes and certificates were distributed. Many campers openly discussed the benefits they received by attending this camp. The students finished off their camp week with a relaxing time at Dalplex where they played volleyball and other sports and then had a nice swim.

DALHOUSIE-CMS MATH CAMP
July 9-14, 2017
By Roman Smirnov

As always in July, last year the Department of Mathematics and Statistics at Dalhousie University was organizing and co-hosting the math camp, whose goals were to identify, stimulate and encourage mathematical talent among Nova Scotia high school students. The camp was jointly sponsored by the AARMS, Dalhousie University and the Canadian Mathematical Society. It consisted of lectures and problem-solving sessions conducted by faculty and graduate students from Dalhousie, Mount Saint Vincent and Acadia Universities and also included extracurricular activities which were held at Dalhousie and Acadia Universities.

Last year's math camp was organized by Caroline Cochran, Marie-Andree B Langlois and Roman Smirnov. The

following faculty and graduate students volunteered to speak at the camp: Ben Cameron, Caroline Cochran, Alan Coley, Danielle Cox, Karl Dilcher, Svenja Huntemann, Marie Andrée B. Langlois, Richard Nowakowski, Keith Taylor, and Holger Teismann.

The students were chaperoned by Dario Brooks and Emma Carline. Last, but not least, our great staff, Queena Crooker-Smith, Maria Fe Elder, Balagopal Pillai, and Ellen Lynch did a fantastic job, while helping us to organize the camp.

This year's upcoming math camp is being organized by Caroline Cochran, Roman Smirnov, and Asmita Sodhi. It is co-sponsored by AARMS, Canadian Mathematical Society and Dalhousie University. One day of the camp will be held once again at Acadia University. We encourage you to think about contributing to the camp as a volunteer speaker.

CMS SUMMER MEETING
By Karl Dilcher

Our department has always had a strong presence at most CMS Meetings, with department members and alumni almost always being among the speakers and/or session organizers. However, this year's Summer Meeting, to be held at UNB Fredericton from June 1 to June 4, will likely mark a record, possibly (but not necessarily) outdone only by meetings that took place here on our campus.
I counted 11 department members and 7 alumni/alumnae (whose names I recognized as such) among the speakers, two of them with multiplicity 2. Also noteworthy is the fact that among these 18

speakers there is a perfect gender balance.

But that's not all: Six special sessions at the conference are being organized by department members and/or alumni, adding one more faculty member and five alumni to the list of those who are actively involved in this CMS Meeting.

The only drawback of all this is the fact that this very strong Dalhousie presence will likely cut into attendance at the June 1 convocation and Awards Ceremony, as the CMS meeting begins later that day.

The following department members are among the invited speakers:
Evangelia Aleiferi, Marzieh Bayeh (twice), Karl Dilcher, Michael Lambert, Melissa Huggan, Svenja Huntemann, Lin Jiu, Theodore Kolokolkinov (twice), Richard Nowakowski, Dorette Pronk, and Asmita Sodhi.

Our alumni who will speak at the conference are:
Danielle Cox (MSVU), Darien DeWolf (St.FX), Shannon Ezzat (Winnipeg), Stephen Finbow (St.FX), Shannon Fitzpatrick (UPEI), Neil McKay (UNB-SJ), and Rebecca McKay (UNB-SJ).

The following special sessions are organized by department members and/or alumni:
-- "Active Learning in Undergraduate Mathematics Classrooms":
Caroline Cochran (Acadia), Danielle Cox (MSVU).
-- "Categories and Topology": Darien DeWolf (St.FX), Dorette Pronk (Dal).
-- "Combinatorial Game Theory": Svenja Huntemann (Dal), Neil McKay (UNB-SJ) and Rebecca Milley (MUN).
-- "Computational and Diophantine Number Theory": Mike Bennett (UBC Vancouver),

Keith Johnson (Dal).
-- "Graph Searching & Pursuit-Evasion Games on Graphs": Danielle Cox (MSVU), Chris Duffy (U of S).
-- "Representation theory of algebras and related topics": Colin Ingalls (UNB-F).

Finally, it should be mentioned that the current CMS President (Mike Bennett) and one of the conference's Scientific Directors (Colin Ingalls) are alumni of our department, while the current CMS Vice President Atlantic is our colleague Sara Faridi.

Further information on the CMS Summer Meeting can be found at
https://cms.math.ca/Events/summer18/

DMSGSA REPORT
By Ethan Lawler

This year's executive committee for the Dalhousie Mathematics and Statistics Graduate Student Association consisted of the following members: Ethan Lawler, President; Jonathan Babyn, Vice-President Internal; Marie B. Langlois, Vice-President External; Jordan Barrett, M.Sc. Math representative; Tom Potter, Ph.D. Math representative; Lauren McLennan, M.Sc. Stat representative. (The Ph.D. Stat representative was unfilled.)

As a society, we celebrated the end of each semester with a dinner; at the Auction House to close out the summer, Your Father's Moustache for the fall, and the Wooden Monkey for winter. We also held a number of smaller events such as going to Clay Café for pottery, playing board games at the Board Room Game Café, coffee at Smiling Goat, a Hungarian movie night at Dal, and more. We also continued hosting exam review sessions for first and second year courses during midterms and finals.

ACTUARIAL SCIENCE SOCIETY

President: David Iruegas
(Write-up unavailable at time of printing)

THE UNDERGRADUATE MATHEMATICS AND STATISTICS SOCIETY (DUMASS)

President: Lindsay MacCormick
Vice President: Morgan Garnier
Treasurer: Alison Patterson
Secretary: Madi Moffat-Wild
Communications: James Eckstein
DSS Reps: Finlay Rankin and Mason Maxwell

(Write-up unavailable at time of printing)

CanaDAM 2017

The 6th biennial Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM) was held on June 12-15, 2017 on the Toronto campus of Ryerson University.
Our Ph.D. student Ben Cameron gave a talk called "On the Unimodality of Independence Polynomials of Very Well-Covered Graphs"

MATHEMATICS COLLOQUIUM
Organizer: Sara Faridi

Each year, the Mathematics Colloquium features an interesting mix of talks from many areas of mathematics. I would like to

thank all members of the Chase community who suggested speakers for this year's colloquium.
The speakers were:

Jun 5, 2017:
Dr. Dave Touchette (Perimeter Institute)
Quantum information complexity.

Jun 6, 2017:
Dr. Marzieh Bayeh (Dalhousie)
A mathematical journey: From Equivariant LS-Category to Quantum Computing

Jun 7, 2017:
Dr. Julien Ross (University of Maryland)
Mathematical Methods in Quantum Circuit Theory

Aug 21, 2017:
Robin Cockett, University of Calgary
A Restriction Categorical Hike

Sep 7, 2017:
Dr. Andrew J Irwin (Mount Allison University)
Modeling Microbial Biogeography in a Dynamic Ocean

Sep 21, 2017:
Dr. Mayada Shahada (Dalhousie)
Relationships Between the Canonical Ascending and Descending Central Series of an Associative Algebra Combinatorial Method Using the Verbal and Marginal Properties of Associative Algebras

Oct 12, 2017:
Lin Jiu (Dalhousie University)
Visualization of Bernoulli Numbers

Oct 19, 2017:
Federico Galetto (McMaster University)
Distinguishing k-configurations

Nov 20, 2017:
Julia Gordon (UBC/ Cornell University)
Volumes, and counting almost-isomorphic things

Nov 30, 2017:
Mina Bigdeli (Institute for Research in Fundamental Sciences, Tehran)
A gentle introduction to Isotonian Algebras

Dec 14, 2017:
Dennis The (University of Tromso, Norway)
Exceptionally simple PDE

Jan 15, 2018:
Roman Smirnov (Dalhousie)
Towards a new paradigm for mathematical modelling of economic growth

Jan 29, 2018:
Judith Packer (University of Colorado)
Wavelets associated to representations of graph C*-algebras
Feb 5, 2018:
Anthony Bonato (Ryerson)
The new world of infinite random geometric graphs

Mar 1, 2018: Adam Van Tuyl (McMaster University) *Studying graphs using commutative algebra and combinatorial algebraic topology*

Mar 8, 2018: Kuei-Nuan Lin (Penn State University, Greater Allegheny) *Blow up algebras of monomial ideals*

Mar 15, 2018: Kohei Kishida (Dalhousie University) *Probability and Topology of Quantum Non-Locality and Contextuality*
Mar 19, 2018: Alex Kasman (College of Charleston) *On the Duplexing of DNA's Genetic and Geometric Codes*

Mar 26, 2018: Imran Anwar (Abdus Salam School of Mathematical Sciences) *Ancient Greek Conjectures on Constructible Length*

Mar 29, 2018: Sanjeev Seahra (UNB) *Einstein's ripples: listening to the violent universe with waves of gravity*

Apr 2, 2018: Stephanie A. Dick (University of Pennsylvania) *After Math: Reasoning, Proving, and Computing in Postwar United States*

Apr 5, 2018: Peter Selinger (Dalhousie) *Number-Theoretic Methods in Quantum Computing*

Apr 12, 2018: Ram Murty (Queen's University) *The Central Limit Theorem in Algebra and Number Theory*

Apr 19, 2018: Tai Ha (Tulane University) *Combinatorial structures through algebraic lenses*

SPECIAL STATISTICS SEMINAR
By Chris Field

Sep 12, 2017:
In September 2017, Professor **David Bellhouse** of Western University visited Dalhousie as part of the Statistical Society of Canada's celebration of Canada's sesquicentennial. Professor Bellhouse has carried out extensive studies of the history of Probability and Statistics. He presented a well-received lecture to a large audience entitled "150 Years and More of Data Analysis in Canada".

STATISTICS COLLOQUIUM

Oct 12, 2017:

Paul McNicholas (McMaster University) *Clustering Via Mixture Models*

Oct 30, 2017:
Ed Susko (Dalhousie University) *Bayes factor biases for non-nested models and corrections*

@CAT SEMINAR 2017-2018
Organizer: Robert Paré

July 11, 2017
Soumen Sarkar (Indian Institute of Technology Madras, Chennai), *On integral cohomology of toric orbifolds*

September 12, 2017
Kohei Kishida (Dalhousie), *Non-Locality, Contextuality, and Topology*

September 19, 2017
Geoff Cruttwell (Mount Allison), *Calculus via functors and natural transformations*

September 26, 2017
Frank Fu (Dalhousie), *Encoding Data in Lambda Calculus: An Introduction*

October 3, 2017
Geoff Cruttwell (Mount Allison), *Geometric spaces in a tangent category*

October 10, 2017
Marzieh Bayeh (Dalhousie), *Higher Topological Complexity*

October 17, 2017
Geoff Cruttwell (Mount Allison), *The rich structure of affine geometric spaces*

October 24, 2017
Darien DeWolf (Saint Francis-Xavier) *Restriction bicategories: two approaches*

October 31, 2017
Dorette Pronk (Dalhousie), *On Suborbifolds*

November 14, 2017
Francisco Rios (Dalhousie), *On Categorical Models of Intuitionistic Linear Logic*

November 21, 2017
Marzieh Bayeh (Dalhousie), *A lambda calculus for quantum computation*

January 9, 2018
Bob Paré, *Introduction to double categories*

January 16, 2018
Bob Rosebrugh (Mount Allison), *Symmetric lenses and cospans*

January 23, 2018
Bob Paré (Dalhousie), *Kleisli double categories*

January 30, 2018
Michael Lambert (Dalhousie), *Flat Category-Valued Pseudo-Functors*

February 6, 2018
Frank Fu (Dalhousie), *An introduction to initial algebraic semantics for data types*

February 13, 2018
Marzieh Bayeh (Dalhousie), *Type inference for quantum lambda calculus*

February 27, 2018
Julien Ross (Dalhousie), *Quantum magic games*

March 6, 2018
Evangelia Aleiferi (Dalhousie), *Involutive Structures on Cartesian double categories*

March 20, 2018

Xiaoning Bian (Dalhousie), *Relations for Clifford+T operators on two qubits*

March 27, 2018
Fahimeh Bayeh (Dalhousie), *A Categorical Model of Linear Logic*

April 3, 2018
Francisco Rios (Dalhousie), *Typed Calculi, Constructive Logics, and Categorical Models: The Intuitionistic Linear Logic Case*

NUMBER THEORY SEMINAR
Organizer: Lin Jiu

Sep 15, 2017: Christophe Vignat (Université d'Orsay and Tulane University) *Finite generating functions for the sum of digits sequence*

Jan 22, 2018: Lin Jiu (Dalhousie) *Introduction to Zonal Polynomials*

Jan 29, 2018: Marie-Andrée B. Langlois (Dalhousie) *Introduction to Integer Valued Polynomials*

Feb 5, 2018: Karl Dilcher (Dalhousie) *On the polynomial part of a restricted partition function*

Feb 12, 2018: Asmita Sodhi (Dalhousie) *Integer-Valued Polynomials on 3×3 Matrices*

Feb 26, 2018: Lin Jiu (Dalhousie) *Hidden Walks*

Mar 5, 2018: Abdullah Al-Shaghay (Dalhousie) *Irreducibility and Roots of a Class of Polynomials*

Mar 12, 2018: Michelle Bouthillier (Dalhousie) *Representations of Epitrochoids and Hypotrochoids*

Mar 19, 2018: Keith Johnson (Dalhousie) *Some open problems about Bhargava's "p"-orderings of finite sets*

Mar 26, 2018: Marie-Andrée B. Langlois (Dalhousie) *Building 3-Variable Homogeneous Integer-valued Polynomials Using Projective Planes*

FACULTY OF SCIENCE SPECIAL EVENTS:

March 8, 2018: Erik Demaine **"The Art & Science of Origami"**

200 Circles by Erik Demaine- Dal alumnus (BSc'95), artist and MIT Professor:
Erik is a Professor in Computer Science at the Massachusetts Institute of Technology. Demaine's research interests range throughout algorithms, from data structures for improving web searches to the geometry of understanding how proteins fold to the computational difficulty of playing games. Identified as a child prodigy at 7 years old, Erik graduated from Dalhousie at the age of 14 and later became the youngest professor ever hired at the Massachusetts Institute of Technology (MIT). His artwork is featured in New York's Museum of Modern Art and the Renwick Gallery in the Smithsonian. The Faculty of Science was honoured to welcome Erik back to campus on March 8, 2018 to unveil a one-of-a-kind curved-

crease sculpture created in celebration of Dalhousie's 200th anniversary. Erik and Martin are well-established origami artists who let mathematics and computer science guide their approach to the craft.

Aptly named *200 Circles*, the sculpture uses a montage of pages from <u>The Lives of Dalhousie University Volume One</u>, written by Dal historian P.B. Waite.

(Photo credit: Danny Abriel)

200 Circles will be on permanent display in the heart of the Wallace McCain Learning Commons, a student-centric space on Studley campus.

MATHEMATICS HONOURS SEMINAR
Organizer: Dorette Pronk

This seminar serves the dual role of featuring talks by faculty geared towards an undergraduate audience, and giving honours students the opportunity to give talks on their honours projects.

FACULTY TALKS:

June 15-16, 2017: Field Institute [14th Workshop on Algorithms and Models for the Web Graph (WAW2017)], Toronto *Recognizing graphs formed by a spatial random process*

September 27, 2017: Jeannette Janssen
The Virtual Space Hidden Behind a Social Network

October 4, 2017: Alan Coley *Open Questions in Mathematical Physics*

October 11, 2017: Karl Dilcher *An Old Sequence that Counts*

October 18, 2017: Julien Ross *Topics in Quantum Compiling*

October 25, 2017: Genevieve Boulet {faculty (MSVU)} *Make a Difference: Be a Math Teacher*

November 1, 2017: Keith Taylor *The Wavelets Revolution*

November 15, 2017: Theodore Kolokolnikov *Agent-based Models Exhibiting Spatial Aggregation*

November 21, 2017: Peter Selinger *The Dynamics of Pythagorean Triples and Quadruples*

November 29, 2017: Roman Smirnov *The Cobb-Douglas Function Revisited*

January 17, 2018: Jason Brown *The Roots of Combinatorial Polynomials*

January 31, 2018: Rob Milson *Classical Orthogonal Polynomials*

February 7, 2018: Peter Selinger *The Potrace Algorithm*

February 14, 2018: Karl Dilcher *Much Ado About Nothing: Zeros of Polynomials*

STUDENT TALKS:

January 24, 2018: Amir Farrag
Introduction to Supervised Learning with an Application to Health Science

February 28, 2018: Luke MacLean
An Introduction to the Reconstruction Conjecture

March 7, 2018: Finlay Rankin
The Calderon Reproducing Formula in Dimension Three

March 21, 2018: Yi Shi *Graphical Properties of Transportation Networks*

March 28, 2018: Naveen Khanduri
Dynamical System Analysis of the Exponential Quintessence Model

April 4, 2018: Jiaye Chen
A Simple Model for Wealth Distribution

April 11, 2018: Neyousha Shahisavandi
Node Reliability of Undirected Graphs

VISITING SPEAKERS

September 12, 2017: David Bellhouse
Title: "150 Years or More of Data Analysis in Canada"
(This was a special initiative of the Statistical Society of Canada to celebrate Canada's 150th birthday. David also gave other presentations at several locations across the country. The lecture was held in the Charles Tupper Medical Building and light refreshments were served afterward.)

July 18, 2017: Chad Topaz (A.B. Harvard, Ph.D. Northwestern)
Title: Swarms, Models, and the Unreasonable Effectiveness of Mathematics

UPCOMING EVENTS

Organized by Peter Selinger and Julien Ross, both the 15th International Conference on Quantum Physics and Logic (QPL 2018, June 3–7) and the 34th Conference on the Mathematical Foundations of Programming Semantics (MFPS 2018, June 6-9) will take place at Dalhousie. Julien Ross will be giving a talk entitled *"Proto-Quipper: A circuit description language for quantum computing"* at both events.