DALHOUSIE UNIVERSITY

CHASE REPORT

Department of Mathematics and Statistics

June 2019

CONGRATULATIONS TO OUR 2018 - 19 AWARD WINNERS!

Sir William Young Gold Medal in Mathematics
Alex Christie

University Medal in Statistics
Renny Doig

University Medal in Actuarial Science
Renny Doig

Ralph & Frances Lewis Jeffery Scholarship
Alex Christie & Curran McConnell

Barry Ward Fawcett Memorial Prize
Sarah Li

Ken Dunn Memorial Prize
Christy Sabu Zacharia

Katherine M. Buttenshaw Prize
Jeremy Peters

Waverly Prize
James Munday

Emil and Stella Blum Award in Mathematics
Yeping Wang

Ellen McCaughin McFarlane Prize
Kieran Bhaskara

Professor Michael Edelstein Memorial Graduate Prize
Corey DeGagne

Heller-Smith Scholarship
Claire Botelier

Field Prize in Statistics
Mengyao Wang

R.P. and Kamla Gupta Scholarship
Renjie Peng

Arnold and Beatrice Tingley Memorial Scholarship
Adam Lucas

Erma Geddes Fillmore Memorial Scholarship
Xiaoyu Jia

OCTOBER 2018 CONVOCATION:

Honours Degree Recipients - Statistics
Sean Cao

Master's Degree Recipients - Mathematics
Jordan Barrett - MSc
Alan Shi – MSc

Master's Degree Recipients - Statistics
Afaf AlZahrani - MSc
Mingzhu Wang - MSc

Doctor of Philosophy Recipients - Mathematics
Evangelia Aleiferi - PhD
Marie Andree Langlois - PhD
Svenja Huntemann - PhD

MAY 2019 CONVOCATION:

Honours Degree Recipients – Mathematics
Mason Maxwell
Cuiting Zhong (with Actuarial Science)
Owen Zhang (with Computer Science)
Curran McConnell (with Contemporary Studies)
Alexander Christie (with Statistics)

Honours Degree Recipients – Statistics
Mengyao Wang
Renny Doig (with Actuarial Science)
George Wang (with Economics)

Honours Degree Recipients – Actuarial Science
Fu Xi Wu (with Statistics)

Master's Degree Recipients - Mathematics
Emma Carline – MSc

Doctor of Philosophy Recipients - Mathematics
Ben Cameron – PhD

Doctor of Philosophy Recipients -Statistics
Stuart Carson – PhD

KILLAM RENEWALS
Ethan Lawler
Kim Whoriskey

CHAIR'S MESSAGE

By Bruce Smith, Acting Chair

Congratulations to all of our graduates! Convocation Day is a special time to celebrate your hard work and achievements. Special congratulations to those of you who have been recognized through receipt of honours and awards.

Congratulations:

- To Andrea Fraser, who is the recipient of the Canadian Mathematical Society's Excellence in Teaching Award (See write-up below.)
- To Keith Taylor, who is the recipient of the Canadian Mathematical Society's Graham Wright Award for Distinguished Service (See write-up below.)
- To Ammar Sarhan, who was appointed to University Teaching Fellow in fall, 2018. This well-deserved appointment recognizes Ammar's substantial contributions to teaching and curriculum development in Statistics, from first year through graduate level.
- To Roman Smirnov, who will shortly receive the Dalhousie long service award for his 15 years of service.
- To Theo Kolokolnikov, Richard Nowakowski, and Ed Susko on the successful renewal of their NSERC Discovery grants. Special congratulations to Joanna Mills Flemming, who in addition to the renewal of her Discovery grant, received an NSERC Accelerator Supplement, recognizing her leadership in the statistical analysis of fisheries stocks and catches, which is having substantial impact on fisheries management in Canada and abroad. (See write-up below.)
- To Jin Yue (Dalhousie PhD Mathematics and MSc Statistics) who was the 2019 honorary Barley Ring recipient of the Faculty of Agriculture (https://www.dal.ca/faculty/agriculture/newsevents/news/2019/04/09/dr__jin_yue_receives_honourary_barley_ring.html) which recognizes Jin's many outstanding contributions to the Faculty.

Curriculum/Program News

We have a number of initiatives underway for expansion of our 2+2 programs. In these programs, students do the first two years of their degree at their home institution, and complete years 3 and 4 at Dalhousie. We currently have 2+2 agreements in Statistics, Mathematics, and Actuarial Science with the Shandong University of Finance and Economics (SDUFE), and we are working to expand our opportunities there. In the list of Award winners, you will see that Renjie Peng, who came to the 2+2 program in Statistics this past September, is the inaugural recipient of the R.P. and Kamla Gupta Scholarship in Statistics. Congratulations, Renjie. Dalhousie and SDUFE have developed a proposal for a direct entry program in Statistics/Data Science, which, if approved, would substantially increase the number of students coming to Dalhousie. I visited SDUFE in March to finalize details of the proposed program, which is under currently review by the

Chinese government. A delegation led by Provost and Vice President Academic Zuosheng Han visited Dalhousie April 18 to sign a five year extension of the very successful 2+2 program in Economics, and Jeannette Janssen and I had an opportunity to meet with the group to discuss the Statistics/Data Science proposal.

On April 23, a second delegation from SDUFE, led by Dean Yan Qingyue of the School of Insurance, was at Dalhousie to discuss opportunities for expansion of our 2+2 cohort in Actuarial Science. Toby Kenney gave the group an overview of our degree program in Actuarial Science, including recent and planned curriculum changes. Details of the visit were organized by Shannon Peng, Dalhousie's China Program Coordinator. Shannon was assisted by student Yunzheng Zhang, who came to Dalhousie from SDUFE last September, as a 2+2 student in Actuarial Science. Thanks, Shannon and Yunzheng, for organizing this visit.

We are working on a 2+2 agreement in Actuarial Science with Bermuda College. Bermuda College offers primarily two year Associateship programs, including a two year Associateship in Actuarial Science, with students from that program often going elsewhere to complete a degree. There have been a number of Bermuda College students finish their degrees at Dalhousie in past, including some in our Department. A notable example is Maximillian Kehrli (BSc Major in Mathematics and Statistics, 2010), who is now a Fellow of the Casualty Actuary Society, and Assistant Vice President of Hamilton Re(insurance) in Bermuda. Given the past flow of students between the institutions, and the fundamental role that the financial industry, including actuarial science, plays in the economy of Bermuda, we believe that a formal 2+2 program in Actuarial Science will be beneficial to both Dalhousie, and to students from Bermuda College.

We are in preliminary negotiations with the Southwest University of Finance and Economics in Chengdu, China, for a 2+2 program in Actuarial Science. The private insurance industry in China is in a period of dramatic expansion, and there is tremendous demand there for Actuaries, and professionals trained in other aspects of Mathematical Finance. Among his many attributes, President Zhuo Zhi of SWUFE is an Associate of the Society of Actuaries, and so he has personal insight into opportunities for students trained in Actuarial Science, and the formal requirements for attaining Associateship or Fellowship in the Society of Actuaries. President Zhou held the same position at SDUFE when we developed our current 2+2 programs in Actuarial Science, Mathematics and Statistics with that institution, and we are delighted that he is leading the initiative for this 2+2 program between Dalhousie and SWUFE.

Comings and Goings

Four individuals have joined the Department since our 2018 Awards Day. Ann Bannon began her role as Department Administrator in the spring of 2018. Ann has held a number of positions at Dalhousie, and has been an Administrator with the Faculty of Science since 2011. Sarah Chisholm began her role as Instructor and Learning Centre Coordinator this past summer as well. Sarah has come home to Halifax, having done her first degree- a BSc with Honours in Mathematics- at Dalhousie.
Andrew Irwin has joined us from Mount Alison University, where he was previously Professor and Chair. The move to Dalhousie was a family affair, with Andrew's spouse, Zoe Finkel, having taken a position in the Department of Oceanography.

Kasia Wolkowicz has just this week joined the Department, in the role of Financial Assistant. Kasia comes to us from the Department of Community Health and Epidemiology at Dalhousie.

Welcome Ann, Sarah, Andrew and Kasia.

Keith Johnson will retire on July 1st, 2019 from a distinguished career in Mathematics at Dalhousie. (See write-up below.)
The retirement will be in name only, as Keith will continue to be active in research and graduate supervision.

We are currently in the process of hiring an individual through the Dalhousie Diversity Faculty Award program. These positions are not easy to secure, and we owe substantial debt to Jeannette Janssen for her efforts in obtaining this position for the Department. An offer has been sent out and negotiations are underway, with a tentative start date of July 1st.

Approval has also been obtained from Faculty of Science for a tenure stream Assistant Professor position with a start date of July 1, 2020. We will begin the search process for this faculty member in early fall.

Social Events

Thank you to Julia and Keith Taylor, who organized a potluck dinner for faculty, families, and others on February 8th. The event was very well attended. I have a personal anecdote that illustrates the benefit of these kinds of social activities. In casual conversation with my spouse, Deborah, Keith mentioned that Julia grew up in McGrath, Alberta. Deborah replied that her grandparents Zelpha and Burt Dow taught elementary school in McGrath. Much discussion with Julia ensued, and she indicated not only that Zelpha had been her grade one teacher and Burt the school principal, but even had class photos to prove it! This was the first time that Deborah had met someone whom her grandparents had taught. It was very exciting for her.

Thanks to Roman Smirnov, who organized a Department Social Committee, and planned a first social event at the Faculty Club on April, 15 to formally welcome Sarah, Andrew Irwin, and, belatedly, Lam Ho, who joined the Department in 2017.

Thanks to the many individuals - students, staff, and faculty – who are responsible for the diverse activities of our department; to Angela for her impeccable upkeep of our building; and to Balagopal, Pillai who keeps us on top technologically.

Special thanks to Ann, Ellen, Jenny and Maria, for keeping me on track as much as possible, and for making my year to date as Acting Chair such a pleasant one.

MATHEMATICS DIVISION

By Roman Smirnov, Director

This has been a fantastic year for the Mathematics Division.

Our collective achievements and contributions to academia, including research, teaching, administration and outreach, have been commended and recognized at all levels, which is attested by many articles in this year's Chase Report. I wish to congratulate all of our students - the ones who are graduating this year, as well those who have just finished their exams and are looking forward to the next academic year.

Now, I wish to thank all members of this Division and our support staff for doing such a great job and being unselfish, hard-working and supportive colleagues and also highlight some of our achievements and contributions. **Jason Brown** agreed this year to serve as the co-op Director and worked for the very important DDFA hiring committee. **Alan Coley**, one of our most active, prolific and accomplished researchers, has been especially busy this year with his various projects and publishing many research articles of the highest academic

standard. **Karl Dilcher** has had the time not only to do research of the highest quality, to supervise and mentor students and a PDF, but also to help many of his colleagues solve administrative problems as a result of his capacity as a former Department Chair and Mathematics Director. **Sara Faridi**, as Colloquium organizer, has had a very busy year and has organized many interesting talks by both local and outside speakers in various areas of mathematics, especially in algebra. **Andrea Fraser** has been awarded the 2019 Canadian Mathematics Society Excellence in Teaching Award. Congratulations, Andrea! **David Iron** has been very busy with his teaching, research, and very importantly, serving the Division as the Graduate Coordinator. **Andrew Irwin** has joined the Department this year and has brought both Divisions a wealth of experience in administration, a dedication to teaching, and a record of research of the highest calibre. Our Chair **Jeannette Janssen** has been on sabbatical this year and we look forward to next winter, when she will return reinvigorated and full of new ideas. Jeannette has been able to combine her very demanding job as Chair with an active research program and excellent teaching. This past year **Keith Johnson** chaired a very important hiring committee that has helped to shape the future of this Department, which is very symbolic as he is retiring this year. We wish to thank him for all the good he has done for the Department over the course of his career. Our latest recipient of the Killam Professorship Award, **Theo Kolokolnikov**, has been very busy this year as Chair of the Curriculum Committee which is tasked to revamp many of our courses and programs. **Robert Milson** has been contributing to all areas of departmental activity, including teaching, research and committee work. In winter of 2020, Robert will be teaching MATH2002 (Intermediate Calculus II) following his son **Nick**, who took the course in winter 2019: those are big shoes to fill for Robert as Nick is an excellent student. **Dorette Pronk**, as always, has been very busy this year with her research, teaching, supervision and mentoring of graduate students and PDFs, as well as running two mathematics clubs for school children. In April 2018, Dorette led our National team to the 2019 European Girl's Mathematics Olympiad – which was held in my home town, Kyiv, by the way. **Julien Ross** and **Peter Selinger** organized two important conferences in the area of Quantum Computing. Julien has been also running the ATCAT weekly seminar. **Keith Taylor** received the 2018 Graham Wright Award for Distinguished Service. Congratulations, Keith! Also, in February Keith Taylor and his wife **Julia** opened their house and hearts to the whole Department, with a fantastic potluck dinner. We should have such social events more often. In conclusion, reflecting on all that we have done this year, I have only three messages for the members of the Division:

1. Changes are important and we should introduce change where it belongs, however, we should not change things merely for the sake of making changes. May we never forget that "Plus ça change, plus c'est la même chose." (Jean-Baptiste Alphonse Karr).

2. We should more often employ the **principle of sufficient reason** (google it!) which suggests that when it comes to changing things, we should first ask ourselves ``why?" instead of ``what?" For instance, the question of whether or not to merge MATH2135 and MATH2040 should be considered within the context of the question ``why do we have two 2nd year algebra courses?'', but not ``these two courses are similar, ergo let us get rid of one of them!'' This example is a metaphor, of course.

3. Be cool.

In addition, I would like to mention that inspired by the success at Keith and Julia's, we held a long overdue welcoming party at the University Club for our four newest and most valuable faculty members, **Lam Ho**, **Julien Ross, Sarah Chisholm, and Andrew Irwin**. It went very well and the members of the social committee

(**Alan Coley, Hong Gu and Sara Faridi**) tell us that there will be many more parties – stay tuned!

I would also like to commend **Sarah Chisholm**, our new Learning Centre Coordinator, who has joined the Department (or, rather, come home) this year. Sarah, with her excellent organizational and communication skills has made many positive changes to how things are run around here and together with **Rob Noble**, continues to improve the quality of the delivery of our 1st and 2nd year courses.

Many special thanks to our Main Office staff. After joining the Department last year, **Ann Bannon** has reshaped the way things are done in the Main Office, which is now run as a well-oiled machine. We thank **Maria Fe Elder** for always doing her job with a smile and reminding us of important deadlines. We are grateful to **Ellen Lynch** for being strong and humble at the same time, and for her excellent work ethic. **Jenny Edison** always does a great job and thanks to her efforts, our website is now much more up-to-date. Last but not least, Jenny has put this Chase Report together. Many thanks also to **Balagopal Pillai**, the man we cannot do without. Is there anything that Balagopal does not know about computers? I wonder…

There are many good tidings from our alumni. For example, from **Jin Yue**, who first did a PhD degree in Mathematics in 2005, then held a teaching positing in the US, and after that (at this point many of our colleagues in Statistics, probably, would say – ``saw the light'' and) returned to do a MSc degree with **Bruce Smith** in Statistics. This rigorous training turned him into a very versatile instructor, able to teach a broad range of university courses. Jin works as a Senior Instructor at the Faculty of Agriculture in Truro. This year he was awarded the prestigious honorary Barley Ring. He also received the DASA Student Appreciation Award (2016), DSU Teaching Award (2014-2015), Sessional and Part-Time Instructor Award of Excellence for Teaching (2013-14), Faculty Award for Teaching Excellence (2013), and Dalhousie University Impact Student Leadership Award.

On that note, our graduate students have also been doing very well, with a substantial number of MSc and PhD theses defended this year and numerous other achievements. For example, **Kunpeng Wang**, a PhD candidate who will be defending his thesis soon, has had his first publication accepted for presentation at the prestigious 28th European Workshop on Economic Theory that will be held in Berlin from June 13-15. **Caroline Cochran** (née Adlam), who was a graduate student (MSc, 2006; PhD, 2011) in this Department and holds a position of Instructor and MASH coordinator in the Department of Mathematics and Statistics at Acadia University, received the Faculty of Science Teaching Award there last spring.

I love you, guys!

Jin Yue receives honorary Barley Ring

STATISTICS DIVISION

By Mike Dowd, Director

News over the past year in Statistics is the following: Dr. Andrew Irwin arrived in September of 2018 as a new faculty member in the Department as a member of both the Statistics and Mathematics Divisions. Welcome Andrew! Stuart Carson completed his PhD in Statistics and will graduate at the May 2019 Convocation. His thesis was entitled "Spatial and Spatio-Temporal Models for Use in the

Marine Environment with Applications to the Scotian Shelf", and was supervised by Dr. Joanna Flemming. Graduates from our undergraduate Honours program were: Mengyao Wang, Renny Doig, George Wang, and Sean Cao. The following new graduate students entered our program this year: Claire Boteler and Xinyue Zhang started their PhDs, and Abe Adeeb, Mia Parenteau, Wanru Jia and Jonathan Bradet-Legris began their MSc degrees. Two post-doctoral fellows also began to work with faculty researchers – Fran Broell started a MITACS post-doc with Mike Dowd, and Wei Zhou began a post-doc with Hong Gu.

ACTUARIAL SCIENCE

By Toby Kenney

The Actuarial Science program continues to grow, with 4 graduates this year, including 3 honours students. There were minor changes to the Actuarial Science program to follow changes to the Society of Actuaries curriculum. Further changes will be phased in over the coming years to reflect the new requirements.

The new 2+2 program has reached an agreement with the School of Insurance at Shandong University of Finance and Economics, which is beginning to recruit students. A delegation from SDUFE School of Insurance visited Dalhousie in April to finalize the program details. The first batch of students from this program should arrive at Dalhousie in September of 2021, to start the third year.

AWARDS DAY SPEAKER

Dr. Chris Levy

This year's Awards Day speaker is Chris Levy. Chris graduated with a PhD in Applied Mathematics from Dalhousie in 2015. During his time at Dalhousie, Chris held both a Killam Pre-doctoral Scholarship as well as an NSERC Alexander Graham Bell Award. He worked with Dr. David Iron on 3D models of cell signal transduction. After graduating, Chris worked at Morneau Shepell as a data scientist for a year before joining Mobivity's Halifax team (Mobivity is based out of Arizona) where he is currently employed as a data scientist. Chris is passionate about programming and building data driven applications into products for industry. Chris lives in Halifax with his wife and three kids.

VANIER CANADA GRADUATE SCHOLARSHIP AWARD

Ethan Lawler

Joanna Mills Flemming's PhD student, Ethan Lawler, was awarded this prestigious scholarship in June of 2018 just after the last edition of the Chase Report was printed. In order to be considered for the scholarship, Ethan had to first be nominated by a committee from Dalhousie and then submitted to the Vanier CGS Program for eligibility review. The selected nominees were then each evaluated by an agency-specific selection committee (CIHR, NSERC, and SSHRC). From a total of 166 eligible candidates, the Tri-Agency Program steering committee (made up of the presidents of the three federal granting agencies, and the deputy ministers of Innovation, Science and

Economic Development Canada and Health Canada) approved the scholars for funding based on the following criteria: Academic Excellence, Research Potential and Leadership (potential and demonstrated ability).

Ethan was awarded an NSERC scholarship in the research area of Mathematical Sciences - Statistics and Probability for his research proposal entitled: *Improving fisheries stock assessment models through spatio-temporal, multi-species, and integrated data models.*

Congratulations to Ethan!

Andrea earned her undergraduate and Master's degrees from the University of Toronto, and her PhD from Princeton University in 1997 under Elias M. Stein. After a four year position at the University of New South Wales in Australia, she returned to Canada, where she has been a faculty member at Dalhousie University since 2001.

Andrea will receive her award at the upcoming CMS Summer Meeting being held in Regina in June. She will also give a prize lecture at the meeting.

Congratulations to Andrea!

MATHEMATICS DIVISION'S ANALYST WINS PRESTIGIOUS AWARD

By Roman Smirnov

Andrea Fraser

Andrea Fraser is the recipient of the 2019 Canadian Mathematical Society Excellence in Teaching Award. Her continued high standard in training our honours and graduate students in higher year analysis courses is a backbone of our program. She is also a much-loved teacher in our first and second year courses. There is an overwhelming amount of positive student feedback that speaks to Andrea's dedication and commitment to student success, and to the originality and exceptional clarity of her presentation. Students praise her ability to make difficult concepts easy and intuitive, and her lecturing style, which makes students feel they are "discovering" the material.

CMS AWARD FOR KEITH TAYLOR

By Karl Dilcher

Keith Taylor

During the 2018 CMS Winter Meeting in Vancouver, Keith Taylor received the Graham Wright Award for Distinguished Service. To quote from the citation:

Praised by his colleagues as being an 'excellent role model for a well-rounded mathematician', Dr. Taylor's career, spanning more than four decades, has truly exemplified what this award represents, not just because of his excellent record of research and mentorship, but also through his academic work as Associate Dean, Dean and Associate Vice President at two Universities and through years of fundamental service to the CMS, including a term as

President (2012-2014). Indeed, just to list his CMS committee work and appointments takes a full page on his vitae!

The citation goes on to state that "Taylor's real contribution to Canadian mathematics goes far beyond a few lines on his CV. It lies more in his continued striving for educational excellence, in award-winning teaching, and through remarkable and continuing commitment to outreach."

"Dr. Taylor's later outreach work focusses on developing pathways to mathematical literacy for underrepresented groups in Saskatchewan and Nova Scotia, and consistently supporting and championing disadvantaged communities."

Congratulations, Keith, on this award and on the achievements it honours!

2019 PRESIDENT'S GRADUATE TEACHING ASSISTANT AWARD

Asmita Sodhi

Our graduate student, Asmita Sodhi has been selected as this year's co-recipient of the 2019 President's Graduate Teaching Assistant Award in recognition of her exceptional contributions to learning and teaching at Dalhousie. The award will be presented to Asmita at the Dalhousie Legacy Awards event scheduled for June 19, 2019. The selection committee for the award noted the following excerpt from Asmita's nomination:

Asmita Sodhi has demonstrated all-around engagement with the act of teaching and has taken an active role in building her teaching credentials. In addition, she has been heavily involved in outreach activities within her department, and has both adopted and developed creative teaching methods through her work with NS Math Circles and the Math Challenge Club. Her students think highly of her organization and the impact she has had on their learning.

Congratulations to Asmita

BIG NSERC NEWS

Joanna Mills Flemming

Joanna Mills Flemming recently received both an NSERC Discovery Grant and a DAS (Accelerator Supplement) toward a three year collaborative research team (CRT) project funded by the Canadian Statistical Sciences Institute (CANSSI). The title of the project is: *Towards Sustainable Fisheries: State Space Assessment Models for Complex Fisheries and Biological Data*. Along with several other statistical collaborators from other universities around the world, Dalhousie's William Aeberhard and Chris Field are both working with Joanna on this project. The project also has collaborations with many international fisheries institutes and several key partner organizations such as the Ocean Tracking Network of Canada. This project will not only improve tools for accurate fish stock assessment, it will also address the void of highly qualified personnel in Canada. As a result, it will help to develop best practice for the conservation of fish.

Related:
{On February 20/21, Joanna led the CANSSI Collaborative Research Team to give a two-day short course on Applied Fishery Data Analytics at Bedford Institute of Oceanography. The short course was well-received, and interesting discussions were inspired.}

KEITH JOHNSON RETIRES

By Karl Dilcher

After decades of service to this department and to Dalhousie, Keith Johnson will be officially retiring as of June 30, 2019.

Keith grew up in London, Ontario, and he received both his B.Sc. and M.Sc. degrees at the University of Toronto. He then studied at Brandeis University in Waltham, MA, where he received his Ph.D. in 1980. Keith first joined our department as a postdoc, then returned as tenure track faculty in July, 1983, and has been with us ever since, as assistant, associate, and then full professor.

Over the years, Keith served the department and the university in numerous ways, perhaps most importantly as mathematics honours and graduate coordinator over many years. He was also much involved in curriculum matters, and served on various related committees.

Keith is known as an inspiring, successful and versatile teacher. While most of us mathematicians have taught honours courses either in the analysis stream or in the algebra stream, as far as I know Keith is the only one who consistently taught both streams throughout his career. Some years ago one of our top honours students referred to Keith's classes admiringly as "Story time with Dr. Johnson".

Also as a researcher, Keith has been unusually versatile. His expertise and interests include generalized cohomology theories, homotopy theory, algebra, algebraic topology, and category theory. During the last decade, Keith has become a leading expert on integer-valued polynomials, an area that spans several fields, including number theory. He visited Amiens in France several times, and collaborated with researchers there. He has been a successful and prolific supervisor of graduate students, two of whom are still working under his supervision. Keith will remain an active member of this department, and we will continue to benefit from his vast mathematical knowledge in many different fields, and from his wisdom and experience. Happy retirement, Keith!

CANADIAN MATHEMATICAL SOCIETY

By Sara Faridi
(Vice President Atlantic of the Canadian Mathematical Society)

The Canadian Mathematical Society added a fresh face to its team this year by welcoming a new Executive Director, Dr. Termeh Kousha from the University of Ottawa, in September, 2018. Termeh brings her experience and new ideas to the CMS.

This year the CMS also introduced its inaugural class of Fellows at the winter meeting in Vancouver. The fellows program recognizes mathematicians who have contributed to the society, and to mathematics in general. The inaugural class included four Dalhousie professors: Peter Fillmore, Richard Nowakowski, Srinivasa Swaminathan, and Keith Taylor.

Another highlight of the past year for the CMS was its ability to prepare and send a team to the European Girls' Math Olympiad (EGMO) in Ukraine. EGMO is a by-invitation-only event to which Canada was invited to send a team only two years go. Our ability to support an EGMO team was the result of the tireless efforts of CMS

staff and members in fundraising and organizing training camps.

Many members of the Dalhousie mathematical community have contributed to the operations of the CMS over the past year. Sara Faridi served on the Executive Committee, the Board of Directors and the Research Committee; Jeannette Janssen served on the International Affairs Committee; Dorette Pronk chaired the Mathematical Competitions Committee and served on the International Mathematical Olympiad Committee; Richard Nowakowski served on the Canadian Open Mathematics Challenge Committee; Keith Johnson served on the Nominating Committee; Srinivasa Swaminathan was the Editor-in-Chief of the CMS Notes and served as Associate Technical Editor of the CMS publications office; Karl Dilcher and Keith Taylor were Editors-in-Chief for CMS Books in Mathematics Series; Asmita Sodhi served on the student and education committees.

And even more of us contributed to the 2018 winter and 2019 summer CMS meetings by giving talks or organizing sessions: Jordan Barret, Marzieh Bayeh, Maryam Ehya Jahromi, Sara Faridi, Jonathan Gallagher, Charlie Gerrie, David Iron, Theodore Kolokolnikov, Michael Lambert, Curran McConnell, Richard Nowakowski, Dorette Pronk, Neil Ross, and Keith Taylor.

The Canadian Mathematical Society needs, more than ever, the support of the Canadian mathematical community in order to grow and to prosper. With many new initiatives on the way - mini-courses, conferences, competitions, outreach and more - every bit of help counts. Please join!

CMS WINTER MEETING

The Canadian Mathematical Society's annual winter meeting was held in December of 2018 in Vancouver, BC. At the event, Dalhousie retirees Peter Fillmore, Richard Nowakowski, and Srinivasa Swaminathan, along with current Professor, Keith Taylor, received appointments as 'Fellow of the Canadian Mathematical Society'. The December, 2019 winter meeting will be hosted by York University in Toronto.

EUROPEAN GIRLS MATHEMATICAL OLYMPIAD

Dorette Pronk (far right) and the 2019 EGMO team

Canada's second EGMO (European Girls Mathematical Olympiad) team, led by Dalhousie's Dorette Pronk (and Sarah Sun from GoldSpot Discoveries, Inc.), has earned two Bronze Medals and two Honourable Mentions at this year's competition which was held in Kyiv, Ukraine. The 'by invitation only' team of girls was largely chosen based on their results in the Canadian Open Mathematics Challenge as well as by a team selection test. The chosen team of girls (none from NS) was trained over a weekend in February at the Fields Institute in Toronto. The EGMO is an international competition for school aged girls consisting of six questions that each girl must solve individually over two days. Dorette was quoted as saying, "We are celebrating two bronze medals and two honourable mentions, but more

importantly, hard work, beautiful mathematics and unique solutions by all team members." EGMO 2020 will take place in the Netherlands.

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. This past year's conference was held in October at Universite de Moncton. Traditionally, on the Friday night of the conference, a problem solving competition is held. Our students, Alex Christie and Curran McConnell, earned third place in the competition.

Additionally, presentations about their summer/honours research projects were given at the conference by Zhiyuan Zhang, Alex Christie, Adam Lucas and Charlie Gerrie. All four presentations were very clearly presented and well-received by the audience. Two of our students won awards for Best Oral Presentation:
2nd place- Charlie Gerrie (title: The Power-Index Game)
3rd place- Alex Christie (title: Trace Equivalence in Three Dimensions)

This conference was also a wonderful opportunity for all participants to interact with students and faculty from other Atlantic universities and get a broader introduction to mathematical research. Dorette Pronk organized the trip and coached the students for the competition. Students that attended were: Alex Christie, Charlie Gerrie, Adam Lucas, Curran McConnell, Vaughn Menchions, Aeriana Narbonne, and Zhiyuan (Owen) Zhang. Graduate student Rebecca Ryan and postdoc Daniele Turchetti also attended and helped Dorette with organizing the trip.

CAIMS CONFERENCE 2018

The Annual Meeting of the Canadian Society of Applied and Industrial Mathematics (CAIMS) took place from June 4 to 7, 2018 at Ryerson University in Toronto, ON.

At the conference, Dr. Joanna Mills-Flemming from Dalhousie gave a talk called "Recent Developments in Aquatic Animal Movement Modelling".

PUTNAM COMPETITION

By Dorette Pronk

The Putnam Competition was held on December 1, 2018. Students Vaughn Menchions and Liam Orovec both participated in this annual competition. The exam was extremely challenging this year. Although both students enjoyed the challenge of working on the problems for six hours, their scores this year were 2 points for Liam and 1 point for Vaughn.

INTERNATIONAL CONFERENCE ON QUANTUM PHYSICS AND LOGIC (QPL 2018) and the 34th CONFERENCE ON THE MATHEMATICAL FOUNDATIONS of PROGRAMMING SEMANTICS (MFPS 2018)

By Peter Selinger

QPL & MFPS 2018 Attendees

The Department of Mathematics and Statistics hosted the 15th International Conference on Quantum Physics and Logic (QPL 2018) and the 34th Conference on the Mathematical Foundations of Programming Semantics (MFPS 2018), which were held on June 3-7 and June 6-9, 2018, respectively. Each conference had a separate external program committee and steering committee. The local organizers were Julien Ross and Peter Selinger, with help from Marzieh Bayeh, Xiaoning Bian, Frank Fu, Kohei Kishida, and Francisco Rios.

QPL is an annual conference that brings together researchers working on mathematical foundations of quantum physics, quantum computing, and related areas. MFPS conferences are dedicated to the areas of mathematics, logic, and computer science that are related to models of computation in general, and to semantics of programming languages in particular.

The two conferences had a joint special session on Quantum Programming Languages. The conferences had 123 participants in total, of which 96 attended QPL and 79 attended MFPS (and therefore 52 participants attended both conferences).

QPL had four invited speakers and two invited tutorials and a total of 55 talks, as well as a poster reception. The QPL best student paper award went to Matthew Amy from the University of Waterloo for his submission titled "Towards large-scale functional verification of universal quantum circuits".

MFPS had four special sessions as well as contributed papers for a total of 32 talks. The special session topics were quantum programming languages, session types, differentiable programming, and gradual typing.

Both conferences received support from AARMS, Dalhousie University, Pacific Institute for the Mathematical Sciences (PIMS), and the U.S. Office of Naval Research (ONR). Further support for QPL was provided by the Institute for Quantum Computing at the University of Waterloo (IQC), the Perimeter Institute for Theoretical Physics, and Xanadu.

STATISTICAL ANALYSIS WORKSHOP

By Hong Gu

A workshop entitled “Statistical analysis and machine learning with application in medicine, biology, environmental sciences”, organized by Dr. Hong Gu, was held on May 9th and 10th at Dalhousie University. The workshop was co-sponsored by AARMS, CANSSI MSHSCC and an AARMS CRG grant. There were 15 researchers, including 8 faculty members, 2 postdoctoral fellows, 4 PhD students and 1 MSc student, coming from Acadia Univ., MSVU, Univ. of PEI, Memorial Univ. of Newfoundland and Dalhousie Univ., with several other faculty members and students from Dalhousie Univ. attending some of the talks during the workshop.

The workshop covered a large range of different statistical methodologies including time series, hierarchical state-space models, missing values, measurement errors, phylogenetic comparative methods, biomarker detection and dynamic modelling using stochastic differential equations. There were also talks about open questions and data in marine microbial ecology. It proved very successful with researchers with backgrounds in statistics and in science presenting their questions and methods in the workshop, and discussing possibilities for collaboration. There were a lot of good talks and discussions during the workshop which inspired new collaboration and applications.

SIAM DM 18

By Ben Cameron

The 19th biennial Society for Industrial and Applied Mathematics Conference on Discrete Mathematics (SIAM DM 18) was held on June 4-8, 2018 on the Denver campus of the University of Colorado. Ph.D. student Ben Cameron and Professor Jason Brown organized a mini-symposium at this conference entitled "Graph Polynomials". In addition to the talks given by the organizers, the session included talks by Joshua Hallam of Wake Forest University, Samantha Dahlberg of the University of British Columbia, and recent graduate of our department, Lucas Mol, of the University of Winnipeg.

COMAP MATHEMATICAL CONTEST IN MODELING

By Dorette Pronk

Three teams of students from our department participated in the Mathematical Contest in Modeling organized by COMAP: a record number so far! All three teams spent most of their time in the Chase Building from January 24 - 28, modeling the problems they had chosen and drawing conclusions based on these models. The team consisting of Alex Christie, Renny Doig and Nicholas Barreyre studied the opioid crisis and the influence of law enforcement as well as its effects on the economy. The team consisting of Jeremy Peters, Vaughn Menchions and Zhiyuan Zhang and the team consisting of Annamieka Aerts, Curran McConnell and Aeriana Narbonne both worked on the ecological impact and requirements of raising dragons. All three teams won the standing of 'Successful Participant'. Congratulations to all team members and thank you for your commitment and hard work!

ECCC 2018

By Jason Brown

The 13thEast Coast Combinatorics Conference (ECCC) was held May 7-9, 2018 at Dalhousie University, Halifax. This annual conference series was designed to bring together regional mathematicians and computer scientists (primarily but not exclusively from the Atlantic region) interested in all aspects of combinatorics and graph theory. The scope of the conference covers most aspects of modern combinatorics, including but not limited to graph theory, extremal combinatorics, combinatorial optimization, probabilistic combinatorics, combinatorial number theory, design and coding theory, finite geometries, and applications.

The conference included plenary and public talks, given by Gary Gordon and Elizabeth McMahon of Lafayette College, Easton, Pennsylvania USA, respectively. Dr. Gordon's plenary talk was entitled Trees and Subtrees, involving both combinatorics and probability theory, and featured joint work with several undergraduate students. Dr. McMahon's engaging public lecture, The Joy of SET: Combinatorics and Geometry, spanned both recreational mathematics and pure mathematics. Both talks were extremely well attended

(approximately 40 and 50 attendees, respectively). The conference also featured 16 contributed talks by faculty, graduate students, and post-docs. The conference this year offered, for the first time, two afternoon Problem Sessions where the conference participants broke into small groups to work on open problems. Open problems were solicited in advance and disseminated at the start of the conference. To round out the event, there was a conference dinner held on Monday May 7, 2018 and a Student Gala on the evening of Tuesday, May 8, 2018.

ALL SySTEMs GO 2019
(An AARMS- Girl Guides Event)
By Sanjeev Seahra & Dorette Pronk

Daniele Turchetti, Darlene Banks and Dorette Pronk

On May 11-12, 2019, AARMS hosted the second annual All SySTEMs Go event in collaboration with the Girl Guides of Nova Scotia. This year's event involved nearly 500 girls aged 9-17 along with almost 200 adult volunteers from the Guiding community.

Over the course of the two days, each of the girls attended five one-hour mini-workshop sessions. There were nearly 100 sessions offered in total, delivered by more than 80 faculty, postdoctoral fellows, and students from Saint Mary's and Dalhousie universities. The workshops covered the entire spectrum of the STEM disciplines, including sessions on mathematics, physics, chemistry, biology, medicine, computer science, and engineering. From our department, Jason Brown, Dorette Pronk, Peter Selinger, Mayada Shahada, Asmita Sodhi, and Annamieka Aerts participated as workshop presenters.

On Saturday evening, the older girls got a chance to ask a diverse group of women working in the STEM fields about their current jobs and career paths. The panel consisted of a mathematician, an oceanographer working in the private sector, a physicist, a software developer, and a veterinarian. The younger girls participated in a round robin event where they interacted in small groups with twenty female scientists and engineers. They learned about the medical science program at Dalhousie, the mathematics of robot planning, the formation of rocks and fossils, the breathing of the ocean, the mathematics of polyhedra and weaving, the fun of coding, and many other topics.

The AARMS-Girl Guides collaboration started in 2017 and is supported by the National Science and Engineering Research Council of Canada (NSERC) via the PromoScience program. A large number of outreach organizations helped organize workshop sessions, including Let's Talk Science, the Discovery Centre, Women in Technology and Science (WiTS), Women in Science and Engineering (WISE), Brilliant Labs, Supernova, and Engineers Nova Scotia.

The principal event organizers were Darlene Banks (Girl Guides of Nova Scotia), Dorette Pronk (Dalhousie University), and Daniele Turchetti (AARMS and Dalhousie University). The student assistants, Kieran Bhaskara, Sarah Li, Tammy Zhang played a crucial role in promptly solving any issue that arose and making sure that the whole weekend ran smoothly. Next year's STEM event will be at the Memorial University of Newfoundland before returning to the University of New Brunswick in 2021.

CanaDAM 2018

The 7th biennial Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM) was held on May 28-31, 2019 at Simon Fraser University, Vancouver, BC. Dalhousie students, Ben Cameron, Iain Beaton, Kyle MacKeigan and Todd Mullen attended the conference.

GORDON RESEARCH CONFERENCE 2019: MOVEMENT ECOLOGY OF ANIMALS

From March 3 to 8, 2019, *Animal Movement as a Link between Ecology, Evolution and Behavior* was held at Renaissance Tuscany Il Ciocco in Lucca (Barga), Italy. Joanna Mills Flemming attended the conference and gave an invited talk on "Statistical Tools for Validating Animal Movement Models".

FIBONACCI CONFERENCE

By Karl Dilcher

The 18th International Conference on Fibonacci Numbers and Their Applications (Fibonacci-18) took place here on campus from July 1 to July 7 of last year. The scope of the Fibonacci conferences is wider than the name indicates; they are mainly about recurrent sequences of numbers and polynomials, and other special sequences and functions; this was also the case with Fibonacci-18.

The Fibonacci conferences have taken place every second year since 1984, alternating between North America and Europe. Fibonacci-18 continued this egalitarian tradition: There were (almost) no invited talks, and everybody, from student to senior researcher, had the same amount of time for their talks. The 40 speakers raged in age from barely 20 to two in their early 80s.

The one invited lecture was the "Lucas Lecture", a one-hour special lecture, open to the public. This time the Lucas Lecturer was 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.

Further information on the conference can still be found at **https://www.fq.math.ca/fibonacci18/**.

Conference proceedings will be published as an open-access special issue of the Fibonacci Quarterly (**https://www.fq.math.ca/**), a journal whose electronic issues, by the way, are hosted and maintained in this department.

LOTS OF COFFEE

By Karl Dilcher

A well-known quotation attributed to the great Hungarian mathematician Paul Erdos (1913-1996) states that "a mathematician is a device for turning coffee into theorems". This came to mind in a recent brief exchange with someone within the Dalhousie administration.

Not too long ago I submitted my receipts to get a refund for the commemorative conference coffee cups (shown above) which all Fibonacci-18 participants were given as part of their

registration package. A few days later I received a request to "please explain the purpose of 60 coffee mugs in your research program". I was tempted to quote Erdos in my reply, but the explanation was a simple confusion between a research and a conference account.
In any account, there are still some coffee mugs available, for $8 each; just come to my office (Chase 325), or write to dilcher@mathstat.dal.ca.

10 YEARS AGO…
(Notes from Chase Report 2009-
By Jenny Edison)

In the 2009 edition of the Chase Report, three items of interest caught my attention. The first was that in June of that year, the Student Resource Centre officially opened and was immediately recognized as a multi-purpose space that was used for a book launch, a movie showing, a rock and jazz concert, the annual Awards Day ceremony, and even a wedding. (Happy 10th Anniversary to Hong Gu and Toby Kenney!). *{See additional information in Karl's article following.}*

The second item was that this was the year that Imperial Oil made a generous grant to our Math Circles program that enabled it to be taken to schools around the province. The very successful program continues today with an annual grant from Eastlink.

The third item was a small contest involving an unidentified stain on a ceiling. Here is the paragraph written by Karl Dilcher from that report:

"Right at the beginning of the winter term it was noticed that an unidentified frying object had found its way to the very high ceiling of our 2nd floor lounge, where it had landed in the middle of a greasy circle. A contest was then launched to guess the most likely nature of the object, and how it got there. While the grand prize, the object itself, was never claimed, it now seems likely that it was a piece of a hotdog, with mustard as adhesive. It appears that some people can't keep their food down."

2019 Update: The stain appears to have been painted over and is no longer providing any entertainment value. ☺ JE

THE LEARNING CENTRE TURNS 10
By Karl Dilcher

Ten years ago this past term we celebrated the opening of the new Math & Stats Learning Centre in what remains the most central location in the Chase Building and the nicest room, which is also used for various other functions. Below are some excerpts from an article in the 2009 Chase Report.

"The Comfort Quotient" was the title of an article in DalNews just before the official opening, on January 26, 2009. Everybody who remembers the old Learning
Centre in the basement will appreciate the enormous difference. The new space is bright, pleasant, and comfortable, and the art work displayed gives it a special touch. There are several large pieces of modern art in the "wings" of the room, on loan from the Dalhousie Art Gallery. The mathematical art, covering the sound panels in the front part of the room, was designed by Eva Knoll, a member of the Faculty of Education at Mount St. Vincent University.

The opening ceremony drew a large crowd of faculty, students, and members of neighbouring departments. Speakers at the event include President Traves and several Deans and VPs. A special attraction was a musical performance by

"Proof!"- a duo consisting of Jason Brown (guitar and vocals) and David Langstroth (Bass).

The original impetus for this new Learning Centre came from Keith Taylor when he was Dean of Science. Since in this room we possibly had the nicest mathematics library in the country, we did not wish to give it up lightly, and the decision for switching spaces was made only after careful consideration and full consultation with everybody. Late in 2007 a planning committee was put together, chaired by Jason Brown. By the spring of 2008 the financing had been secured, which included a generous donation from Mrs. Alberta and
Dr. Graeme Boswall, which made the Learning Centre the pleasant space it now is.

The actual renovation and move of the library took place between mid-June and late August of 2008, and the room slowly converged towards it final stage during the Fall term of 2008, while it was already being used as Learning Centre. Our former Administrator, Gretchen Smith was heavily involved in all stages of planning and the actual renovation, looking with great care after every single detail. Among other invaluable contributions it was her idea to commission the mathematical art for the originally very bland sound panels.
As the Chair said during the opening ceremony, "This is Gretchen's Room!"

A FULL-SERVICE DEPARTMENT

By Karl Dilcher

I cannot write about the opening of the Learning Centre without mentioning the following event, again with excerpts from the 2009 Chase Report. In that issue I had asked which department could boast its own licensed wedding officer? Our retired colleague, Dr. S. Swaminathan, known as Swami to all, is a valued member of the local Indian and Hindu communities and serves as Priest in the Hindu Temple on Cork Street.

On Saturday, August 16th, 2008, Swami officiated at the wedding of our colleagues Dr. Hong Gu Dr. Toby Kenney. Originally the wedding was supposed to take place in Point Pleasant Park, with the Chase Building as alternate venue in case of rain. Well, it did rain, and so the space that was to become our new Learning Centre had a wedding as its first official function. The timing was ideal: The room had just been painted, and the new floor had just dried. Otherwise the room was empty, but it was tastefully decorated by Gretchen Smith for the occasion.

The wedding was well attended by department members and friends of the couple. Dr. Chris Field "gave away" the bride, but after her sabbatical he got her back as a colleague and co-author.

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 2018/19:

Marzieh Bayeh:
Marzieh Bayeh works on equivariant topological complexity. Topological complexity measures the complexity of a space as related to motion planning related questions. She also works with Peter Selinger on quantum programming languages, and on quantum algorithms for topological data analysis. Marzieh is involved in many departmental activities, including the math club for school age children.

Fran Broell:
Fran Broell has a MITACS Accelerate Entrepreneurship and is currently working with Mike Dowd on developing advanced signal processing methods for accelerometers. Fran works externally, and thus is not often into the Chase building.

Frank Fu:
Frank Fu is a type theorist who works with Peter Selinger on dependent type systems for quantum programming. Previously, he worked on problems related to type systems in functional programming languages. He received his Ph.D. from the University of Iowa and held a previous postdoc position at Heriot-Watt University in Scotland.

Benjamin Folliot:
Benjamin started in January of this year as a postdoc with Joanna Mills Flemming and is working on her CRT team. He obtained his PhD in 2018 at the University of Montpellier in France. His current research focuses on the Greenland Halibut, whose main goal is to better define its growth demographic parameter in order to integrate it into a stock assessment model".

Jonathan Gallagher
Jonathan came to us in March 2019, from the University of Calgary where he finished his Ph.D. He is currenly working with Dorette Pronk and Geoff Cruttwell as an AARMS postdoctoral fellow. Jonathan is part category theorist, part logician, part computer scientist, and amazingly, part human. During his Ph.D. he was awarded the university's top prize for community development; he loves collaboration driven research and community involvement, so feel free to send him an email. His postdoctoral project seeks to extend the toolset of differential geometry for orbifolds and deep learning.

Shapour Heidarkhani:
Shapour Heidarkhani, a visiting Professor, has been working with Theo Kolokolnikov since September of 2018. He earned his B.Sc. in pure mathematics from Razi University, and his M.Sc. and Ph.D. in pure mathematics from the University of Mazandaran. After finishing his Ph.D. in 2009, he held a faculty position at Razi University. He also worked as a visiting researcher at several institutes - University of Perpignan, Mediterranea University of Reggio Calabria, University of Tennessee at Chattanooga, and University of Messina.

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.

Kohei Kishida:
Kohei Kishida is a mathematician, computer scientist, and philosopher. He works with Peter Selinger on modal logics for quantum computing and the semantics of quantum programming languages. He previously held postdoctoral positions at the University of Oxford, the University of Amsterdam, and the University of Groningen.

Niall McGinty:
Niall is a zooplankton ecologist with a PhD from Galway and post-doc experience in the Azores and Iceland. He is combing 3D ocean simulation models with statistical representations of zooplankton niches to gain insight into the coming changes in their biogeography anticipated over the next century. Niall is currently working from Wales, but will visit the department this summer to work with Andrew Irwin and Zoe Finkel in their interdisciplinary lab in LSC-O 3627.

Zhi-Ping Mei:
Zhi-Ping is a biological oceanographer who received his PhD at Laval University. After several years in China at Shantou University he has returned to Canada to work on theoretical ecology, in particular using statistical models to describe the distribution of marine microbes. Zhi-Ping works with Andrew Irwin and Zoe Finkel in their interdisciplinary lab in LSC-O 3627.

Crispin Mutshinda
Crispin earned his PhD in Statistics in Helsinki working in Bayesian models with ecological applications. He has been working on applications to marine species, focusing on ecological models of the determinants of growth and quantifying interactions among species and functional types. Crispin also has interests in model selection and averaging, outlier detection, and quantitative trait loci. Crispin works with Andrew Irwin and Zoe Finkel in their interdisciplinary lab in LSC-O 3627.

Mayada Shahada:
Mayada is currently the Director of the Math Circles program and also working with Sara Faridi on topological and combinatorial methods in lattice theory to solve problems related to syzygies of ideals in polynomial rings.

Joseph Siddons:
Joe has a PhD in mathematics from Liverpool working on physical-biological models of phytoplankton in 3D ocean models. Presently he is working with sparse regression models to define interaction graphs in species-rich communities and to study spatial and temporal changes in those interactions. Joe works with Andrew Irwin and Zoe Finkel in their interdisciplinary lab in LSC-O 3627.

Daniele Turchetti:
Daniele Turchetti completed his doctoral studies at the University of Versailles and the Institut de Mathématiques de Jussieu. He held positions at Leiden University, the Max-Planck-Institute for Mathematics, and the University of Caen, where he curated the first mathematical exhibition to take place in the city, animated the local mathematical circles, math festivals, and other outreach activities. He is currently pursuing his research in arithmetic geometry with Sara Faridi and maintaining his math communication interests in the framework of AARMS outreach initiatives.

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.

Yuan (Sofie) Yan:
Sofie joined Joanna Flemming's group as a post-doc for the CANSSI-CRT project "Towards Sustainable Fisheries: State Space Assessment Models for Complex Fisheries and Biological Data" since January 1st, 2019, after she obtained her Ph.D. in Statistics from King Abdullah University of Science and Technology (KAUST).

THE MATH CHALLENGE CLUBS

By Dorette Pronk

This year our department has continued to host two Math Clubs that are specifically focused on problem solving and math competitions. 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. The average attendance in the senior club was around 25 students a week, whereas the average attendance in the junior club was around 16 students, although more students were registered.

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 and students enjoy the problem solving approach to mathematics. 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).

Although for some students the engagement with math and each other during club time is a goal in its own right, others participated in several competitions throughout the school year, where they received the additional reward of medals and prizes. Our first contest was the Canadian Open Math Challenge organized by the Canadian Math Society. All winners listed on the CMS website for Nova Scotia this year are members of the Dalhousie Math Club; something we have celebrated with the whole club! Another annual highlight for both clubs is the Math Kangaroo Contest which was held in the Chase Building on Sunday, March 24. We are grateful to Dr. Lois Murray from the Department of Microbiology and Immunology for organizing this once again! In addition, some of our math club assistants helped to let the contest run smoothly. And I have heard that this year our students put Halifax on the national map for the Math Kangaroo, by coming first nationally in their grades! We are looking forward to a big celebration once the medals arrive in June. Another highlight for the senior club is the team competitions in April and May: 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. We hosted the Waterloo Canadian Team Competition on campus this year and aside from our own students, two teams from local high schools joined us for a fun afternoon of problem solving.

Both challenge clubs can only run because of the wonderful group of volunteers that help out each week. For the senior club, the AARMS outreach postdoc Daniele Turchetti has been a great partner in teaching and inspiring the students with new ways of looking at mathematics. Also, graduate students Asmita Sodhi, Fatemeh Bayeh and Fahimeh Bayeh have been invaluable in terms of both teaching and assisting with the administration of the club. Undergraduate students Kieran Bhaskara, Xiaoyue Jia and Samantha Hatt have done a wonderful job in helping different groups of students work on specific questions. I am grateful for the ways they have assisted and inspired the younger members of the senior club to learn a lot of new topics over the past months. For the junior math club, we had an amazing group of undergraduate students engage the younger students in wonderful creative ways: Maddie Torres, Aeriana Narbonne, Annamieka Aerts and Adam Lucas. The junior club has received fantastic help from Dr. Mayada Shahada, the Math Circles Director.

During the fall semester, both clubs also benefited from the students in the MATH 3790 course: a course on mathematical problem solving that is part of the Science Leadership and Communication Program, hosted by the faculty of science. Students in the course are 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, and the students really enjoyed learning from a new person. 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.

MATH KANGAROO CONTEST

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

The 2019 Canadian Math Kangaroo Contest was hosted in classrooms at the Chase Building on March 17th, 2019. Some parents had a taste of the questions posed to the students: they worked away at a Parents' Contest in the Learning Centre while their children wrote the official contest papers. Here at Dalhousie University there were 95 competitors, representing grades 1 through 11. In Canada, this year, a total of 6,368 students, enrolled in grades 1 through 12 competed while, worldwide, there were over six million competitors.

Important volunteers on the contest date included **Annamieka Aerts, Dr. Darien DeWolf**, **Ian MacIntosh** and **Dr. Dorette Pronk.** These people made a 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 8 student had a perfect score, thus placing first in Canada! Other results include: one Grade 6 student placed second in Canada with a score of 146/150; an additional six students won National Gold medals; two won National Silver medals; and 18 other students scored high enough to receive Regional ribbons.

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

COMPUTING RESOURCES

By Balagopal Pillai

Webwork and Capa services worked mostly trouble free last year. Apart from a few power outages, the machine room infrastructure and servers 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 within Dalhousie University, and outside Dalhousie including government, hospitals, business and scientific communities. The statistical consultant is Dr. Huaichun Wang, with Dr. Edward Susko acting as Director.

Several relatively large and interesting consulting projects were carried out over the past year, including:

1) Statistical requirements for mould inspections in the Nunavut communities. Sample sizes were determined for environmental sampling of houses in Nunavut (Dillon Consulting Ltd.);

2) Closing the achievement gap in African Nova Scotian learners: the AGinANS

project. A hierarchical linear model was applied to account for the nesting levels in the school system to properly analyze the data. (Dr. John Leblanc and student, IWK Pediatrics);

3) Comparing different radiology diagnoses on the survival rates of oropharynx cancer patients (Carol-Anne Davis, Nova Scotia Cancer Center);

4) Analyzing clinical survey data on prostate cancer patients in the Maritime Provinces. Multilevel mixed linear models are being developed to handle the complexity in the multidimensional longitudinal data involving nesting relations among the explaining variables and covariates (Dr. Gabriela Ilie, Department of Community Health and Epidemiology, Dalhousie University);

5) Comparing the effect of apneic oxygenation via nasal cannulae for anesthesia. Several general mixed-effects models were developed to analyze the data. A joint publication of the research is in preparation. (Dr. Tim Mullen, Department of Anesthesia, IWK and Dalhousie University).

BOOKS FOR SALE

By Karl Dilcher

As I mention every year in the Chase Report, 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 three years, around 1,500 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.

Almost 2,000 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.

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, it would help if you put any books you'd like to contribute in my mailbox, or leave them outside my office door (rather than in the bookshelves around the department), so I can sort them accordingly.

Please let me know if you wish to see the collection or the catalogue, which is not on-line.

AARMS REPORT

By David Langstroth

2018 was another really good year for AARMS; continuing our ongoing programs in support of scientific workshops, conferences and events, postdoctoral fellowships, collaborative research groups and the AARMS Summer School. We

are also proud to have set up two entirely new programs: the AARMS Industrial Problem Solving Workshops and the AARMS-Girl Guides STEM camps.

AARMS held its first ever Industrial Problem Solving Workshop (IPSW) in the summer of 2018 at Dalhousie. This event involved around 35 university faculty, postdocs and graduate students working collaboratively on mathematical sciences problems presented by five Atlantic Canadian companies. The problems ranged from detecting violent behaviour in security camera footage using machine learning, to using advanced techniques from pure mathematics to validate engineering designs. Our industrial partners were extremely pleased with the event, which has, to date, spawned several NSERC Engage applications, a Mitacs Accelerate Fellowship, and a few informal job offers. AARMS is grateful to the IPSW's sponsors, which included PIMS, Mitacs, NSERC, Dalhousie and Springboard Atlantic. The AARMS Executive has decided to make this an annual event, and the next edition will be at UNB (Fredericton) in July 2019.

In September of 2018, we appointed the new Dalhousie-AARMS Outreach Postdoc, Dr. Daniele Turchetti. We also awarded a postdoctoral fellowship to Dr. Jonathan Gallagher, under the supervision of Dr. Dorette Pronk and Dr. Geoffrey Crutwell. In September 2019, two new postdocs will also start at Dalhousie - Dr. Matthew Amy and Dr. Martin Szyld.

The second AARMS-Girl Guides STEM Camp has just wrapped up, with over 500 girls aged 9-17 participating in STEM-based workshops run by university faculty at Dalhousie and St. Mary's over a two day period in early May. The event was very rewarding to organize, and extremely inspiring to participate in, if somewhat exhausting. A **big** thank you to Daniele Turchetti and Dorette Pronk for their work on organizing the event. Next year we hope to hold the 2nd annual AARMS-Girl Guides STEM camp in St. John's, NL.

And finally, our perennial summer school offers courses usually not available in the curriculum of Atlantic Universities, taught by international experts. This will take place at UPEI this year from June 17 to July 12 on the topic of Dynamical Systems, Differential Equations and Special Functions.

NOVA SCOTIA MATH CIRCLES

By Mayada Shahada

As the academic year draws to a close, Nova Scotia Math Circles remains busy with several outreach activities. This past year has been an even greater success than the years prior; we both increased the number of students attending the presentations and visited more new schools throughout the province of Nova Scotia.

From September 2018 – June 2019, the program has been run by Director, Mayada Shahada and Assistant Director for Campus Events, Asmita Sodhi. Professor Dorette Pronk continued overseeing the program in the role of Faculty Advisor. With partial support from the department, Tom Potter, Rebecca Ryan and Ryley Urban were full year teaching assistants. Our casual presenters for this year were Corey DeGagne, Maryam Ehya, Joey Latta, Mozhgan Saeidi and Christina Walker.

We started the year off strong with a week-long trip to the Cape Breton School Board. Over 800 students in the counties of Cape Breton, Richmond, Inverness and Victoria were visited. In November, there was another week-long trip for schools in the Tri-County School Board area resulting in almost 600 students being reached in Digby, Yarmouth and Shelburne counties.

As of early May, we have reached nearly 7000 students and have given 266 presentations at 55

different schools in seven different school districts and we still have three trips per week planned for the rest of May and June!

In addition to school trips, we visited three homeschooling groups (Dartmouth, Tantallon and Bedford) as well as the Generation 1 Leadership Initiative group. In October, we had a table at the annual NS Math Teacher Association Conference to network and advertise our program.

Math Circles hosts ten monthly events over the course of the academic year and this year's events attracted between 35 and 55 participants each; consisting of students, parents, and teachers. At these events, members from our department (Asmita Sodhi, Peter Selinger, Roman Smirnov and Mayada Shahada) volunteered to give very engaging talks. We also had guest presenters, namely John McLoughlin (UNB), Svenja Huntemann (Mount Allison), Erick Lee (HRCE) and Danielle Cox & Alan Godin (MSVU). The November event was held at Dalhousie's Agriculture Campus in Truro, where 21 participants enjoyed a talk about the history of solving mathematical problems by our former program director, Svenja Huntemann.

Dalhousie Math Discovery Days were held in the Learning Centre on April 24th and 25th. Four sessions full of solving mysteries, learning some cards tricks and creating artworks were delivered. 128 grade 7-9 students participated and also enjoyed a snack break half way through each session.

In May, Math Circles will participate in the AARMS Girl Guides Outreach event being held here at Dalhousie on the 11th and 12th. It is expected that we will run two sessions for groups of approximately 70 girl guides, pathfinders and rangers. The program director, Mayada Shahada, will participate in the evening panel at the event; a great way to introduce and talk about the Math Circles program at Dalhousie.

As our funding from Eastlink comes to an end, with the help of the Development Office at Dalhousie, we are organizing a thank you event on May 17th to celebrate what has been a fantastic program over the past five years because of Eastlink's generous support. Next, we will actively search for new funding opportunities so that we can continue to offer our fun outreach activities across the province, free of charge.

A big thank you to everyone who helped make this year a great success!

Keep up to date with our events and activities through our website www.nsmathcircles.com.

MATH CIRCLES EVENTS
Organizer: Asmita Sodhi

September 26 (Halifax Campus)
Speaker: Asmita Sodhi (Dal)
Topic: Pentomino Puzzlers

October 19 (Halifax Campus)
Speaker: Dr. John McLoughlin (UNB)
Topic: Random Walks and other Mathematical Journeys

November 23 (Truro Campus)
Speaker: Dr. Svenja Huntemann (Mt. A)
Topic: A History of Problem Solving
December 12 (Halifax Campus)
Speaker: Erick Lee (HRCE)
Topic: Chopsticks, Ciphers and Curves

January 16 (Halifax Campus)
Speaker: Dr. Peter Selinger
Topic: Counting and Symmetry

February 20 (Halifax Campus)
Speaker: Dr. Roman Smirnov
Topic: Linear Inequalities and Economic Problems

March 13 (Halifax Campus)
Speaker: Dr. Danielle Cox (MSVU)
Topic: Recipes for Pi

April 26 (Halifax Campus)
Speaker: Emma Carline
Topic: TBA

May 22 (Halifax Campus)
Speaker: Nicholas Banks
Topic: TBA

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

June 5 (Halifax Campus)
Speaker: Dr. Mayada Shahada
Topic: TBA

MATH CAMP 2018 REPORT
By R.P. Gupta

The Dal-BEA Math camp for Black Students was held July 9-15, 2018. 31 campers from all over NS attended the camp. On the Sunday, parents brought their campers to Howe Hall, where registration and a reception were held. They were told about the expectations and responsibilities required of them for the week. The campers resided in Howe Hall under the supervision of four chaperones- Kyiasha Benton, Joshua Riley, Venessa Thomas and Joshua Lunda. Each morning and two afternoons were devoted to academic teaching. The instructors were: Gerry Clarke, Sunita Pinet, Nauzer Kalyaniwalla and Jordan Barrett. The instructors of the Math classroom and Computer Science classroom work together when creating the curriculum. In the Mathematics classroom, students are taught via lectures, student-led discussion/activities/partner work, group work, games and independent discovery. Throughout the week the students are introduced to new topics as well as building on topics and ideas that they are introduced to throughout the school year. In the Computer Science classroom, we introduced the students to topics that they would later use to program and subsequently simulate or graph. These topics included playing the games 10 and NIM, where students discuss strategies on winning and look at the mathematics behind the simple games that they play. Students were also 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 the 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, "career night" presentations were made by Winnie Grant and local meteorologist, Cindy Day. They discussed the importance of education and the vital role mathematics plays in the business world. The students were very focused and engaged, and the Q&A session was amazing. On Tuesday, campers went to the Black Cultural Centre. The highlight was a historical presentation of the arrival of Blacks to Nova Scotia by Mr. Ken Fells. On Wednesday, they went for a fun bowling session. On Thursday afternoon, Math Circles presented a two hour session. In the session, the activities included trying to cut a donut into as many pieces as possible with just three cuts, trying to draw lines from three facilities to three cottages, cutting a piece of paper to make a loop as large as possible, and more. In the evening, 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. Afterward, they had a relaxing, fun time at Dalplex where they engaged in volley ball, swimming and other sports. Many of

the campers openly discussed the benefit they received by attending this camp.

AARMS-DALHOUSIE-CMS MATH CAMP
July 15 - 20, 2018

By Roman Smirnov

During the second week of July, the Department of Mathematics and Statistics at Dalhousie University hosted the annual math camp for high school students, whose goals were to identify, stimulate and encourage mathematical talent among Nova Scotia high school students. To select the participants we sent invitations to all of the schools in the province asking them to nominate two top students from each school. We then selected the 20 best students from this pool of qualified nominees, based on the letters of recommendations from their respective math teachers, math competition results, as well as their school grades.

The camp was jointly sponsored by Dalhousie University, the Canadian Mathematical Society and AARMS. It consisted of lectures and problem-solving sessions conducted by faculty members and graduate students from Dalhousie, Mount Saint Vincent and Acadia Universities and also included extracurricular activities. There were 20 students (10 girls and 10 boys) from Grades 10 and 11 participating in the math camp, which was organized by Caroline Cochran (Acadia), Roman Smirnov (Dalhousie) and Asmita Sodhi (Dalhousie). The speakers at the camp this year were Peter Selinger, Mayada Shahada, Ben Cameron, Sarah Chisholm, Robert Milson, Chelluri Sastri (all from Dalhousie), Caroline Cochran, Holger Teismann (both from Acadia) and Danielle Cox (MSVU).

Over the years many of the former math camp participants came to Dalhousie to study mathematics and/or other STEM subjects, doing very well in the process. For example, Dan Abarbanel, who came to Dal first as a high school student to participate in one of our summer math camps, later graduated from Dalhousie with a combined honours degree in mathematics and physics. He is working now on his PhD thesis in physics at McGill University.

This year's upcoming math camp is being organized by Roman Smirnov, and Asmita Sodhi. It is co-sponsored by AARMS, Canadian Mathematical Society and Dalhousie University. We strongly encourage you, since you are reading this post, to think about contributing to the camp as a volunteer speaker.

DMSGSA REPORT

By Lauren McLellan

The Annual General Meeting of the Dalhousie Mathematics and Statistics Graduate Student Association culminated in the election of the following executive members:

President: Lauren McLennan
Vice President (internal): Tom Potter
Vice President (external): Molly Hayes
PhD Statistics: Claire Boteler
PhD Mathematics: Leila Valehzaghard
MSc Statistics: Mia Parenteau
MSc Mathematics: Rebecca Ryan

Over the past year, there were several food-oriented events that we continued to host as in previous years; monthly coffee and Timbits, Halloween, Pie Day, Chinese New Year, and Persian New Year. Our biggest and most popular events tend to be the end-of-semester dinners. This year we ventured to the Wooden Monkey to cap off the fall semester, Studio East to celebrate the end of winter, and TBD for our summer festivities. These events are made possible via the funds raised through first year math and stat course tutorials, as well as by the volunteer time put in by your council members so, thank you to them for their contributions. We have a few more events that we are hoping to offer this summer such as a camping trip and some crafty time at the clay café.

In addition to the fun events we put on, there are a number of issues we are working on to improve student life for the grad students in our department. These include: helping to inform and update the department's Conflict of Interest Policy, working with Faculty of Science Graduate Coordinators Committee by giving feedback on the graduate student experience in order to inform programming going forward, improving the graduate handbook, and the re-introduction of an orientation for new graduate students to Dalhousie.

MATHEMATICS COLLOQUIUM

Organizer: Sara Faridi

The Mathematics Colloquium provides a variety of talks from local and visiting speakers on many topics in mathematics. Here is the list of the talks from this past year:

Jun. 18, 2018: Alex Fink
Characteristic polynomials of hyperplane arrangements and Hilbert functions

Aug 17, 2018: Safoura Zadeh
Disjointness preserving maps and noncommutative structures

Sep. 17, 2018: Theodore Kolokolnikov (Dal)
Mathematics of emergent behavior

Sep. 20, 2018: Ronald Haynes (Memorial)
Parallel methods for PDE based mesh generation and other nonlinear problems

Oct. 1, 2018: Kathryn Hare (Waterloo)
The size of self-similar sets and measures

Oct. 4, 2018: Larry Ericksen
Mathematics in the Fine Arts

Oct. 15, 2018: Keith Taylor (Dal)
Wavelet Sets for Crystal Symmetry Shifts

Nov. 5, 2018: Sascha Troscheit (Waterloo)
Galton-Watson trees: Big, small, and sometimes continuous

Nov. 19, 2018: Daniele Turchetti (Dal)
Analytic geometry over $\mathbb{Z}$

Nov. 22, 2018: Joseph Siddons (University of Liverpool)
A Large Eddy Simulation Study of the Formation of Deep Chlorophyll Maxima: The Roles of Turbulent Mixing and Grazing

Nov. 26, 2018: Shapour Heidarkhani (Razi University/Dal)
Existence results for impulsive boundary value problems via variational methods and critical point theory

Dec. 13, 2018: Nathan Johnston (Mt. A)
The Minimal Superpermutation Problem

Jan. 14, 2019: Dominique Unruh (University of Tartu)
Theorem proving with Isabelle/HOL

Feb. 25, 2019: Reza Farivar (McGill University)

The shape of neural information: representational spaces, transformations, and a conceptual language

Mar. 7, 2019: Jenna Rajchgot (University of Saskatchewan)
Schubert varieties and quiver representation varieties

Mar. 14, 2019: Mayada Shahada (Dal)
On polynomials that are not quite an identity on an associative algebra

Mar. 21, 2019: Suresh Eswarathasan (Cardiff University)
High-energy behavior of eigenfunctions on Riemannian surfaces

Mar 23, 2019: Vignon Oussa (Bridgewater State University)
A new discretization scheme for the construction of frames and wavelets

Mar 27, 2019: Mahya Ghandehari (University of Delaware)
Fourier analysis on non-Abelian topological groups

Mar. 28, 2019: Susan Morey (Texas State University)
Depths and initially regular sequences for ideals in polynomial rings

Mar 29, 2019: Nguyen Lam (University of British Columbia)
Best constants and optimizers for Sobolev type inequalities

Apr.1, 2019: Andrew Obus (CUNY)
Dynamical systems, periodic points, and dynatomic curves

Apr. 8, 2019: Uwe Nagel (University of Kentucky)
Unexpected curves and line arrangements

Apr.11, 2019: David Gosset (University of Waterloo)
Quantum advantage with shallow and noisy circuits

April 22, 2019: Pieter Hofstra (University of Ottawa)
Toposes as generalized group(oid)s

STATISTICS COLLOQUIUM
Organizer: Lam Ho

Oct.18, 2018: Crispin M. Mutshinda (Dal)
Bayesian methods for variable selection in high-dimensional regression models

Nov. 22, 2018: Chris Field (Dal)
Statistics for the Birds

Jan. 31, 2019: Gary Sneddon (MSVU*)*
Modelling of cross-classified count data

Feb.28, 2019: Peter Wentzell (Dal)
Exploring Multivariate Data with Sparse Projection Pursuit Analysis

Mar. 14, 2019 Paulo Henrique Março (Federal Technological University of Paraná - Campo Mourão Campus)
How statistics is improving food analysis in South America: An overview of Brazilian cases

Mar. 28, 2019 Cuong Nguyen *(Amazon Web Services)*
Online Variational Inference for Gaussian Processes and Deep Neural Networks

ATCAT SEMINAR 2018-2019
Organizer: Julien Ross

Sep. 11, 2018: Gabor Lukacs (Dal)
Long colimits of topological algebras
Sep. 18, 2018: Dorette Pronk (Dal)
A double category approach to ordered groupoids and left cancellative categories

Sep. 25, 2018: Jeff Egger
Generalised Hilbert objects and orthocomplemented lattices I

Oct. 2, 2018: Jeff Egger
Generalised Hilbert objects and orthocomplemented lattices II

Oct. 16, 2018: Kohei Kishida (Dal)
An Allegorical Semantics of Modal Logic (Part 1)

Oct. 23, 2018: Kohei Kishida (Dal)
An Allegorical Semantics of Modal Logic (Part 2)

Oct. 30, 2018: Marzieh Bayeh (Dal)
The Svarc genus of a fibration

Nov. 6, 2018: Frank Fu (Dal)
An introduction to the nominal technique

Nov. 20, 2018: Michael Lambert (Dal)
Exactness of an Internal Colimit Functor for 2-Categories

Nov. 27, 2018: Justin Makary (Dal)
Completeness of the ZX-calculus for stabilizer quantum mechanics.

Jan.8, 2019: Dominique Unruh (University of Tartu)
Quantum Relational Hoare Logic

Jan.15, 2019: Robert Paré (Dal)
The Double Category of Rings

Jan. 22, 2019: Toby Kenney (Dal)
Abstract Convexity Spaces and Completely Distributive Lattices

Jan. 29, 2019: Geoffrey Cruttwell (Mt. A)
A linear/non-linear approach to tangent categories (Part I)

Feb. 5, 2019: Geoffrey Cruttwell (Mt. A)
A linear/non-linear approach to tangent categories (Part II)

Feb. 26, 2019: Jeff Egger

Mar. 26, 2019: Darien DeWolf (St. FX)

Apr. 2, 2019: Robert Raphael (Concordia)

Apr. 30, 2019: Curran McConnell (Dal)
Spaces of Trees: Investigating Metric Spaces Used in Phylogenetics

May 7, 2019: Pablo Andres-Martinez (University of Edinburgh)
The input-output behaviour of quantum walks: a traced category

May 14, 2019: Jeff Egger

May 21, 2019: Jeff Egger

NUMBER THEORY SEMINAR
Organizer: Lin Jiu

Jun. 6, 2018 Karl Dilcher
Derivatives and special values of higher-order Tornheim zeta functions

Jun. 20, 2018 Scott Cameron
A Linear Algebra Problem Related to Legendre Polynomials

Sept. 7, 2018 : Maciej Ulas
p-adic Valuations of Certain Colored Partition Functions

Sept. 21, 2018: Lin Jiu
Matrix Representations for Multiplicative Nested Sums

Sept. 28, 2018: Karl Dilcher
Gauss Factorials, Jacobi Primes, and Generalized Fermat Numbers

Oct. 5, 2018: Abdullah Al-Shaghay
Galois Irreducible Polynomials

Oct. 19, 2018: Larry Ericksen
Generalized Stern Polynomials: Their Recursions and Continued Fractions

Oct. 26, 2018: Keith Johnson
p-orderings, Fekete n-tuples and capacity in ultra-metric spaces

Nov. 2, 2018: Asmita Sodhi
A Composite Problem

Nov. 9, 2018: Anne Johnson
ρ-ordering and Valuative Capacity in Ultrametric Spaces

Nov. 23, 2018: Scott Cameron
A Linear Algebra Problem Related to Legendre Polynomials

Nov. 30, 2018: Karl Dilcher
Fermat's Last Theorem

Jan. 14, 2019: Lin Jiu
Orthogonal Polynomials for Bernoulli and Euler Polynomials

Jan. 21, 2019: Karl Dilcher
Zeros and irreducibility of some classes of special polynomials

Feb. 4, 2019: Anne Johnson
Valuative capacity of some compact subsets of $\mathbb{Z}_p$

Feb. 11, 2019: Keith Johnson
Rational Polynomials which Preserve the Ring of 2x2 Matrices with Integer Coefficients

Feb. 25, 2019: Lin Jiu
Random Walk Approaches to Identities on Higher-order Bernoulli and Euler Polynomials

Mar.11, 2019 : Karl Dilcher
Some polynomial and geometric Diophantine equations

Mar. 25, 2019: Abdullah Al-Shaghay
A Survey of Polynomial Results

Apr.1, 2019: Mason Maxwell
Irreducibility of Generalized Stern Polynomials

COMBINATORICS SEMINAR

The combinatorics seminar is a chance for students and professors alike to talk about their research, or material that they find interesting.

This year's talks were:

Sep. 19, 2018: Richard Nowakowski
Permutations that avoid permutations, part 1

Sep. 26, 2018: Richard Nowakowski
Permutations that avoid permutations, part 2

Oct. 3, 2018: Iain Beaton
The reconstruction problem

Oct. 10, 2018: Todd Mullen
Ramsey theory

Oct. 17, 2018: Rebecca Ryan
On pre-periods of discrete influence systems
Oct. 24, 2018: Ben Cameron
Graceful trees conjecture

Nov. 7, 2018: Kyle MacKeigan
Hedetiemi's conjecture

Nov. 21, 2018: Melissa Huggan
The Index: a measure of equality

Nov. 28, 2018: Corey Degagne
On reliability roots of simplicial complexes and matriods

Jan. 23, 2019: Kyle MacKeigan
Orthogonal colouring of degenerate graphs

Jan. 30, 2019: Iain Beaton
An introduction to the domatic polynomial

Feb. 26, 2019: Daniele Turchetti
Combinatorial aspects of tropical curves

Mar. 13, 2019: Todd Mullen
Complete Graphs and Polynomials

Apr. 3, 2019: Danielle Cox
Chromatic Polynomials of Oriented Graphs

May 15, 2019: Sean English
Recent Problems on Hypergraph Saturation

TEACHING MATHEMATICS AND STATISTICS SEMINAR

Organizer: Sarah Chisholm

A group of professors, instructors, and graduate students met several times this year to talk about strategies for engaging students, such as using worksheets in class to highlight key pieces of lessons and to provide scaffolding to help students walk through problems more independently. Peter Selinger gave a demonstration on how to effectively use a tablet in large classroom setting, and highlighted the features that would make tablet use also appealing for small classroom settings. He also showcased many of the problems that he has developed in *WeBWork for Linear Algebra*, including proof base problems. Chad O'Brien, from the Centre for Teaching and Learning, demonstrated the polling software *Top Hat and Forms* as an option for getting feedback from students during class. Joseph Mingrone demonstrated some of the features of *CAPA*, and gave some history about the software and its use across Canada. We also discussed the topic of "Active Learning in the classroom" to think about ways to involve the students more in the learning process, barriers to doing so, and ways to overcome those barriers in a mathematics or statistics class.

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.

Sep. 19, 2018: David Iron
Models of an Epidemic

Sep. 26, 2018: Julien Ross
Topics in Quantum Compiling

Oct. 3, 2018: Karl Dilcher
Leonhard Euler, the Master of Us All

Oct. 10, 2018: Roman Smirnov
Is Democracy Accurate?

Oct. 17, 2018: Lin Jiu
Three Examples of Computer Proofs of Combinatorial Results

Oct. 24, 2018: Jason Brown
All You Need Is Math - The Connections Between Mathematics and Music

Oct. 31, 2018: Kohei Kishida
Probabilities, Graphs, Games, and Quantum Paradoxes

Nov. 7, 2018: Daniele Turchetti
Monsky's Theorem on Dissecting a Rectangle into Triangles

Nov. 21, 2018: Dorette Pronk
The Shape of Data

Nov. 28, 2018: Cuiting Zhong
Optimal Reinsurance Strategy

Jan. 16, 2019: David Iron
The Brachistochrone Curve and the Calculus of Variations

Jan. 23, 2019: Peter Selinger
The Agda proof assistant

Jan. 30, 2019: Daniele Turchetti
Crystals and Groups

Feb. 6, 2019: Melissa Huggan
Simultaneous Combinatorial Game Theory: Challenges and Solutions

Feb. 27, 2019: Curran McConnell
Studying Lateral Gene Transfer with Persistent Homology

Mar. 6, 2019: Ravi Ravi
Classical and Quantum Graph Isomorphisms

Mar. 13, 2019: Alex Christie
Wavelet Sets in R^2

Mar. 20, 2019: Owen Zhang
Zero Forcing Sets and the Minimum Rank

Mar. 27, 2019: Mahya Ghandehari
Fourier analysis on non-Abelian Topological Groups

Apr. 3, 2019: Mason Maxwell
Irreducibility of Generalized Stern Polynomials

FACULTY TALKS

Karl Dilcher:
Stern Polynomials: Irreducibility, Continued Fractions, and Generalizations. ALaNT conference, Bedlewo, Poland, June, 2018.

Gauss Factorials, Jacobi Primes, and Generalized Fermat Numbers. Seminar talk, Brock University, September, 2018.

Peter Borwein: Friend, Mentor, Colleague, Mathematician. Retirement event, SFU, October, 2018.

Four lectures in elementary and analytic number theory. Abdus Salam School of Math. Sciences, Lahore, Pakistan, December, 2018.

Solutions of Certain Polynomial Diophantine Equations. AMS Sectional Meeting, Univ. of Hawai'i, March 2019.

Heronian triangles, Gauss primes, and some linear recurrences. Hawai'i International Number Theory Conference, March 2019.

Zeros and irreducibility of gcd-polynomials. Brock Number Theory Conference II, Brock Univ., May, 2019.

Richard Nowakowski:
"Boiling point: Temperature Bounds for games" at INTEGERS 2018, October in Augusta, Georgia;
"Orthogonal Graph Colouring game", 2018 CMS Winter meeting, December, Vancouver;
"Trends in Combinatorial Games" at Combinatorial Games Colloquium III, January 2019, Lisbon, Portugal;
"A matter of perspective", Recreational Mathematics Colloquium VI, January 2019, Lisbon, Portugal

Dorette Pronk:
"Conditions to Simplify the Bicategory of Fractions Construction", at the Octoberfest Category Theory Workshop 2018, at City University of New York, New York City, October 28, 2018

"On Suborbifolds", at the International Conference on Category Theory 2018, University of Azores, Ponta Delgada, S. Miguel, Azores, Portugal, July 9, 2018

"Metrics on Fractals Defined Using Equational Systems", in the special session on Ergodic Theory, Dynamical Systems, Fractals and Applications during the CMS Summer Meeting 2018, University of New Brunswick, Fredericton, June 3, 2018

Peter Selinger:
Guest lecturer. University of Warsaw, Department of Mathematics, Informatics, and Mechanics. 3 lectures on quantum programming. Warsaw, Sept 24-26, 2018.

Efficient synthesis of quantum circuits by number-theoretic methods. Invited lecture, 20th International Conference on Descriptional Complexity of Formal Systems (DCFS 2018). Halifax, July 25-27, 2018.

Challenges in quantum programming languages. Invited lecture, 3rd International Conference on Formal Structures for Computation and Deduction, (FSCD 2018). Oxford, July 9-12, 2018.

Tutorial on dagger categories. 26th Workshop on Foundational Methods in Computer Science (FMCS 2018), Sackville, New Brunswick, Canada, May 31 - June 2, 2018.

Roman Smirnov:
In search of a new economic model determined by logistic growth, Applied Math Seminar, Department of Applied Mathematics, University of Waterloo, Waterloo, Ontario, April 25, 2019.

Bowley's law revisited, The 2019 Canadian Humbodt "Kolleg" organized by the Alexander von Humboldt Association of Canada, University of Ottawa, Ottawa, Ontario, May 10, 2019.

VISITORS

The department has had many research visitors from several countries over the past year whom contributed to the department's overall research climate.

Christophe Vignat of the Université Orsay (France) and Tulane University visited the department from May 8 to September 12, 2018. He was here to work with Karl Dilcher and Lin Jiu, and also participated in the Fibonacci Conference in July. This is Christophe's fourth visit to Dalhousie; he will visit again later in the summer of 2019.

Larry Ericksen of New Jersey is a combinatorial number theorist, and so it is fair to say that he visited the department countless times, to work with Karl Dilcher. This past year he was here three times, first to attend the Fibonacci Conference in early July, and then for two research visits from September 17 to October 29, 2018, and again from May 5 to May 31, 2019.

Maciej Ulas of the Jagiellonian University in Krakow, Poland, visited the department from August 26 to September 9, to work with Karl Dilcher.

Dr. Reza Farivar, a neuropsychologist from McGill, visited Sara Faridi in the winter term to initiate a collaboration between Dalhousie and McGill. The long term goal is to use methods of topological data analysis to study vision, based on MRI scans of the brain. Dr. Farivar met with many people in the department who are interested in this area, gave a colloquium talk to the whole department, and led a discussion at the Topological Data Analysis seminar.

Alan Coley has two visitors staying for about 6 months. They are Ismael Delgado Gaspar from U. Mexico and Robert Van den Hoogen from St. FXU.

Hong Zhao has been visiting the department since January, from Qingdao University. She is working on Agricultural Insurance Pricing- with Toby Kenney.

Jenna Rajchgot from the University of Saskatchewan was here to visit Sara Faridi and gave a seminar talk called, “On the algebra generated by three commuting matrices"

Uwe Nagel from the University of Kentucky gave an algebra talk entitled "Hilbert Functions of Fat Point Schemes" when he was here visiting Sara Faridi.

CMS SUMMER MEETING

By Karl Dilcher

Our department has always had a very strong representation at CMS Summer and Winter Meetings, and this tradition continued with the past Winter Meeting in Vancouver and the upcoming Summer Meeting, June 7-10, in Regina. While time does not allow to give many details of the Winter Meeting, here is a snapshot of the Dalhousie involvement in Regina:

The Session "Assessment in Mathematics" is organized by Shannon Ezzat (Winnipeg) and Rebecca McKay (UNB), both of them Dalhousie graduates. Speakers include Rebecca McKay herself, as well as Rebecca Milley (Grenfell Campus, Memorial University) and Marie Langlois (Cornell University), two more Dalhousie Ph.D. graduates.

The Session "Categorical Approaches to Topology and Geometry" is organized by Marzieh Bayeh (Dal), Darien DeWolf (SFX) and Dorette Pronk (Dal). Darien is also one of our graduates. Speakers include the three organizers and Geoff Cruttwell (Mount Allison), another Dal PhD graduate, as well as Jonathan Gallagher (AARMS PDS at Dal) and Michael Lambert, who recently defended his PhD thesis with Dorette Pronk.

One of the speakers in the session "Equivariant Methods in Differential and Algebraic Geometry" is Peter Crooks (Northeastern University), one of our math honours graduates of a few years ago.

Masoud Khalkhali (Western), who received his PhD in the 1980s under Peter Fillmore, is a speaker in the session "Finite and Infinite Dimensional Structures in Non-Commutative Analysis"

The session "Indigenization and Reconciliation in Mathematics" is co-organized by Keith Taylor.

One of the speakers in the session "Mathematical Techniques for Analysing Quantum Structures and Materials" is our colleague Julien Ross. Julien will also give a second talk, in the session "The Mathematics behind Quantum Information Science".

Last, but not least, Andrea Fraser will receive the 2019 CMS Excellence in Teaching Award, as mentioned previously in the Chase Report.

Photo by Jenny Edison

Thank you for reading this edition of the Chase Report!

Chase Report is published for alumni and friends of the Department of Mathematics and Statistics, Dalhousie University.

Your suggestions and comments are welcomed for future issues!
admin@mathstat.dal.ca phone: 902-494-2572

This edition of Chase Report was compiled and edited by
Jenny Edison, Office Assistant

Cover Photo by Asmita Sodhi