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CMS NOTES de la SMC

December /
décembre
2018

Vice-President's Notes / Notes du Vice président

Juris Steprans (York University)

Vice President – Ontario / Vice président – Ontario

Are CMS meetings meeting their goals?



On December 7 of each year my Google calendar reminds me of an event crucial to much of my professional life; on that day in 1873 Cantor wrote to Dedekind explaining his argument that the real numbers form an uncountable set. While this notice from Google reminds me of an event of enormous mathematical significance, it also triggers some reflection on the enormous advances that have been made in the technology that we, the mathematical community, use to communicate with each other. The communication of mathematical information — through its journals, conferences, web site and press releases — is of course a key function of the CMS. And, while the CMS is quite effective at using modern technology for its journals and electronic media, I wonder how different a CMS meeting is today from one of the era of Cantor and Dedekind?

Cantor's letter was probably delivered by the *Reichspostgesetz* which had in 1873, recently taken over the responsibility of carrying mail from the family monopoly of Thurn and Taxis. One can assume it arrived in Dedekind's hands quite promptly. Indeed, some snail-mail delivery systems may have rivaled email in speed. If the legends are to be believed, Hardy and Littlewood relied on the four daily deliveries of the British postal service to communicate, even though their offices at Cambridge were separated by only a short walk. But speed is not the main disadvantage of corresponding the results of mathematical inquiry by mail. The dissemination of Cantor's discovery to the

Les Réunions de la SMC atteignent-elles leurs objectifs?

Le 7 décembre de chaque année, mon calendrier Google me rappelle un événement qui s'est avéré déterminant pour une grande partie de ma vie professionnelle. En effet, ce jour-là en 1873, Cantor a écrit à Dedekind pour lui expliquer que les chiffres réels forment un ensemble infini non dénombrable. Bien que cet avis de Google me fasse penser à un événement extrêmement important pour les mathématiques, il suscite aussi une réflexion sur les énormes progrès qui ont été réalisés dans la technologie que nous, la communauté mathématique, utilisons pour communiquer les uns avec les autres. À la SMC, la communication de l'information mathématique – par l'entremise de ses journaux, de ses congrès, de son site web et de ses communiqués de presse – est bien sûr une fonction clé. Et, bien que la SMC utilise assez efficacement la technologie moderne pour ses revues et ses médias électroniques, je me demande à quel point une Réunion de nos membres aujourd'hui est différente de celles que tenaient Cantor et Dedekind à l'époque.

La lettre de Cantor a probablement été livrée par le *Reichspostgesetz* qui, en 1873, venait de prendre en charge le transport du courrier, devoir qui incomba alors au monopole familial de Thurn et Taxis. On peut supposer que la lettre est arrivée entre les mains de Dedekind assez rapidement. En effet, certains systèmes de distribution du courrier escargot peuvent avoir rivalisé en vitesse avec le courrier électronique. Si l'on en croit la légende, Hardy et Littlewood comptaient sur les quatre livraisons quotidiennes des services postaux britanniques pour communiquer,

Midterm Madness

Robert Dawson, St. Mary's CMS Notes Editor-in-Chief



Next week the first-year calculus course that I'm co-teaching will have its midterm exam. It's a responsibility that cannot be avoided. For two hours, each student will be alone in a crowded classroom with a booklet of questions. Even now, I remember what it's like: the universe shrinks to the size of a desk. With luck, the answers come quickly and the paper can

be handed in, more or less completed, before the time's up. Only, sometimes, they don't.

Even this week, the looming midterm is distorting the teaching process. Usually, in our weekly recitations, students spend most of their time learning rather than being tested. They work in groups, they can use their notes, and if all else fails they can raise a hand and get a hint. This week, to make sure that they're ready for next week's test, we spent the entire period doing a dry run. Most of them seemed to do well - but the classroom was strangely quiet. I missed the atmosphere of learning.

Yes, I know we have to examine students. The occasional student wants to get a good grade without earning it, but nobody wants to learn the material and not get graded. (I know this, because the university gives the option of auditing a course, and nobody ever takes it.) There's a measure of personal satisfaction in knowing that the instructor thinks you know how to take a derivative. And, down the road, grad schools and employers are going to want to see that transcript.

As for the midterm, that's more or less forced upon us by university regulations. Before the final drop date (a couple weeks from now), students have to have received a certain proportion of their marks for the course. We don't want them to drift on blissfully through the term unaware that they are failing until the week after the final exam. And I can't disagree.

It all makes perfect sense. But I'll be glad once it's over, to see my classroom go back to being a construction site, rather than a court.

La folie de la mi-session

La semaine prochaine, ce sera l'examen de mi-session dans le cours de calcul de première année que je donne avec une autre personne. C'est une responsabilité à laquelle on n'échappe pas. Pendant deux heures, chaque étudiant se retrouvera fin seul dans une salle de classe bondée devant son cahier d'examen. Mon souvenir de ces moments-là est encore vif : l'univers se réduit à la taille d'un pupitre. Avec un peu de chance, les réponses arrivent rapidement, et l'épreuve est remise, plus ou moins terminée, avant la fin du temps accordé. Parfois, aussi, les réponses se font attendre.

Même cette semaine, les examens de mi-session perturbent la routine d'enseignement. Habituellement, dans les cours hebdomadaires, les

étudiants passent le plus clair de leur temps à apprendre plutôt qu'à se faire tester. Ils travaillent en groupes, ils peuvent utiliser leurs notes et, en cas d'échec, ils peuvent lever la main pour obtenir de l'aide. Cette semaine, pour nous assurer qu'ils sont prêts pour l'examen de la semaine prochaine, nous avons consacré toute la période à un test de pratique. La plupart d'entre eux ont semblé bien s'en tirer, mais la salle de classe était étrangement calme. L'atmosphère d'apprentissage me manquait.

Oui, je sais bien qu'il faut évaluer les étudiants. Il arrive qu'un étudiant veuille obtenir une bonne note sans la mériter, mais personne ne veut apprendre la matière sans recevoir de note. (Je le sais parce que l'université donne la possibilité de s'inscrire comme auditeur libre, mais que personne ne le fait.) Les étudiants éprouvent une certaine satisfaction à savoir que le professeur pense qu'ils savent calculer une dérivée. Et en fin de compte, les écoles d'études supérieures et les employeurs voudront voir des relevés de notes.

En ce qui concerne les examens de mi-session, ils nous sont plus ou moins imposés par les règlements des universités. Avant la date limite d'abandon (dans quelques semaines), les étudiants doivent avoir reçu une certaine partie de leurs notes pour le cours. Nous ne voulons pas les voir traverser leur session nonchalamment sans savoir qu'ils sont en échec jusqu'à la semaine suivant l'examen final.

Je ne peux pas le nier, c'est tout à fait logique. Mais j'ai déjà hâte que ce soit terminé et que ma classe redevienne un chantier de construction plutôt qu'un tribunal.

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Pacific Institute for the Mathematical Sciences

Letters to the Editors

The Editors of the NOTES welcome letters in English or French on any subject of mathematical interest but reserve the right to condense them. Those accepted for publication will appear in the language of submission. Readers may reach us at the Executive Office or at notes-letters@cms.math.ca

Lettres aux Rédacteurs

Les rédacteurs des NOTES acceptent les lettres en français ou en anglais portant sur n'importe quel sujet d'intérêt mathématique, mais ils se réservent le droit de les comprimer. Les lettres acceptées paraîtront dans la langue soumise. Les lecteurs peuvent nous joindre au bureau administratif de la SMC ou à l'adresse suivante : notes-lettres@smc.math.ca.

2019 CMS MEMBERSHIP RENEWALS RENOUVELLEMENTS 2019 À LA SMC



The 2019 membership renewals have been sent! Please renew your membership online by March 31, 2019 at portal.cms.math.ca by logging into your member account. Should you have any questions, please email us at memberships@cms.math.ca

Le renouvellement pour l'an 2019 a été envoyé! S'il vous plaît renouveler votre adhésion en ligne avant le 31 mars, 2019 à portail.smc.math.ca et en vous connectant à votre compte de membre. Si vous avez des questions, s'il vous plaît écrivez-nous à adhessions@smc.math.ca

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CMS NOTES

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La Société mathématique du Canada appuie l'avancement, la découverte, l'apprentissage et l'application des mathématiques. L'exécutif de la SMC encourage les questions, commentaires et suggestions des membres de la SMC et de la communauté.

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Continued from cover

broader mathematical community would have proceeded quite slowly by today's standards, his original letter being available only to Dedekind and, perhaps a few of his students and colleagues.

The problem of the limited readership of handwritten letters was somewhat solved by the circulation of notes reproduced on the Ditto machines that became increasingly common in universities starting in the 1950s. However, this technology only partially addressed the problem of limited readership, because duplicates were made by rubbing a thin layer of blue ink off of a master copy, so only a fixed number of copies were available for distribution before the ink was depleted. Nevertheless, mathematicians were now able to send-off copies of their work to those colleagues fortunate enough to be on their mailing list. The advent of photocopying allowed for longer mailing lists, but researchers at smaller institutions, to say nothing of those in third world countries, would continue to be excluded from the loop. The democratizing effect on mathematical research of technological innovations such as e-mail and arXiv cannot be understated.

The advent of the era of the mathematics institute provided a further step in this democratization process. A colleague of mine recalls arranging to travel to a conference in Britain in the 1960s that he had seen advertised in a professional publication. Upon arrival, though, he was told that the conference was only for invited participants and, even though there was plenty of space and he was willing to pay a registration fee, he was not allowed to attend the talks. The response he received to his question as to why such a restricted conference would be advertised to the general mathematical audience, was essentially that the announcement was intended to bolster the egos of the selected attendees.

While it is still the case that the events run by mathematics research institutes must exercise some selectivity in order to accommodate the space available to them, it is also true that there is much better access to conferences and workshops than in the past. This accessibility continues to grow along with the number of institutes. Ten years ago, when I was serving on the directorate of the Fields Institute, it was not difficult for me to keep abreast of the happenings in all of the major institutes throughout the world. Now I doubt if I could even name half of these institutes.

While these developments have provided excellent new opportunities for everyone involved with mathematics, from students

to international stars, they do pose an important question for the CMS: What role do the research programs of the CMS meetings serve in an environment dominated by research institutions? Has there been any innovation introduced to the CMS special sessions over the past half-century, other than the use of LED projectors? While the special sessions of fifty years ago may have been only one of a few venues for mathematicians to present their research, this is no longer the case today. Indeed, organizing or even participating in a CMS special session is seen by many as more of a duty than an opportunity. Perhaps this is why general research meetings covering a broad spectrum of mathematics do not seem to be as attractive as they once were. Although the broad meeting of the Mathematical Congress of the Americas hosted by the CMS in 2017 in Montreal attracted 1067 participants, it was lower than anticipated.

Of course, identifying a problem is not the same as solving it and I do not pretend to have any good ideas to offer. However, the issue of how to recalibrate the CMS meetings to the current research environment is one to which anyone interested in the long term health of the CMS should be willing to devote some thought. An extreme solution, but one which has its champions, is to eliminate the special session entirely and leave the responsibility of organizing such events to the institutes. A less draconian solution would be to organize only special sessions related to the topics of the CMS plenary lectures. This would allow the plenary lecturers to meet Canadians working in their field, especially more junior researchers. A shorter CMS meeting, focussed on the plenary speakers and the CMS prize winners and without the distraction of business meetings and countless special sessions, might also add to the prestige of being selected for such an honour. This honour would be enhanced by using the very good technology for streaming mathematics talks that many of the institutes already use.

In spite of my criticisms, I believe that it is essential for the CMS to maintain its close connection to mathematical research. While the institutes are currently the centres of most of this activity, they are relative newcomers and very vulnerable to changes in political fashions and the CMS may well outlive them. If this were to be the case, it would be crucial that the CMS not disappear from any future Canadian mathematical research landscape and to do this, it must adapt its research programs to the present landscape, and not to that of the era of Cantor and Dedekind.

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même si leurs bureaux à Cambridge ne se trouvaient qu'à une courte distance de marche l'un de l'autre. Mais la rapidité n'est pas le principal inconvénient que l'on rencontre lorsqu'il s'agit de transmettre les résultats d'une enquête mathématique par la poste. La diffusion de la découverte de Cantor à l'ensemble de la communauté mathématique aurait été assez lente selon les normes actuelles, sa lettre originale n'étant accessible que pour Dedekind, et peut-être quelques-uns de ses étudiants et collègues.

Le problème du nombre limité de lecteurs de lettres manuscrites a été quelque peu résolu par la circulation des notes reproduites sur les machines Ditto, devenues de plus en plus courantes dans les universités à partir des années 1950. Cependant, cette technologie ne permettait de résoudre que partiellement le problème du lectorat limité, car les reproductions étaient produites en frottant une fine couche d'encre bleue sur l'exemplaire original, de sorte que seul un nombre fixe de copies pouvait être distribué avant que l'encre soit épuisée. Néanmoins, les mathématiciens étaient désormais en mesure d'envoyer des copies de leurs travaux à leurs collègues qui avaient la chance de figurer sur leur liste d'envoi. L'avènement de la photocopie a permis d'allonger les listes de diffusion, mais les chercheurs des petits établissements, sans parler de ceux des pays du tiers monde, continuaient d'être exclus de la liste des destinataires. L'effet démocratisant des innovations technologiques comme le courriel et les archives électroniques (arXive) ne peut être sous-estimé.

L'ère des instituts de sciences mathématiques a marqué une nouvelle étape dans ce processus de démocratisation. Un de mes collègues se souvient d'avoir organisé un voyage pour assister à un congrès en Grande-Bretagne dans les années 1960, dont il avait vu la publicité dans une publication professionnelle. À son arrivée, cependant, on lui a dit que le congrès était réservé aux participants invités et que, même s'il y avait beaucoup de place et s'il était prêt à payer les droits d'inscription, il n'était pas autorisé à assister aux conférences. Lorsqu'il a demandé pourquoi un congrès aussi restreint était annoncé à l'auditoire mathématique général, on lui a répondu qu'essentiellement, l'annonce avait pour but de renforcer l'ego des participants sélectionnés.

S'il est toujours vrai que les événements organisés par les instituts de recherche mathématique doivent faire preuve d'une certaine sélectivité afin de s'adapter à l'espace dont ils disposent, il est également vrai que l'accès aux conférences et aux ateliers est bien meilleur que dans le passé. Cette accessibilité continue de croître avec le nombre d'instituts. Il y a dix ans, alors que j'étais membre de la direction de l'Institut Fields, il n'était pas difficile pour moi de me tenir au courant des événements dans tous les grands instituts du monde. Maintenant, je doute même de pouvoir nommer la moitié d'entre eux.

Bien que ces développements aient fourni d'excellentes nouvelles possibilités à tous ceux qui s'intéressent aux mathématiques, des étudiants aux vedettes internationales, ils soulèvent des questions importantes pour la SMC : quel est le rôle des programmes scientifiques des Réunions de la SMC dans un milieu dominé par les établissements de recherche? Des innovations ont-elles été apportées aux sessions spéciales de la SMC au cours des cinquante dernières années, à part l'utilisation de projecteurs LED? Si les sessions spéciales d'il y a cinquante ans étaient au nombre des rares endroits où les mathématiciens pouvaient présenter leurs recherches, ce n'est plus le cas aujourd'hui. En effet, le fait d'organiser une session spéciale de la SMC ou même d'y participer est considéré par beaucoup comme un devoir plutôt qu'une occasion à saisir. C'est peut-être la raison pour laquelle les congrès scientifiques généraux couvrant le large spectre des mathématiques ne semblent plus aussi attrayants qu'autrefois. Bien que le grand rassemblement du Congrès mathématique des Amériques organisé par la SMC en 2017 à Montréal ait attiré 1 067 participants, le nombre de congressistes a été moins élevé que prévu.

Bien sûr, déceler un problème ne revient pas à le résoudre, et je ne prétends pas avoir de bonnes idées à suggérer. Cependant, la manière de recalibrer les Réunions de la SMC dans le contexte de recherche actuel est un sujet auquel toute personne intéressée par la vitalité à long terme de la SMC devrait être prête à réfléchir. Une solution extrême, mais qui a ses défenseurs, consiste à éliminer complètement la session spéciale et à laisser aux instituts la responsabilité d'organiser de tels événements. Une solution moins draconienne serait d'organiser uniquement des sessions spéciales liées aux thèmes des conférences plénaires de la SMC. Cette option permettrait aux conférenciers des plénaires de rencontrer des Canadiens qui travaillent dans leur domaine, en particulier des chercheurs moins expérimentés. Une Réunion plus courte de la SMC, centrée sur les conférenciers de la plénière et les lauréats des prix de la SMC, sans la distraction des rencontres d'affaires et des innombrables sessions spéciales, pourrait également ajouter au prestige d'être sélectionné pour un tel honneur. Cet honneur serait rehaussé par le recours à l' excellente technologie de diffusion en continu des discussions mathématiques que de nombreux instituts utilisent déjà.

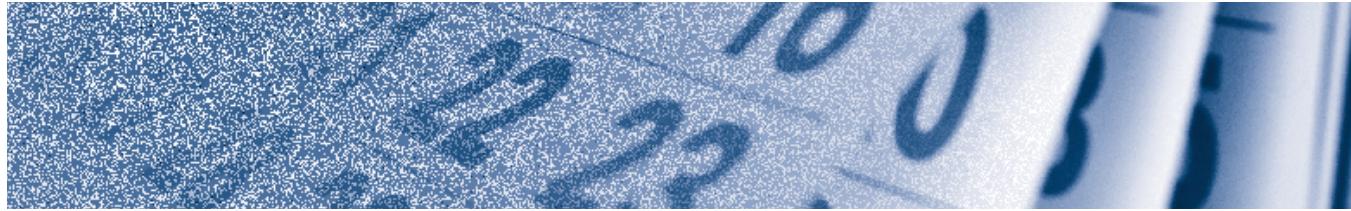
Malgré mes critiques, il me semble essentiel que la SMC maintienne ses liens étroits avec la recherche mathématique. Bien que les instituts soient actuellement les centres de la plus grande partie de cette activité, ils sont relativement nouveaux et très vulnérables aux changements de mode politiques, et la SMC pourrait bien leur survivre. Si tel devait être le cas, il serait crucial que la SMC ne disparaisse pas du paysage canadien de la recherche mathématique et, pour ce faire, elle doit adapter ses programmes scientifiques au contexte actuel, et non à celui de l'époque de Cantor et Dedekind.

The Calendar brings current and upcoming domestic and select international mathematical sciences and education events to the attention of the CMS readership. Comments, suggestions, and submissions are welcome.

Denise Charron, Canadian Mathematical Society,
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Le calendrier annonce aux lecteurs de la SMC les activités en cours et à venir, sur la scène pancanadienne et internationale, dans les domaines des mathématiques et de l'enseignement des mathématiques. Vos commentaires, suggestions et propositions sont le bienvenue.

Denise Charron, Société mathématique du Canada
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DECEMBER 2018 DÉCEMBRE

- | | |
|--------------|---|
| 2-7 | BIRS Workshop: Integrating the Integrators for Nonlinear Evolution Equations: from Analysis to Numerical Methods, High-Performance-Computing and Applications , BIRS, Banff, Alta. |
| 7-10 | 2018 CMS Winter Meeting/Réunion d'hiver de la SMC 2018, Sheraton Vancouver Wall Centre, Vancouver, B.C. |
| 9-14 | BIRS Workshop: Shape Analysis, Stochastic Mechanics and Optimal Transport , BIRS, Banff, Alta. |
| 11-14 | CRM Workshop: Workshop on Mathematical and Computational Methods for Quantum Systems , CRM, Montreal, Que. |

JANUARY 2019 JANVIER

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|--------------|--|
| 13-18 | BIRS Workshop: Models and Algorithms for Sequential Decision Problems under Uncertainty , BIRS, Banff, Alta. |
| 16-19 | 2019 Joint Mathematics Meetings (JMM), Baltimore, Maryland, U.S.A. |
| 20-25 | BIRS Workshop: Representation Theory Connections to (q,t)-Combinatorics , BIRS, Banff, Alta. |
| 21-25 | Mini-course “ Representations of simple finite dimensional and affine Lie algebras ”, Memorial University, St. John's, NL |
| 22-25 | CRM Workshop: Nirenberg Lectures in Geometric Analysis by Vadim Kaloshin, CRM, Université de Montréal, Montreal, Que. |
| 23-26 | 2019 Workshop on Testing Gravity , Simon Fraser University, Burnaby, B.C. |
| 25-27 | Combinatorial Algebra meets Algebraic Combinatorics 2019 , University of Ottawa, Ottawa, Ont. |
| 27-31 | BIRS Workshop: Optimal Transport Methods in Density Functional Theory , BIRS, Banff, Alta. |
| 29 | Integration Challenge at StFX , St. Francis Xavier University, Antigonish, N.S. |

FEBRUARY 2019 FÉVRIER

- | | |
|-----------------|--|
| 6 | Math Biology Seminar: Joy Richman, University of British Columbia, Vancouver, B.C. |
| 10-15 | BIRS Workshop: Computational Light Transport , BIRS, Banff, Alta. |
| 17-22 | BIRS Workshop: Statistical Analysis of Large Administrative Health Databases: Emerging Challenges and Strategies , BIRS, Banff, Alta. |
| 24-Mar 1 | BIRS Workshop: Frontiers in Single-cell Technology, Applications and Data Analysis , BIRS, Banff, Alta. |
| 24-Mar 1 | BIRS Workshop: Isogeometric Splines: Theory and Applications , BIRS, Banff, Alta. |
| 27-Mar 1 | Workshop on Quantitative Analysis and the Digital Turn in Historical Studies, The Fields Institute, Toronto, Ont. |

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| 1-31 | New Developments in Free Probability and Applications, CRM, Université de Montréal, Montreal, Que. |
| 3-8 | BIRS Workshop: Phase-Field Models of Fracture , BIRS, Banff, Alta. |
| 4-8 | CRM Workshop: Free Probability: the theory, its extensions , CRM, Université de Montréal, Montreal, Que. |
| 10-15 | BIRS Workshop: Asymptotic Algebraic Combinatorics , BIRS, Banff, Alta. |
| 17-22 | BIRS Workshop: Mathematical Criminology and Security , BIRS, Banff, Alta. |
| 22-24 | Montreal-Toronto Workshop in Number Theory: Period Maps , CRM, Université de Montréal, Que. |
| 24-29 | BIRS Workshop: The Topology of Nucleic Acids: Research at the Interface of Low-Dimensional Topology, Polymer Physics and Molecular Biology , BIRS, Banff, Alta. |
| 25-29 | CRM Workshop: Free Probability: the applied perspective , CRM, Université de Montréal, Montreal, Que. |

Book Reviews brings interesting mathematical sciences and education publications drawn from across the entire spectrum of mathematics to the attention of the CMS readership. Comments, suggestions, and submissions are welcome.

Karl Dilcher, Dalhousie University (notes-reviews@cms.math.ca)

Editor's Note

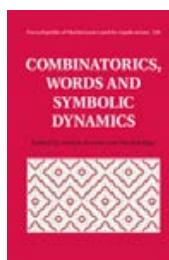
Only a relatively small number of full-length book reviews can be published each year. This issue of the Book Reviews contains four short reviews, written by myself, of books with some connections to Canadian mathematics, which will not be reviewed in full. In the case of one of these books, a full review of its first edition was published a few years ago. More short reviews will be published at regular intervals.

Combinatorics, Words and Symbolic Dynamics

Edited by Valérie Berthé and Michel Rigo

Cambridge University Press, 2016

ISBN: 978-1-107-07702-7



This sizeable book of 475 pages is a “collaborative volume [which] aims at presenting and developing recent trends in combinatorics with applications in the study of words and in symbolic dynamics”, to quote from the beginning of the Preface. The purpose of this book is best described by quoting a further paragraph from the Preface:

“This book is primarily intended for graduate students or research mathematicians and computer scientists interested in combinatorics on words, pattern avoidance, graph theory, quivers and frieze patterns, automata theory and synchronized words, tilings and theory of computation, multidimensional subshifts, discrete dynamical systems, ergodic theory and transfer operators, numeration systems, dynamical arithmetics, analytic combinatorics, continued fractions, and probabilistic models. We hope that some of the chapters can serve as useful material for lecturing at the master/graduate level. Some chapters of the book can also be interesting to biologists and researchers interested in text algorithms or bio-informatics.”

The main body of the book consists of 11 chapters, with the first chapter a general introduction written by the editors, where the main notions that occur in the book are presented. The remaining chapters are as follows:

“Expansions in non-integer bases”, by M. de Vries and V. Komornik; “Medities, end-first algorithms, and the case of Rosen continued fractions”, by B. Rittaud; “Repetitions in words”, by N. Rampersad

Les comptes-rendus de livres présentent aux lecteurs de la SMC des ouvrages intéressants sur les mathématiques et l’enseignement des mathématiques dans un large éventail de domaines et sous-domaines. Vos commentaires, suggestions et propositions sont les bienvenus.

Karl Dilcher, Dalhousie University (notes-critiques@smc.math.ca)

and J. Shallit; “Text redundancies”, by G. Badkobeh, M. Crochemore, C.S. Iliopoulos, and M. Kubica; “Similarity relations on words”, by V. Halava, T. Harju, and T. Kärki; “Synchronized automata”, by M.-P. Béal and D. Perrin; “Cellular automata, tilings and (un)computability”, by J. Kari; “Multidimensional shifts of finite type and sofic shifts”, by M. Hochman; “Linearly recursive sequences and Dynkin diagrams”, by C. Reutenauer; “Pseudo-randomness of a random Kronecker sequence. An instance of dynamical analysis”, by E. Cesaratto and B. Vallée.

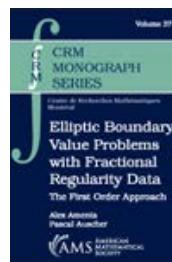
This book is Volume 159 in the well-known “Encyclopedia of Mathematics and Its Applications” Series, and like all volumes in this series it is well-produced and seems carefully edited. Finally, I’d like to mention that three of the chapter authors are Canadians, namely Narad Rampersad (Winnipeg), Jeffrey Shallit (Waterloo), and Christophe Reutenauer (UQAM).

Elliptic Boundary Value Problems with Fractional Regularity Data. The First Order Approach

by Alex Amenta and Pascal Auscher

CRM Monograph Series, AMS, 2018

ISBN 978-1-4704-4250-7



This research monograph is Volume 37 of one of the book series of the Centre de Recherches Mathématiques in Montréal, co-published with the American Mathematical Society. The contents of this book are best described by quoting the text on the back cover:

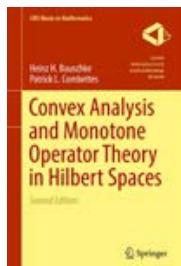
“In this monograph the authors study the well-posedness of boundary value problems of Dirichlet and Neumann type for elliptic systems on the upper half-space with coefficients independent of the transversal variable and with boundary data in fractional Hardy-Sobolev and Besov spaces. The authors use the so-called ‘first order approach’ which uses minimal assumptions on the coefficients and thus allows for complex coefficients and for systems of equations.”

“This self-contained exposition of the first order approach offers new results with detailed proofs in a clear and accessible way and will become a valuable reference for graduate students and researchers working in partial differential equations and harmonic analysis.”

The introduction, table of contents, and some other material can be found at the book’s web page at <https://bookstore.ams.org/crmm-37/>

Convex Analysis and Monotone Operator Theory on Hilbert Spaces, 2nd Ed.

by Heinz Bauschke and Patrick Combettes
 CMS Books in Mathematics, Springer Verlag, 2017
 ISBN 978-3-319-48310-8



The first edition of this massive volume of 620 pages was published in 2011 and was very well received in terms of citations and reviews. A full and very detailed review appeared in Vol. 45(1), Feb. 2013, of the CMS Notes (<https://cms.math.ca/notes/v45/n1/Notesv45n1.pdf>).

The review by Frank Deutsch of the first edition begins with, "This is a wonderful book!". Deutsch concludes his review with an equally strong endorsement: "In my view, any mathematical monograph that one always keeps conveniently on his desk (as opposed to in his bookcase) since it is frequently opened, studied, or referred to, is a classic. According to this definition, I expect the Bauschke-Combettes book to become a classic." The citation numbers certainly support Frank Deutsch's prediction.

To quote from the text on the back cover, as I often do in brief reviews: "This reference text [...] offers a modern unifying presentation of three basic areas of nonlinear analysis: convex analysis, monotone operator theory, and the fixed point theory of nonexpansive operators. Taking a unique comprehensive approach, the theory is developed from the ground up, with the rich connections and interactions between the areas as central focus, and it is illustrated by a large number of examples."

As far as new material in this second edition is concerned, the back cover continues, "[It] greatly expands on the first edition, containing over 140 pages of new material, over 270 new results, and more than 100 new exercises. It features a new chapter on proximity operators including two sections on proximity operators of matrix functions, in addition to several new sections distributed throughout the original chapters. Many existing results have been improved, and the list of references has been updated."

If the success of the first edition is any indication, this new edition can also be expected to become a classic.

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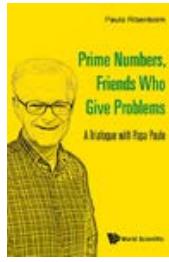


cms.math.ca

Prime Numbers, Friends Who Give Problems. A Trialogue with Papa Paulo

by Paulo Ribenboim
 World Scientific, 2017.

ISBN 978-9814725-80-4



Full disclosure: Paulo Ribenboim was my PhD thesis supervisor in the early 1980s.

Already a successful author of several books in algebra and number theory at the time, he later wrote several interesting and unique books for a more general mathematically educated audience, such as "The Book of Prime Number Records" (1988, with two later editions), "The Little Book of Big Primes" (1991, with a "Bigger" edition 2004), or "My Numbers, My Friends. Popular Lectures on Number Theory" (2000).

Ribenboim's latest book, "Prime Numbers, Friends Who Give Problems", is to some extent written in the same unique style the author has developed for his popular and expository books over his long writing career. However, it is probably his most unusual and quirkiest book yet. The subtitle, "A Trialogue with Papa Paulo", gives an indication of the book's premise: Two bright and interested young people in lively conversations with the author, "Papa Paulo". It begins with the innocent question, "Can you explain prime numbers to me?", and what follows leads the reader (or, more to the point, the listener) through what amounts to a course in elementary number theory, all presented in the form of often lighthearted dialogues. But the book goes well beyond elementary material, discussing the Riemann zeta function, primes in arithmetic progressions, the prime number theorem, numerous conjectures related to primes, and many other topics, including Mersenne and Fermat primes and public key cryptography.

Throughout the book there are short biographies, usually just under a page in length, of most of the important number theorists mentioned in the book. Like Ribenboim's earlier books mentioned above, this volume is different from other popular books on mathematics in that it requires more patience and perseverance from the (student) reader, but it will be well worth the effort.

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Education Notes brings mathematical and educational ideas forth to the CMS readership in a manner that promotes discussion of relevant topics including research, activities, and noteworthy news items. Comments, suggestions, and submissions are welcome.

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Kseniya Garaschuk, University of Fraser Valley

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Les Notes pédagogiques présentent des sujets mathématiques et des articles sur l'éducation aux lecteurs de la SMC dans un format qui favorise les discussions sur différents thèmes, dont la recherche, les activités et les nouvelles d'intérêt. Vos commentaires, suggestions et propositions sont les bienvenus.

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This issue recognizes the mathematical efforts of Amarjit (Amar) Sodhi, a dear friend and colleague in the math community, who passed away in April 2018. Specifically the column is prepared as an expression of appreciation. The piece is co-authored and presented in two parts. The first is written from the perspective of a colleague of Amar's who shared mutual interests in outreach, the second is offered by his daughter.

In Recognition of Amar Sodhi's Gifts to the Math Community

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Part I

Amar Sodhi taught in various universities prior to commencing a contractual appointment in the fall of 1993 at Sir Wilfred Grenfell College (now known as Grenfell Campus, Memorial University of Newfoundland). Curiously I had begun a two-year contract months earlier in the winter semester. It became apparent quickly that we would enjoy working together. Mutual respect and interest in the work of the other continued from that time, though our overlapping period in the department was just one year. Amar remained at Grenfell assuming a tenure track appointment in 1995.

Playing with mathematics was a pastime for Amar and this playful spirit extended into outreach. For example, Amar initiated a collaborative effort with the local school district around the idea of *Math Fairs*. He enjoyed puzzles of various sorts. Amar adapted familiar games such as *Mastermind* or lesser-known games such as *Chomp* in ways designed to engage school aged audiences. He organized an annual CMS Math Camp from 2001 through 2006. Participants represented most high schools in the western portion of the province including southern Labrador over three days each spring. The idea of extending and developing young mathematicians featured prominently in Amar's outreach efforts. One such example arose through the development of regional math fairs. Amar wrote on this idea in an outreach article that appeared in December 2010. An excerpt from the piece appears below.

(See <https://cms.math.ca/notes/v42/n6/Notesv42n6.pdf> for the complete version.) Quoting Amar Sodhi,

Based on my interest and experience in promoting the recreational side of mathematics within the school system, I approached Terry Pike, the itinerant for enrichment with the Western School District, with the idea of having me host a "math show" designed for students in grade 9. This idea was enthusiastically received by Terry and hence, the 2008 Western Newfoundland "Junior High School Math Fair" was born.

Because of the immense area of the School District, it was decided that we needed two performances for our inaugural year; one staged in Corner Brook, serving schools south of Deer Lake and another held in Plum Point (some 400 km north of Corner Brook) to accommodate schools on the Northern Peninsula and in Southern Labrador. About 60 students and ten teachers were to be accommodated at each site for the day-long event. Teacher involvement was important to the Western School District as the hope was teachers would find something new to take back to the classroom. To facilitate this, Terry arranged for a handbook to be issued which gave details of the various activities that were planned for the day.... Some students had to endure a three-hour journey on a yellow school bus to get to the event. The Fair itself had two main components: a session on games and a session on arithmetic and logic.

Many summers Amar supported the *WISE (Women in Science and Engineering)* initiative by hiring a student. Typically extensive involvement with a specific mathematical problem or idea would be central to this experience. One such example featured a favourite problem of Amar's, namely, *Kirkman's Schoolgirl Problem*.

A school teacher wishes to provide a walking schedule for 15 girls so that, over a period of a week, each girl walks daily with two companions but no two girls appear together in a threesome twice. Can you help the teacher find such a schedule?

My understanding of this problem grew through a sabbatical visit by Amar including a presentation to my math education class at UNB in 2003. There he offered a presentation on this problem in a scaffolded way while having students engage with this problem amongst other challenges integrated into the evening. Readers interested in a detailed discussion of the problem will find insights and extensions in a *CRUX* piece authored by Amar. The article can be obtained from the link: https://cms.math.ca/crux/v33/n4/public_page211-213.pdf

Our mutual interests in recreational mathematics and outreach connected us in ways that offered some quiet comfort knowing that there was a sounding board welcoming challenges to consider. Collaboration took a different form without many actual direct face-to-face meetings aside from occasional conference encounters. One noteworthy crossover involved the Education Session at the 1999 *APICS* (now *Science Atlantic*) Meeting in St. John's with a theme of recreational mathematics.

Problems of varied levels appealed to Amar's instincts, as they became fodder for camps, contest preparation, teaching, or simply amusing and challenging his children. The range of interests made for another professional connection, as he became a regular reviewer of books with a recreational mathematical flair or collections of problems. This support extended beyond reviewing to later assuming the role of book review editor for *Crux Mathematicorum* from 2009 to 2013.

In closing my part, I want to add that *quietly many mathematicians influence others through varying models of mentorship unseen by most*. Amar's work with the *WISE* initiative over several summers represented such an example, as did his extensive outreach efforts particularly in western Newfoundland and Labrador. Perhaps the most striking example comes through the mathematical development of his daughter Asmita.

Part II

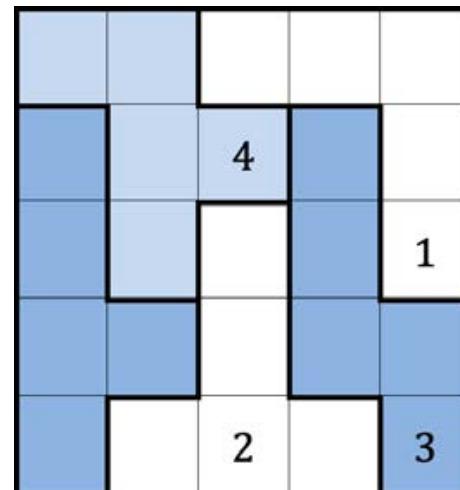
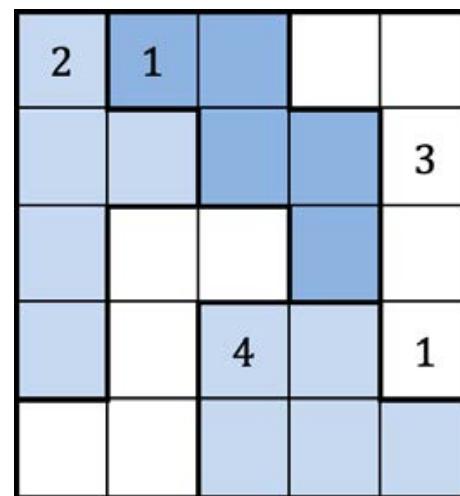
My earliest memory of mathematics was through math sticker books Amar, my dad, gave to me when I was four. By the age of seven I became his helper for preparing materials for outreach presentations in schools, sometimes acting as the guinea pig for activities along the way. I would help draw playing mats for games of *Cops and Robbers* on Bristol board, or place dominoes on a checkerboard with some spots missing, or tape class sets of paper loops and Möbius strips, picking up various pieces of mathematical knowledge along the way.

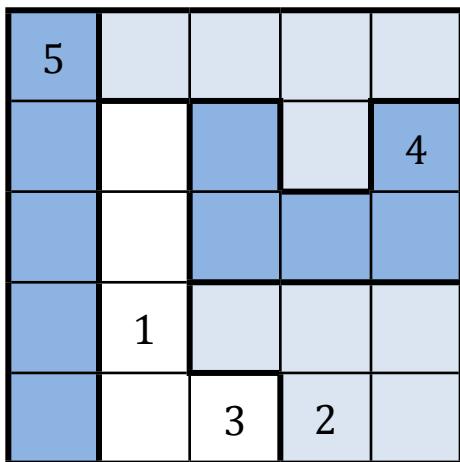
Amar involved himself in outreach activities for all ages. For a few years he was an annual guest in the Grade 4 classroom of our elementary school (though, interestingly, not when either of his own children were in Grade 4), and helped to run a Young Mathematicians workshop for Grade 5 and 6 students hosted by the Newfoundland Western School District at Sir Wilfred Grenfell College. He also organized math-themed Mini Courses for several

years, a program within the school district that rewarded strong students in Grades 7 through 9 by letting them miss school for two to three days for enrichment purposes in a variety of subjects.

In conjunction with the Western School District, Amar developed a Junior High School Math Fair, which lasted for a few years and were held in different communities in order to reach as many students and teachers within the enormous district as possible. Handbooks of activities from the fair were provided to teachers in attendance, in the hope that these teachers could bring this "fun math" back to their schools and classrooms.

Amar enjoyed bringing "fun math" home as well. His son became very interested in pentominoes at a young age, and soon later was swept up in the Sudoku craze, leading to Amar's creation of a logic puzzle he dubbed "Pentodoku": a Sudoku-like puzzle wherein one places the numbers 1 through 5 so they are each in every row, column, and pentomino piece arranged in a 5x5 square. With the help of *WISE* and undergraduate students under his supervision, and under the insistence of my brother that he received a puzzle book for his birthday, Amar built a small collection of Pentodoku puzzles that, as yet, remain unpublished. A few of them are included here:





When John sent a copy of Martin Gardner's *aha! A Two Volume Collection* to his office for the purposes of review (which appeared in *Crux Mathematicorum* in Nov 2007), Amar sneakily left it beside my place at the dinner table, fully aware of my bad habit of reading while eating. Though I didn't understand all of it, I enjoyed the book enough to bring it to my junior high school to read between classes, and to this day it remains my very favourite "fun math" book. When he became book review editor of *Crux* in 2009, he continued the practice of leaving books he thought I'd like in the same place for me to discover and pore over during supper, much to my mother's chagrin.

Though my dad and I were only loosely in the same area of mathematical study, our real connection has always been sharing our love of math with others and each other. Ten years after I was finally eligible to go to a CMS Math Camp myself, I was

able to help in the organization of one. Decades after my dad started doing math outreach in schools, I find myself sometimes presenting to kids of all ages in classrooms as part of a program through my university, volunteering with a group of wonderful students doing math enrichment, and supervising some of the same math contests I was encouraged to write as a high school student. The interest I have in math outreach and enrichment today is unquestionably due to the influence of my father.

When John asked me to help him write this tribute, I approached Terry Pike, Amar's main contact at the Western School District, to check for any information about his outreach work that I may have forgotten or missed. She shared some very kind memories of my dad, and a wonderful summary with which it feels appropriate to close this article:

Many, many teenagers experienced the fun of mathematics because of the efforts of Dr. Sodhi. Many teenagers from small communities came to spend social time with others who shared those interests and aptitudes. In those workshops, they were not unique and different "math brains and geeks", they were one of dozens and dozens who showed each other that there are many places for lovers of Math fun! [Dr. Sodhi] gave that gift and left that legacy to many of our next generation of leaders in his adopted home of western Newfoundland. We are the richer for his gentle ways, innovative community-outreach workshops, and willingness to share his time and skills with his own children and other people's children, also. In my estimation, it is a wonderful epitaph of high esteem to be remembered as a generous man.

Annual Fundraising Campaign

Last year, members of the CMS Board of Directors, staff members and friends of the CMS took time to contact current and past members of the Society (either by email or phone) and thank them for their participation in CMS activities and to encourage them to renew their CMS membership (if they hadn't already done so). This friend-raising and fundraising campaign was very successful and gave members a chance to comment upon what they enjoyed about belonging to the Society, as well as constructive advice on how the Society could be improved.

Once again, at the close of the year, the CMS plans to contact and thank its community again, as well as to encourage further membership in the Society and to encourage its members to give as generously as possible to the CMS.

With your regular donations, as well as those from foundations, corporations, governments and institutions, the CMS programs and activities will be expanded as will our ability to truly represent the full community of Mathematicians in Canada.

The CMS encourages you to consider donations through **Planned Giving**.

Bequeathing money to a charity of your choice will offset the taxes in the estate. If your net income in the year of your death is lower than the amount you bequeathed, your executor can claim a rebate against your previous year's income and add that to your estate. You can also transfer ownership of a life insurance policy as a taxable donation.

You can also help by:

- If you have contacts in private industry or with foundations, who the CMS contact to explore partnerships, please communicate this information to Patricia Dack, CMS Fundraising and Communications Officer.
- If you are interested in volunteering for a CMS committee, please contact the Chair of the Nominating Committee, David Pike (Memorial) - chair-nomc@cms.math.ca
- Encourage colleagues to become members of the CMS!

Working together, we can continue to promote the advancement, discovery, learning, and application of mathematics. If you have questions or want more information, please contact Patricia Dack at pdack@cms.math.ca

Campagne de financement annuelle

L'année dernière, les membres du conseil d'administration, les membres du personnel et les amis de la SMC ont pris le temps de contacter les membres actuels et les anciens membres de la Société (par courriel ou téléphone), de les remercier de leur participation aux activités de la SMC et de les encourager à renouveler leur adhésion (s'ils ne l'avaient pas déjà fait). Cette campagne de recrutement et de collecte de fonds a été couronnée de succès et a permis aux membres de nous dire ce qu'ils aimeraient du fait d'être membres de la Société et de faire des conseils constructifs sur ce que la Société pourrait faire de mieux.

Une fois de plus, à la fin de l'année, la SMC prévoit contacter et remercier sa communauté, encourager d'autres personnes à devenir membres et inviter ses membres à donner le plus généreusement possible à la Société.

Grâce à vos dons constants, ainsi qu'à ceux de fondations, de sociétés, de gouvernements et d'établissements d'enseignement, les programmes et activités de la SMC seront améliorés, tout comme notre capacité de représenter véritablement l'ensemble de la communauté mathématique canadienne.

La SMC vous invite à réfléchir à la possibilité de faire un **don planifié**.

Le fait de léguer de l'argent à un organisme de bienfaisance de votre choix réduira l'impôt que devra payer votre succession. Si votre revenu net dans l'année de votre décès est inférieur au montant que vous avez légué, votre exécuteur testamentaire peut demander une réduction sur votre revenu de l'année précédente et l'ajouter à votre succession. Vous pouvez également transférer la propriété d'une police d'assurance-vie en tant que don imposable.

Ce que vous pouvez aussi faire pour aider la SMC :

- Si vous avez des contacts dans le secteur privé ou des fondations avec qui la SMC peut communiquer pour discuter d'éventuels partenariats, parlez-en à Patricia Dack, agente de la collecte de fonds et des communications à la SMC.
- Si vous souhaitez devenir membre d'un comité de la SMC, veuillez contacter le président du Comité des mises en candidature, David Pike (Memorial) – chairnomc@smc.math.ca
- Encouragez vos collègues à devenir membres de la SMC!

En travaillant ensemble, nous pouvons continuer à promouvoir l'avancement, la découverte, l'apprentissage et l'application des mathématiques. Si vous avez des questions ou pour obtenir plus d'informations, veuillez contacter Patricia Dack à l'adresse pdack@smc.math.ca

Research Notes brings mathematical research ideas forth to the CMS readership in a generally accessible manner that promotes discussion of relevant topics including research (both pure and applied), activities, and noteworthy news items. Comments, suggestions, and submissions are welcome.

Patrick Ingram, York University (notes-research@cms.math.ca)

Counting and geometry in number theory

Arthur Baragar, Department of Mathematical Sciences, University of Nevada at Las Vegas

The Markoff equation $x^2 + y^2 + z^2 = 3xyz$ has many fascinating properties, one of which is that it has a non-trivial infinite set of integer solutions that is easy to describe. The Markoff tree of all positive integer solutions can be generated from the root solution $(1, 1, 1)$ and applications of the maps $\sigma_1(x, y, z) = (3yz - x, y, z)$ and similarly defined σ_2 and σ_3 . The number of integer solutions with largest component bounded by B was investigated by Zagier [14], who showed that it grows asymptotically like $c(\log B)^2$ and calculated c . He compared the Markoff tree to the Euclid tree by applying a roughly logarithmic map Ψ , and used classical number theoretic results to count the latter.

The Hurwitz equation $x_1^2 + \dots + x_4^2 = 4x_1 \cdots x_4$ is an analog of the Markoff equation with a similar tree of solutions generated from $(1, 1, 1, 1)$. There is a similar map Ψ to a Euclid-like tree, but the rate of growth of the latter is much more subtle. In this case, the number of solutions bounded by B grows asymptotically like $c(\log B)^\beta$ for a fractal exponent $\beta \approx 2.45 \pm .03$ [1, 3, 9].

The Mordell variation $x^2 + y^2 + z^2 = 2xyz + 1$ has the fascinating property that it includes an infinite tree of curves, generated from the root curve $(1, t, t)$. The analog of Ψ in this case is exactly the degree map, so counting the number of curves of degree bounded by B is relatively simple. Asymptotics are $9(\log B)^2/(4\pi^2)$.

A natural generalization of the Markoff equation are equations of the form $F_0(Y, Z)X_0^2 + F_1(Y, Z)X_0X_1 + F_2(Y, Z)X_1^2 = 0$, where $X = (X_0 : X_1) \in \mathbb{P}^1$, and the coefficients F_i are quadratics (over \mathbb{Q}) in each of the projective variables Y and Z . A smooth surface \mathcal{X} of this type is a K3 surface [13] (called a Wehler K3 surface). The maps σ_i generalize in the obvious way. For generic \mathcal{X} , the group $\mathcal{A} = \langle \sigma_1, \sigma_2, \sigma_3 \rangle$ has finite index in the automorphism group $\text{Aut}(\mathcal{X})$ and an analog of Ψ again sends rational points in the \mathcal{A} -orbit of a point $P \in \mathcal{X}$ to a Euclid-like tree. The images, though, have a geometric interpretation: They are the orbit of a point in the hyperbolic plane \mathbb{H}^2 under the action of a discrete group of isometries with fundamental domain an ideal triangle. Counting rational points in an orbit is therefore (mostly) the Gauss circle problem solved by Selberg and asymptotics are $c(B) \log B$ for a bounded function $c(B)$ [2].

Les Notes de recherche présentent des sujets mathématiques aux lecteurs de la SMC dans un format généralement accessible qui favorise les discussions sur divers sujets pertinents, dont la recherche (pure et appliquée), les activités et des nouvelles dignes de mention. Vos commentaires, suggestions et propositions sont les bienvenus.

Patrick Ingram, York University (notes-recherche@smc.math.ca)

Generic Wehler K3 surfaces contain no smooth rational curves, but if there exists a point $(Q_Y, Q_Z) \in \mathbb{P}^1 \times \mathbb{P}^1$ so that $F_i(Q_Y, Q_Z) = 0$ for all i , then \mathcal{X} contains the smooth rational curve L given by (X, Q_Y, Q_Z) . This makes \mathcal{X} an analog of the Mordell equation. Looking at just degrees, though, is rather puzzling, as there are frequently common factors amongst the polynomials we get after applying the maps σ_i . This cancellation is nicely explained by the beautiful field of intersection theory, and the appropriate analog of Ψ is exactly the map from curves on \mathcal{X} to their divisor classes in $\text{Pic}(\mathcal{X})$. If \mathcal{X} contains L but is otherwise generic, then the divisor classes of curves are vectors with four components, three of which can be interpreted as degrees. Smooth rational curves on \mathcal{X} (like those in the \mathcal{A} -orbit of L) are called -2 curves and their divisor classes again have a nice geometric interpretation: They represent planes in \mathbb{H}^3 . The image of the \mathcal{A} -orbit of L after applying Ψ is shown in (1) (dark lines), where each circle represents a plane in the Poincaré upper half-space model of \mathbb{H}^3 . We know that this cannot represent all the -2 curves on \mathcal{X} , and in fact, \mathcal{A} has infinite index in $\text{Aut}(\mathcal{X})$. The set of all -2 curves on \mathcal{X} is the orbit of L under $\text{Aut}(\mathcal{X})$, and its image is all of (1). The group $\text{Aut}(\mathcal{X})$ is generated by \mathcal{A} and a fourth involution that can be described using the group structure of elliptic curves on \mathcal{X} [4].

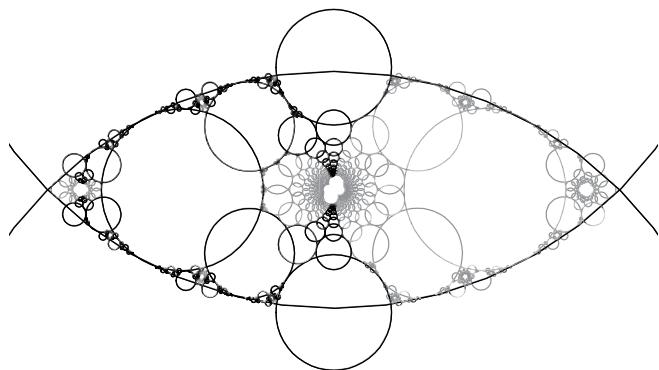


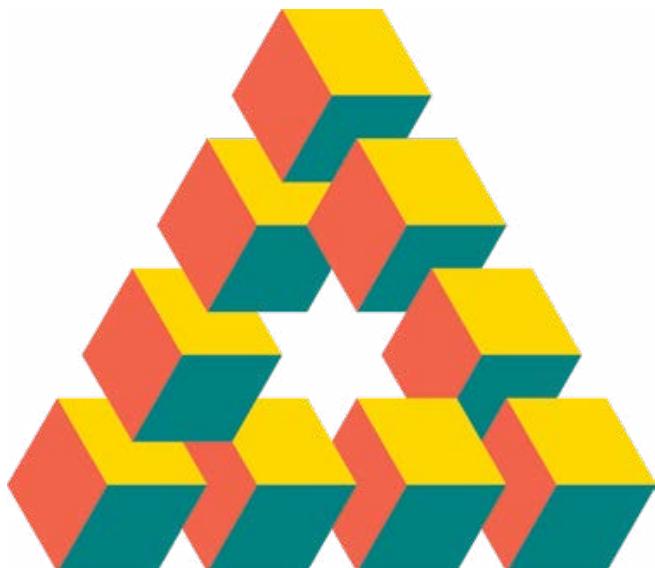
Figure 1. The image of the \mathcal{A} -orbit of L (dark), and the image of all -2 curves on \mathcal{X} . Different perspectives of the latter appear in [4]

In (1), the discs cover all of \mathbb{R}^2 except for a residual fractal with Hausdorff dimension $\delta \approx 1.3$ (empirically calculated [4]). Using recent results in [11], the asymptotic growth of the number of -2 curves on \mathcal{X} with degree bounded by B is $c(\log B)^\delta$. Thus \mathcal{X} can also be thought of as an analog of the Hurwitz equation, only now we can ‘see’ the fractal. Calculating rigorous bounds or good approximations for δ is not easy, as it appears to be at least as difficult as the calculation of δ for the residual fractal for the Apollonian disc packing [8, 10].

The vague similarity of (1) to the Apollonian circle packing might lead one to wonder whether the latter can also be thought of as the image under a Ψ of the set of smooth rational curves on some K3 surface. This is indeed the case [5] (using a result in [12]). So too the Soddy sphere packing and many Apollonian-like packings in the literature. This shed a new perspective on how to construct Apollonian packings in higher dimensions, and led to the discovery that such packings exist in dimensions 4, 5, and 6 [6]. These were once thought to not exist – see the *Mathematical Review* of [7]. Recent research has established existence in dimensions 7 and 8 as well; the question in dimensions ≥ 9 remains open.

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CSHPM Notes brings scholarly work on the history and philosophy of mathematics to the broader mathematics community. Authors are members of the Canadian Society for History and Philosophy of Mathematics (CSHPM). Comments and suggestions are welcome; they may be directed to either of the column's co-editors:

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Why Use Primary Sources in a Mathematics Classroom?

Janet Heine Barnett, Colorado State University –Pueblo

In an earlier issue of these *Notes*, Glen Van Brummelen [4] gave a compelling explanation for why history belongs in our mathematics classrooms. To illustrate how “history provides a natural path to a broader and deeper mathematical experience,” he gave examples of stories that can be used to enrich students’ understanding of certain aspects of that experience:

- *Motivation*: the societal or mathematical needs that give rise to a problem
- *Research*: devising new methods to attack a problem
- *Critical Thinking*: understanding alternate avenues of attack, and their relative validity and power
- *Implications*: the questions opened up as a result of new methods

This note describes how primary historical sources can serve as a vehicle for student engagement with these important features of a genuine mathematical journey.

Some General Thoughts

Our colleagues in the humanities have long understood the benefits to be derived from reading original texts versus textbook expositions of the ideas in those sources. As the historian of mathematics Michael Fried [2, p. 402] has aptly explained:

Textbooks and texts are different precisely because the latter are original, where being original has not to do with being old but with the immediacy of the author’s engagement with his subject. Because of this difference, readers of textbooks and texts will be led in different directions. For when a book merely sets out accepted knowledge, as a textbook must do almost by definition, it must essentially be closed to inquiry. ...For inquiry to arise, what one faces must be, in a sense, conditional, open, uncertain; one must be in the position of asking not so much whether what one is reading is clear and understood (as important as that may be), but whether it is true. This is the position of a thinker in an original encounter

Les articles de la SCHPM présente des travaux de recherche en histoire et en philosophie des mathématiques à la communauté mathématique élargie. Les auteurs sont membres de la Société canadienne d’histoire et de philosophie des mathématiques (SCHPM). Vos commentaires et suggestions sont le bienvenue; ils peuvent être adressées à l’une des co-rédacteurs:

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with his subject, and, to the extent that the author is a great one, that is, is wholly engaged in the kind of inquiry such an original encounter requires, the reader is drawn into the inquiry.

Drawing students in the direction opened up by the immediacy of an author’s original inquiry is exactly what the Primary Source Projects (PSPs) being developed by *Transforming Instruction in Undergraduate Mathematics via Primary Historical Sources (TRIUMPHS)* seek to accomplish. A five-year collaboration launched in 2011 with funding from the US National Science Foundation (NSF), TRIUMPHS is a nation-wide expansion of two prior NSF-funded projects focused on bringing primary sources into the undergraduate mathematics classroom. Of course, few undergraduate students have the background needed to interpret original mathematical sources without some form of expert guidance. To maintain the benefits of primary sources while addressing the associated challenges, TRIUMPHS’ PSPs follow a “guided reading” approach that carefully intertwines student tasks with excerpts from the historical sources. In this way the original words of great authors become vehicles for engaging students with the motivation, research, critical thinking, and implications of those authors’ works.

Two Examples

The PSP *Primes, Divisibility and Factoring* [3] is based on Leonard Euler’s first paper on number theory, written in 1732: *Observationes de theoremate quodam Fermatiano aliisque ad numeros primos spectantibus (Observations on a theorem of Fermat and others concerned with prime numbers)*. In this paper Euler shared ideas about integers and primes that he was inspired to investigate after reading a set of letters written a century earlier by Pierre de Fermat. Euler’s new ideas touched on a surprising number of standard topics in a first course on number theory: Fermat primes, Mersenne primes, perfect numbers, Fermat’s Little Theorem, and the use of “modular arithmetic” to show that certain particular forms of numbers are composite. Because Euler wrote this paper with the expectation that his readers knew no number theory, it (and the PSP) can be profitably read by any student with a strong algebra background. As part of his own initial foray into this new territory, however, Euler also stated several results that he believed were true but was unable to prove at the time. Today’s students of number

theory thus have the opportunity to try their hands at proofs that were initially unavailable even to Euler!

Fast-forwarding more than 100 years, the PSP *Gaussian Integers and Dedekind's Creation of an Ideal* [1] continues the theme of prime numbers. Characteristics of Richard Dedekind's work that make it an excellent vehicle for student reading include his emphasis on abstraction, his continual quest for generality and his careful methodology. The 1877 version of his ideal theory, *Sur la Théorie des Nombres Entiers Algébriques* (On the Theory of Algebraic Integers), is an especially good choice due to the care devoted therein to motivating the algebraic concept of an ideal as a means to restore unique prime factorization to integral domains that lack this familiar property. In essence Dedekind asked, then answered, the question: *What makes a prime number 'prime'?* To set the stage for this inquiry, he began with the example of the Gaussian integers $\mathbb{Z}[i]$, itself a unique factorization domain. The PSP similarly begins by studying divisibility and primes within $\mathbb{Z}[i]$, and culminates in a proof that unique factorization holds there. Dedekind's next example, $\mathbb{Z}[\sqrt{-5}]$, then provides an accessible illustration of the insufficiency of 'indecomposability' as the defining property for the concept of a prime number. The PSP closes with an overview of Kummer's notion of an ideal prime, and a preview of the ideal structure that Dedekind proposed in its place.

In addition to the scenic mathematical content they traverse, both these PSPs include tasks that engage students in activities that model how mathematicians actually work: extending conceptual understanding through computation; generalizing familiar concepts to new contexts; using data to formulate conjectures, then testing, refining and proving those conjectures; and making sense of mathematical texts. This latter activity relates to another aspect of mathematical experience that, as Glen Van Brummelen noted, is well supported by using history in the classroom: *communication*. Beyond promoting students' ability to read mathematical texts, PSPs also include a variety of tasks that invite implementation via a combination of whole-class discussions, small-group work, student presentations and written homework, thereby supporting students' written and oral communication skills.

Getting started

While writing this note I found that an old saying kept springing to mind: *The journey is the destination*. In this case the journey is a mathematical one . . . and one well worth taking with students! Everything needed to begin can be found at <http://webpages.ursinus.edu/nscoville/TRIUMPHS.html>.

TRIUMPHS' NSF funding includes support for instructors who officially site-test any project in the TRIUMPHS collection—a growing collection that now offers 28 full-length PSPs and 21 shorter “mini-PSPs” ready for use in courses across the entire undergraduate mathematics curriculum. These and another 36 PSPs developed with prior NSF funding are freely available via the TRIUMPHS' website, and ready for your classroom journey.

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Janet Heine Barnett (janet.barnett@csupueblo.edu) is emerita professor of mathematics at Colorado State University – Pueblo, and has written, and taught with, primary source projects for over two decades. She is one of seven PIs on the TRIUMPHS collaborative grant, along with Kathy Clark (Florida State University), Dominic Klyve (Central Washington University), Jerry Lodder (New Mexico State University), Danny Otero (Xavier University), Nick Scoville (Ursinus College), and Diana White (University of Colorado Denver).



2019 Canadian Mathematical Society **Summer Meeting**

June 7 - 10, 2019

Deadline: January 15, 2019

University of Regina, Regina, Saskatchewan

CALL FOR SESSIONS

The Canadian Mathematical Society (CMS) welcomes and invites session proposals for the 2019 CMS Summer Meeting in Regina from June 7 to 10, 2019.

Proposals should include (1) names, affiliations, and contact information for all session co-organizers, (2) title and brief description of the focus and purpose of the session, (3) a preliminary list of potential speakers, with their affiliations and if they have agreed to participate, along with a total number of expected speakers.

Sessions will take place June 8, 9, or 10. The meeting schedule will accommodate 9 speakers per full day, and 4 or 5 per half day. Sessions will be advertised in the CMS Notes, on the web site and in the AMS Notices. Speakers will be requested to submit abstracts, which will be published on the web site and in the meeting program. Those wishing to organize a session should send a proposal to the Scientific Directors.

Proposals should be submitted by January 15, 2019.

Scientific Directors:

Allen Herman (University of Regina)
allen.herman@uregina.ca

Alexander Litvak (University of Alberta)
alitvak@ualberta.ca

Karen Meagher (University of Regina)
karen.meagher@uregina.ca

Réunion d'été de la SMC 2019

7 - 10 juin 2019

Date limite : 15 janvier 2019

Université de Regina, Regina, Saskatchewan

APPEL DE PROPOSITIONS DE SESSIONS

La Société mathématique du Canada (SMC) invite la communauté mathématique à proposer des sessions pour sa Réunion d'été 2019, qui se tiendra à Regina du 7 au 10 juin.

Ces propositions doivent comprendre : 1) le nom, l'affiliation et les personnes à contacter pour tous les coorganisateurs de session; 2) le titre et une brève description de l'orientation et des objectifs de la session; 3) une liste préliminaire de conférenciers potentiels avec leur affiliation et leur intention de participer, ainsi que le nombre de conférenciers prévus.

Les sessions se dérouleront les 8, 9 et 10 juin. Le format de la Réunion peut accommoder 9 conférenciers par journée pleine, et 4 ou 5 par demi-journée. Toutes les sessions seront annoncées dans les Notes de la SMC, sur le site Web et dans les notices de l'AMS. Les conférenciers devront présenter un résumé, qui sera publié sur le site Web et dans le programme de la Réunion. Toute personne qui souhaiterait organiser une session est priée de faire parvenir une proposition à l'un des directeurs scientifiques.

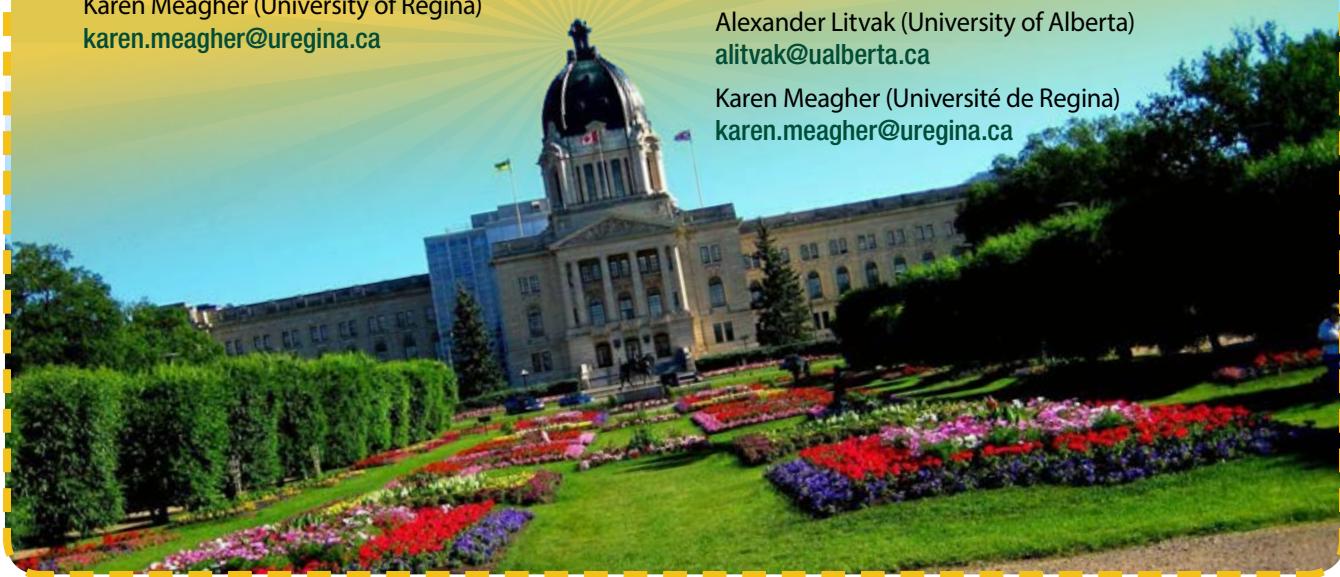
Ces demandes doivent nous parvenir au plus tard le 15 janvier 2019.

Directeurs scientifiques :

Allen Herman (Université de Regina)
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Alexander Litvak (University of Alberta)
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Karen Meagher (Université de Regina)
karen.meagher@uregina.ca



2019 CMS Winter Meeting

December 6-9, 2019

Deadline: March 29, 2019

The Chelsea Hotel, Toronto, Ontario

CALL FOR SESSIONS

The Canadian Mathematical Society (CMS) welcomes and invites session proposals for the 2019 CMS winter meeting in Toronto from December 6-9.

Proposals should include (1) names, affiliations, and contact information for all session co-organizers, (2) title and brief description of the focus and purpose of the session, (3) a preliminary list of potential speakers, with their affiliations and if they have agreed to participate, along with a total number of expected speakers.

Sessions will take place December 7, 8, and 9. The meeting schedule will accommodate 9 speakers per full day, and 4 or 5 per half day. Sessions will be advertised in the CMS Notes, on the web site and in the AMS Notices. Speakers will be requested to submit abstracts, which will be published on the web site and in the meeting program. Those wishing to organize a session should send a proposal to the Scientific Directors. Those submitting proposals are encouraged to pay attention to the diversity of both the session invitees and the proposed session organizers.

Proposals should be submitted by **March 29, 2019**.

Scientific Directors:

Patrick Ingram (York University) pingram@yorku.ca

Jane Heffernan (York University) jmheffer@yorku.ca



Réunion d'hiver de la SMC 2019

6-9 décembre 2019

Date limite : 29 mars 2019

The Chelsea Hotel, Toronto, Ontario

APPEL DE PROPOSITIONS DE SESSIONS

La Société mathématique du Canada (SMC) invite la communauté mathématique à proposer des sessions pour sa Réunion d'hiver 2019, qui se tiendra à Toronto du 6 au 9 décembre.

Ces propositions doivent comprendre : 1) le nom, l'affiliation et les personnes à contacter pour tous les coorganisateurs de session; 2) le titre et une brève description de l'orientation et des objectifs de la session; 3) une liste préliminaire de conférenciers potentiels avec leur affiliation et leur intention de participer, ainsi que le nombre de conférenciers prévus.

Les sessions se dérouleront les 7, 8, et 9 décembre. Le format de la Réunion peut accommoder 9 conférenciers par journée pleine, et 4 ou 5 par demi-journée. Toutes les sessions seront annoncées dans les Notes de la SMC, sur le site Web et dans les notices de l'AMS. Les conférenciers devront présenter un résumé, qui sera publié sur le site Web et dans le programme de la Réunion. Toute personne qui souhaiterait organiser une session est priée de faire parvenir une proposition aux directeurs scientifiques. Nous vous invitons, dans votre proposition, à porter attention à la diversité des personnes invitées et des organisateurs de la session proposée.

Ces demandes doivent nous parvenir au plus tard le **29 mars 2019**.

Directeurs scientifiques :

Patrick Ingram (York University) pingram@yorku.ca

Jane Heffernan (York University) jmheffer@yorku.ca

2019 Adrien Pouliot Award

CALL FOR NOMINATIONS

Nominations of individuals or teams of individuals who have made significant and sustained contributions to mathematics education in Canada are solicited. Such contributions are to be interpreted in the broadest possible sense and might include: community outreach programs, the development of a new program in either an academic or industrial setting, publicizing mathematics so as to make mathematics accessible to the general public, developing mathematics displays, establishing and supporting mathematics conferences and competitions for students, etc.

CMS aims to promote and celebrate diversity in the broadest sense. We strongly encourage department chairs and nominating committees to put forward nominations for outstanding colleagues regardless of race, gender, ethnicity or sexual orientation.

Nominations must be received by the CMS Office **no later than April 30, 2019**.

Please submit your nomination electronically, preferably in PDF format, to apaward@cms.math.ca.

Nomination requirements

- Include contact information for both nominee and nominator.
- Describe the nominated individual's or team's sustained contributions to mathematics education. This description should provide some indication of the time period over which these activities have been undertaken and some evidence of the success of these contributions. This information must not exceed four pages.
- Two letters of support from individuals other than the nominator should be included with the nomination.
- Curricula vitae should not be submitted since the information from them relevant to contributions to mathematics education should be included in the nomination form and the other documents mentioned above.
- If nomination was made in the previous year, please indicate this.
- Members of the CMS Education Committee will not be considered for the award during their tenure on the committee.

Renewals

Individuals who made a nomination last year can renew this nomination by simply indicating their wish to do so by the deadline date. In this case, only updating materials need be provided as the original has been retained.

Prix Adrien Pouliot 2019

APPEL DE CANDIDATURES

Nous sollicitons la candidature de personne ou de groupe de personnes ayant contribué d'une façon importante et soutenue à des activités mathématiques éducatives au Canada. Le terme « contributions » s'emploie ici au sens large; les candidats pourront être associés à une activité de sensibilisation, un nouveau programme adapté au milieu scolaire ou à l'industrie, des activités promotionnelles de vulgarisation des mathématiques, des initiatives spéciales, des conférences ou des concours à l'intention des étudiants, etc.

La SMC a pour but de promouvoir et de célébrer la diversité au sens le plus large. Nous encourageons fortement les directeurs de département et les comités de mise en candidature à proposer des collègues exceptionnels sans distinction de race, de genre, d'appartenance ethnique ou d'orientation sexuelle.

Les mises en candidature doivent parvenir au bureau de la SMC **avant le 30 avril 2019**.

Veuillez faire parvenir votre mise en candidature par voie électronique, de préférence en format PDF, à prixap@smc.math.ca

Conditions de candidature

- Inclure les coordonnées du/des candidat(s) ainsi que du/des présentateur(s).
- Décrire en quoi la personne ou le groupe mis en candidature a contribué de façon soutenue à des activités mathématiques. Donner un aperçu de la période couverte par les activités visées et du succès obtenu. La description ne doit pas être supérieure à quatre pages.
- Le dossier de candidature comportera deux lettres d'appui signées par des personnes autres que le présentateur.
- Il est inutile d'inclure des curriculums vitae, car les renseignements qui s'y trouvent et qui se rapportent aux activités éducatives visées devraient figurer sur le formulaire de mise en candidature et dans les autres documents énumérés ci-dessus.
- Si la candidature a été soumise l'année précédente, veuillez l'indiquer.
- Les membres du Comité d'éducation de la SMC ne pourront être mis en candidature pour l'obtention d'un prix pendant la durée de leur mandat au Comité.

Renouveler une mise en candidature

Il est possible de renouveler une mise en candidature présentée l'année précédente, pourvu que l'on en manifeste le désir avant la date limite. Dans ce cas, le présentateur n'a qu'à soumettre des documents de mise à jour puisque le dossier original a été conservé.

Call for Nominations 2019 Doctoral Prize

The CMS Doctoral Prize recognizes outstanding performance by a doctoral student. The prize is awarded to one or two recipients of a Ph.D. from a Canadian university whose overall performance in graduate school is judged to be the most outstanding. Although the dissertation will be the most important criterion (the impact of the results, the creativity of the work, the quality of exposition, etc.) it will not be the only one. Other publications, activities in support of students and other accomplishments will also be considered.

Nominations that were not successful in the first competition will be kept active for a further year (with no possibility of updating the file) and will be considered by the Doctoral Prize Selection Committee in the following year's competition.

The CMS Doctoral Prize will consist of an award of \$500, a two-year complimentary membership in the CMS, a framed Doctoral Prize certificate and a stipend for travel expenses to attend the CMS meeting to receive the award and present a plenary lecture.

Nominations

Candidates must be nominated by their university and the nominator is responsible for preparing the documentation described below, and submitting the nomination to the address below. CMS aims to promote and celebrate diversity in the broadest sense. We strongly encourage department chairs and nominating committees to put forward nominations for outstanding colleagues regardless of race, gender, ethnicity or sexual orientation. The deadline for the receipt of nominations is **January 31, 2019**.

The documentation shall consist of:

- A curriculum vitae prepared by the student.
- A resumé of the student's work written by the student and which must not exceed ten pages. The resumé should include a brief description of the thesis and why it is important, as well as of any other contributions made by the student while a doctoral student.
- Three letters of recommendation of which one should be from the thesis advisor and one from an external reviewer. A copy of the external examiner's report may be substituted for the latter. More than three letters of recommendation are not accepted.

CMS aims to promote and celebrate diversity in the broadest sense. We strongly encourage department chairs and nominating committees to put forward nominations for outstanding colleagues regardless of race, gender, ethnicity or sexual orientation.

All documentation, including letters of recommendation, should be submitted electronically, preferably in PDF format, no later than **January 31, 2019**, to docprize@cms.math.ca.

Appel de mises en candidature Prix de doctorat 2019

La SMC a créé ce **Prix de doctorat** pour récompenser le travail exceptionnel d'un étudiant au doctorat. Le prix sera décerné à une personne qui aura reçu son diplôme de troisième cycle d'une université canadienne l'année précédente (entre le 1er janvier et le 31 décembre) et dont les résultats pour l'ensemble des études supérieures seront jugés les meilleurs. La dissertation constituera le principal critère de sélection (impact des résultats, créativité, qualité de l'exposition, etc.), mais ne sera pas le seul aspect évalué. On tiendra également compte des publications de l'étudiant, de son engagement dans la vie étudiante et de ses autres réalisations.

Les mises en candidature qui ne seront pas choisies dans leur première compétition seront considérées pour une année additionnelle (sans possibilité de mise à jour du dossier), et seront révisées par le comité de sélection du Prix de doctorat l'an prochain. Le lauréat du Prix de doctorat de la SMC aura droit à une bourse de 500 \$. De plus, la SMC lui offrira l'adhésion gratuite à la Société pendant deux ans et lui remettra un certificat encadré et une subvention pour frais de déplacements lui permettant d'assister à la réunion de la SMC où il recevra son prix et présentera une conférence.

Candidatures

Les candidats doivent être nommés par leur université; la personne qui propose un candidat doit se charger de regrouper les documents décrits aux paragraphes suivants et de faire parvenir la candidature à l'adresse ci-dessous. La SMC a pour but de promouvoir et de célébrer la diversité au sens le plus large. Nous encourageons fortement les directeurs de département et les comités de mise en candidature à proposer des collègues exceptionnels sans distinction de race, de genre, d'appartenance ethnique ou d'orientation sexuelle. Les candidatures doivent parvenir à la SMC au plus tard le **31 janvier 2019**.

Le dossier sera constitué des documents suivants :

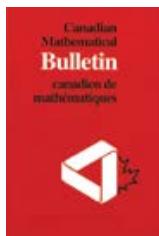
- Un curriculum vitae rédigé par l'étudiant.
- Un résumé du travail du candidat d'au plus dix pages, rédigé par l'étudiant, où celui-ci décrira brièvement sa thèse et en expliquera l'importance, et énumérera toutes ses autres réalisations pendant ses études de doctorat.
- Trois lettres de recommandation, dont une du directeur de thèse et une d'un examinateur de l'extérieur (une copie de son rapport serait aussi acceptable). Le comité n'acceptera pas plus de trois lettres de recommandation.

La SMC a pour but de promouvoir et de célébrer la diversité au sens le plus large. Nous encourageons fortement les directeurs de département et les comités de mise en candidature à proposer des collègues exceptionnels sans distinction de race, de genre, d'appartenance ethnique ou d'orientation sexuelle.

Veuillez faire parvenir tous les documents par voie électronique, de préférence en format PDF, au plus tard le **31 janvier 2019** à prixdoc@smc.math.ca.

CANADIAN MATHEMATICAL BULLETIN (CMB)

EDITOR-IN-CHIEF (EIC)



The CMS invites expressions of interest for the Editor-In-Chief (EIC) of CMB; two EICs are being solicited, with a term scheduled to commence January 1, 2020. Funding support from the CMS is available for both these EIC positions.

Since 1958, the Canadian Mathematical Bulletin (CMB) has been committed to publishing original mathematical research of high standard following rigorous academic peer review. New research papers are published continuously online and collated into print issues four times each year.

Expressions of interest should include a covering letter indicating the type of editorships you are interested in or becoming involved with, your curriculum vitae, and an expression of views regarding the publication. For EIC consideration, please also include an indication of support from your respective university.

Please submit your expression of interest electronically to: CMB-EIC-2019@cms.math.ca before April 15, 2019.

Current CJM/CMB Editorial Board

Louigi Addario-Berry (McGill)	12/2021	Editor-in-Chief CJM
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BULLETIN CANADIEN DE MATHÉMATIQUES (BCM)

RÉDACTEUR EN CHEF

La SMC invite les personnes intéressées par un poste de rédacteur en chef au BCM à lui faire part de leur intérêt. Deux postes de rédacteurs en chef sont à pourvoir, pour un mandat qui commencera en le 1 janvier 2020. La SMC offre du soutien financier pour ces deux postes.

Depuis 1958, le Bulletin canadien de mathématiques s'engage à publier des recherches en mathématiques, originales et de haut niveau, suivant de rigoureux examens par des pairs. Les articles de recherches sont disponibles en tout temps en ligne et sont rassemblés en quatre éditions imprimées par année.

Les propositions de candidature comprendront les éléments suivants : une lettre de présentation précisant le type de poste qui vous intéresse, votre curriculum vitae et un texte dans lequel vous exprimez votre opinion et vos idées par rapport à la publication. Pour les postes de rédacteur en chef, veuillez ajouter une preuve du soutien de votre université.

Veuillez faire parvenir votre candidature par courriel à : BCM-REC-2019@smc.math.ca au plus tard le 15 avril 2019.

Conseil de redaction pour le JCM et le BCM à présent :

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Hans Boden (McMaster)	12/2020	Rédacteur associé
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2018 International Mathematical Olympiad – Leader's Report

James Rickards

The International Mathematical Olympiad (IMO) is an annual competition for the brightest high school math students from around the world.

This year's competition in Cluj, Romania, attracted 594 students from 107 countries. The selection of the Canadian team was largely based on the results of three competitions: Canadian Mathematical Olympiad, the Asian Pacific Mathematical Olympiad, and the USA Mathematical Olympiad. Before writing these contests students qualify through the Canadian Open Mathematics Challenge, written in November each year. This year, the Canadian team consisted of Thomas Guo, Howard Halim, Victor Rong, Nicholas Sun, William Zhao, and Zixiang (Peter) Zhou.

I was joined on the leadership team by Calvin Deng (Princeton) and Vincent Chan (Calgary). It was our task to train the students, accompany them to the competition, and to make cases to the coordinators for how many marks they deserve. The training this year was held at the Banff International Research Station (BIRS). We were also joined by a fourth trainer, Mike Pawliuk, for the duration of the two-week training camp.

During the training camp, we had two main styles of sessions: lectures on problem solving techniques accompanied by a sheet of practice problems, and mock Olympiads (in the same style as the IMO). We found plenty to do during the down time, with some hikes up Tunnel Mountain, finding a few geocaches, and a daily dose of basketball. The BIRS site was an excellent environment for our training; we were very grateful to have our training there again this year.

I left for Romania 3 days before the team, as it is up to the Leaders to prepare the contest. Upon arrival, I was given a shortlist of 28 problems, divided into four sections: algebra, combinatorics, geometry, and number theory. All of the problems can be solved with high school level material and ideas, though most problems would be quite difficult without a lot of self-study. The problems which appear in the algebra and geometry sections are not exactly what a research mathematician might expect. The algebra section is typically a mélange of inequalities, sequences, functional equations, and polynomial problems (nothing about rings or groups of course!).

and the geometry section is mostly classical Euclidean geometry (thus, no Riemann surfaces).

The IMO contest is two 3-question papers written over two days, with 4.5 hours to solve each paper. The Leaders' task is to choose the 6 problems which form the best test, while ensuring that the difficulty is appropriate, and that there is an appropriate subject distribution (the current protocol dictates that there needs to be a bijection between the four subjects and the four easiest questions). Once we choose the questions, it remains to debate on the exact wording in all official languages, translate them into all requested languages, and generate the marking schemes.

After the two contest days were over, the students enjoyed local excursions, while Calvin, Vincent, and I marked the Canadian papers. The IMO also has coordinators who mark all of the papers, and we met with them to agree upon marks for our team. The marking schemes are able to resolve most disputes, but for students with partial solutions which stray from the marking scheme, it can be difficult.

The Canadian team did very well, placing 16th overall, with everyone receiving a medal. William, Victor, Thomas, Howard, and Nicholas all received silver medals, and Zixiang received a bronze medal. It is an excellent result for a very young team: five of the six members will be competing to make Math Team Canada again next year.

Below is the nicest problem on the contest (Problem #3). The statement and proof are very accessible, however it is quite difficult! Only 11 out of the 594 students managed to find a complete solution.

Problem 3: An anti-Pascal triangle is an equilateral triangular array of numbers such that, except for the numbers in the bottom row, each number is the absolute value of the difference of the two numbers immediately below it. For example, the following array is an anti-Pascal triangle with four rows which contains every integer from 1 to 10.

$$\begin{array}{ccccccccc} & & & & & & 4 & & \\ & & & & & & 2 & 6 & \\ & & & & & & 5 & 7 & 1 \\ & & & & & & 8 & 3 & 10 & 9 \end{array}$$

Does there exist an anti-Pascal triangle with 2018 rows which contains every integer from 1 to $1 + 2 + \dots + 2018$?



2019 Graham Wright Award for Distinguished Service

CALL FOR NOMINATIONS

In 1995, the Society established this award to recognize individuals who have made sustained and significant contributions to the Canadian mathematical community and, in particular, to the Canadian Mathematical Society. The award was renamed in 2008, in recognition of Graham Wright's 30 years of service to the Society as the Executive Director and Secretary.

CMS aims to promote and celebrate diversity in the broadest sense. We strongly encourage department chairs and nominating committees to put forward nominations for outstanding colleagues regardless of race, gender, ethnicity or sexual orientation.

Nominations should include a reasonably detailed rationale and be submitted by **March 31, 2019**.

All documentation should be submitted electronically, preferably in PDF format, by the appropriate deadline, to gward@cms.math.ca

Prix Graham-Wright pour service méritoire 2019

APPEL DE CANDIDATURES

In 1995, la Société mathématique du Canada a créé un prix pour récompenser les personnes qui contribuent de façon importante et soutenue à la communauté mathématique canadienne et, notamment, à la SMC. Ce prix était renommé à compter de 2008 en hommage de Graham Wright pour ses 30 ans de service comme directeur administratif et secrétaire de la SMC.

La SMC a pour but de promouvoir et de célébrer la diversité au sens le plus large. Nous encourageons fortement les directeurs de département et les comités de mise en candidature à proposer des collègues exceptionnels sans distinction de race, de genre, d'appartenance ethnique ou d'orientation sexuelle.

Pour les mises en candidature prière de présenter des dossiers avec une argumentation convaincante et de les faire parvenir, **le 31 mars 2019** au plus tard.

Veuillez faire parvenir tous les documents par voie électronique, de préférence en format PDF, avant la date limite à prixgw@smc.math.ca

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