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DANS CE NUMÉRO

CMS
NOTES
February
2014
de la SMC

President's Notes

Keith Taylor, *CMS President*

As this is my last opinion piece in the CMS Notes as President of the CMS, I want to take the opportunity to put down a few thoughts on the environment in which we do mathematics in Canada. It really is a very complex intellectual ecosystem that has evolved significantly since 1973 when I began to consider myself to be a mathematician. An entity that has been a factor for me personally throughout this evolution is the Canadian Mathematical Society. I see the CMS as an essential and positive contributor to our ecosystem.

Today, a vibrant Canadian research community in the mathematical sciences is supported by an array of institutions, many of which we often take for granted. It starts with the universities that employ most of us. Although the amount of support provided varies with the nature of the university, it is common to have about 40% of your paid time available for research and we can spend one seventh of our time on sabbatical leave. Many universities also have scholarships to help with our research students and usually a travel fund that might cover one conference per year. We should remember that this research support ultimately comes from provincial operating grants and student tuition. Arguably, the majority of the mathematics created in Canada is funded through university budgets because that is what pays for the time we and our students have to sit and think. But I digress from my intention to highlight the more explicit mechanisms of research support and their interconnectedness.

Many provinces have funds earmarked to support research such as dedicated graduate student scholarships, or funds to match federal research awards such as CRCs; however, the bulk of the government money for research in the mathematical sciences is federal and most of that is distributed through a variety of programs at NSERC. Discovery Grants feel like our "own money" once granted and enable us to increase the size of our research groups and collaboration activities. Our community has felt the strain as the success rate in the grants competitions declined in recent years and the average grant size has either gone down or not matched inflation of research costs. We also feel the changes in NSERC scholarships for graduate students. Perhaps, the most damaging impact on the flow through the pipeline producing well-trained mathematical scientists has been the reduction of the number of post-doctoral fellowships not tied to the need for an industrial partner. Accepting these somewhat negative comments, we must recognize that NSERC continues to be a vital partner for mathematical research and has been receptive to creative ideas from our community.

Over the past several decades, our community has built a system of institutes for research in the mathematical sciences and key decisions by NSERC enabled the funding structure for those institutes to be constructed. Of course, the annual budgets of CRM, Fields, PIMS, and AARMS depend on substantial contributions from provinces, universities and other partners besides NSERC. These institutes for research in the mathematical sciences now contribute greatly to our ecosystem supporting a wonderful array of short and long-term workshops, conferences, summer schools, graduate stipends, post-docs, scholarly publications and educational outreach – to name just some of their activities.

Canadian Mathematical Society
Société mathématique du Canada

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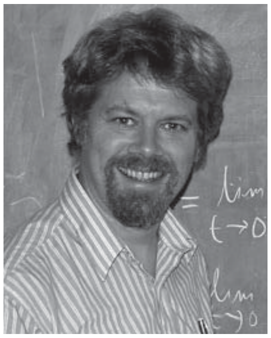
What Do You Do With A Rotten Apple?

Robert Dawson, *Saint Mary's University*



The student was apologetic. "I'm sorry, Dr. Dawson. I don't think my term paper is working out." (I'm reconstructing this from memory - I don't swear to the accuracy of the dialog.)

Because of the cultural and scientific importance of geometry, my upper-level undergraduate geometry course has involved a term paper for many years. Many math students don't have a lot of experience with essay writing, so I get them to submit three times. First an outline: it gets heavily marked up and returned, but only a few points are awarded. Then a complete first draft - again, it is graded and returned. A few more points are awarded, but only for structure and completeness. Finally, based on this, a final draft is written: it has to be solid in every way, and it carried most of the marks.

"I'm sorry, Dr. Dawson. I don't think my term paper is working out."

His choice of topic - an unlikely application of the golden ratio - had raised a yellow flag at outline time, but my student assured me that he had found a journal paper that made such a connection. And stranger things have happened - it's hard to see the direct connection between the regular pentaon and the Fibonacci sequence. The secret, of course, is that both involve the simplest nondegenerate quadratic equation, $x^2 = x + 1$ - and who knows, perhaps it could appear elsewhere?

Now my student was looking worried. After what must have been a long and difficult struggle, he had concluded that the paper he had hoped to base his essay on was nonsense - despite the fact that it appeared in a journal published by Elsevier. We went online and looked it up together. *Chaos, Solitons, and Fractals.* The journal title sounded ominously familiar.

Sure enough, the article was more or less content-free. There were a few trivial calculations involving the Golden Ratio. Much of it was a mish-mash of references to papers involving a "transfinite field theory" in which spacetime "looks like a fractal with the properties of a random Cantor set." Most of these papers were written by the editor of the journal. Many were published in the self-same journal, under his own editorship. Ouch!

I remembered now. There had been a scandal. The editor in question had left *Chaos, Solitons, and Fractals.* [1] The new editorial board appear to be maintaining reasonable standards.

But the rotten apples have been left in the bag. Elsevier has left the first seventeen years of the journal online, with no warning that it was not effectively reviewed and contained a large number of thoroughly substandard papers. When we use "peer reviewed publication" as a standard, the community is not served well by this.

What can be done? Presumably some good papers were published during this period, and to sort the wheat from the chaff would be a Herculean task. An obvious solution would be to modify the journal's web page so that anybody searching for a paper from this period would be warned that CS&F had not been edited to accepted standards during this period, and that the quality of the contents could not be guaranteed. Nothing like this has yet happened, as far as I can see. There is still time.

The student got his paper written, by the way - and learned a hard lesson about standards.

[1] Schiermeier, Q. Self-publishing editor set to retire, Nature 456 (2008)

Que faire avec les pommes pourries?

L'étudiant se confondait en excuses. « Je suis désolé, M. Dawson. Je ne pense pas que ma dissertation tient la route. » (J'y vais de mémoire, ce ne sont sans doute pas ses paroles exactes.)

« Je suis désolé, M. Dawson. Je ne pense pas que ma dissertation tient la route. »

En raison de l'importance culturelle et scientifique accordée à la géométrie, j'ai intégré depuis de nombreuses années une dissertation finale à mon cours de géométrie avancé de premier cycle. La plupart de mes étudiants n'ayant pas beaucoup d'expérience en rédaction de dissertations, je leur permets de la rendre en trois étapes. D'abord un plan, que je corrige et commente amplement et que je leur remets, mais qui ne compte que pour quelques points. Ensuite une version préliminaire complète, que je corrige et leur remets à nouveau. Quelques points supplémentaires y sont accordés, mais seulement pour la structure et l'exhaustivité. Enfin, les étudiants me remettent leur dissertation finale à la lumière de tous ces commentaires : la dissertation doit être solide à tous les niveaux, et elle compte pour le plus grand nombre de points.

Le choix de sujet de mon étudiant – une application peu plausible du nombre d'or – avait semé un doute à mon esprit quand j'ai reçu le plan, mais mon étudiant m'a assuré qu'il avait trouvé un article qui établissait une telle connexion. Soit. Nous avons déjà vu plus étrange, bien qu'il soit difficile de voir le lien direct entre le pentagone régulier et la suite de Fibonacci. Le secret, bien sûr, c'est que les deux sont liés à l'équation quadratique non dégénérée la plus simple, soit $x^2 = x + 1$. Qui sait, peut-être pouvait-elle apparaître ailleurs?

Mon étudiant semblait maintenant inquiet. Après ce qui a dû être pour lui un long et difficile combat intérieur, il avait conclu que l'article sur lequel il espérait fonder sa dissertation ne faisait pas de sens,

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Notes du Président

Keith Taylor, *président SMC*

Comme il s'agit de mon dernier article pour les Notes de la SMC à titre de président de la Société, j'aimerais profiter de l'occasion pour faire quelques réflexions sur le contexte qui entoure les mathématiques au Canada. Il s'agit d'un écosystème intellectuel très complexe, qui a évolué considérablement depuis 1973, année où j'ai commencé à me considérer comme un mathématicien. L'un des éléments qui ont joué un rôle marquant pour moi dans cette évolution est la Société mathématique du Canada. J'estime que la SMC occupe une place essentielle et positive dans cet écosystème.

Aujourd'hui, notre dynamique communauté canadienne de chercheurs en mathématiques est soutenue par un large éventail d'établissements et d'organismes, que nous tenons souvent pour acquis, en commençant par les universités qui emploient la plupart d'entre nous. Bien que la contribution financière varie selon la nature de l'université, il est courant que les professeurs disposent d'environ 40 % de leur temps (rémunéré) pour faire de la recherche et qu'ils puissent consacrer un septième de leur temps en congé sabbatique. Bon nombre d'universités offrent aussi des bourses pour aider nos chercheurs étudiants et disposent généralement d'un fonds pour déplacements qui permet à la plupart d'entre nous d'assister à un congrès par année. Il ne faudrait pas oublier que ce soutien à la recherche est offert grâce aux subventions provinciales et aux droits de scolarité que paient les étudiants. La majorité des travaux mathématiques qui se font au Canada est donc financée à même les budgets universitaires, car ce sont ces fonds qui paient pour le temps que nos étudiants et nous consacrons à réfléchir. Mais je m'éloigne de mon intention première, qui était de faire ressortir les mécanismes plus complexes de soutien à la recherche et leurs interconnexions.

De nombreuses provinces ont des fonds consacrés spécifiquement à la recherche, par exemple des bourses réservées aux étudiants des cycles supérieurs ou des fonds destinés à jumeler des bourses de recherche fédérales comme celles du programme des Chaires de recherche du Canada. Toutefois, la majeure partie du financement gouvernemental consacrée à la recherche en mathématiques est de source fédérale, et la plupart de ces fonds sont distribués par l'entremise de divers programmes du CRSNG. Nous considérons pratiquement les Subventions à la découverte comme notre « propre argent », et ces subventions nous permettent d'élargir nos groupes de recherche et nos activités de collaboration. Les compressions se font cependant sentir sur notre communauté : le taux de succès aux concours de subventions a baissé au cours des dernières années, et la valeur moyenne des subventions a diminué ou n'a pas suivi le rythme de l'inflation des coûts de la recherche. Nous ressentons aussi les changements apportés au régime des bourses du CRSNG pour les étudiants aux cycles supérieurs. Mais l'impact sans doute le plus dommageable sur la production de

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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 **notes-letters@cms.math.ca** or at the Executive Office.

Lettres aux Rédacteurs

Les rédacteurs des NOTES acceptent les lettres en français ou anglais portant sur un 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'addresse suivante : **notes-lettres@smc.math.ca**.

NOTES DE LA SMC

Les Notes de la SMC sont publiés par la Société mathématique du Canada (SMC) six fois l'an (février, mars/avril, juin, septembre, octobre/novembre et décembre).

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Note aux auteurs : indiquer la section choisie pour votre article et le faire parvenir au Notes de la SMC à l'adresse postale ou de courriel ci-dessous.

Les Notes de la SMC, les rédacteurs et la SMC ne peuvent être tenus responsables des opinions exprimées par les auteurs.

CMS NOTES

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No responsibility for the views expressed by authors is assumed by the CMS Notes, the editors or the CMS.

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Notes du president, suite de la page 3

chercheurs mathématiciens bien formés est la réduction du nombre de stages postdoctoraux non liés au soutien d'un partenaire de l'industrie. Malgré ces commentaires quelque peu négatifs, il faut toutefois reconnaître que le CRSNG demeure un partenaire essentiel pour la recherche mathématique et qu'il a été réceptif aux idées novatrices présentées par notre communauté.

Depuis quelques dizaines d'années, notre communauté s'est établi un réseau d'instituts qui se consacrent à la recherche en sciences mathématiques, et d'importantes décisions prises par le CRSNG nous ont permis d'élaborer la structure de financement de ces instituts. Bien sûr, les budgets annuels du CRM, des instituts Fields et PIMS et de l'AARMA dépendent de la contribution substantielle des gouvernements provinciaux, des universités et d'autres partenaires hormis le CRSNG. Ces instituts de recherche en sciences mathématiques contribuent désormais de façon importante à notre écosystème en finançant, à court et à long terme, un éventail extraordinaire d'ateliers, de conférences, de congrès, d'écoles d'été, d'allocations aux étudiants diplômés, de stages postdoctoraux, de publications savantes et d'activités éducatives, entre autres initiatives. L'expérience acquise, en partie du moins, en gestion d'instituts de recherche a donné lieu à la création de l'un des Réseaux de centres d'excellence canadiens les plus reconnus, soit le réseau MITACS (devenu le réseau Mprime), réseau qui a grandement contribué au rapprochement avec le secteur privé. Dans la même veine, la Station de recherche internationale de Banff est le fruit d'une collaboration nord-américaine dirigée par le Canada et elle est maintenant reconnue comme centre privilégié pour la tenue de congrès internationaux spécialisés dans un milieu unique.

Je considère que la Société mathématique du Canada est un élément essentiel de la vitalité de cet écosystème de recherche. Uniques au Canada, les Réunions semestrielles de la SMC réunissent des mathématiciens aux intérêts de recherche des plus variés. En tant qu'analyste s'intéressant particulièrement aux groupes localement compacts et à leurs représentations, je trouve toujours, parmi les 15 à 20 sessions spéciales et les 6 à 8 conférences plénières ou de lauréats de prix, des conférences qui m'intéressent et portent ma compréhension des choses dans de nouvelles directions. Ce sont souvent des communications présentées par des conférenciers que je ne rencontrerais jamais si je n'assistais qu'à des colloques en analyse harmonique abstraite. Je profite aussi souvent de conférences ou d'ateliers liés à l'enseignement présentés aux Réunions de la SMC. Outre cet effet d'enrichissement mutuel, les Réunions de la SMC sont le lieu où l'on trouve l'éventail le plus diversifié de membres de la communauté mathématique. J'oserais même avancer que les grandes discussions initiales ayant mené à la création d'un ou de plusieurs de nos instituts de recherche se sont tenues dans le cadre de discussions formelles ou informelles aux Réunions de la SMC. La Société est un cadre privilégié pour la circulation de l'information et l'atteinte d'un certain degré de cohérence au sein de notre communauté.

Bref, nous devrions tous être fiers du contexte productif dans lequel nous évoluons en tant que mathématiciens canadiens et reconnaître les nombreux acteurs qui nous permettent d'exercer pleinement notre métier, notamment la Société mathématique du Canada.

President's Notes, continued from cover

Building, at least partly, on the experience gained in managing research institutes, one of the most successful Networks of Centres of Excellence, MITACS (now Mprime), in Canada was established and has greatly enhanced connections with industry. Similarly, BIRS is a Canadian led North American collaboration that is now established as a premier centre for focused international conferences in a unique environment.

It is my view that the Canadian Mathematical Society is crucial to the health of this research ecosystem. The biannual CMS meetings are unique in Canada in bringing together mathematicians with a wide array of research interests. As an analyst with a core interest in locally compact groups and their representations, I always find, among the 15 to 20 special sessions and the six to eight plenary and prize lectures, talks that attract my interest and expand my understanding in new directions. These are often by speakers I would never meet if I just attended conferences in abstract harmonic analysis. Moreover, I often profit from pedagogy related talks or workshops at the CMS meetings. As well as this cross-fertilization effect, the CMS meetings are where the broadest sampling of our community comes together. I venture to suggest that some of the key initial discussions that led to the formation of one or more of our research institutes took place in formal or informal gatherings at CMS meetings. The CMS provides the opportunities for information flow and some level of coherence within our community.

In conclusion, we should all be proud of the productive environment we find ourselves in as Canadian mathematicians and recognize the many contributors who give us the opportunity to ply our craft, including the Canadian Mathematical Society.

FEBRUARY 2014

2–7 Positivity of Linear Series and Vector Bundles *(Banff, AB)* http://www.birs.ca

16–21 Computational contact mechanics *(Banff, AB)* http://www.birs.ca

17–21 Perfectoid Spaces and their Applications *(Berkeley, CA)* http://www.msri.org/workshops/731

MARCH 2014

14–28 Representation Theory and Geometry of Reductive Groups, *(Altheim, Germany)* http://www2.math.uni-paderborn.de/konferenzen/conferencespring-school.html

2–7 Advances in Scalable Bayesian computation *(Banff, AB)* http://www.birs.ca

9–14 Geometric Tomography and Harmonic Analysis *(Banff, AB)* http://www.birs.ca

APRIL 2014

4 An afternoon in honor of Cora Sadosky *(Albuquerque, New Mexico)* http://www.math.unm.edu/conferences/13thAnalysis/

7–11 Tools from Algebraic Geometry *(Los Angeles, CA)* http://www.ipam.ucla.edu/programs/ccgws2/

13–18 Subfactors and Fusion Categories *(Banff, AB)* www.birs.ca

27–May 2 Time Series Analysis etc *(Banff, AB)* http://www.birs.ca

MAY 2014

5–9 Kakeya Problem, etc *(Los Angeles, CA)* http://www.ipam.ucla.edu/programs/ccgws2/

5–9 Projective modules and A1-homotopy theory *(Palo Alto, CA)* http://www.aimath.org/ARCC/workshops/projectiveA1.html

10-11 12th Western Canadian Linear Algebra Meeting, Host: University of Regina *(Regina, SK)* http://uregina.ca/~abstsubm/index.html

12-23 Random Matrix theory *(Princeton, NJ)* www.math.ias.edu/wam/2014

19 Bers 100 celebration *(CUNY, NY)* http://fsw01.bcc.cuny.edu/zhe.wang/IB.html

20–25 16th International Conference on Fibonacci Numbers *(Rochester, NY)* www.mathstat.dal.ca/Fibonacci/ | http://www.msri.org/web/msri/scientific/workshops/all-workshops/show/-/event/Wm9805

26–30 European Conference on Elliptic & Parabolic Problems *(Gaeta, Italy)* http://www.math.uzh.ch/index.php/conferencedetails

JUNE 2014

15–20 Quantum curves and Quantum Knot invariants *(Banff, AB)* http://www.birs.ca

20-21 Conference on Graph Theory, Matrix Theory and Interactions *(Queen's University)*

JULY 2014

27–Aug 1 Statistics and Non-linear Dynamics in Biology & Medicine *(Banff, AB)* http://www.birs.ca

AUGUST 2014

3–8 Approximation algorithms & hardness of algorithms *(Banff, AB)* http://www.birs.ca

10–15 Recent progress in Dynamical Systems and related topics *(Banff, AB)* http://www.birs.ca

17–22 Math Modelling of particles in fluid flow *(Banff, AB)* http://www.birs.ca

24–29 Communication complexity and applications *(Banff, AB)* http://www.birs.ca

NOVEMBER 2014

1-5 38th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing *(Wellington, New Zealand)* msor.victoria.ac.nz/Events/38ACCMCC

17–21 Categorical Structures in Harmonic Analysis Workshop *(Berkeley, CA)* http://www.msri.org/web/msri/scientific/workshops/all-workshops/show/-/event/Wm9805

DECEMBER 2014

1–5 Automorphic Forms, Shimura varieties etc. *(Berkeley, CA)* http://www.msri.org/workshops/719

LES NOUVEAUX RÈGLEMENTS ADMINISTRATIFS DE LA SMC S'EN VIENNENT

La SMC fait circuler à tous ses membres la version préliminaire de ses nouveaux règlements administratifs à des fins d'examen et de commentaires. Une version finale des nouveaux règlements devrait être déposée pour approbation à la prochaine AGA de la Société en juin prochain à Winnipeg. Si vous n'avez pas reçu un courriel contenant la version préliminaire des nouveaux règlements, veuillez écrire à Johan Rudnick, directeur administratif et secrétaire de la SMC à l'adresse **directeur@smc.math.ca**.

NEW DRAFT CMS BY-LAWS COMING

New CMS by-laws have been drafted and are being circulated to all CMS members for review, consideration and comment. A final set of new by-laws is expected to be put forward for approval at the June CMS AGM in Winnipeg. If you have not received your 'New Draft CMS By-laws' e-mail, please let Johan Rudnick, CMS Executive Director and Corporate Secretary know by e-mailing him at: **director@cms.math.ca**.

2014 CMS Summer Meeting

June 6 - 9, 2014, Delta Winnipeg
Host: University of Manitoba

Réunion d'été SMC 2014

6-9 juin 2014, Delta Winnipeg
Hôte : Université du Manitoba

CALL FOR SESSIONS

The Canadian Mathematical Society (CMS) and the University of Manitoba welcomes and invites proposals for sessions for the 2014 Summer Meeting in Winnipeg from June 6th to 9th, 2014. Proposals should include a brief description of the focus and purpose of the session, the expected number of speakers, as well as the organizer's name, complete address, telephone number, e-mail address, etc. All 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. **Deadline: February 28, 2014**

PROPOSITION DE SESSIONS

La Société mathématique du Canada (SMC) et l'Université du Manitoba vous invitent à proposer des sessions pour la Réunion d'été 2014 qui se tiendra à Winnipeg du 6 au 9 juin 2014. Ces dernières doivent inclure une brève description de l'orientation et des objectifs de la session, le nombre de conférenciers prévus ainsi que le nom, l'adresse complète, le numéro de téléphone et l'adresse courriel de l'organisateur. Toutes les sessions seront annoncées dans les Notes de la SMC, sur le site web et dans les AMS Notices. 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 au plus tard le 30 janvier 2014. **Date limite : 28 février 2014**

Scientific Directors | Directeurs scientifiques

Nina Zorboska : **zorbosk@cc.umanitoba.ca** and
Stephen Kirkland : **stephen.kirkland@umanitoba.ca**

Public Lectures | Conférences publiques

Barbara Keyfitz (Ohio State University)

Education Plenary Speakers | Conférences plénières

John Mighton (Fields)

Plenary Speakers | Conférences plénières

Thomas Ransford (Laval), Bela Bollobas (Cambridge, Memphis), James Maynard (Montreal), Mark Lewis (Alberta)

Photo : Dan Harper

Que faire avec les pommes pourries?, suite de la page 2

même s'il était paru dans une revue publiée par Elsevier. Nous avons cherché l'article ensemble sur Internet dans *Chaos, Solitons, and Fractals*. Il me semblait avoir déjà entendu le nom de cette revue quelque part, mais cela ne laissait rien présager de bon.

Comme je le soupçonnais, l'article était à peu près dépourvu de contenu. Il présentait quelques calculs insignifiants impliquant le nombre d'or, et il était en bonne partie constitué d'un ramassis de renvois à des articles portant sur une « théorie transfinie des champs », où l'espace-temps « ressemble à une fractale ayant les propriétés d'un ensemble de Cantor aléatoire ». La plupart de ces articles avaient été écrits par le rédacteur de la revue, et bon nombre avaient été publiés dans la même revue, dirigée par cette même personne. Aïe!

Ça me revient maintenant. Il y avait eu un scandale. Le rédacteur en question avait quitté *Chaos, Solitons, and Fractals*.[1] Le nouveau conseil de rédaction semble maintenant respecter des normes raisonnables.

Le problème, c'est que les pommes pourries sont restées dans le sac. Elsevier a laissé en ligne les sept premières années de la revue, sans avertir les lecteurs que les articles n'avaient pas véritablement été relus ni que les numéros contenaient un grand nombre d'articles de qualité bien inférieure à la norme. Le concept de « publication à comité de lecture » étant considéré comme un standard, une telle pratique se fait au détriment de la communauté scientifique.

Que peut-on faire? Il est fort probable que de bons articles aient été publiés durant cette période, mais séparer le bon grain de l'ivraie serait une tâche herculéenne. Une solution évidente serait de modifier la page web de la revue de sorte que toute personne cherchant un article publié durant cette période serait avertie que la revue n'a pas été relue par un comité de lecture selon les normes acceptées, et que la qualité du contenu ne peut être garantie. Pour autant que je sache, rien de tel n'a été fait jusqu'à présent. Mais il n'est pas trop tard.

En passant, mon étudiant a fini par rédiger sa dissertation, non pas sans avoir appris une bonne leçon sur les normes.

[1] Schiermeier, Q. « Self-publishing editor set to retire », Nature 456 (2008)

CALL FOR NOMINATIONS

NATIONAL MATH COMPETITIONS PROBLEMS COMMITTEE

The CMS invites expressions of interest from math high school teachers, mathematicians, and others for various committee member positions for the CMS series of national mathematics (**http://cms.math.ca/Competitions**). The CMS is in the process of developing the competitions program, expanding committee membership, and is soliciting interest in the following areas:

- Competition creation: helping to create and develop the competitions from beginning to end;
- Problem development: identifying and/or creating problems for the competitions; and
- Competition Assessment: assessing problem appropriateness and presentation.

Prior math contest experience, while desirable, is not a requirement. Your committee participation will help shape the current and future direction of the competitions. The time commitment is generally not onerous and can sometimes be tailored to availability.

Anyone with an interest in problem solving is invited to forward an expression of interest, including a covering letter indicating the area of interest, an expression of views regarding math publications, and a brief CV. Please submit your expression of interest electronically to: volunteer@cms.math.ca. **Deadline for submission of interest is February 15, 2014**.

APPEL DE CANDIDATURES

COMITÉ DES CONCOURS DE MATHÉMATIQUES NATIONAUX

La SMC invite les personnes intéressées, notamment les enseignants du secondaire et les mathématiciens, à poser leur candidature pour divers postes au comité qui s'occupera des concours nationaux de mathématiques de la SMC (**http://smc.math.ca/Concours/**). La SMC a entrepris l'expansion de son programme de concours et souhaite aussi augmenter le nombre de membres de son comité. Elle sollicite donc des candidatures aux postes suivants :

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- Élaboration de problèmes : trouver ou créer des problèmes pour les concours;
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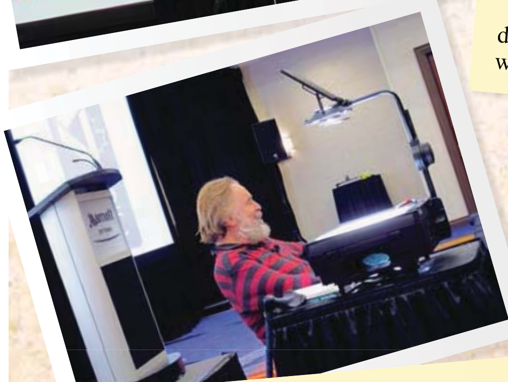
Artwork by **Manuel A. Báez** and students (Carleton University)
manuelbaez.pbworks.com

DAVID SANKOFF, University of Ottawa – **A bunch of flower problems**

Models of evolution of genome structure incorporate operations that change the order of genes on chromosomes. The phylogeny problem becomes the inference of the minimum number of rearrangement operations to account for a set of given genomes, assuming they evolved along the branches of an given evolutionary tree, as well as the "ancestral" genomes. The evolution of flowering plants is characterized by a particular pattern of genomic change, involving a duplication or "polyploidization" of the entire genome, followed by "fractionation", the random loss over time of one or other of each duplicate gene pair. New phylogenetic inference problems arise due to genome duplication and fractionation, involving the comparison of subgenomes within a single genome and the scrambling of gene order due to random loss of one copy or the other. One of these is the "consolidation" problem, trying to recover the pattern of fractionation in reconstructing ancestral genomes. Another is "genome aliquoting", piecing together the rearranged parts of subgenomes, and still another is trying to find the distribution of runs of deleted versus retained genes on chromosomes of fractionated genomes. We illustrate with recently published genomes of flowering plants. albuquerque.bioinformatics.uottawa.ca



JOHN CONWAY, Princeton – **From Games to Numbers**

How playing childish games led to an enormous extension field of the reals.

www.math.princeton.edu/directory/john-conway

The Welcome Reception
cms.math.ca/events/winter13

StudC (CMS Student Committee)
studc.math.ca

NORBERT SCHAPPACHER, Université de Strasbourg
Political Space Curves (Reflections on the centennial fate of a mathematical 'fact')

Mathematicians tend to view their science as cumulative ; what has once been proved belongs to a durable body of knowledge and will not be undone by future generations. Philosophers or historians of mathematics may find it difficult to be quite as enthusiastic. But when they point out that different standards of mathematical rigor prevailed at different times of the historical process, this hardly threatens the mathematicians' profound confidence in the perennity of their science.

The story I will tell in my talk on "Political Space Curves" suggests a different question, which may get us closer to what is really going on : How exactly do mathematic(ian)s manage to generate stable knowledge ? A steady creative reinvention of truth seems to do the trick. In passing, we will see that controversies do in fact exist in mathematics, vbut they tend to do surprisingly little to unveil the truth.

www-irma.u-strasbg.fr/~schappa/NSch/Home.html

ALEXANDER KARP, Teachers College, Columbia University
Mathematicians and pre-college mathematics education: Thinking about productive involvement

The presentation will be devoted to a discussion of certain aspects of the current state of mathematics education in high and middle schools, and to the role that the mathematics community might play in its improvement. In particular, the discussion will touch on issues related to the content of the school course in mathematics and to the preparation and professional development of mathematics teachers.

www.tc.columbia.edu/academics/?facid*apk16

Women in mathematics luncheon
cms.math.ca/women

Stephen Kudla (University of Toronto), **Marc Ryser** (Doctoral Prize recipient), and **Nilima Niligam** (Simon Fraser University)

cms.math.ca/Prizes/info/dp.html

ROBERT SMITH?, The University of Ottawa
When Zombies Attack! Mathematical Modelling of an Outbreak of Zombie Infection

Zombies are a popular figure in pop culture/entertainment and they are usually portrayed as being brought about through an outbreak or epidemic. Consequently, we model a zombie attack, using biological assumptions based on popular zombie movies. We introduce a basic model for zombie infection, determine equilibria and their stability, and illustrate the outcome with numerical solutions. We then refine the model to introduce a latent period of zombification, whereby humans are infected, but not infectious, before becoming undead. We then modify the model to include the effects of possible quarantine or a cure. Finally, we examine the impact of regular, impulsive reductions in the number of zombies and derive conditions under which eradication can occur. We show that only quick, aggressive attacks can stave off the doomsday scenario: the collapse of society as zombies overtake us all. mysite.science.uottawa.ca/rsmith43/

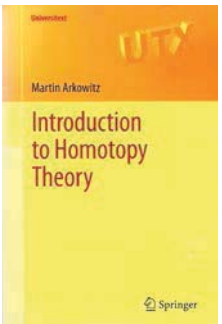
Introduction to Homotopy Theory

by Martin Arkowitz

Springer Universitext Series, New York 2011

ISBN : 978-1-4419-7328-3

Reviewed by ***Fred Cohen****, The University of Rochester, Rochester*



Introduction

Two continuous functions between topological spaces $f, g : X \to Y$ are said to be homotopic if and only if there is a continuous function

$$H : [0,1] \times X \to Y$$

such that $H(0, x) = f(x)$, and $H(1, x)) = g(x)$. One of the main goals of the subject of homotopy theory is an analysis of the set of equivalence classes of continuous maps obtained from the equivalence relation of homotopy.

This problem has been important for over one hundred years originating with Poincaré's invention of the fundamental group with the additional caveat that all such functions must preserve a fixed base-point in the domain and range, namely functions are *based functions or based maps*. The set of homotopy classes of based maps from a based space X to a based space Y is frequently denoted $[X, Y]$. In addition to the fundamental group, a second example is given by the structure of the homotopy classes of based maps of the n-sphere S^n to a topological space X, the n-th homotopy group of X denoted $\pi_n(X)$. These groups introduced by Čech are still not well-understood for various natural spaces including spheres of dimension at least 2, and most Lie groups. Work within the homotopy groups of spheres is an ongoing active subject. These structures have enjoyed applications to many other fields including applied mathematics.

The purpose of the book under review is to provide an introduction to classical homotopy theory, thus an introduction to basic properties of homotopy classes of maps between two topological spaces. This book is intended as an introduction for students of this subject who have some familiarity with the fundamental group and the singular homology of a topological space. Thus this review is directed to the non-expert.

The topics consist of nine chapters together with a substantial list of problems at the end of each chapter. Proofs in this book are clear, as well as direct with numerous opportunites to compute examples. The nine chapters are given next with a list of highlights to follow.

(1) Basic Homotopy,

(2) H-spaces and Co-H-spaces,

(3) Cofibrations, and Fibrations,

(4) Exact Sequences

(5) Applications of Exactness

(6) Homotopy Pushouts and Pullbacks

(7) Homotopy and Homology Decompositions

(8) Homotopy Sets

(9) Obstruction Theory

Chapter 1 develops initial basic properties as well as the subject of CW-complexes as a fundamental, ubiquitous as well as well-behaved collection of spaces in this setting. This chapter concludes with classical motivation for the subject of homotopy theory.

Chapter 2 introduces H-spaces, a generalization of the notion of a topological group, as well as co-H-spaces, a "dual" version with examples of co-H spaces such as spheres, and the suspension of a topological space. Namely, the suspension of a space X denoted $\Sigma(X)$ is given by the quotient of the product $[0, 1] \times X$ with the "top" $1 \times X$ collapsed to a single point, and the "bottom" $0 \times X$ also collapsed to a single point. Suspensions are basic in what follows.

Related fundamental constructions are developed. Some examples are (1) pointed loop spaces, the space of based continuous functions of a circle to a fixed target space X, (2) Eilenberg-Mac Lane spaces which are topological spaces having a single non-vanishing homotopy group, and (3) Moore spaces which are topological spaces having a single non-vanishing reduced homology group. At this point, the author frames these subjects within the context known as "Eckmann-Hilton duality".

Two of the basic tools in the analysis of homotopy classes of maps are fibrations, and co-fibrations. These are the subject of chapter 3. Fibrations, generalizations of a fibre bundle together with the "dual" notion of co-fibrations are defined and developed. Applications are made to Stiefel manifolds and Grassmann manifolds.

This topological setting then translates to an algebraic setting of "exactness" for which information about homotopy classes, homotopy groups, or homology groups are codified in terms of extensions of either sets or groups as developed in chapter 4. For example, given a pointed map $f : A \to X$, there is an associated sequence of spaces and maps where K is the mapping cone of f given by

$$A \to X \to K \to \Sigma(A) \to \Sigma(X) \to \Sigma(K) \to \cdots$$

known as the Barratt-Puppe sequence. There is an associated long exact sequence of pointed sets

$$[A, T] \leftarrow [X, T] \leftarrow [K, T] \leftarrow [\Sigma(A), T]$$
$$\leftarrow [\Sigma(C), T] \leftarrow [\Sigma(X), T] \leftarrow \cdots .$$

With this setting, various homotopy classes of maps can sometimes be compared in informative ways. The issue of exactness is basic as well as potentially finicky in the part of the exact sequence above given by $[A, T] \leftarrow [X, T] \leftarrow [K, T]$ the cases for which these sets may fail to be groups in a natural way. The author takes care to consider exactness properties in detail in chapter 4 via the so-called principal action map. This action is analyzed with clarity, and with care.

The universal coefficient thorem for the singular cohomology of a topological space as well as the analogue in homology are developed in chapter 5. Basic calculations for spheres and Stiefel manifolds are given. Additional applications and examples are given by basic computations with the classical Hopf map $S^3 \to S^2$ together with a computation the first few non-zero homotopy groups of (1) the 3-sphere, (2) $SO(3)$, and (3) Moore spaces. This chapter concludes with the natural comparison of homotopy classes of unbased maps with based maps.

Chapter 6 is a development of properties of push-outs and pull-backs with proofs of the following principal results:

(1) the classical Hurewicz theorem stating that the first non-vanishing homotopy group of a space is isomorphic to the first non-vanishing homology group via the "Hurewicz map" for simply-connected spaces,

(2) the Serre exact sequence in homology associated to a fibration of simply-connected spaces,

(3) the Blakers-Massey theorem which can be regarded as comparison of the homotopy groups of a pair (X, A) with those of the quotient X/A in low dimensions, and

(4) the Whitehead theorem stating that a map between simply-connected CW-complexes is a homotopy equivalence if and only if the map induces an isomorphism on the level of either homology or homotopy groups.

Chapter 7 introduces homotopy and homology decompositions of a space. Namely, homotopy decompositions arise by comparing natural fibrations as defined earlier. Homology decompositions are developed from co-fibrations also introduced earlier.

Chapter 8 gives some general structure theorems for homotopy classes of maps. One sample result is that if a space X is a finite CW complex, and Y is a countable CW complex, then the set of pointed homotopy classes of maps $[X, Y]$ is a countable set. Lusternik-Schirelmann category is introduced here. If in addition, either X is a suspension or Y is a loop space, the set $[X, Y]$ is naturally a group. The fundamental features of this group are also developed in chapter 8.

The book concudes with chapter 9 which is an introduction to obstruction theory from two points of view. The first direction is the question of the existence of an extension of a map defined on a subspace to the entire space. The second is through liftings of a map to the total spce of a fibration where the map to the base is specified. The first obstruction for the existence of such maps is developed

Good features of this book are the care, and clarity of the presentation. Natural, basic computations are given which illustrate important favorable cases occurring in nature. To this reviewer, this book is a lucid, enjoyable exposition of some fundamental tools in the subject.

The Canadian Mathematical Society invites nominations for the 2015 Excellence in Teaching Award.

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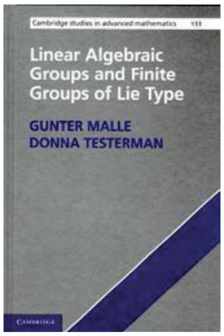
Linear Algebraic Groups and Finite Groups of Lie Type

by Gunter Malle and Donna Testerman

Cambridge University Press, Cambridge 2012

ISBN : 978-1-107-00854-0

Reviewed by ***Meinolf Geck****, Universitaet Stuttgart*



The classical work of Cartan and Killing shows that the simple Lie groups and Lie algebras over the complex numbers are classified in terms of Dynkin diagrams. The list of these diagrams consists of four infinite series of "classical type" A_n, B_n, C_n, D_n and five "exceptional" types G_2, F_4, E_6, E_7, E_8. This has turned out to be a model for classification problems arising from quite diverse contexts. In the early 1950's Chevalley succeeded in giving, for each of the above types, a uniform construction of an analogous Lie group and Lie algebra over an arbitrary ground field. In particular, this lead to the discovery of new families of finite simple groups. In the meantime, with the rise of abstract algebraic geometry, it became possible to study in geometric terms Lie groups (and the corresponding Lie algebras) over arbitrary algebraically closed ground fields. The result of the "Séminaire Chevalley" in Paris during the academic years 1956/57 and 1957/58 is the truly remarkable and deep fact that the original Cartan–Killing classification of simple Lie groups remains valid with $\mathbb{C}$ replaced by any arbitrary algebraically closed field, in particular, a field of positive characteristic. This is remarkable for several reasons: For example, the classification of simple Lie algebras in positive characteristic is much more complicated, where "new" infinite families exist which do not fit into the list of Dynkin diagrams; for Lie groups, however, we essentially get the same picture as over $\mathbb{C}$! Nowadays, the theory of "linear algebraic groups" (= Lie groups over arbitrary algebraically closed ground fields) is a central area of modern mathematics, with many applications and connnections to other areas. The classification of finite simple groups (another fundamental achievement of the past few decades) shows that Chevalley's construction of analogues of Lie groups over finite fields accounts, in some sense and with some variations (see [C1]), for almost all the finite simple groups.

For many years, the textbooks by Borel [Bo], Humphreys [Hu] and Springer [Sp] have been standard references which, among other things, lead to Chevalley's classification theorem. In each case, this includes fairly substantial background material from algebraic geometry. As Humphreys writes in the preface to his book, the "difficulty of the theory also stems in part from the fact that the main results culminate a long series of arguments which are hard to see through from beginning to end". In [Ge], the reviewer tried to give a modest introduction to the subject, with a view to what is needed as background material, for example, in Carter's book [C2] which covers a number of advanced topics of current interest (conjugacy classes, Deligne–Lusztig representations).

The book by Malle and Testerman has, of course, some overlap with the above texts, but it also has a number of distinguishing features, both in terms of content and in terms of style. Part I begins with basic concepts concerning algebraic groups and carefully describes the steps and ingredients leading to Chevalley's classification theorem. Part II deals with the subgroup structure (BN-pairs, centralisers) and the representation theory of semisimple algebraic groups (highest weight theory, Steinberg's tensor product theorem etc.). The final chapters of this part are concerned with more recent developments concerning the classification of maximal positive-dimensional subgroups of semisimple algebraic groups (results of Liebeck, Seitz, and others). The subject of Part III are the finite groups of Lie type (Lang-Steinberg theorem, tori, order formulae). The authors conclude with a discussion of the current state of knowledge about the maximal subgroups of these finite groups (results of Aschbacher, Kleidman, Liebeck, Saxl, Seitz and others). Thus, the book covers many topics that are central to the subject, but missing from existing textbooks.

In order to keep the whole text within a reasonable size, a number of proofs have been omitted. As a rough rule, as far as the general theory is concerned, proofs of a more group theoretical nature, or proofs which just use the basic notions of connectedness and dimensions, are included; for arguments which require deeper methods from algebraic geometry, precise references to one of the above textbooks are given. There must have been some difficult choices about what to include and what to omit, but I find the authors have found an excellent balance here. This is especially true in view of the aim to prepare a text which will be useful to doctoral students and researchers who wish to apply the theory in areas which rely upon a general knowledge of the groups—but not upon knowing every detail of the proof of the classification. The material and layout of this book has been "tested" in a summer school on "Finite Groups and Related Geometrical Structures"; it would also serve as an excellent basis for a first-year graduate level course. In conclusion, the book by Malle and Testerman is a most valuable and original addition to the literature on algebraic groups.

References

[Bo] A. Borel, *Linear algebraic groups. Second enlarged edition*, Graduate Texts in Mathematics vol. 126. Springer Verlag, 1991.

[C1] R. W. Carter, *Simple groups of Lie type*, Wiley, 1972; reprinted 1989 as Wiley Classics Library Edition.

[C2] R. W. Carter, *Finite groups of Lie type: Conjugacy classes and complex characters*, Wiley, 1985; reprinted 1993 as Wiley Classics Library Edition.

[Ge] M. Geck, *An introduction to algebraic geometry and algebraic groups*. Oxford Graduate Texts in Mathematics 10, Oxford University Press, 2003.

[Hu] J. E. Humphreys, *Linear algebraic groups* (second edition), Graduate Texts in Mathematics vol. 21. Springer Verlag, 1991.

[Sp] T. A. Springer, *Linear algebraic groups* (second edition), Progress in Math. vol. 9, Birkhäuser, 1998.

Jennifer Hyndman, *University of Northern British Columbia*
John McLoughlin, *University of New Brunswick*

Using Origami to Teach Mathematical Structures and Proofs

James L. Bailey, *College of the Rockies, British Columbia [bailey@cotr.ca]*

1. Introduction

I had a problem: students attended my college for two years and became excited about mathematics, but when they transferred to a university they found they were missing a crucial course, Mathematical Structures and Proofs, which was a prerequisite for many of their third-year courses. I decided that we needed to offer this course and asked several former students about their experiences. Their comments tended to be "The course consisted of watching the professor do proofs" and "Could you teach it so we can understand it?"

I decided to model our course after the one at Okanagan College which uses the following texts:

- Daniel Solow: How to Read and Do Proofs [1]
- Kevin Houston: How to Think Like a Mathematician [2]
- Robert S. Wolf: Proof, Logic and Conjecture [3]

That Christmas I received *Project Origami* by Thomas Hull [4], bought a cube of square memo paper, and as I worked my way through the book I realized that here was a microcosm of mathematical thought which I could exploit in my teaching.

Note: For maximal enjoyment of this article you should have a supply of origami paper close at hand.

2. How It Worked

With about 20 minutes left in the class I handed out origami paper. For the remainder of the class the students worked in groups on an activity, generally taken directly from Hull's book; they were asked to be aware of their thought processes so we could discuss them later. By the end of the class they had made a start on the exercise which they finished at home. The next class we looked at their ideas, discussed how they were related to the problem at hand, and pasted them together to form a proof. Initially I wrote the proofs on the board, but fairly quickly students were able to take over. We discussed the nature of the proof techniques which had been used, both in their explorations and in the final proof. Then we consulted one of the texts, looked at what it had to say about those techniques, and talked about them in a general setting.

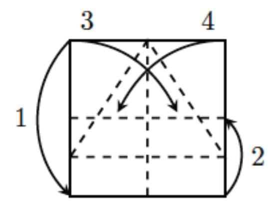
3. Equilateral Triangles

The first set of activities involved equilateral triangles.

3.1 Fold an Equilateral Triangle in a Square

Use origami folds to construct an equilateral triangle from a square piece of paper.

Students generally started by making folds more or less at random and complaining that they always seemed to get isosceles right triangles. Then someone did something like

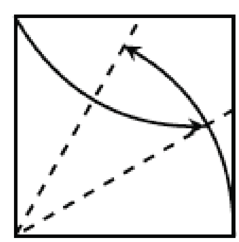


and asked "Is this right?" I pointed out that now we had a candidate which we have to *prove* is equilateral. There was a silence while the student stared at the paper—in the past it had been good enough to get an answer — now it needed to be justified? This leads naturally to the concept of a key question, which, in this case, is "How do we know that a triangle is equilateral?" One possible answer is "A triangle is equilateral when half of it has sides in the ratio $1 : \sqrt{3} : 2$." This one has sides in ratio $2 : 3 : \sqrt{13}$ so it is not equilateral.

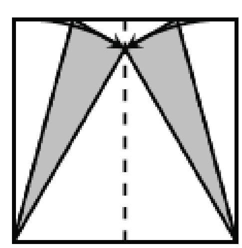
The student tried to work forwards —randomly apply what he was given (origami folds) to arrive at what he wants (an equilateral triangle). There are simply too many folds which might be made, and most of them do not lead to a solution. It is more efficient to formulate the key question and then work backwards.

Here are two solutions which students have come up with:

First Solution. Answer to the key question: A triangle is equilateral when all its angles are $60°$.
Make two folds through a vertex so the edges of the square fall on the folds. This trisects the $90°$ angle giving a $60°$ angle. Do the same at an adjacent vertex and we have an equilateral triangle.



Second Solution. Answer to the key question: A triangle is equilateral when all three sides are the same length.
Fold the square in half with a vertical crease. Make a fold through a lower vertex so the vertex above it falls on the vertical crease. Do the same on the other side. The edges of the paper form an equilateral triangle.



This very simple exercise led to discussions which included most of Chapter 2 in Solow [1]

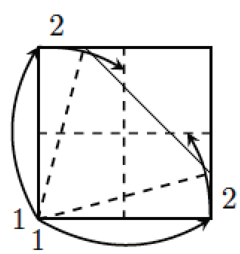
- getting an answer is not as important as proving that it is correct;
- your solution might not be correct, in which case you would have to prove that it is not correct;
- the difficulty in working forwards;
- formulating the key question; there can be many answers and the one which you choose will influence how you proceed. In this case there were three answers, each of which was useful (the first one allowed us to show the triangle was not equilateral but did not suggest a construction); and
- using the key question to work backwards.

Remark: What qualifies as an origami fold? "Superimpose one point on another and make a crease" (this amounts to finding the right bisector of the line joining the given points) and "place one line (edge or fold) on another and make a crease" (find the bisector of an angle) seem quite natural. The second solution, "make a crease through a given point so that another point falls on a given line" (find the intersection of a circle and a line) made me pause for a moment. The first solution amounts to "make a crease so that a given line falls on a crease which has not been made yet…" (this allows us to trisect angles) and seems rather suspect. On the other hand, the proof techniques are more important than the origami, so any folds which accomplish a well-defined purpose are legitimate.

3.2 Fold a Maximal Equilateral Triangle

Use origami folds to construct an equilateral triangle with the largest area.

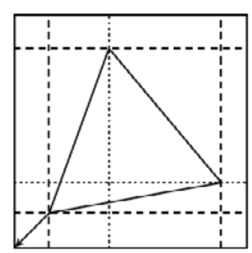
Students quickly come up with the following construction: fold the square in half with a vertical crease. Make a fold through a lower vertex so the vertex above it falls on the vertical crease. Fold the square in half with a horizontal crease. Make a fold through the same vertex so the vertex beside it falls on the horizontal crease.



This is close enough to the previous activity that students have no trouble finding this construction. I believe that their thought process went something like this: start with the last triangle which we constructed in Section 3.1. We can rotate the triangle about one of the common vertices and lengthening the sides until it "jams" in a symmetrical position (and symmetry is usually a good thing). The difference between the angle in the square and the equilateral triangle is $90^\circ - 60^\circ = 30^\circ$ which has to be shared equally between two angles of 15° each. Earlier we made a fold so the edge of the square made an angle of 60° for our equilateral triangle; this fold bisected the complementary angle so we have a 15° angle. Do this twice at the same vertex of the square and we have a triangle with two equal sides and a contained angle of 60° which is therefore equilateral.

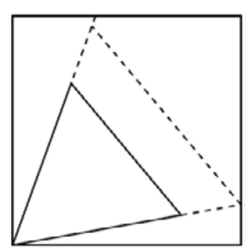
Students were certain that this was the maximal equilateral triangle, but had trouble seeing how to prove it —"Isn't it obvious?" They needed to be reminded to formulate the key question: "How can we tell that an equilateral triangle inscribed in a square has the largest possible area?" Because the answer to this question was not part of their background, they needed to delve further. What properties are necessary for an equilateral triangle to be maximal? How do we prove that a maximal triangle must have these properties? Are they sufficient? They needed only to look at their construction to formulate the conjecture "A maximal equilateral triangle must have one of its vertices on a vertex of the square and the other two vertices on opposite edges of the square." This is too much to try to prove all at once: there are really three things which we need to prove. Can we prove each part separately? What follows is a sketch of the students' proofs; there are some subtleties so this section is more rigorous than the preceding one.

Lemma 1: If there is a maximal equilateral triangle then there there is a maximal equilateral triangle with at least one vertex on a vertex of the square.



Proof: Choose any maximal equilateral triangle and draw lines parallel to the sides of the square through each of the three vertices. Remove the middle (dotted) ones. This gives a rectangle which is contained in the original square, has a vertex which coincides with one of the vertices of the triangle (the one which didn't have either of its lines removed), and which contains the maximal triangle. Move this rectangle parallel to itself so the vertex of the triangle coincides with a vertex of the square.

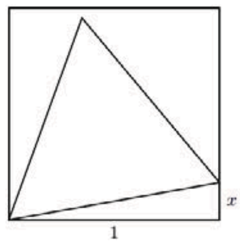
Lemma 2: Every maximal equilateral triangle which shares a vertex with the square must have at least one vertex on an opposite side of the square.



Proof by contradiction: Take any maximal equilateral triangle in the square. Without loss of generality we can assume that one vertex of the triangle coincides with one vertex of the square. Suppose that neither of the other vertices lies on an edge of the square. Extend the two sides of the triangle which share that vertex until they meet the sides of the square. Through the intersection of the shorter extension draw a line which is parallel to the third side of the triangle.

This gives an equilateral triangle with an area which is larger than the given one, a contradiction.

Theorem: Of the equilateral triangles which share one vertex with the square and which have at least one vertex on an opposite side of the square, the one we constructed has the maximum area.



Proof: We can increase x (and also the area of the equilateral triangle) until the third vertex meets the side of the square. The triangle is placed symmetrically in the square, the two angles between the sides of the square and the triangle must be 15° so we have the triangle which was originally constructed.

Several topics were discussed:

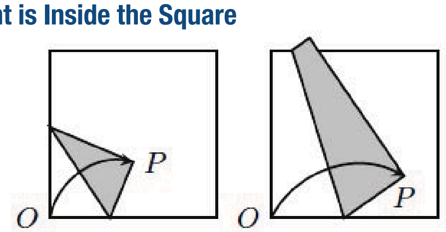
- proof techniques: contradiction, choose, specialization, cases, construction, forward uniqueness;
- breaking a complex task into simpler ones and proving them one at a time; the use of lemmas;
- necessary and sufficient conditions;
- properties of convex sets;
- symmetry; and
- the necessity of constructing an object — you cannot simply assume that it exists.

4. Haga's Origamics

To this point the challenge had been to construct an object and then prove that it had certain properties. This had stimulated students to "invent" a number of proof techniques. Haga's origamics[1] felt more like an exploration in ever widening circles, and allowed students to see how to generalize and build on earlier results.

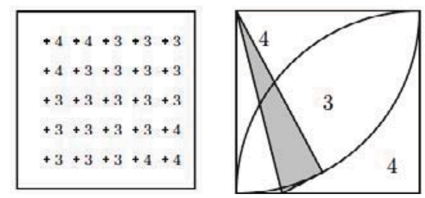
4.1 Turned Up Parts

The Point is Inside the Square



Choose a corner O and a point P in the square. Fold the corner to the chosen point. This creates a Turned-Up Part (TUP). Sometimes the TUP has three sides, sometimes four. How can we tell how many sides a TUP will have?

One student marked a square array of dots on the paper, made folds to them and recorded the number of sides on the TUP.



This exploration suggested the key question: When does the TUP change from being 3-sided to 4-sided? Answer: When the fold passes through a vertex of the square. Although you can move P around to convince yourself that this is true, we still need a proof. Should it be analytic or synthetic? My experience has been that students are more comfortable with analytic proofs, and this is what they chose. But before they could do that, they needed to choose a coördinate system and be able to find an equation for the crease. The proof is quite different from any they had done before.

Analytic proof: Place the origin O at the lower left hand corner of the square (this will become the TUP) and let the chosen point be $P(x_0, y_0)$. The fold will be the right bisector of OP and consequently has equation

$$\frac{y - \frac{y_0}{2}}{x - \frac{x_0}{2}} = -\frac{x_0}{y_0}.$$

The TUP has three sides when

$$x = 0 \text{ and } 0 \le y \le 1 \Rightarrow 0 \le \frac{y_0}{2} + \frac{x_0^2}{2y_0} \le 1$$

$$\Rightarrow 0 \le x_0^2 + y_0^2 \le 2y_0 \Rightarrow x_0^2 + (y_0 - 1)^2 \le 1$$

or $y = 0$ and $0 \le x \le 1 \Rightarrow (x_0 - 1)^2 + y_0^2 \le 1$. These inequalities define the middle region in the figure.

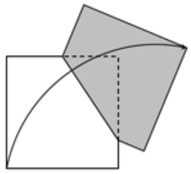
Topics discussed:

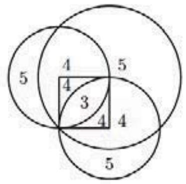
- the need for precise definitions, in this case for the equation of the crease and the TUP;
- the statement of the theorem must reflect what has been proven;
- finding critical values where behaviour changes; and
- actual values at the boundaries.

1 Dr. Kazuo Haga is a retired professor of biology at the University of Tsukuba, Japan. During free time, while he was waiting for his experiments, he explored paper folding. Rather than seeing origami as a means to an end, he found himself experimenting, asking questions, looking for patterns, making conjectures, and eventually discovering the theorems which have been named after him [5]. Nothing beyond high school mathematics is needed, but the results are often startling, elegant, and mathematically satisfying. Because origami is considered a child's exercise, Haga called what he was doing "origamics", the "-ics" suffix indicating that it is a field of knowledge or practice, as we have in the word "mathematics."

The Point is Outside the Square

How many sides does the TUP have if we allow the point P to be outside the square?





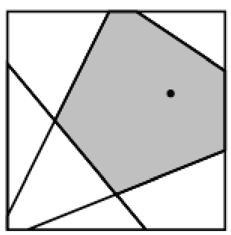
It was easy enough to extend the previous proof. As before, we answered the question on the basis of which sides of the square the fold crosses. As you would expect, the solution contains the previous exercise as a special case.

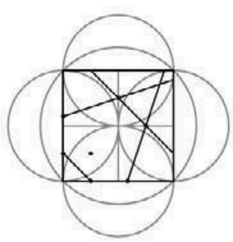
Topics discussed:

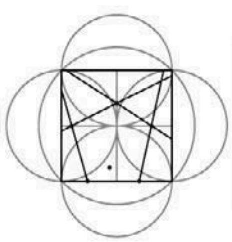
- generalizing theorems;
- using symmetry;
- first proving specialized results, then applying them to the problem at hand; and
- use of cases.

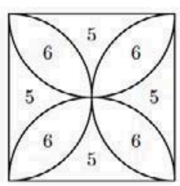
4.2 All Corners to a Point

This time choose a point in the square and fold all the corners to that point. How many sides does the region determined by the folds and edges of the square have? Again it is possible to reduce this question to the previous case; by symmetry we need only consider $\frac{1}{8}$ of the square.



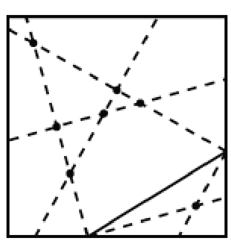






4.3 Mother Lines, Baby Lines

Make a random crease through a square piece of paper. This is the *mother line*. Now fold and unfold each of the sides of the square so they coincide with this line. These are the *baby lines*. What can you say about the points of intersection of the baby lines which is independent of the position of the mother line?

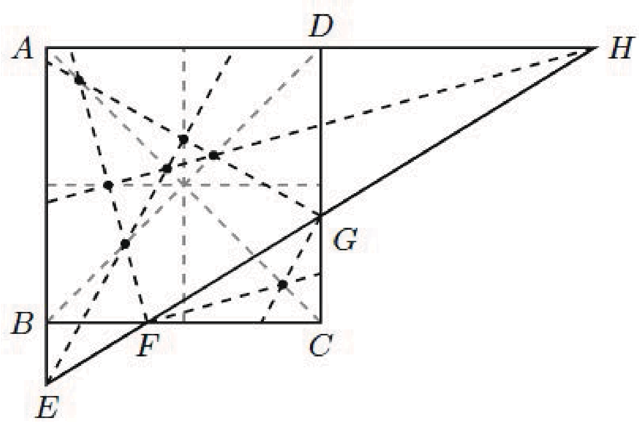


Students were usually impressed when they saw the answer. There was a discussion whether the proof should be analytic or synthetic; they had their usual preference for an analytic proof. After a few minutes one of them asked "Can we use Maple?" I had no objection, but fairly quickly there was a concensus: they would try a synthetic proof.

They quickly realized that each fold was an angle bisector, but didn't make any further progress until I suggested that they concentrate on triangle $\triangle CFG$, where the mother line connects F and G. The two angle bisectors meet in the incentre, which is on one of the diagonals of the square. If the sides of this triangle were extended to B and D then the bisectors of the external angles meet in the excentre which lies on the same diagonal. Knowing that a fold implies an angle bisector suggested extending more of the lines to make these angles explicit.

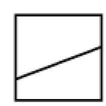
Triangle	Intersection of angle bisectors
$\triangle CFG$	incentre and excentre
$\triangle AEH$	incentre
$\triangle BEF$	excentre
$\triangle DGH$	excentre
$\triangle A^+EGD^+$	incentre
$\triangle B^+FHA^+$	incentre

The last two "triangles" have one vertex at infinity and require a careful consideration of what this means.



Topics discussed:

- synthetic geometry: each fold implies an angle bisctor.
  - an angle bisector is the locus of points which are equidistant from the two lines;
  - incentres, excentres;
  - limiting case: triangles with two parallel sides and an angle at infinity.
- dangers in the choose proof technique. Have we been mislead by our diagram? What about a mother line which meets opposite sides of the square? Is this case different from the one which we considered?



- do the separate cases require separate approaches or is there a general framework which can handle everything?

- what about the intersections on the boundary? What about intersections which are off the paper? Do they fit into the general framework?

There are several advantages to starting a proofs course with origami. Students are engaged —any idea which they have is only a few origami folds away. They don't sit around with blank looks on their faces, not having any idea of where to start. They are asked a question, but once they have an answer they still need to prove that it is correct. Not only that, their answer may be wrong. The questions are open-ended so that once they have completed the assigned task there are obvious generalizations.

There is a natural progression:

- exploration of the problem leading to conjectures;
- a period of going back and forth between trying to find proofs and counter examples;
- construction of the proof and verification that there are no holes;
- making certain that the statements of the lemmas and theorems reflect what was proved; and
- the production of a final, polished proof.

For me the greatest advantage of this approach is that proof techniques arise naturally.

The origami section of the course lasted four to five weeks of a fifteen-week course. Not every proof technique was covered (in particular contrapositive, induction, direct and indirect uniqueness, and elimination were not), but by the time we needed them the students were comfortable and quickly understood. By the end of the course it was possible to cover most of the material in the three texts, so students had an introduction to the most important topics in mathematics. Number theory (the Euclidean algorithm and modular arithmetic), and naïve set theory and Russell's paradox tended to be the most popular.

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[1] Daniel Solow, *How to Read and Do Proofs*. John Wiley & Sons, Inc, 5th Edition, 2010.

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[4] Thomas Hull, *Project Origami*. A K Peters, Ltd. Wellesley, Massachusetts, 1st Edition, 2006.

[5] Kazuo Haga (edited and translated by Josefina C. Fonacier and Masami Isoda), *Origamics: Mathematical Exploration through Paper Folding*, 2008, World Scientific, Singapore. **http://www.worldscientific.com/doi/pdf/10.1142/9789812834911_fmatter**

Math Competition Grants

The CMS is now accepting applications for the 2015 Math Competition Grants.

The Math Competition Grants are open to contests of different kinds at the school level. This includes:

- Traditional: students solve problems in a timed written exam
- Projects: Teams competing to solve a strategic problem over a longer period of time
- Posters: Preparation of a mathematical solution or discussion for display purposes

Preference will be given to:

- Competitions which embrace a number of regional schools (city, county or province-wide)
- New ventures or those which are aiming to expand their reach
- Competitions which have matching sources of funding or which are aiming to become self-sufficient

The deadline for applications is November 15, 2014. An application form and more information about the math competition grants can be found at: **http://cms.math.ca/Competitions/grants**

Subventions pour les concours de mathématiques

La SMC accepte maintenant des demandes de subventions pour les concours de mathématiques de 2015.

Les subventions pour les concours de mathématiques s'appliquent à divers concours organisés au niveau scolaire. Cela comprend :

- Traditionnel : les étudiants règlent des problèmes pendant un examen écrit à temps limité
- Projets : des équipes font la lutte afin de régler un problème stratégique au cours d'une plus longue période
- Affiches : la préparation d'une solution mathématique ou d'une discussion à afficher

La préférence sera accordée à :

- Les concours qui s'entendent à un certain nombre d'écoles régionales (à toute une ville, un comté ou une province)
- De nouveaux projets ou ceux qui visent à étendre leur portée
- Les concours qui jouissent de sources de financement de contrepartie ou qui visent à devenir autonomes sur le plan financier

La date d'échéance pour les candidatures est le 15 novembre 2014. Un formulaire de demande et plus amples renseignements sur le subventions pour les concours de mathématiques sont disponibles à : **http://smc.math.ca/Concours/grants**

A short introduction to Gröbner bases

Ilias S. Kotsireas[1], *Wilfrid Laurier University, Department of Physics & Computer Science, Waterloo, Ontario, N2L 3C5, Canada, e-mail: ikotsire@wlu.ca*

Gröbner bases are a particular kind of basis of polynomial ideals in multivariate polynomial rings. They enjoy some nice properties and can be used to answer algorithmically some questions regarding the ideals and their associated polynomial systems of equations.

Gröbner bases were invented by Bruno Buchberger in his 1965 PhD thesis [1], under the supervision of algebraic geometer Wolfgang Gröbner. Buchberger also devised an algorithm to compute Gröbner bases of ideals in multivariate polynomial rings. The crucial concepts in Buchberger's algorithm are the notion of the S-polynomial and a pair-completion process structurally similar to the 1967 Knuth-Bendix completion algorithm for the word problem in semi-groups and algebras. Termination of Buchberger's algorithm is ensured by Noetherianity of the inclusion relation in ideals in multivariate polynomial rings.

In [2] termination is proved by Dixon's lemma, which can also be used as a starting point to devise a concrete complexity analysis for Gröbner bases. Buchberger's algorithm for computing Gröbner bases has been implemented in all major commercial and open-source software systems for symbolic computation, such as Maple, Mathematica, Magma, Singular, Plural, Macauley2, CoCoA, SAGE etc.

We illustrate Gröbner bases with an example using Maple. First we need to load the appropriate package in Maple with the command **with(Groebner)**: Consider the following ideal I of three polynomials in three variables x, y, z

$$I = \langle x^2 + xy - 2, y^2 + xz - 3, xy - z^2 - 5 \rangle$$

and impose the (pure) lexicographical ordering with $x > y > z$ on the variables. The Maple command is: **F:= [x^2 + x*y -2, y^2 + x*z -3, x*y -z^2 -5]** ; Then the reduced lexicographical Gröbner basis of I with respect to this ordering is computed in Maple by issuing the command **g := Basis(F, plex(x,y,z))** : and is given by the three polynomials:

$$\begin{aligned} p_1 &= 1156 + 911\,z^2 + 264\,z^4 + 35\,z^6 + 2\,z^8 \\ p_2 &= -7336\,z - 3743\,z^3 - 635\,z^5 - 46\,z^7 + 136\,y \\ p_3 &= -1614\,z - 827\,z^3 - 141\,z^5 - 10\,z^7 + 68\,x \end{aligned}$$

Gröbner basis theory tells us that I coincides with the ideal generated by these three polynomials $\langle p_1, p_2, p_3 \rangle$.

If we examine the three polynomials in the Gröbner basis of I, we realize that p_1 is a univariate polynomial of degree 8 in z (and therefore its roots can be found with a numerical solver), p_2 yields y as a function of z and p_3 yields x as a function of z. Therefore the Gröbner basis provides a "canonical" way of solving the system of polynomial equations that corresponds to the ideal I, i.e. the system $x^2 + xy - 2 = 0, y^2 + xz - 3 = 0, xy - z^2 - 5 = 0$.

The univariate polynomial p_1 can not only be solved numerically but also algebraically (not always by radicals of course) but by working exactly in extension fields. In fact Gröbner bases are a way to construct the appropriate extension fields algorithmically.

The fact that p_1 is a univariate polynomial in z is not accidental, it is in fact a consequence of the fact that we chose z to be the "smallest" variable among x, y, z, combined with the fact that the number of solutions of the system of polynomial equations corresponding to I happens to be finite. Ideals whose corresponding systems of polynomial equations have a finite number of solutions are called zero-dimensional ideals.

The Gröbner basis of a zero-dimensional ideal provides a "canonical" way of counting the number of solutions of the corresponding systems of polynomial equations.

This is done by computing the leading monomials of all polynomials in the Gröbner basis and multiplying their degrees. In our example we obtain the three leading monomials z^8, y, x using the Maple commands

LeadingMonomial(g[1], plex(x,y,z)):

LeadingMonomial(g[2], plex(x,y,z)):

LeadingMonomial(g[3], plex(x,y,z)):

Therefore the system has $8 \times 1 \times 1 = 8$ solutions. The number of solutions is the product of the degrees only in the simple cases where the i-th polynomial in the Gröbner basis has exactly i variables. In general, this is not the case but still, the number of solutions can be immediately read off the polynomials of the Gröbner basis, namely as the number of power products which are not multiple of any of the leading power products of polys in the Gröbner basis.

Note that Gröbner bases theory tells us that in the case of zero-dimensional systems, the reduced lexicographical Gröbner basis will contain a polynomial whose leading monomial is a power of a variable and this will be the case for all variables appearing in the generators of the ideal.

In the past several decades, the theory of Gröbner bases has been developed extensively, extended in several directions and found applications [4] in several domains of Science and Engineering. We wish to emphasize the important and intricate connections of Gröbner bases with algebraic geometry, coding theory, cryptography, integer programming, computational statistics, polynomial system solving and polyhedral geometry.

There are several excellent textbooks to learn Gröbner bases from or use them to teach a course, we defer an annotated bibliography of Gröbner bases to a future CMS note. The Gröbner bases bibliography project [3] is a very useful on-line database of papers and books on all aspects of Gröbner bases.

Acknowledgement

The author would like to thank Bruno Buchberger for a careful reading of this note and several suggestions on how to improve it. The author would like to thank Florin Diacu for all his encouragement and editorial help.

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[1] Bruno Buchberger. An Algorithm for Finding the Basis Elements in the Residue Class Ring Modulo a Zero Dimensional Polynomial Ideal (in German). PhD Thesis, Mathematical Institute, University of Innsbruck, Austria, 1965. (English Translation: J. of Symbolic Computation, Special Issue on Logic, Mathematics, and Computer Science: Interactions. Volume 41, Number 3-4, pp. 475–511, 2006).

[2] Bruno Buchberger. An Algorithmical Criterion for the Solvability of Algebraic Systems of Equations (in German). Aequationes mathematicae 4/3, 1970, pp. 374–383. (English translation in: B. Buchberger, F. Winkler (eds.), Gröbner Bases and Applications. London Mathematical Society Lecture Note Series, Vol. 251, Cambridge University Press, 1998, pp. 535-545.)

[3] Bruno Buchberger et al. Gröbner bases bibliography project, maintaned at RISC-Linz, Austria **http://www.risc.jku.at/Groebner-Bases-Bibliography/**

[4] Bruno Buchberger and Franz Winkler (Editors). Gröbner Bases and Applications, London Mathematical Society Lecture Note Series 251, Cambridge University Press, 1998

MATH CAMP GRANTS 2014

The CMS is accepting grant applications for a limited number of new math camps to be staged in 2014.

Math camp grants are intended to support, in part, individuals staging a math camp at their respective university or CEGEP and can be either residential or day camps. Camps generally target student and teacher participants from the local outreach area of the university. CMS is particularly interested in expanding specialty camps for under-represented groups and teachers. Math camp information can be found at: http://cms.math.ca/MathCamps/.

Applications should contain an outline of the camp proposal and a budget. The deadline for application is April 1, 2014 and should be submitted electronically to: **camps-coordinator@cms.math.ca**.

SUBVENTIONS POUR CAMPS MATHÉMATIQUES 2014

La SMC accepte en ce moment les demandes de subvention pour l'organisation de quelques nouveaux camps mathématiques en 2014.

Les subventions pour camps mathématiques procurent une partie du financement nécessaire à une personne qui souhaite organiser un camp mathématique dans son université ou son cégep. Il peut s'agir d'un camp avec hébergement ou d'un camp de jour, qui cible habituellement les étudiants et les enseignants de la région desservie par l'établissement d'enseignement. La SMC souhaite particulièrement étendre ses camps spécialisés aux groupes sous-représentés et aux enseignants. Pour tous les détails sur les camps mathématiques, consultez le http://cms.math.ca/Camps/.

Veuillez nous faire parvenir par courriel votre demande de subvention, qui comprendra une description du projet de camp et un budget, au plus tard le 1er mai 2014 à l'adresse **camps-coordinator@smc.math.ca**.

CALL FOR NOMINATIONS

NATIONAL MATH COMPETITIONS PROBLEMS COMMITTEE

The CMS invites expressions of interest from math high school teachers, mathematicians, and others for various committee member positions for the CMS series of national mathematics (http://cms.math.ca/Competitions/). The CMS is in the process of developing the competitions program, expanding committee membership, and is soliciting interest in the following areas:

- Competition creation: helping to create and develop the competitions from beginning to end;
- Problem development: identifying and/or creating problems for the competitions; and
- Competition Assessment: assessing problem appropriateness and presentation.

Prior math contest experience, while desirable, is not a requirement. Your committee participation will help shape the current and future direction of the competitions. The time commitment is generally not onerous and can sometimes be tailored to availability.

Anyone with an interest in problem solving is invited to forward an expression of interest, including a covering letter indicating the area of interest, an expression of views regarding math publications, and a brief CV. Please submit your expression of interest electronically to: volunteer@cms.math.ca. Deadline for submission of interest is February 15, 2014.

APPEL DE CANDIDATURES

COMITÉ DES CONCOURS DE MATHÉMATIQUES NATIONAUX

La SMC invite les personnes intéressées, notamment les enseignants du secondaire et les mathématiciens, à poser leur candidature pour divers postes au comité qui s'occupera des concours nationaux de mathématiques de la SMC (http://smc.math.ca/Concours/). La SMC a entrepris l'expansion de son programme de concours et souhaite aussi augmenter le nombre de membres de son comité. Elle sollicite donc des candidatures aux postes suivants :

- Création de concours : participer à la création et au développement des concours du début à la fin;
- Élaboration de problèmes : trouver ou créer des problèmes pour les concours;
- Évaluation des concours : évaluer le caractère approprié et la présentation des problèmes.

De l'expérience des concours de mathématiques n'est pas obligatoire, mais serait considérée comme un atout. Votre participation guidera l'orientation actuelle et future des concours mathématiques. La contribution en temps n'est généralement pas très grande et peut s'adapter à votre disponibilité.

Toute personne qui s'intéresse à la résolution de problèmes est invitée à soumettre un dossier de candidature, qui comprendra les éléments suivants : une lettre de présentation précisant le type de poste qui vous intéresse, un texte dans lequel vous exprimez votre opinion et vos idées par rapport à la publication et un bref curriculum vitae. Faites parvenir votre proposition de candidature à : volunteer@smc.math.ca au plus tard le 15 février 2014.

Movement in Heterogeneous Landscapes

Rebecca Tyson, *Associate Professor, Mathematical Biology, University of British Columbia, Okanagan, British Columbia [rebeccatyson@ubc.ca]*

Movement is a fundamental component of living, and not surprisingly, mathematical modelling offers an interesting perspective. No organism has all the resources it needs for growth and reproduction in perpetuity in a single location. Either the environment must move and bring resources to the organism, or the organism or it's progeny must be able to disperse or spread. Sessile organisms that rely on movement of the environment include, for example, anemones, mussels, epiphytes, and venus fly traps. Organisms that are mainly sessile, but can spread over increasing geographic area to acquire new resources include most plants, which grow in size thereby increasing leaf area as well as root mass. Funghi represent, perhaps, the most sophisticated example of this approach, where one organism can extend over an astonishingly large area, drawing nutrients from and feeding a whole network of plants.

I am mostly interested in organisms capable of self-locomotion. These organisms move to find resources (food, shelter), to escape from predators, or to find mates. They may have very simple or very complex responses to the environment. In either case, these responses are generally based on the local information available to each individual. The population-level patterns that we observe arise from the local responses of multiple individuals. Anticipating the population-level patterns that will result from changes to individual behaviour (as a result of, perhaps, habitat fragmentation or climate change), as well as discerning the individual behaviours that give rise to known population-level patterns (examples include the coordinated movement of a flock of birds, or the mass migration of salmon upstream to their natal site), are key questions. It is only when we understand these two aspects of movement—the individual behaviours, the population-level patterns, and the connections between the two—that we can confidently predict future population-level patterns or determine how individual behaviours should be manipulated for a desired population-level effect.

I am interested in the dispersal and resulting population dynamics of organisms in heterogeneous landscapes of all sorts. My study organisms have so far included insects, small rodents, large mammals, and raptors. The beauty of mathematical modelling is that one modelling approach can be used to describe organisms all across spatial scales, and so I have enjoyed modelling a large range of organisms in an equally wide range of contexts. The modelling tools I use are partial differential equations (PDES, reaction-diffusion-chemotaxis equations), systems of ordinary differential equations (ODEs), and individual-based models.

An interesting project I worked on concerned cyclic populations in fragmented habitat. Populations that exhibit multiannual cycles are ubiquitous, especially in the northern hemisphere. Perhaps the most famous example of cyclic dynamics is the well-documented 10-year population cycle of the Canada lynx and snowshoe hare. The northern populations have dramatic, high amplitude cycles that are unmistakable, and have inspired mathematical biologists for decades. The same two species however, are apparently not cyclic, or at best minimally cyclic, in the southern portions of their range. It is not clear why the cycles are absent in the south, though a possible cause is the increased fragmentation of habitat due to more intense forest harvesting and human settlement in the more populous south. I investigated this hypothesis via a series of PDE models in a fragmented habitat composed of good and bad patches, [3], and in the same habitat but with the addition of edge-specific behaviour, [1]. This work also led me to help organize a workshop at the Banff International Research Station this past fall, [10].

Another project I pursued was related to bee movement and wild bee conservation. My work in this direction started when a colleague asked me to model the bee-mediated dispersal of apple pollen. The question was highly relevant: a transgenic apple had been developed, and any application for approval of the cultivar would need to address the issue of spread. Apple pollen, it turns out, is moved *only* by bees, that is, there is no wind pollination. Consequently, in order to understand pollen movement, I needed to understand bee movement.

My co-authors and I started with the usual diffusion-based approach, and then rapidly found that we couldn't fit both the near-distance and long-distance portions of the data for bee and pollen dispersal. After much thought, we found that by splitting the bee population into two groups, harvesters (moving diffusively in an intensive search mode) and scouts (moving advectively in an extensive search mode), we could match the data beautifully [6]. What we had developed was a new way of mechanistically modelling organism movement that was still based on a diffusion approach, but which could give the leptokurtic tails characteristic of the dispersal data.

Once we had the bee movement piece working, we were able to model the movement of pollen, [7]. We were able to explain seemingly contradictory field studies showing that when surrounded by competing pollen sources, the dispersal distance for transgenic pollen is extremely limited, while the opposite is true when there is little competing pollen.

A third modelling project I pursued recently was the recolonization of second growth forest. For this I used a patch-based approach. I was interested in understanding how tree squirrels recolonize second-growth forest patches. The system is an interesting one, as the squirrels occupy discrete, nonoverlapping territories that are essentially fixed from one generation to the next. The central feature of each territory is the midden, a large pile of discarded cone bracts within which the squirrel stores sufficient cone supplies to make it through the winter. In addition, the midden provides shelter from the cold and from predators. The midden is passed down from one occupant to the next, and can only be occupied by one squirrel at a time.

When a forest is harvested, the territories that were formerly present become uninhabitable, until such time as the new trees start producing cones. I used a system of ODEs to model the harvesting and recolonization process, where each ODE represented a patch of forest, and I was interested in tracking the squirrel population in each patch. The discretization of the continuous domain via the creation of territories leads to some interesting questions around the process of recolonization. We found that there was a trade-off between the rapidity of the recolonization process and the cost to the population in the mature forest patch supplying the colonizers [8].

Another interesting research project was about assessing the sterile insect technique. For this last example, I return to the insect world, this time modelling the movement of the iconic worm in the apple: the codling moth. If left unchecked, a codling moth infestation will result in worms throughout the region and unacceptable economic losses for growers. An alternative to pesticides (the standard method of control) is the Sterile Insect Technique (SIT). Codling moths are mass-reared in a facility, then made reproductively sterile through irradiation. The sterile moths are then released in large numbers in orchards, where they disperse and mingle with the wild moths preventing wild-wild matings and thereby causing the wild population to collapse. The technique has been used successfully against other insects, and so a facility was built in the Okanagan Valley, BC, and a codling moth Sterile Insect Release (SIR) program established.

The program was initially highly successful, and the amount of pesticide use dropped significantly. Unfortunately, the wild population did not collapse entirely, and several years after the initiation of the SIR program there were signs that the wild population was actually increasing. We were interested in understanding why, in spite of satisfactory wild-sterile ratios in monitoring traps, the wild population might be increasing. To do this, we built an individual-based model that included wild and sterile moths of both sexes, wind, female pheromone plums and traps with anthropogenic pheromone plumes, [9]. We showed that small changes in individual movement behaviour could result in large changes in the effectiveness of the SIR, but remain undetected in monitoring traps.

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2014 CMS Winter Meeting

December 5 - 8, 2014, Hamilton (Ontario)
Hamilton Sheraton
Host: McMaster University

CALL FOR SESSIONS

The Canadian Mathematical Society (CMS) and McMaster University welcomes and invites proposals for sessions for the 2014 Winter Meeting in Hamilton from December 5th to 8th, 2014. Proposals should include a brief description of the focus and purpose of the session, the expected number of speakers, as well as the organizer's name, complete address, telephone number, e-mail address, etc. All 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 by **March 30, 2014**.

Scientific Directors

Nicholas Kevlahan : **kevlahan@mcmaster.ca**

Deirdre Haskell : **haskell@math.mcmaster.ca**

Réunion d'hiver 2014 de la SMC

5-8 décembre 2014, Hamilton (Ontario)
Hamilton Sheraton
Hôte : Université McMaster

PROPOSITION DE SESSIONS

La Société mathématique du Canada (SMC) et l'Université McMaster vous invitent à proposer des sessions pour la Réunion d'hiver 2014 qui se tiendra à Hamilton du 5 au 8 décembre 2014. Ces dernières doivent inclure une brève description de l'orientation et des objectifs de la session, le nombre de conférenciers prévus ainsi que le nom, l'adresse complète, le numéro de téléphone et l'adresse courriel de l'organisateur. Toutes les sessions seront annoncées dans les Notes de la SMC, sur le site web et dans les AMS Notices. 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 au plus tard le **30 mars 2014**.

Directeurs scientifiques

Nicholas Kevlahan : **kevlahan@mcmaster.ca**

Deirdre Haskell : **haskell@math.mcmaster.ca**

CANADIAN MATHEMATICAL BULLETIN (CMB)

EDITOR-IN-CHIEF (EIC) AND OTHER EDITORS

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 in June 2014. Funding support from the CMS is available for both these EIC positions.

In addition, the CMS intends to expand the current compliment of supporting editors for the CMS journals and is also soliciting interest in the following editorships:

Assistant Editor-in-Chief
Technical Editor
Graphics Editor
Managing Editor

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-2014@cms.math.ca** before April 15, 2014.

Current CJM/CMB Editorial Board:

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Dani Wise (McGill)	Associate Editor
Jie Xiao (Memorial)	Associate Editor
Efim Zelmanov (UCSD)	Associate Editor

BULLETIN CANADIEN DE MATHÉMATIQUES (BCM)

RÉDACTEUR EN CHEF ET AUTRES POSTES

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 juin 2014. La SMC offre du soutien financier pour ces deux postes.

La SMC souhaite en outre élargir le bassin de rédacteurs qui appuient les activités de rédaction de ses revues. Elle sollicite donc également des candidatures aux postes suivants :

rédacteur en chef adjoint
rédacteur technique
infographiste
rédacteur gérant

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 : **CMB-EIC-2014@cms.math.ca** au plus tard le 15 avril 2014.

Conseil de rédaction pour le JCM et le BCM à present:

Terry Gannon (Alberta)	Rédacteur en chef du BCM
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Robert McCann (Toronto)	Rédacteur en chef du JCM
Volker Runde (Alberta)	Rédacteur en chef du BCM
Louigi Addario-Berry (McGill)	Rédacteur associé
Florin Diacu (Victoria)	Rédacteur associé
Ilijas Farah (York)	Rédacteur associé
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Dani Wise (McGill)	Rédacteur associé
Jie Xiao (Memorial)	Rédacteur associé
Efim Zelmanov (UCSD)	Rédacteur associé

CALL FOR CRUX EDITOR-IN-CHIEF (EIC) AND OTHER EDITORS

The CMS invites expressions of interest for various editor positions for CRUX, the CMS international problem solving journal. CRUX is in the process of redeveloping journal content, expanding the current compliment of editors, and is soliciting interest in the following opportunities to help shape a new direction for CRUX:

Editor-in-Chief

Associate Editor-in-Chief

Assistant Editor

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Managing Editor

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Anyone with an interest in problem solving is invited to forward an expression of interest, including a covering letter indicating the type of editorships you are interested in becoming involved with, a curriculum vitae, and an expression of views regarding the publication.

Please submit your expression of interest to: **CRUX-EIC-2014@cms.math.ca** no later than **April 15, 2014**.

APPEL À CANDIDATURES CRUX RÉDACTEUR EN CHEF ET AUTRES POSTES

La SMC invite les personnes intéressées à occuper un poste de rédacteur pour le CRUX, le journal international de résolution de problèmes de la SMC. Le CRUX a entrepris la refonte de son contenu et souhaite élargir son bassin de rédacteurs. Il sollicite donc des candidatures aux postes suivants pour se donner une nouvelle orientation à CRUX:

Rédacteur en chef

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Toute personne qui s'intéresse à la résolution de problèmes est invitée à soumettre un dossier de candidature, qui comprendra 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.

Faites parvenir votre proposition de candidature à : **CRUX-EIC-2014@cms.math.ca** au plus tard **le 15 avril 2014**.

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