



A Summer School for Women in Math

8

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CMS
SMC

Canadian Mathematical Society
Société mathématique du Canada

CMS NOTES December 2012 de la SMC

From the Vice-President's Desk

Stephen Kudla, *University of Toronto*

A little about JUMP



There was recently a meeting at the Fields Institute in Toronto with Deborah Newman, Deputy Minister, of the Ontario Ministry of Training, Colleges and Universities. At issue was the renewal of financial support for the Institute from the province. Various testimonials for the achievements of the Institute were given; they ranged from formative student experiences through medical research applications and conferences on advance topics in number theory – a wonderful array of mathematical activities. It remains to be seen how the financially stressed Ontario government will respond.

Among the participants in this meeting was John Mighton, who gave a fascinating and spirited description of the JUMP math program.

What is JUMP? It is quite likely than many of you are already well informed about JUMP, but others, myself among them, who do not have a current involvement in schools math education (K-12), may not be aware of this program. The JUMP program, a national non-profit organization, was begun by John Mighton to implement on a broad scale ideas about math instruction that he had developed over years of tutoring. A fundamental tenant of JUMP is that, in spite of extensive prejudices to the contrary, the vast majority of students can be highly successful in math and that such success is not dependent on some special math talent, possessed only by the 'gifted'. The program provides a method and materials that are aimed at radically improving

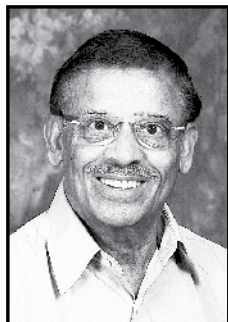
the performance in mathematics of students in elementary and high school. Of course, 'easy to do is easy to say'. But there is extensive evidence that the JUMP program is delivering the goods. Indeed, this year JUMP will be used by over 100,000 grade one to eight students as their main in-class program across Canada.

There are two excellent articles about JUMP in the NY Times, written by David Bornstein, "A better way to teach math", NYT, April 18, 2011, and "When math makes sense (to everyone)", NYT, April 21, 2011. These articles describe the rather remarkable progress made by students using the JUMP materials and discuss the relevance of these results to issues of innumeracy, math anxiety, tracking, student self-esteem.

The JUMP method involves a number of components. Among them is the use of guide discovery, in which discovery-based lessons are supported by 'prompt and sufficient feedback'. There is an emphasis on breaking things down into sufficiently small steps, the idea being that student difficulties are frequently the result of an attempt to master a complex process in one go, and getting confused and dispirited on the way. The focus on small steps also allows the instructor to identify student difficulties and correct them quickly. And, crucially, there is the underlying concern with maintaining and building student confidence through 'the excitement of small victories' and with making the lessons a successful discovery of mathematics shared by the class as a whole. Finally, a nice feature is an underlying emphasis on building the students' awareness of the patterns and rules. Students become very excited at making these discoveries and meeting these challenges while learning the material. *For many, it is the first time they*

Talks and Lectures

Srinivasa Swaminathan, *Dalhousie University*



In the September 2012 issue of the NOTES, Benoit Charbonneau points out, in the Education Notes article on 'The Bridges Lecture Series,' how general lectures by mathematicians fail to satisfy the general audience which may include those familiar with mathematics. Such a remark is expressed also by the delegates at math conferences after attending a general survey talk by an expert mathematician.

A lecture at a conference or a colloquium talk should be distinguished from a series of lectures on a topic, either to a specific audience or in a classroom.

The lecturer should note that his/her audience consists of persons with widely varying interests in mathematics or other subjects. Hence it is not a good idea to focus on the technical aspects of any one subject. It is advisable to follow the following scheme suggested by Halmos: the first quarter of the talk should be intelligible to a novice in the audience; the second to those who may be familiar with the basics of the topic under discussion; the third to all those who have peripheral interest in the subject of the talk; and finally the last quarter either to the specialists or to those who are conversant with topic themselves. If the lecturer were to get bogged down with detailed proofs of theorems or with intricate calculations, he/she is likely to lose the attention of the audience.

Among the best lectures that I have attended are those of A. D. Alexandrov, S. Chandrasekar, P. R. Halmos, C. L. Siegel, and Marshall Stone. They did not refer to any notes or books during their talk; they explained clearly their topics, wrote sentences, equations etc clearly on the black board. Some years ago John Horton Conway visited Dalhousie University and was invited to give a colloquium talk. No title was announced. He walked in to the room, wrote three different titles on the blackboard, asked the audience to choose one of them for his talk and left the room for a while. One title was chosen after some discussion. JHC returned and delivered an excellent talk to a spell-bound audience! Felix Klein was an extremely polished lecturer, and also very conscientious; he could often be seen in the library reviewing the literature references he was going to give in his lectures. In contrast Erhard Schmidt mentioned that David Hilbert's lectures were less polished, but were "with their wealth of insights they were most original and beautiful that I have heard."

Constance Reid writes that great mathematician-teachers fall into two classes: those like Klein who deliver their lecture complete and finished like a perfect jewel; and those who are like Hilbert and Courant, struggle with the subject in front of the students in the classroom. Some members of the audience are stimulated by one type and some by the other. It has been observed that many research

mathematicians cannot teach effectively; they are effective only when they talk about what they are doing in their research.

In general, talks at a conference or at a colloquium are listed for one hour duration. But in practice they are expected to last only about 50 minutes, which is also the duration of the attention-span of most listeners. The lecturer should also plan to allot some time for questions and minor discussions.

A well planned and well delivered math talk would ideally begin with an indication of the scope of the lecture, introduce the necessary definitions, state the important results, prove not more than one important theorem, discuss its importance and impact, and conclude with questions to be explored. Such a procedure will be well received and might also encourage some members of the audience to study and work further on the subject of the lecture. Indeed lectures by legendary outstanding speakers like Emil Artin and John von Neumann inspired listeners to go forth and do something further; their charisma and enthusiasm contributed much to the effect!

One might think that a good lecturer will be a good teacher too and *vice-versa*. But experience has shown that it is not so in general. A good teacher of calculus, for example, might consistently produce senior students who turn out to be outstanding graduate students, but may turn out to be a poor speaker at a colloquium! The methodology for success in teaching does not adopt well for delivering lectures.

Many years ago P.R. Halmos wrote an article *How to Talk Mathematics* in the Notices of the AMS (Vol. 21, 1974). Conference speakers would benefit greatly by following the advice given in this article. Another article of Halmos that I would recommend is his report *Why is Congress?* [Math. Intelligencer 9 (2), 1987, 20-27] in which he comments on the lectures and talks given at the 1986 International Congress of Mathematicians at Berkeley, CA.

It might, perhaps, be worthwhile if organizers of conferences consider including some guide-lines for preparing and delivering talks in their communications with those invited to give talks.

Conférences et exposés

Dans l'édition de septembre 2012 de NOTES, Benoit Charbonneau, dans son article *La série d'exposés bridges* qui faisait partie de la section *Education Notes*, décrit en quoi les conférences générales des mathématiciens s'avèrent toujours frustrantes pour les membres de l'auditoire général, public qui peut compter des personnes qui connaissent déjà les mathématiques. Les délégués à des conférences de mathématiques sont du même avis après avoir participé à une séance de sondage générale donnée par un mathématicien expert.

Un exposé au cours d'une conférence ou d'un colloque devrait offrir des caractéristiques qui le démarquent d'une série d'exposés sur un sujet donné, qu'il soit adapté à un public particulier ou donné dans une salle de classe. Le conférencier devrait tenir compte du fait

que son auditoire est formé de personnes qui n'ont pas toutes les mêmes intérêts en mathématiques ou les mêmes intérêts par rapport à d'autres sujets. Il ne faut donc pas traiter exclusivement des volets techniques d'un sujet donné. Il est préférable d'adopter la stratégie suivante proposée par Halmos : le premier quart de l'exposé devrait être de niveau de difficulté adapté à un novice dans l'auditoire; le deuxième est adapté aux personnes qui connaissent les rudiments du sujet abordé; le troisième à tous ceux qui ont un intérêt périphérique dans le sujet abordé; et le dernier aux spécialistes ou à ceux qui connaissent à fond le sujet. Le conférencier qui s'enlise en énumérant des preuves détaillées de théorèmes ou des calculs complexes perdra probablement l'attention des membres de l'auditoire.

Je compte parmi les meilleurs exposés auxquels j'ai assisté celui de A.D. Alexandrov, de S. Chandrasekar, de P. R. Halmos, de C. L. Siegel et de Marshall Stone. Ces personnes n'ont jamais lu de leurs notes ni cité des ouvrages pendant leur exposé; ces conférenciers ont expliqué clairement leur sujet, écrit des phrases, des calculs, etc. clairement au tableau. Il y a quelques années, John Horton Conway s'est rendu à Dalhousie University et a été invité à donner un exposé dans le cadre d'un colloque. Aucun titre n'a été annoncé. Il est arrivé dans la pièce, a inscrit trois titres au tableau, a demandé à l'auditoire de choisir un des titres qui serait le sujet de son exposé et a quitté la pièce pendant quelque temps. Les participants ont choisi un titre après s'être consultés pendant quelque temps. JHC est revenu et a donné un excellent exposé à un auditoire complètement conquis! Felix Klein était un conférencier qui avait maîtrisé l'art de l'exposé. Il était aussi très consciencieux. On le voyait souvent à la bibliothèque en train de revoir les références aux ouvrages qu'il allait énumérer au cours de ses exposés. Par ailleurs, Erhard Schmidt a mentionné que les conférences de David Hilbert étaient moins polies, mais « elles étaient, vu les vastes connaissances qui étaient partagées, des plus originales et comptaient parmi les plus belles qu'il m'ait été donné d'entendre ».

Selon Constance Reid, les grands mathématiciens-enseignants appartiennent à deux catégories : ceux qui, comme Klein, donnent leur conférence complète et peaufinée comme un bijou parfait et ceux qui, comme Hilbert et Courant, s'enlisent à présenter le sujet à des étudiants dans une classe. Certains membres de l'auditoire sont stimulés par un des types de présentateurs, d'autres par l'autre. On a déjà noté que de nombreux chercheurs mathématiciens ne peuvent pas enseigner efficacement; ils ne sont efficaces que s'ils traitent directement de leur recherche.

En général, on prévoit à l'heure une durée d'une heure pour les exposés au cours d'une conférence ou d'un colloque. En pratique, on s'attend plutôt à ce qu'ils durent 50 minutes, période qui correspond aussi au champ d'attention de la plupart des membres de l'auditoire. Le conférencier devrait également prévoir quelques minutes pour répondre aux questions et entamer de courtes discussions.

Un exposé mathématique bien planifié et bien donné commencerait idéalement par une indication de sa portée. On présenterait ensuite

les définitions incontournables et l'état des résultats importants. On ne démontrerait pas plus d'un seul théorème important, traiterait de son importance et de ses effets et on terminerait avec des questions à examiner de manière plus approfondie. Une telle démarche serait bien accueillie et inciterait peut-être même certains membres de l'auditoire à étudier davantage le sujet abordé. En effet, des exposés de conférenciers exceptionnels et légendaires tels que Emil Artin et John von Neumann ont inspiré les personnes qui les ont entendus à repousser les frontières; leur charisme et enthousiasme ont beaucoup contribué à l'effet marquant!

On pourrait penser qu'un bon conférencier est un bon enseignant et *vice versa*. Mais l'expérience démontre qu'il n'en est rien, en général. Un bon enseignant en calcul pourrait, par exemple, former année après année, des finissants qui deviennent des étudiants doctoraux particulièrement doués, mais peut ne pas avoir de grands talents pour les exposés au cours de colloques! La méthodologie pour réussir en enseignement ne s'adapte pas bien à la présentation d'exposés.

Il y a de nombreuses années, P. R. Halmos a rédigé un article intitulé *How to Talk Mathematics* (comment parler « mathématiques ») dans les « Notices of the AMS » (vol. 21, 1974). Les conférenciers profiteront beaucoup des conseils donnés dans cet article. Je recommanderais un autre article de M. Halmos aussi, soit son rapport intitulé *Why is Congress?* [Math. Intelligencer 9 (2), 1987, 20-27] où il formule des commentaires sur les conférences et les exposés donnés au cours du Congrès international des mathématiques de 1986 à Berkeley, en Californie.

Il serait peut-être utile aussi que les organisateurs de conférences présentent quelques lignes directrices pour la préparation et la présentation d'exposés dans la documentation qui est fournie aux personnes invitées à donner des exposés.

Letters to the Editors Lettres aux Rédacteurs

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.

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'adresse suivante : notes-lettres@smc.math.ca.

Quelques faits au sujet du programme JUMP

Stephen Kudla, *Université de Toronto*



Une rencontre a eu lieu récemment à l'Institut Fields, à Toronto, avec Deborah Newman, sous-ministre du ministère de la Formation et des Collèges et Universités de l'Ontario. Il y a été question du renouvellement du soutien financier accordé par la province à l'Institut. On a eu droit à divers témoignages sur les réalisations de l'Institut, qui vont d'expériences formatrices

pour les élèves à des applications de la recherche médicale et de conférences sur des sujets pointus en théorie des nombres, soit un formidable éventail d'activités mathématiques. Il reste à voir comment réagira le gouvernement de l'Ontario, qui connaît des difficultés financières.

Parmi les participants à cette rencontre figurait John Mighton, qui a présenté un exposé fascinant et passionnant sur le programme de mathématiques JUMP.

En quoi consiste le programme JUMP? Il est fort probable que certains d'entre vous le connaissent déjà bien, mais ce n'est pas forcément le cas pour d'autres, comme moi, qui n'interviennent pas dans l'enseignement des mathématiques de la maternelle à la 12^e année. Le programme JUMP est une organisation nationale à but non lucratif qui a été fondée par John Mighton pour appliquer à grande échelle des concepts de l'enseignement des mathématiques qu'il avait mis au point au fil de ses années comme tuteur. L'un des principes clés du programme JUMP est que, en dépit des importants préjugés supposant le contraire, la grande majorité des élèves peuvent obtenir de très bons résultats en mathématiques sans posséder un talent particulier pour ce sujet, talent qui serait réservé uniquement aux plus doués. Le programme s'appuie sur une méthode et du matériel pédagogique ayant pour objet d'améliorer de façon radicale les résultats en mathématiques des élèves du primaire et du secondaire. Facile à faire est bien sûr facile à dire, mais les preuves ne manquent pas pour confirmer l'efficacité du programme. En effet, cette année, le programme JUMP sera le principal programme offert en classe à plus de 100 000 élèves de la première à la huitième année d'un bout à l'autre du Canada.

Les 18 et 21 avril 2011 respectivement, le *New York Times* a publié deux excellents articles de David Bornstein sur le programme JUMP : « A better way to teach math » (Une meilleure façon d'enseigner les mathématiques) et « When math makes sense (to everyone) » (Les mathématiques à la portée de tous). Ces articles décrivent les progrès assez remarquables réalisés par des élèves utilisant le matériel pédagogique JUMP et traite de la pertinence des résultats obtenus au regard de questions comme l'incapacité de calculer, l'angoisse des mathématiques, le groupement par aptitudes et l'estime de soi chez les élèves.

La méthode JUMP comporte un certain nombre d'éléments, dont la découverte guidée, où des leçons de découverte reposent sur des interventions rapides et adéquates auprès des élèves. L'accent est mis sur la décomposition du processus d'apprentissage en étapes suffisamment petites, les difficultés des élèves découlant souvent d'une tentative de maîtriser un sujet complexe du premier coup, ce qui est source de confusion et de découragement. Les petites étapes permettent aussi à l'éducateur de remédier rapidement aux difficultés relevées. Par ailleurs, il ne faudrait surtout pas oublier la nécessité sous-jacente de maintenir et de renforcer la confiance des élèves par le « plaisir que procurent les petites victoires » et de transformer les leçons de mathématiques en séances de découvertes qui profiteront à toute la classe. Enfin, l'un des aspects intéressants du programme est qu'il permet aux élèves de se familiariser avec les modèles et les règles mathématiques. « Les élèves sont fort ravis de faire ces découvertes et de relever ces défis tout en apprenant la matière. » *Pour un grand nombre d'entre eux, ils ont pour la toute première fois envie de prêter attention aux règles et aux modèles mathématiques ou d'élargir leurs connaissances des nouveaux cas.* » (Traduction libre) (extrait tiré du guide de l'enseignant JUMP, AP Book 4.1, p.A-9, sans soulignement dans l'original). Bien entendu, en tant que mathématiciens, nous nous réjouissons que cet aspect de nos travaux soit communiqué aux élèves.

Les articles de David Bornstein et le site Web de JUMP, à www.jumpmath.org, contiennent bien d'autres renseignements et commentaires intéressants sur le sujet.

Il va de soi que tout programme visant à améliorer les écoles suscitera de vifs débats. Au cœur de ces débats réside la question de l'« habileté », du « talent inné », des « gènes mathématiques », etc. Je suis certain que nous tous, mathématiciens en recherche, reconnaissons l'existence d'un talent vraiment exceptionnel pour les mathématiques. Certains possèdent des connaissances et des aptitudes incomparables en mathématiques et qui, dans des circonstances convenables (ou pas, c'est-à-dire Galois), peuvent apporter une contribution décisive à l'évolution future du domaine. Mais l'enjeu principal ne concerne pas l'enseignement des mathématiques dans les écoles, ni même dans les programmes spécialisés à l'université, mais plutôt les compétences et la maîtrise des outils mathématiques fondamentaux. Ce qui frappe notamment dans le programme JUMP, c'est que son efficacité en salle de classe a été mesurée quantitativement. Le programme s'est prêté à deux études contrôlées où les élèves JUMP ont obtenu de bien meilleurs résultats que les élèves du groupe témoin. Une synthèse de ces études paraîtra dans la section consacrée à la recherche du site Web du programme JUMP.

Pourquoi le programme JUMP présente-t-il un intérêt pour le mathématicien professionnel? Voici quelques réflexions :

1. Ce serait bien si on pouvait faire disparaître cette grande angoisse/phobie que suscitent les mathématiques chez des étudiants universitaires par ailleurs confiants et appliqués, voire dans la société en général. On s'entend tous sur l'importance fondamentale des mathématiques dans le monde d'aujourd'hui. Ce serait génial si les mathématiques, dans la vie de tous les jours,

faisaient naître un sentiment de confort plutôt que de résignation du genre « Je n'ai jamais été doué pour les mathématiques », qui est malheureusement la norme. Tous conviennent de l'importance des ordinateurs – quoi qu'ils soient de nos jours – et cette conception englobe leur utilisation quotidienne efficace. Des programmes comme JUMP peuvent certainement contribuer à une amélioration des attitudes.

2. Les concepts mis en œuvre dans le programme JUMP peuvent-ils être appliqués à l'enseignement des mathématiques à l'université, en particulier à nos pratiques d'enseignement des cours de services et d'enseignement du calcul intégral et de l'algèbre linéaire dans les grandes salles de cours, notamment? Là aussi il y a la pression constante suscitée par les taux d'échec et la nécessité d'atteindre un niveau de maîtrise acceptable.
3. Le programme de mathématiques JUMP a sûrement des racines dans le milieu d'apprentissage créé par l'Institut Fields. Sans ce dernier, où et comment la mise au point du programme aurait-elle pu se produire? Il s'agit d'un autre exemple du rôle essentiel joué par de telles institutions, qui se distingue du rôle plus structuré joué par les universités. Un financement soutenu important, voire élargi, pour les instituts Fields, CRM et PIMS et d'autres instituts de mathématiques devrait faire partie intégrante d'une stratégie nationale permettant de jeter les bases d'un avenir prospère.

A little about JUMP, continued from cover

have ever been motivated to pay attention to mathematical rules and patterns or to try to extend their knowledge in new cases." (From the JUMP Teacher's Guide for AP Book 4.1, p.A-9, emphasis added.) Of course, as mathematicians we are pleased that this aspect of our own endeavors might be conveyed to students.

Much more information and interesting discussion can be found in the Bornstein articles and on the JUMP website, www.jumpmath.org.

Of course, as with any program aimed at improving the schools, heated debate arises. At the core of this is the issue of 'ability', 'giftedness', 'math genes' etc. As working research mathematicians, I doubt that any of us would deny the existence of truly exceptional mathematical talent. There are individuals whose mathematical insights and abilities are incomparable and who, given decent circumstances (or not, viz Galois), can have a decisive impact on the future development of the field. But this is not what is at stake in the teaching of math in schools, nor even in the specialist programs in the university. Rather the problem concerns competence and fluency with fundamental mathematical tools. And one of the striking things about JUMP is that its effectiveness in the classroom has been measured quantitatively. JUMP has participated in two controlled studies in which JUMP students did significantly better than students in the control group. The results of these studies will be summarized in the research section of the JUMP website.

Why is JUMP relevant to the professional mathematician? Here are a few thoughts:

1. It would be nice to witness a change from the current unfortunate level of math anxiety/phobia in otherwise confident and effective university students and, indeed, in our society as a whole. There is a common agreement about the fundamental importance of mathematics in our world today. It would be nice if that view could also include a sense of comfort with its use in everyday life, rather than the 'I was never good at math' attitude that is the unfortunate norm. Everyone agrees on the importance of 'computers' – whatever those are these days – and this view involves their effective daily use. No doubt programs like JUMP can contribute to a positive shift in attitudes.
2. Can the ideas implemented in JUMP be brought into the teaching of math in the university, especially into our service teaching, large lecture calculus and linear algebra, for example? Here too there is constant pressure about failure rates vs the need to achieve an acceptable level of mastery.
3. The JUMP math program certainly has some roots in the environment provided by the Fields Institute. In the absence of this institution, where and how would the development of JUMP have occurred? This is another example of the essential role played by such institutions, a role that is distinct from the more structured university environment. Continued strong and, indeed, expanded funding for Fields, CRM, PIMS and other mathematical centers should be an important component of a national strategy to build the foundations for a prosperous future.

NOTES DE LA SMC

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DECEMBER 2012

6-8 Thailand-Japan Conference on Computational Geometry and Graphs (Bangkok, Thailand)

<http://www.tjccgg2012.com/index.htm>

7 Canadian Launch of Mathematics of Planet Earth 2013
Lancement canadien de Mathématiques de la planète Terre 2013
www.mpe2013.org

8-10 CMS Winter Meeting Fairmont Queen Elizabeth, Montreal, Quebec Scientific program: CRM
www.cms.math.ca/winter12

10-14 Reproducibility in Computational & Experimental Maths. (Providence, RI)
<http://icerm.brown.edu/tw12-5-rcem>

17-21 International Conference on Theory, Methods & Applications of Nonlinear Equations, (Kingsville, TX)
www.tamuk.edu/artsci/math/conference_2012/html

17-22 The legacy of Srinivasa Ramanujan (Delhi, India)
<http://www.legacyoframanujan.com>

19-22 Conference on Commutative Rings, Integer-valued Polynomials, etc (Graz, Austria)
www.integer-valued.org/conf2012

JANUARY 2013

31-Jan 11 Recent Advances in Operator Theory & Algebras (Bangalore, India)
<http://www.isibang.ac.in/~jay/rota.html>

1-9 Workshop & Conference on Limit Theorems in Probability (Bangalore, India)
<http://www.isibang.ac.in/~html>

4-8 ICERM Workshop on Whittaker Fns, Schubert Calculus & Crystals (Providence, RI)
<http://icerm.brown.edu/sp-s13-w2>

20-22 Discrete Geometry for Computer Imagery (Seville, Spain)
<http://dgci2013.us.es/>

FEBRUARY 2013

11-15 Sage Days: Multiple Dirichlet Series, Combinatorics, And Representation Theory (Providence, RI)
<http://www.icerm.brown.edu/sp-s13-w1>

11-17 Representation Theory, Homological Algebra & Free Resolutions (Berkeley, CA)
<http://www.msri.org/web/msri/scientific/workshops/all-workshops/show/-event/Wm8999>

FEBRUARY CONTINUED

15 PIMS/UBC Distinguished Colloquium by Béla Bollobás (Vancouver, BC)
www.pims.math.ca

25-March 1 AIM Workshop: Brauer groups & obstruction problems: Moduli spaces and arithmetic (Palo Alto, CA)
<http://www.aimath.org/ARC/workshops/brauermoduli.html>

MARCH 2013

4-8 Whittaker Functions, Schubert Calculus & Crystals (Providence, RI)
<http://www.icerm.brown.edu/sp-s13-w2>

4-8 Conference on Combinatorics, Graph Theory & Computing (Boca Raton, FL)
<http://www.math.fau.edu>

APRIL 2013

6-7 AMS Spring Eastern Sectional Meeting
<http://www.ams.org/meetings/sectional/sectional.html>

8-9 IMA Mathematics in Finance (Edinburgh, UK)
<http://www.ima.org.uk/>

8-12 AIM Workshop: Geometric perspectives in mathematical Quantum field theory (Palo Alto, CA)
<http://www.aimath.org/ARC/workshops/geometricqft.html>

8-12 Interactions between Noncommutative Algebra, Representation Theory, and Algebraic Geometry (Berkeley, CA)
<http://www.msri.org/web/msri/scientific/workshops/all-workshops/show/-event/Wm9063>

15-19 Multiple Dirichlet Series, Combinatorics, And Analytic Number Theory (Providence, RI)
<http://www.icerm.brown.edu/sp-s13-w3>

JUNE 2013

16-23 51st International Symposium on Functional Equations (Rzeszów, Poland)
tabor@univ.rzeszow.pl

JULY 2013

1-5 Erdős Centennial (Budapest, Hungary)
<http://www.renyi.hu/conferences/erdos100/index.html>

16-20 HPM 2012 History and Pedagogy of Mathematics The HPM Satellite Meeting of ICME-12 (Daejeon, Korea)
<http://www.hpm2012.org>

2013 Doctoral Prize

The CMS **Doctoral Prize** recognizes outstanding performance by a doctoral student. The prize is awarded to the person who received a Ph.D. from a Canadian university in the preceding year (January 1st to December 31st) and whose overall performance in graduate school is judged to be the most outstanding. Although the dissertation will be the most important criterion (the impact of the results, the creativity of the work, the quality of exposition, etc.) it will not be the only one. Other publications, activities in support of students and other accomplishments will also be considered.

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

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

Nominations

Candidates must be nominated by their university and the nominator is responsible for preparing the documentation described below, and submitting the nomination to the address below. No university may nominate more than one candidate and the deadline for the receipt of nominations is January 31, 2013.

The documentation shall consist of:

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

All documentation, including letters of recommendation, should be submitted electronically, preferably in PDF format, by the appropriate deadline, to docprize@cms.math.ca.

Prix de doctorat 2013

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

Les mises en candidature qui ne seront pas choisies dans leur première compétition seront considérées pour une année additionnelle (sans possibilité de mise à jour du dossier), et seront révisées par le comité de sélection du Prix de doctorat l'an prochain.

Le lauréat du Prix de doctorat de la SMC aura droit à une bourse de 500 \$. De plus, la SMC lui offrira l'adhésion gratuite à la Société pendant deux ans et lui remettra un certificat encadré et une subvention pour frais de déplacements lui permettant d'assister à la réunion de la SMC où il recevra son prix et présentera une conférence.

Candidatures

Les candidats doivent être nommés par leur université; la personne qui propose un candidat doit se charger de regrouper les documents décrits aux paragraphes suivants et de faire parvenir la candidature à l'adresse ci-dessous. Aucune université ne peut nommer plus d'un candidat. Les candidatures doivent parvenir à la SMC au plus tard le 31 janvier 2013.

Le dossier sera constitué des documents suivants :

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

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



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CORRECTION NOTICE: In the October/November 2012 print issue of CMS Notes, the Education Notes article on Page 10 was mistakenly titled “Endless Algebra - the Deadly Pathway from High School Mathematics to College Mathematics” by J. Michael Shaughnessy. The correct title of the article which appeared is “PIMS and Mathematics Education in BC” by Malgorzata Dubiel, Simon Fraser University. The CMS apologizes for any confusion this misprint may have caused.

ERRATUM : Dans la version imprimée du numéro d'octobre-novembre 2012 des Notes de la SMC, l'article de la section « Education Notes » à la page 10 a été intitulé par erreur « Endless Algebra - the Deadly Pathway from High School Mathematics to College Mathematics » et attribué à J. Michael Shaughnessy. Cet article aurait dû porter le titre « PIMS and Mathematics Education in BC », de Malgorzata Dubiel, de l'Université Simon Fraser. La SMC s'excuse pour toute confusion que cette erreur aurait pu causer.

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

One of the priorities of Education Notes is to raise awareness of ongoing mathematical activities. This issue brings attention to two initiatives: first, a CMS Women in Mathematics notion that was developed and staged by the University of Waterloo and second, some perspectives on outreach in New Brunswick schools. Outreach will be the theme of the Education Session at the Summer 2013 Meeting in Halifax. An announcement appears at the close of the Education Notes.

The editors welcome ideas for future issues including stories of mathematical events in your area. Please send comments along to jennifer.hyndman@unbc.ca and/or johngm@unb.ca.

Two Weeks at Waterloo – A summer school for women in math

Kathryn Hare, *University of Waterloo*

“**T**wo weeks at Waterloo – A summer school for women in math” was a two week workshop, held at the University of Waterloo from August 12-25, 2012 for outstanding female undergraduate mathematics students. The purpose of the workshop was to encourage and inspire talented women students to continue their studies in mathematics and to consider graduate work in mathematics.

The program was advertised across Canada and 16 women were chosen from over 50 applicants. They came from 7 provinces and 13 different universities, with most entering their final year of undergraduate studies.

The students all attended two mini-courses, “Introduction to elliptic curves”, taught by Dr. Matilde Lalin (U. Montreal) and “Introduction to math biology”, taught by Dr. Gail Wolkowicz (McMaster U.). To emphasize the collaborative nature of mathematical research, the students worked in small groups on a research project for each course.

Three guest lectures by prominent women mathematicians were given, including a public lecture by Dr. Charmaine Dean, Dean of Science from Western University. There was also one presentation on mathematically-oriented careers in industry given by a pair of women from Manulife Financial. Tours were made to meet with female mathematicians in industry at IBM, Manulife Financial and Maplesoft. The students also visited the Fields Institute and had a day of sightseeing at Niagara Falls.

The summer school was a worthwhile experience for all involved. Most of the students indicated that they were more interested in graduate school now than they had been before the program. They enjoyed meeting and doing mathematics with other women students and instructors, and found it informative to hear about different career paths and life stories of women mathematicians.

It is our hope that this workshop will become a regular event. Sponsors of the program included TD, Manulife Financial, Maplesoft, Fields Institute, PIMS, AARMS, CMS, CAIMS, ISM and the University of Waterloo. Enough funds were raised that all the students' travel and living costs were covered.



Observations from Outreach

John Grant McLoughlin, *University of New Brunswick*

Ryan Jones, *University of New Brunswick*

Ryan Jones and John Grant McLoughlin have been extensively involved in outreach activities, particularly with respect to classroom visits in local elementary schools. This article opens with a longer piece on this subject, largely written from Ryan's perspective as a graduate of the secondary years program in math and science. (Ryan Jones is presently an M.Ed. student.) This piece is followed by a selection of snapshots into other aspects of the outreach activities in 2011 and 2012.

Math in Elementary Schools: The Benefits of Ongoing Collaboration

Mathematics outreach from University of New Brunswick has taken place in New Brunswick schools, particularly in the Fredericton area, in different capacities: instruction within classes, multiple-class activities, and day-long events. Outreach has included curriculum directed mathematics instruction, problem-solving and challenge questions (curriculum and/or subject exploration), mathematical games and puzzles, and dialogue with students and teachers.

Taking a procedural perspective, outreach instruction naturally varies from that of the students' teacher and this has given a healthy diversity. The introduction of new or mixed methods has provided understanding for some and deepened knowledge for others; teachers are given opportunities to strengthen their own knowledge thereby enhancing practice. An interesting power/authority shift was observed with math content being presented by outreach volunteers; student/teacher tensions may be alleviated allowing for additional engagement.

The presence of outreach has provided a complete math perspective. Where schools may be pressured by curricular and assessment issues, outreach has the flexibility to focus on investigation and exploration. Students have been encouraged to enhance their own understanding and skills through challenges, problem solving, and inquiry. Students

reach the same goal(s) when they are brought together for instruction that ties the event together. Differentiation occurs naturally because the focus isn't a linear procedure-answer format but an open-ended approach that encourages experimentation.

Park Street Elementary is located on the north side of Fredericton and is best used as a contextual example because various forms of outreach have taken place there. Notably, Ryan Jones and John Grant McLoughlin have been collaborating with a teacher, Wendy Sinclair, through regular visits to her class (Grades 3/4 in 2011-2012 and Grade 4 in Fall 2012) mainly on Monday mornings from about 8:30 to 9:45. There have been about 25 such visits during that time, usually focused on curricular topics or skills issues including mental mathematics. Ongoing observations at Park Street Elementary through 2011/2012 revealed an increasingly positive attitude of the grades 3/4 students towards mathematics. (The class of about 20 students doubled with a team teaching arrangement involving Tanya Burke and her grade 4 students following the March break.) Regular outreach has been met with excitement and welcome. For some, outreach has been a source of comfort within mathematics. Risk taking behaviours through active problem solving have been modelled and promoted. The flexibility described above removes the high-stakes value associated with answers; instructor/student dialogue has been an important aspect of outreach in this regard at Park Street.

The continuity has allowed for a development of relationship with the children, along with the staff. The support of Chris Treadwell and Tracy Stewart as administrators, in addition to the enthusiasm from various teachers and educational assistants, has made the experience more enriching for all involved.

A different form of continuity has taken place with Kingsclear Consolidated School and its 100 or so students on the outskirts of Fredericton. It is there that the outreach unofficially began in a significant way. Matt McGuire and John Grant McLoughlin decided to begin with a few visits to Matt's Grade 4 class. Soon enough there was the involvement of Heather Mazerolle's Grade 5 class, and extensions to other grades in the school. The small staff is highly mathematically motivated, including the principal, Karen Godsoe-Daigle. Mathematical events including classroom visits have taken place there over a longer time than Park Street, though not with the same frequency. Catherine Harrop of CBC brought attention to the outreach with a feature on a visit to Kingsclear in May 2011.

Mutual trust and respect have been built over time, thus facilitating an open and honest discussion (and/or negotiation). Benefits of regular outreach are also active on a more simplistic level; learning through games and play help eliminate many of the stigmas associated with traditional rote mathematics. Outreach activities may be an important support in countering mathematical anxiety. Informal reports indicate that positive math attitudes have carried over into everyday instruction.



Photo: Matt McGuire, Kingsclear Consolidated School

Other Snapshots of Outreach in NB

Brief descriptions of some other outreach initiatives are provided here. Anyone interested in learning more is welcome to write to John Grant McLoughlin (johnngm@unb.ca).

Monday visits to schools

UNB's undergraduate education students are placed in schools on Mondays. Hence, an effort has been made to offer outreach on many Mondays in local schools. It is planned in advance so as to accommodate the observations and if necessary, participation of the UNB student interns. For example, this week's visit (at the time of writing) is to a Grade 4 class at Barker's Point Elementary School, thus, allowing two more students to observe the outreach. About 20-25 interns including many at Park Street have had the opportunity to participate in this outreach. This has included some events in middle and secondary schools as well.

Poster presentations

For the third successive year, a mathematical fair-like atmosphere was established in a middle school. Over 60 students in UNB's elementary education program offered poster presentations and activities in October on topics including: mathematical connections with music (e.g. sound) or art (e.g. tessellations); mathematical topics like the golden ratio or Fibonacci's sequence; historical connections such as the history of numbers, Mayan mathematics, or the development of measurement; and much more. This year's host was Devon Middle School with particular acknowledgment of the efforts of Sandi Braun. Quoting a middle school student at Devon: "That was fun, I didn't even know that stuff was Math!"

Mathematical days

Several full day activities have been held in schools around the province including Burnt Church, Miramichi, Oromocto, Burtts Corner, New Bandon, Chipman, and Fredericton. The event in Chipman was organized in conjunction with April Wilson, a district numeracy lead person. April wrote a submission entitled *Math Outreach Reaches Out* for the *AARMS Spring 2012 Newsletter*, an excerpt below of which captures the essence of many of these events.

With increased emphasis being directed to improving students' problem solving skills, the challenges presented during the event certainly promoted a variety of problem solving strategies, such as guess and check, working backwards, and logical reasoning, to name a few. One trait of good problem solvers is determination, and this quality was supported throughout the sessions with encouragement and occasional individual hints to help students push through and not give up. The satisfaction experienced by students upon the successful solving of a puzzle was delightful to witness.

Math in the library

An effort has been made to take the events into the community with mathematical puzzle exhibits and a public lecture series entitled *The Beauty of Mathematics*, the latter featuring talks on four Wednesday evenings in March 2011 at the Fredericton Public Library. The Upper Miramichi Regional Library has also hosted an event. Plans for events in at least two other libraries are preliminary.

Acknowledgments

It is important to acknowledge the support of outreach grants from Atlantic Association for Research in the Mathematical Sciences (AARMS) in making it possible to carry out the work. So many people have contributed to making the outreach effective in its various facets. In addition to the people noted above in the article itself, particular thanks is extended here to Kelda Smith, Kyle Smith, Kelli Wilkie, Cathy Cowe, Erin Fenton, Kimberly Sears, Gaelan Hanlon, Jenna Granger, Michelle Vienneau, Ronda Hooley-Evans, Michael Stewart, Shazia Hadi and the respective hosts/local organizers in many places including Leslie Cockburn, Dianne Clowater, and Larry Flanagan.



Photo: Matt McGuire, Kingsclear Consolidated School

ANNOUNCEMENT

Call for Participation in the Education Session at Dalhousie

Mathematical Outreach is the theme of the **Education Session** to be held at the **Summer CMS 2013 Meeting in Halifax**. If you are interested in sharing examples of outreach from your work, please contact one of the co-organizers for the session: Danielle Cox (mathcircles@dal.ca); John Grant McLoughlin (johnngm@unb.ca); or Andrew Hare (andrew.hare@smu.ca). Ideas are welcomed to support this session. Ideally the event will feature some outreach to the local community, and hence, if you are willing to volunteer some support please let one of us know.



Interested in **Math Community**? So is the CMS!
Check out: <http://cms.math.ca/Community/>

Florin Diacu, *University of Victoria, British Columbia*

Our readers will have noted with concern a recent Italian court decision, in which members of a scientific advisory committee were found guilty of manslaughter and sentenced to six years imprisonment for failing to predict the 2009 L'Aquila earthquake. We hope that their appeal will be successful. The following article, by CMS member Florin Diacu, originally appeared in the New York Times, from which it is reprinted with the author's permission. (The Editors)

Florin Diacu is a professor of mathematics at the University of Victoria and the author of “Megadisasters: The Science of Predicting the Next Catastrophe.”

Is Failure to Predict a Crime?

I learned with disbelief on Monday about the decision of an Italian judge to convict seven scientific experts of manslaughter and to sentence them to six years in prison for failing to give warning before the April 2009 earthquake that killed 309 people, injured an additional 1,500 or so and left more than 65,000 people homeless in and around the city of L'Aquila in central Italy.

By this distorted logic, surgeons who warn a patient that there's a small chance of dying during surgery should be put in prison if the patient does, in fact, die. Imagine the consequences for the health system. The effect on other fields would be just as devastating. In response to the verdict, some Italian scientists have already resigned from key public safety positions. Unless this shortsighted verdict is overturned by wiser minds, it will be very harmful in the long run.

In L'Aquila, the scientists presented a risk assessment in late March 2009 after small seismic events made the public anxious. They found that a major quake was unlikely. Certainly, the timing of the scientists' statements played against them. On April 6, a 6.3-magnitude earthquake devastated the area, where earthquakes had been recorded since 1315. And L'Aquila is built on the bed of a dry lake, so the soil tends to amplify the motions of the ground. These facts, however, do not alter the truth of the scientists' claim that earthquakes are extremely rare there. One of the most important ones took place back in 1703.

In general, if the number of weak temblors is large, the probability of extreme events is small. But improbable does not mean impossible. Scientists generally cannot predict the time, location and magnitude of any major event, in spite of the fact that they did so — once. On Feb. 4, 1975, seismologists issued a warning to residents of Haicheng in northeastern China, prompting people to seek safety outdoors. A 7.3-magnitude earthquake struck that evening, killing more than 2,000 people and destroying more than 90 percent of the city. Without the warning, it might have resulted in close to 150,000 victims. But a 2005 report in the *Bulletin of the Seismological Society of America* qualified the Haicheng success as “a blend of confusion, empirical analysis, intuitive judgment and good luck.”

Earthquake prediction is mostly based on probability. We know, for instance, that in the region of Cascadia, between Vancouver, British Columbia, and Sacramento, some 20 major events of a magnitude of 9 or higher took

place in the past 10,000 years. The periods between those quakes have varied between two and eight centuries. The latest took place on Jan. 26, 1700. The next one could happen today or 10 generations from now.

Earthquakes are hard to predict because we know little about the configuration of the tectonic plates. The deepest hole drilled to learn more about the earth's crust was about 7.5 miles long, and it took more than 20 years to complete. But even if we could drill deeper and faster, it wouldn't help much in terms of quake prediction. It would be like trying to assess a fractured bone with a long needle. The only way we can now learn about the position of the plates is from how seismic waves propagate during earthquakes — in other words, after the disaster.

This doesn't mean that predictions can't be fine-tuned. In Cascadia, for instance, after researchers recently identified an increase in seismic activity — which now occurs every 14 months for two weeks — they concluded that large earthquakes are more probable during those periods. This is similar to knowing that car accidents are more likely during rush hour, which, of course, does not guarantee collisions then or safety at other times.

So what can we do with the information we do know? Officials should enforce tough building codes in seismic areas. After all, earthquakes don't kill people — collapsing buildings do. If anyone should be charged for deaths in earthquake zones, it's those who allow flimsy buildings to be built, whether through policy neglect or incompetence in construction. But as with the collapse of the “tofu schools” in the Sichuan earthquake in China in 2008, nobody was held responsible.

Scientists, however, keep seeking solutions, including real-time warnings. When a large earthquake is set off in the ground, it can take 10 or more seconds until it reaches a major city, enough time to receive automated signals that would give us time to duck and cover or even leave the building. Trains could be stopped to prevent derailments, and gas supplies could be cut to avoid fires. The University of California, Berkeley, will soon implement such a notification project in San Francisco at a cost of about \$80 million, a small price to pay for the lives it might save.

We should not fear earthquakes, since most of us will never experience a major one. But we must prepare infrastructure to withstand disaster and learn how to react when disasters do hit. This is a serious policy issue. Safety messages can never be repeated enough. And we should all know that only friendly collaborations between science and public policy — not arrests and prosecutions — can lead to such achievements.

Icons of Mathematics An Exploration of Twenty Key Images

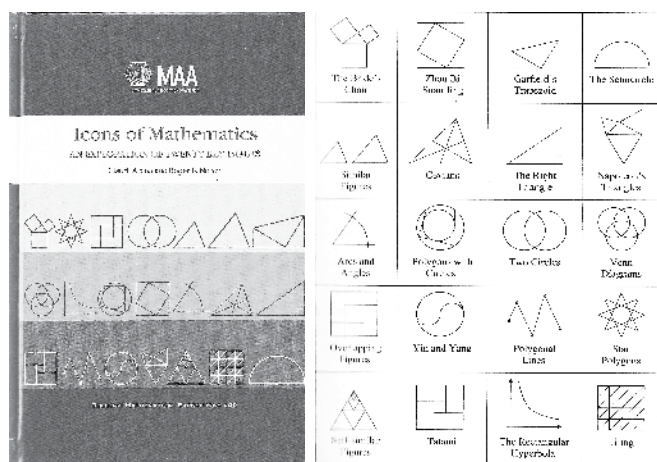
by Claude Alsina and Roger B. Nelson

*Dolciani Mathematical Expositions # 45,
The Mathematical Association of America,
Washington, DC, USA 2011.*

Reviewed by **Rudolf Fritsch**,
Ludwig-Maximilians-Universität München

ISBN 978-0-88385-352-8

Let me say at the beginning: I like the book and recommend it to all teachers of mathematics and mathematics education and to all people who have an interest in mathematics. That should be in your mind when you read some criticism in the following. I start with some phrases from the preface “An *icon* (from the Greek “αἰκῶν, ‘image’) is defined as ‘a picture that is universally recognized to be representative of something’. . . . After many years working with visual proofs . . . we believe that certain geometric diagrams play a crucial role in visualizing mathematical proofs.” For their presentation the authors, renowned masters in visualizing mathematical proofs, have chosen twenty “key” icons of mathematics which they sometimes provide with flowery names: The Bride’s Chair, Zhou Bi Suan Jing, Garfield’s Trapezoid, The Semicircle, Similar Figures, Cevians, The Right Triangle, Napoleon’s Triangle, Arc and Angles, Polygons with Circles, Two Circles, Venn Diagrams, Overlapping Figures, Yin and Yang, Polygonal Lines, Star Polygons, Self-similar Figures, Tatami, The Rectangular Hyperbola, Tiling.



Each chapter contains a lot of information around the icon under discussion and ends with problems, called *Challenges*. Almost all statements are proved, with all detail and striking pictures. Many of the topics are well-known but quite a few were also interesting and new to me. Each chapter closes with a set of problems which the authors call “Challenges”. The solutions can be found at the end of the book; most of them are quite clever. Here is an example: Let P be a point inside a circle C such that there exist three distinct chords AB , CD , EF through

P of equal length. Prove that P is the center of the circle C ! Solution: For $X \in \{A, B, C, D, E, F\}$ let x denote the distance from the point X to the point P . By hypothesis we have $a + b = c + d = e + f$; call this value s . Computing the power of P with respect to the circle C yields $a \cdot b = c \cdot d = e \cdot f$; call this value p . Then all three pairs $\{a, b\}$, $\{c, d\}$, $\{e, f\}$ are solutions of the quadratic equation $x^2 - sx + p = 0$; thus they are equal. Without loss of generality we may assume $a = c = e$. Then the non-collinear points A , C , E have the same distance from the point P ; so they lie on a circle with center P . Since there is only one circle containing three noncollinear points, this circle is the circle C and the point P is its center.

A fascinating section is that on integration via the symmetry of yin and yang (14.3). Also the quite simple carpets theorem has surprising applications shown in the challenges.

Sometimes the reader wishes hints on how to realise given constructions using dynamical geometry software, for instance in the discussion of spirals.

Unfortunately there are some mistakes which should be corrected in a new edition. Sometimes I was reminded of my mathematics teacher in secondary school. If we students pointed to a mistake which he had made, he declared “I do such mistakes more often in order to realise if you are watchful”. An important correction is needed in the treatment of Menelaus’s and Ceva’s theorems. A correct treatment of the converse of Menelaus’s theorem requires signed distances. These are not introduced and the authors state the following fallacy: If A , Z , Z' are three points on a line and $|AZ| = |AZ'|$ then $Z = Z'$. They overlook the possibility of $Z \neq Z'$ with A as midpoint of the segment ZZ' . The presentation of Ceva’s theorem and its converse are correct if one understands that “points on the sides” are precisely interior points of the sides of the triangle under consideration; but with this restriction the given application to the orthocenter of an obtuse triangle is not possible.

The authors present interesting historical remarks, although sometimes misleading for a reader not familiar with the historical developments of mathematics. For example, when the authors introduce the power of a point on page 109 and the radical axis of two circles on page 113 they give credit to a paper [Andreescu and Gelca, 2000]. The unexperienced reader might think these to be a modern concepts, but they are much older. More serious is the remark in the first chapter that the three-dimensional version of Pythagoras Theorem is due to Abbé Gua de Malves. Indeed the latter claims in a paper from 1783 this theorem for his own, but it is much older. It appeared first in 1622 in the work of Johannes Faulhaber (1580-1635) and at the same time in the diaries of Descartes (see Ivo Schneider: Johannes Faulhaber, Basel – Boston – Berlin 1993 for a detailed discussion). At the end of section 4.7 the authors state that the fact that the area of a circle is equal to one-half the product of its radius and its circumference was known to the Indian mathematician Bhāskara (circa 1114-1185). This fact can also be found 1300 years earlier in the work of Archimedes with a proof which fulfils today’s demands of rigour.

There are quite a few minor errors; it is a challenge to the attentive reader to find them. Nevertheless I hope that the book sells well and a second edition will be published correcting these items. As said in the beginning I recommend the book emphatically.

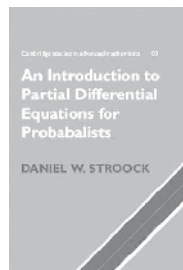
Partial Differential Equations for Probabilists

by Daniel W. Stroock

Cambridge University Press (Reprinted 2012)

ISBN 978-1107005-28

Reviewed by S.R.S. Varadhan



The theory of diffusion processes and the theory of partial differential equations are very closely connected. In the time independent case a d -dimensional diffusion process is to be characterized by an initial distribution μ on R^d and the set of diffusion coefficients $\{a_{ij}(x)\}, \{b_j(x)\}$ with $1 \leq i, j \leq d$. The matrix $\{a_{ij}(x)\}$ is assumed to be symmetric and nonnegative definite. From the coefficients one expects to construct a uniquely defined transition probability function $p(t, x, A)$ that satisfies the Chapman-Kolmogorov equations

$$\int p(s, y, A)p(t, x, dy) = p(t + s, x, A)$$

for $s, t \geq 0, x \in R^d$ and $A \in B(R^d)$. The connection with the diffusion coefficients is established through the differential operator

$$(\mathcal{L}u)(x) = \frac{1}{2} \sum_{ij} a_{ij}(x) \frac{\partial^2 u}{\partial x_i \partial x_j}(x) + \sum_j b_j(x) \frac{\partial u}{\partial x_j}(x)$$

One expects the link to be established by the relation

$$\frac{1}{h} \int [u(y) - u(x)]p(h, x, dy) = (\mathcal{L}u)(x) + o(1)$$

for a suitable class of functions $\{u\}$. One needs to show the existence, uniqueness and some regularity of the transition probability function $p(t, x, A)$. This can be done by solving the (parabolic) heat equation

$$u_t = \mathcal{L}u; \quad u(0, x) = f(x)$$

for a large class of initial data $\{f\}$ and $p(t, x, A)$ is recovered via the Riesz theorem

$$u(t, x) = \int f(y)p(t, x, dy)$$

There is of course Itô's theory of Stochastic Differential Equations that allows one to directly construct the process through a map from the Wiener space, i.e. Brownian motion. This approach requires a Lipschitz condition on $b_j(x)$ as well as the square root $\sigma_{ij}(x)$, i.e. on σ satisfying $\sigma \sigma^* = a$. One then solves, after carefully defining the stochastic integral, the equation

$$x(t) = x + \int_0^t b(x(s))ds + \int_0^t \sigma(x(s))d\beta(s)$$

where β is the standard d -dimensional Brownian motion. Under Lipschitz assumptions on b and σ , $x(t)$ exists, is unique for each $x(0) = x$ and

$$p(t, x, A) = P[x(t) \in A | x(0) = x]$$

provides the transition probability. $x(t)$ itself is the Markov process that we seek. P here is the distribution of $\beta(\cdot)$ and $x(t)$ is viewed as a random variable on the Wiener space of continuous maps of $[0, \infty) \rightarrow R^d$ with Wiener measure P on it.

The theory partial differential equation can help at this point and provide a way of constructing $p(t, x, A)$ under much weaker conditions on $\{a_{ij}(x)\}, \{b_j(x)\}$. The strictly elliptic case, i.e. when $a_{ij}(x)$ is strictly positive definite, it needs much less regularity. Without assuming that $a_{ij}(x)$ is strictly elliptic with enough regularity both probability theory and PDE can be effective in constructing the transition probabilities. But with ellipticity and minimal regularity PDE is much more effective and the book covers different methods of carrying this out.

Chapter 1 contains a proof of the existence, but not uniqueness, of transition probability functions as (weak) solutions to Kolmogorov's forward equation.

$$\int f(y)p(t, x, dy) = f(x) + \int_0^t \int (Lf)(y)p(s, x, dy)ds$$

under suitable conditions on a, b . This is essentially an adaptation of Itô's method without explicit use of Brownian motion.

Chapter 2 studies the duality between solutions of forward and backward equations. Existence of sufficiently many solutions for one implies uniqueness for the other. This is then used to prove uniqueness of solutions of Kolmogorov's forward equations. In particular if σ and b are regular the backward equation is shown to have smooth solutions for smooth initial data. These results do not require ellipticity, but initially do require smoothness of σ rather than a . But this is remedied following Oleinik.

Chapter 3 contains regularity results under ellipticity assumptions. The method is an adaptation of ideas of Malliavin, but replacing the infinite dimensional analysis on Wiener space by an analysis on approximating high dimensional Gaussian probability spaces, avoiding some technical difficulties. This provides eventually regularity estimates on the transition probability density $p(t, x, y)$ in both x as well as y .

While there are no apparent advantage in writing the operator L in divergence form

$$(\mathcal{L}u)(x) = \frac{1}{2} \sum_{ij} \frac{\partial}{\partial x_i} a_{ij}(x) \frac{\partial u(x)}{\partial x_j} + \sum_j b_j(x) \frac{\partial u(x)}{\partial x_j}$$

when a is smooth, there are powerful estimates available under just ellipticity assumptions on a without any regularity. These beautiful results of Nash are developed in Chapter 4.

So far the discussion has been in the context of equations in some R^d . To carry over the analysis to manifolds requires localization and the patching together. This is carried out in the next two Chapters.

Finally the last Chapter provides an exposition of Hormander's theory of hypoelliptic operators using the technology of subelliptic estimates and pseudo-differential operators.

The book is a well put together compilation, often with a unique point of view, of various results from the theory of second order elliptic-parabolic linear partial differential operators that is useful for probabilists and analysts. The discussion is self contained and is a welcome addition to the literature.

The Mathematics of Game Show Scheduling

Richard Hoshino, *National Institute of Informatics, Tokyo, Japan*

Introduction

In August 2010, I received the following e-mail from the executive producer of a television show:

Hi Richard,

I'm working on an action-adventure game show for YTV called "Splatalot", and I need your help. The game sees kids competing on a giant obstacle course. We have 9 Defenders of the castle: 3 from Canada, 3 from the UK, and 3 from Australia. They are actors hired by our production to "defend the castle." I'm wondering if you can help us schedule our Defenders? We have 26 episodes. Each episode has a different set of 6 Defenders. Each episode must have 2 Defenders from each territory. We'd like it so that each performer shoots 3 or 4 episodes then has a day off (or as close as we can get to this type of schedule). Am I making sense? Please let me know if you have any questions. Sorry for the cold call, but we just can't seem to work it out. Thanks in advance. Hope you have been keeping well!

Splatalot premiered in March 2011 on YTV (Canada), BBC (Great Britain), and ABC (Australia). In each episode, 12 teenagers competed as attackers, racing against the clock to complete the medieval-themed obstacle course in their quest to be crowned the King or Queen of *Splatalot*. The defenders' role was to slow down the contestants and protect the castle, ensuring numerous spills and "splats." The show was a big hit in Canada, especially among high school students.

In this note, I present my graph-theoretic solution to the TV producer's scheduling optimization problem, and conclude with a challenge tying concepts from Ramsey theory and design theory for the generalized scenario of c countries, d defenders per country, and e defenders per episode.

Solving the problem

Let's label the Australian, British, and Canadian defenders by $A_1, A_2, A_3, B_1, B_2, B_3, C_1, C_2$, and C_3 , respectively. Since each episode consists of 6 defenders, with 2 from each country, there are $\binom{3}{2}^3 = 27$ possible ways the defenders can be selected. As the producer only needed 26 episodes, each show's taping could consist of a unique subset of 6 defenders. To give an example of a complete 26-episode schedule, arrange the 27 possible episodes *lexicographically*, ignoring the final column. This is illustrated in Table 1, where each marked entry is binary, with 1 representing a "play" and 0 representing a "rest." By definition, each column vector is unique.

Given any schedule Γ , corresponding to a permutation of the 27 possible column vectors, let $p := p(\Gamma)$ be the maximum number of consecutive episodes played by any defender, and let $r := r(\Gamma)$ be the maximum number of consecutive episodes rested by any defender. In Table 1, $p = 18$ and $r = 9$, due to the schedules of defenders A_1 and A_3 . Clearly $p \leq 18$ and $r \leq 9$, which makes Table 1 the worst possible schedule that could be chosen among all 27! options.

The TV producer wanted a schedule Γ that minimized the values of $p := p(\Gamma)$ and $r := r(\Gamma)$, in order to reduce defender fatigue and boredom. I will show that $p \geq 3$ and $r \geq 1$, and generate a schedule Γ for which these optimal values are attained, i.e., in the corresponding 9×27 matrix, no row contains a 1111- or a 00-substring. To do that, I apply the following result, whose proof is straightforward.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
A_1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
A_2	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
A_3	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B_1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	0
B_2	1	1	1	0	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1
B_3	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1
C_1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0
C_2	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
C_3	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1

Table 1. The lexicographic ordering of the 27 episodes.

Proposition 1 Suppose there are c countries, d defenders per country, and e defenders per episode. Let Γ be a schedule, corresponding to a permutation of the $\binom{d}{e}^c$ possible column vectors. Let $p := p(\Gamma)$ be the maximum number of consecutive episodes any defender plays, and let $r := r(\Gamma)$ be the maximum number of consecutive episodes any defender rests. Then $p > \frac{e}{d-e}$ and $r > \frac{d-e}{e}$.

In the case of *Splatalot*, $(c, d, e) = (3, 3, 2)$, so $p \geq 3$ and $r \geq 1$. Let's create a schedule with $(p, r) = (3, 1)$. To do this, consider the set of $\binom{d}{e}^c = 27$ hyperedges that contain 6 elements from $\{A_1, A_2, A_3, B_1, B_2, B_3, C_1, C_2, C_3\}$, with exactly 2 from each country. Label these 27 hyperedges $\{e_1, e_2, \dots, e_{27}\}$ in lexicographic order (see Table 1). For example, $e_1 = \{A_1, A_2, B_1, B_2, C_1, C_2\}$ and $e_{27} = \{A_2, A_3, B_2, B_3, C_2, C_3\}$.

Construct a graph G with vertices $\{e_1, e_2, \dots, e_{27}\}$, where vertices e_i and e_j are adjacent iff $e_i \cup e_j = \{A_1, A_2, A_3, B_1, B_2, B_3, C_1, C_2, C_3\}$. It is easy to see that G contains 108 edges, since each of the 27 vertices has $2 \times 2 \times 2 = 8$ neighbours.

Consider any *Hamiltonian path* of G , i.e. a 26-edge path covering all the vertices in the order H_1, H_2, \dots, H_{27} . By definition, the set $\{H_1, H_2, \dots, H_{27}\}$ is a permutation of $\{e_1, e_2, \dots, e_{27}\}$. By setting H_i to be the i^{th} episode of our schedule, a schedule with $r = 1$ is produced, since for every $1 \leq j \leq 26$, each defender appears at least once in $H_j \cup H_{j+1} = \{A_1, A_2, A_3, B_1, B_2, B_3, C_1, C_2, C_3\}$.

To also ensure $p = 3$, let's require that no defender appears in 4 consecutive episodes, i.e. $\overline{H_j} \cup \overline{H_{j+1}} \cup \overline{H_{j+2}} \cup \overline{H_{j+3}} = \{A_1, A_2, A_3, B_1, B_2, B_3, C_1, C_2, C_3\}$ for each $1 \leq j \leq 24$. A simple computer search finds multiple solutions, including the following Hamiltonian path:

$e_{27} \rightarrow e_{14} \rightarrow e_7 \rightarrow e_{20} \rightarrow e_{15} \rightarrow e_8 \rightarrow e_{22} \rightarrow e_{12} \rightarrow e_5$
 \downarrow
 $e_2 \leftarrow e_{16} \leftarrow e_{21} \leftarrow e_4 \leftarrow e_{17} \leftarrow e_{19} \leftarrow e_6 \leftarrow e_{11} \leftarrow e_{25}$
 \downarrow
 $e_{24} \rightarrow e_{10} \rightarrow e_9 \rightarrow e_{23} \rightarrow e_{18} \rightarrow e_1 \rightarrow e_{26} \rightarrow e_{13} \rightarrow e_3$

This path gives a numbering of the 27 hyperedges corresponding to the episode order and produces a valid schedule Γ solving the *Splatalot* problem with $p = 3$ and $r = 1$. It's easy to verify that Table 2 has 27 unique columns, and no row contains either a 00- or 1111-substring. This is the schedule I sent to the executive producer.

Conclusion

Table 2 is a valid solution for the triplet $(c, d, e) = (3, 3, 2)$: each column consists of a unique subset, with e out of d defenders chosen from each of the c countries; no defender plays more than $p = 3$ consecutive games; and no defender rests more than $r = 1$ consecutive games.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
A_1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
A_2	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
A_3	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0
B_1	0	1	0	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	0	1	1	0	1	1	0	1
B_2	1	0	1	1	0	1	0	1	0	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
B_3	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
C_1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
C_2	1	0	1	0	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0
C_3	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1

Table 2. A solution to the Splatalot scheduling problem.

However, could I optimize this schedule further? In Table 2, B_1 plays 6 times between episodes 7 and 13, but only twice between episodes 21 and 25. So there is an imbalance as A_1 plays at most 5 times during any stretch of 7 consecutive episodes, and at least 3 times during any stretch of 5 consecutive episodes. It would be interesting to develop further criteria to determine whether a schedule is "optimally balanced" to find the best possible solution for the case $(c, d, e) = (3, 3, 2)$.

This problem has a natural connection to a topic in design theory known as *interval-balanced tournament designs*, [1], where the appearances of each element are equitably distributed so that each individual rests at least some minimum amount of rounds between its matches and that this minimum rest is maximized. However, my problem appears even harder as it requires 2 parameters, p and r , to be optimized simultaneously. This motivates the following 2-parameter problem formulated in the language of Ramsey theory:

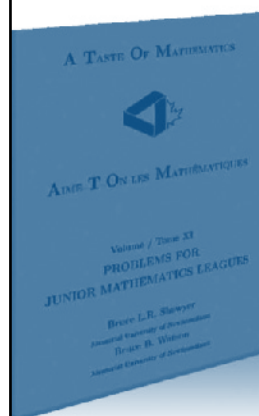
Problem 1 Suppose there are c countries, d defenders per country, and e defenders per episode. Determine the largest values of $p := p(c, d, e)$ and $r := r(c, d, e)$ for which the following statement is true: For any schedule Γ , corresponding to a permutation of the $\binom{d}{e}^c$ possible column vectors, at least one defender plays p consecutive games, and at least one defender rests r consecutive games.

I conjecture that $p = \lfloor \frac{e}{d-e} \rfloor + 1$ and $r = \lfloor \frac{d-e}{e} \rfloor + 1$, but have only verified these formulas for small triplets (c, d, e) . While I was able to solve the TV producer's conundrum and give him an optimal schedule for Splatalot, I had only scratched the surface. The problems in this section suggest fascinating and deep explorations, which may challenge some readers.

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Buffon's needle estimates and vanishing sums of roots of unity

Izabella Łaba, *Department of Mathematics, University of British Columbia*

The 4-corner Cantor set is constructed as follows. Divide the unit square $[0, 1]^2$ into 16 congruent squares and keep the 4 squares on the corners, discarding the rest. This is K_1 . Repeat the procedure within each of the 4 selected squares to produce K_2 , consisting of 16 squares. Continue the iteration indefinitely. The resulting set $K = \bigcap_{n=1}^{\infty} K_n$ is a fractal self-similar set of dimension 1, also called the Garnett set, after John Garnett used it in the theory of analytic functions as an example of a set with positive 1-dimensional length and zero analytic capacity.

We would like to understand the projections of K . Let $\text{proj}_{\theta}(x, y) = x \cos \theta + y \sin \theta$ be the projection of (x, y) on a line making an angle θ with the positive x -axis (all projections are subsets of \mathbb{R}). By a theorem of Besicovitch, $|\text{proj}_{\theta}(K)| = 0$ for almost every $\theta \in [0, \pi]$. There are, however, infinitely many θ for which $\text{proj}_{\theta}(K)$ has positive measure; we invite the reader to verify this for $\theta = \tan^{-1}(2)$ and $\tan^{-1}(8)$.

In general, the projections of the finite iterations K_n can be quite complicated, due to the overlaps between the projections of the different squares of K_n . Nonetheless, we can say something about the average projection of K_n . Let

$$(1) \quad \text{Fav}(K_n) := \frac{1}{\pi} \int_0^{\pi} |\text{proj}_{\theta}(K_n)| d\theta.$$

This is known as the *Favard length* (or *Buffon's needle probability*) of K_n . By Besicovitch's theorem, $\text{Fav}(K_n) \rightarrow 0$ as $n \rightarrow 1$; the question is, how fast? The exact rate of decay is still unknown, but we have the following result, where the lower bound is due to Bateman and Volberg, and the upper bound to Nazarov, Peres, and Volberg, [5].

Theorem 1. *For all $p < 1/6$, there are positive constants C_1 and $C_{2,p}$ such that*

$$(2) \quad \frac{C_1 \log n}{n} \leq \text{Fav}(K_n) \leq \frac{C_{2,p}}{n^p}.$$

What about more general self-similar fractal sets? For example, divide the initial square into L^2 identical squares, fix $A, B \subset \{0, 1, \dots, L-1\}$, let E_1 consist of those squares whose lower left vertices are $(a/L, b/L)$ for $a \in A$ and $b \in B$, then continue the iteration indefinitely. If $|A||B| = L$ (which we will assume from now on), the Cantor set $E = \bigcap_{n=1}^{\infty} E_n$ has dimension 1. In this case, the lower bound is due to Mattila, and the upper bound to Bond, Łaba, and Volberg, [1].

Theorem 2. *For E_n as above, if both A and B have at most 6 elements, then for some positive C_1, C_2 and p we have*

$$(3) \quad \frac{C_1}{n} \leq \text{Fav}(E_n) \leq \frac{C_2}{n^{p/\log \log n}}.$$

Of the bounds in (2) and (3), the upper bounds are by far the more difficult to prove. Power or near-power estimates were attained only in the last few years, first in [5] for K_n , and then in [4], [2], [3], and [1].

For general self-similar sets, the approach of [5] yields an upper bound of the form $\exp(-c \sqrt{\log N})$, [3]. The additional argument improving this to a power bound for K_n seemed specific to that set. My work with Zhai, [4], showed that it was in fact a manifestation of the tiling properties of K_n , i.e. the existence of directions θ for which $\text{proj}_{\theta}(K)$ has positive measure. My paper with Bond and Volberg, [1], further rephrased and generalized this fact in terms of divisibility by cyclotomic polynomials, a point of view we adopt here.

In the setting of Theorem 2, the information we need concerns the distribution of the zeroes (with multiplicity) of the trigonometric polynomial

$$(4) \quad P_{A,n}(\xi) = \frac{1}{|A|^n} \prod_{j=1}^n A(e^{2\pi i L^j \xi}),$$

where $A(x) = \sum_{a \in A} x^a$, and a similarly defined $P_{B,n}(\xi)$. (Taking $n \rightarrow 1$ in (4) yields the Fourier transform of the natural probability measure on the Cantor set $\text{proj}_{\theta}(E)$.)

The first example below is representative of the work in [5], [4], [2]. The second and third capture the phenomena first treated in [1]. Recall that for $s \in \mathbb{N}$, the s -th *cyclotomic polynomial* $\Phi_s(x)$ is the irreducible polynomial whose roots are exactly the s -th primitive roots of unity, $e^{2\pi i k/s}$ with $(k, s) = 1$.

1. The tiling case. Let $A = B = \{0, 1\}$ and $L = 4$. (After a rescaling, this corresponds to the set K_n .) Then we have

$$(5) \quad \prod_{j=1}^n A(e^{2\pi i 4^j \xi}) B(e^{4\pi i 4^j \xi}) = \frac{1 - e^{2\pi i 4^{n+1} \xi}}{1 - e^{2\pi i 4 \xi}}.$$

Hence all roots of $P_{A,n}$ have multiplicity 1 and form an arithmetic progression, a property we can use to our advantage. The work in [4], [1] extends this method to all cases where the only roots of $A(x)$ and $B(x)$ on the unit circle are roots of cyclotomic polynomials Φ_s with $(s, L) \neq 1$.

2. Non-cyclotomic roots. Let $A = B = \{0, 3, 4, 5, 8\}$ and $L = 25$. Then $A(x) = 1 + x^3 + x^4 + x^5 + x^8$ has 4 roots on the unit circle, all of which are non-cyclotomic. There are no identities such as (5) in this case; nonetheless, a version of Baker's theorem in transcendental number theory tells us that the roots of $P_{A,n}$ cannot be distributed too irregularly.

3. **Repeated zeroes.** Let $A = B = \{0, 3, 4, 8, 9\}$ and $L = 25$. Then $P_{A,n}(\xi)$ has very high multiplicity roots. To see this, note that $A(x) = 1 + x^3 + x^4 + x^8 + x^9$ is divisible by $\Phi_{12}(x) = 1 - x^2 + x^4$. Let z be a root of Φ_{12} , say $z = e^{\pi i/6}$. Since 12 is relatively prime to 25, the numbers $e^{25j\pi i/6}$ for $j = 1, 2, \dots$ are again roots of Φ_{12} , hence also roots of $A(x)$.

Here we use a different method based on classical results on vanishing sums of roots of unity. Let z_1, \dots, z_k be s -th roots of unity (not necessarily primitive). When can we have $z_1 + \dots + z_k = 0$? Clearly, this happens if k divides s and z_1, \dots, z_k form a regular k -gon on the unit circle. A theorem of Rédei-de Bruijn-Schoenberg states that all vanishing sums of roots of unity are linear combinations, with integer but not necessarily positive coefficients, of such polygons. We used this result, along with further related work of Lam and Leung, Mann, and others, to prove Theorem 2. Although we can drop the restriction $|A|, |B| \leq 6$ under additional conditions on $A(x)$ and $B(x)$ in terms of their cyclotomic divisors, we do not know how to do it in general. That would require new insights on a previously not investigated, and probably very difficult, aspect of a classical problem.

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Alejandro Adem Accepts Second Term as PIMS Director



Alejandro Adem has been appointed to a second five-year term as Director of the Pacific Institute for the Mathematical Sciences (PIMS), beginning July 1, 2013.

Dr. Adem is a Professor of Mathematics at the University of British Columbia, and holds the Canada Research Chair in Algebraic Topology. His mathematical interests span a variety of topics in algebraic topology, group cohomology and related areas. He has published more than 60 research articles as well as two books, and has delivered over 250 invited talks throughout the world. In 1992 he received the U.S. National Science Foundation Young Investigator Award. He has held visiting positions at the IAS in Princeton, the ETH-Zurich, the Max Planck Institute in Bonn, the University of Paris VII and XIII and Princeton University.

The Canadian Statistical Sciences Institute (CANSSI) is launched!

John Brewster and Christian Léger

Past President and President of the Statistical Society of Canada

The Statistical Society of Canada (SSC) is pleased to announce that, with the formation of the initial Board of Directors and seed funding of \$50K from the SSC development fund, the Canadian Statistical Sciences Institute (CANSSI, pronounced “can-see”) is now launched.

CANSSI will be a national virtual institute offering the leadership and infrastructure necessary to increase and further develop statistical sciences research in Canada and promote the discipline. Building on the international stature of the Canadian statistical community, CANSSI will seek to develop all areas of the statistical sciences, including interdisciplinary research where statistical innovation is essential to the development of other disciplines. Through national networks of researchers, CANSSI will tackle the big research questions in statistics of importance to science and the public interest, and will establish links with other disciplines and organizations that are heavy users and producers of data.

The SSC is particularly pleased that Mary Thompson, FRSC, Distinguished Professor Emerita at the University of Waterloo, has agreed to be the initial Scientific Director of CANSSI. She will also serve on the Board of Directors. With her distinguished career as a

researcher and as an administrator, Mary will do an excellent job of steering CANSSI during this important developmental stage.

The initial Board of Directors of CANSSI, containing a wealth of experience in leadership and including recipients of numerous national and international research awards, is well equipped to launch this new institute in the statistical sciences. It consists of: a) five (regional) Associate Directors—Hugh Chipman (Atlantic Provinces), Christian Genest (Québec), Nancy Reid (Ontario), Alexandre Leblanc (Manitoba/Saskatchewan) and Will Welch (Alberta/B.C.); b) five representatives of statistical sciences organizations in other countries or representatives of disciplines or sectors where statistics is applied—Rosemary Bender (Assistant Chief Statistician, Informatics and Methodology Field, Statistics Canada), Arvind Gupta (Scientific Director, MITACS), Michael Kramer (Professor of Pediatrics and of Epidemiology and Biostatistics, McGill; former Scientific Director, Institute of Human Development, Child and Youth Health, CIHR), Richard Smith (Director, SAMSI: Statistical and Applied Mathematical Sciences Institute) and Francis Zwiers (Director, Pacific Climate Impacts Consortium); and c) the Directors of the three Canadian mathematical sciences institutes—Alejandro Adem (PIMS: Pacific Institute for the Mathematical Sciences), Edward Bierstone (Fields Institute for Research in Mathematical Sciences) and François Lalonde (CRM: Centre de recherches mathématiques).

CANSSI is the result of a large-scale process of reflection within the Canadian statistical sciences community, conducted in tandem with the Long Range Planning Exercise for the Mathematical and Statistical Sciences, initiated by the Natural Sciences and Engineering Research Council of Canada (NSERC). As an outcome of the Long Range Planning discussions, the Directors of the three mathematical sciences institutes are committed to working with the statistical sciences community on the CANSSI initiative, with the inclusion of funding for CANSSI projects and activities in the next cycle of NSERC proposals. CANSSI will be part of the Canadian network of thematic and collaborative resources envisaged in the Long Range Plan, and will seek to increase the recognition of the importance of the statistical sciences in Canada. Having a national institute will allow the statistical sciences community to pursue its own directions and seek additional funding opportunities.

In October, the Board of Directors of the SSC decided to allocate seed money to CANSSI from its development fund, in recognition of the importance of this initiative to the Canadian statistical sciences community. This will allow CANSSI to function until it obtains anticipated funding for infrastructure from institutional memberships (beginning in May 2013).

Stay tuned for further announcements on initial activities of CANSSI!

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RAPPEL : Les avis de renouvellements ont été envoyés électroniquement. Veuillez s'il-vous-plaît renouveler votre adhésion le plus tôt possible. Vous pouvez aussi renouveler au site Web www.cms.math.ca/forms/member?fr=1



Les concours mathématiques, ça vous intéresse?
Nous aussi! Cliquez <http://smc.math.ca/Concours/>

L'Institut canadien des sciences statistiques (CANSSI) est lancé!

John Brewster et Christian Léger

Président-sortant et Président de la Société statistique du Canada

La Société statistique du Canada (SSC) est fière d'annoncer que, grâce à un financement de démarrage de 50K\$ de son Fonds de développement ainsi que la formation de son premier Conseil d'administration, l'Institut canadien des sciences statistiques est maintenant lancé. L'institut sera connu sous son acronyme anglais CANSSI (Canadian Statistical Sciences Institute).

CANSSI sera un institut national virtuel qui fournira le leadership et l'infrastructure nécessaires à l'accroissement et à l'approfondissement de la recherche en sciences statistiques au Canada tout en faisant la promotion de la discipline. En s'appuyant sur la reconnaissance internationale de la communauté statistique canadienne, CANSSI visera à développer tous les domaines des sciences statistiques, notamment la recherche interdisciplinaire dans les disciplines dont le développement dépend de l'innovation statistique. Par l'entremise de réseaux nationaux de chercheurs, CANSSI s'attaquera aux grandes questions de recherche en statistique importantes pour la science et l'intérêt public et établira des liens avec les autres disciplines et organisations qui utilisent et produisent beaucoup de données.

La SSC est particulièrement fière que Mary Thompson, MSRC, professeure distinguée émérite à l'Université de Waterloo, ait accepté d'agir à titre de première directrice scientifique de CANSSI. Elle siègera également sur son Conseil d'administration. De par sa brillante carrière à titre de chercheuse et d'administratrice, Mary sera à même de très bien mener CANSSI durant cette étape cruciale de son développement.

Le premier Conseil d'administration de CANSSI, qui cumule une riche expérience en leadership et comprend les bénéficiaires de nombreux prix de recherche nationaux et internationaux, est bien préparé pour lancer ce nouvel institut en sciences statistiques. Il regroupe : 1) cinq directeurs associés (régionaux) – Hugh Chipman (provinces atlantiques), Christian Genest (Québec), Nancy Reid (Ontario), Alexandre Leblanc (Manitoba/

Saskatchewan) et Will Welch (Alberta/C.-B.); b) cinq représentants d'organisations étrangères de sciences statistiques ou de disciplines ou secteurs dans lesquels s'applique la statistique – Rosemary Bender (statisticienne en chef adjointe, Informatique et méthodologie, Statistique Canada), Arvind Gupta (directeur scientifique, MITACS), Michael Kramer (professeur de pédiatrie et d'épidémiologie et biostatistique, McGill; ancien directeur scientifique, Institut du développement et de la santé des enfants et des adolescents, IRSC), Richard Smith (directeur, SAMSI : Statistical and Applied Mathematical Sciences Institute) et Francis Zwiers (directeur, Pacific Climate Impacts Consortium); et c) les directeurs des trois instituts canadiens de sciences mathématiques – Alejandro Adem (PIMS : Pacific Institute for the Mathematical Sciences), Edward Bierstone (Fields Institute for Research in Mathematical Sciences) et François Lalonde (CRM : Centre de recherches mathématiques).

CANSSI est le résultat d'un vaste processus de réflexion au sein de la communauté canadienne des sciences statistiques, mené en parallèle à l'Exercice de planification à long terme pour les sciences mathématiques et statistiques initié par le Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG). Au terme des discussions de planification à long terme, les directeurs des trois instituts se sont engagés à travailler avec la communauté des sciences statistiques sur le projet CANSSI, en acceptant notamment d'inclure du financement pour les projets et les activités du CANSSI dans leur prochaine demande de financement au CRSNG. CANSSI prendra sa place dans le réseau canadien de ressources thématiques et collaboratives envisagé dans la planification à long terme et travaillera à augmenter la reconnaissance de l'importance des sciences statistiques au Canada. En ayant son propre institut national, la communauté statistique pourra poursuivre ses propres orientations et solliciter des sources additionnelles de financement.

En octobre, le Conseil d'administration de la SSC a voté pour l'octroi d'un financement de démarrage à CANSSI à même son Fonds de développement puisqu'il reconnaît l'importance de cette initiative pour la communauté canadienne des sciences statistiques. Ceci permettra à CANSSI de fonctionner jusqu'à ce qu'il obtienne, tel que prévu, des fonds d'infrastructure de la part de membres institutionnels (à partir de mai 2013).

Demeurez à l'affût, d'autres annonces sur les premières activités de CANSSI suivront sous peu!

Mathematical Congress of the Americas 2013

<http://www.mca2013.org/>

The inaugural Mathematical Congress of the Americas (MCA) will take place in Guanajuato, Mexico, August 5-9, 2013. The goal of the Congress is to highlight the excellence of mathematical achievements in the Americas within the context of the international arena, and foster collaborations among researchers, students, institutions and mathematical societies in the Americas.

As a founding and sponsoring society, the CMS encourages Canadian researchers to participate!



Mathématique Congrès des Amériques 2013

<http://www.mca2013.org/>

Le Congrès inaugural mathématique des Amériques (MCA) aura lieu à Guanajuato, au Mexique, du 5 au 9 août 2013. L'objectif du congrès est de mettre en évidence l'excellence des réalisations mathématiques dans les Amériques dans le contexte de la scène internationale, et de favoriser les collaborations entre les chercheurs, les étudiants, les institutions et les sociétés mathématiques dans les Amériques.

En tant que société de fonder et de parrainage, la SMC encourage les chercheurs canadiens à participer!





Prizes | Prix

Jeffery-Williams Prize | Prix Jeffery-Williams

Roland Speicher (Universität des Saarlandes)

Doctoral Prize | Prix de doctorat

Matthew Kennedy (Carleton)

Adrien Pouliot Award | Prix Adrien-Pouliot

Melania Alvarez (PIMS; UBC)

G. de B. Robinson Award | Prix G. de B. Robinson

Teodor Banica (Université de Cergy-Pontoise)

Serban Belinschi (Saskatchewan)

Benoit Collins (Ottawa, Lyon 1)

Mireille Capitaine (Université Paul Sabatier)

Graham Wright Award for Distinguished Service

Prix Graham Wright pour service méritoire

Bernard Hodgson (Université Laval)

Public Lectures | Conférences publiques

Ivar Ekeland (UBC; Paris-Dauphine)

Doyne Farmer (University of Oxford)

Plenary Speakers | Conférences plénières

Graciela Chichilnisky (Columbia)

Ted Hsu (Physicist and Federal MP)

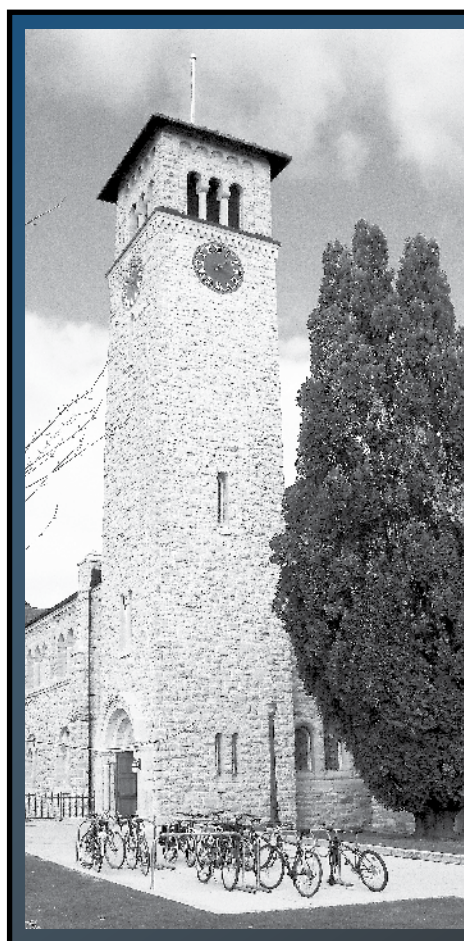
Martin Nowak (Harvard)

Duong H. Phong (Columbia)

Catherine Sulem (Toronto)

Scientific Director | Directeur scientifique

Luc Vinet (Montréal)



JOB OPPORTUNITY QUEEN'S UNIVERSITY, KINGSTON

Mathematics – Applied Math / Mathematical Biology



The Department of Mathematics and Statistics at Queen's University is seeking outstanding candidates for a tenure-track position in Applied Mathematics at the Assistant Professor level, with a starting date of July 1, 2013, pending budgetary approval. Although applications in all areas of Applied Mathematics are invited, priority will be given to candidates able to contribute to the Mathematics and Engineering program or to the Mathematical Biology program.

For complete ad and information on how to apply go to:

www.mast.queensu.ca/positions

Application materials should be submitted through

www.mathjobs.org

Contact: **position@mast.queensu.ca**

Deadline: **January 15, 2013**

Related Activities | Activités liés Canadian Launch of Mathematics of Planet Earth (MPE2013)

Lancement canadien de Mathématiques de la planète Terre 2013 (MPT2013)

University of Montreal / Université de Montréal

Friday, December 7, 12:30 – 14:00

Vendredi, 7 décembre, 12h30 à 14h

Student Lecture | Conférence pour les étudiants

Yvan Saint-Aubin (Montréal)

Fairmont Queen Elizabeth Hotel, St-François Ballroom

Friday, December 7, 9:00-12:00

Vendredi, 7 décembre, 9h à 12h

Mathematical Science Investigation (MSI): The Anatomy of Integers and Permutations

Friday, December 7, 16:30 - 18:00 and Saturday, December 8,
20:30 - 22:00

Vendredi, 7 décembre, 16h30 à 18h et samedi, 8 décembre,
20h30 à 22h

This is an experimental work that blurs the boundaries between pure mathematics, live performance and graphic novel. Andrew Granville, mathematician and writer of popular articles; Jennifer Granville, actor and screenwriter; Michael Spencer, performance designer; and Robert Schneider, musician and composer, have collaborated to present this rehearsed reading.

Thrill to mysterious murders, marvel at detectives' deductions, and groan at the mathematical puns! Don't miss this opportunity to be present at an unusual theatrical and mathematical event.

CMS-CRM-IMS Cegep MPE2013 Activities

Activité MPT2013 cégeps SMC-CRM-ISM

Friday, December 7

Vendredi, 7 décembre

Julien Arino (Manitoba) - Modélisation des épidémies, leur contrôle et leur propagation spatio-temporelle

Florin Diacu (Victoria) - Les systèmes planétaires en mécanique

Auréli Labbe (McGill University) - De la statistique à la génétique, en passant par les mathématiques : identifier les gènes responsables de maladies complexes

Marc Laforest (École Polytechnique) - Les ouragans: un engin de destruction

Justin Leroux (Institut d'économie appliquée, HEC Montréal) - Un défi pour les mathématiciens : tarifier l'eau de manière équitable

Louis-Paul Rivest (Laval) - L'emploi de méthodes de capture et recapture pour l'estimation de la taille de populations humaines et animales

Launch of the LRP Report

Saturday, December 8, 12:30-14:00

Samedi, 8 décembre, 12h30 à 14h

At the request of NSERC, the Canadian mathematical and statistical sciences communities have carried out a comprehensive long range planning exercise, with the aim of formulating a plan setting priorities and directions for the development of mathematical and statistical sciences in Canada over a period of five to ten years. The Long Range Plan (<http://longrangeplan.ca>) is the result of more than two years of work and extensive consultations. It reflects the dynamism, strength and diversity of aspirations of the different segments of the mathematical and statistical sciences communities in Canada.

Mathematics for the Life Sciences, Panel and Discussion

Sunday, December 9, 8:30 - 10:00

Dimanche, 9 décembre, 8h30 à 10h

A number of Canadian universities have taken steps toward creating (or have created) mathematics and/or statistics courses appropriate for future biologists (and life scientists in general). In this session, we plan to discuss issues, challenges and successes surrounding the creation, development and teaching of math and stats courses for life sciences students (MSLS for short).

The objectives of this session are:

- (1) To provide an opportunity for the faculty in charge of thinking about *designing* teaching math and stats for life sciences courses to come together and exchange ideas and experiences.
- (2) To create a network of faculty interested in teaching math for life sciences. This could be a good opportunity for faculty from departments across Canada to collaborate, in order to develop good math courses.
- (3) Decide on ways to continue this dialogue and further the collaboration between faculties at different universities.

CMS Townhall Meeting

Séance de discussion ouverte SMC

Sunday, December 9, 12:30 - 13:30

Dimanche 9 décembre, 12h30 à 13h30

The CMS Executive is inviting all CMS members and meeting participants to join them at an informal luncheon to learn what CMS has planned for 2013 and to discuss any interests or concerns that members of our community may have. Unlike the AGM that focuses on what was achieved last year, this meeting focuses on what lies ahead. There will be a short presentation followed by questions and answers. This is an opportunity for participants to get together with the CMS Executive and discuss emerging issues as well as directly voice their opinions, concerns and interests.

Please visit the website for up to date information
Veuillez visiter le site web pour des informations à jour

<http://cms.math.ca/Events/winter12/>



2013 CMS Summer Meeting

June 4 – 7, 2013

**Dalhousie University and St. Mary's University
Halifax, Nova Scotia**

www.cms.math.ca

Call for sessions

The Canadian Mathematical Society (CMS) welcomes and invites proposals for sessions for this Meeting; in particular, we encourage submissions from all universities in the Atlantic Provinces. 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 December 31, 2012.

Scientific Directors:

Robert Milson, rmilson@dal.ca

Robert J. MacG. Dawson, rdawson@cs.stmarys.ca

Réunion d'été SMC 2013

De 4 au 7 juin 2013

**Universités Dalhousie et St. Mary's
Halifax (Nova Scotia)**

www.smc.math.ca

Appel de sessions

Nous vous invitons à proposer des sessions pour cette Réunion, nous incitons particulièrement les universités des provinces de l'atlantique à faire des propositions. Votre proposition doit 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. Toutes les sessions seront annoncées dans les Notes 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 avant 31 décembre 2012.

Directeurs scientifiques

Robert Milson, rmilson@dal.ca

Robert J. MacG. Dawson, rdawson@cs.stmarys.ca



Summer Meeting Réunion d'été

2013



June 4 - 7 • Halifax, Nova Scotia • Dalhousie University, Saint Mary's University
4 - 7 juin • Halifax, Nouvelle-Écosse • Université Dalhousie, Université Saint Mary's



NEW RELEASES

from the AMS



HIGHER ORDER FOURIER ANALYSIS

Terence Tao, *University of California, Los Angeles, CA*

This book, which is the first monograph in higher order Fourier analysis, aims to cover various topics in the area in a unified manner, as well as to survey some of the most recent developments such as the application of the theory to count linear patterns in primes. The book serves as an introduction to the field, giving the beginning graduate student a high-level overview. The text focuses on the simplest illustrative examples of key results, serving as a companion to existing literature on the subject. There are numerous exercises with which to test one's knowledge.

Graduate Studies in Mathematics, Volume 142; 2012; 187 pages; Hardcover; ISBN: 978-0-8218-8986-2; List US\$54; AMS members US\$43.20; Order code GSM/142



NUMBERS AND FUNCTIONS

FROM A CLASSICAL EXPERIMENTAL MATHEMATICIAN'S POINT OF VIEW

Victor H. Moll, *Tulane University, New Orleans, LA*

This book is a treasure trove of information on classical topics about numbers and functions, but with a very modern flavor. It examines elementary functions, such as those encountered in calculus courses, from the point of view of experimental mathematics. The focus is on exploring the connections between these functions and topics in number theory and combinatorics. There is also an emphasis on how current mathematical software can be used to discover and prove interesting properties of these functions.

Student Mathematical Library, Volume 65; 2012; 504 pages; Softcover; ISBN: 978-0-8218-8795-0; List US\$58; AMS members US\$46.40; Order code STML/65



EUCLIDEAN GEOMETRY

A GUIDED INQUIRY APPROACH

David M. Clark, *State University of New York, New Paltz, NY*

This book develops a modern axiomatic approach to Euclidean geometry. Through a guided inquiry, active learning pedagogy, students are empowered to solve problems and prove theorems on their own while referring to instructors as guides and mentors. This book is particularly well suited for future secondary school teachers. An Instructor Supplement is available at ams.org/bookpages/mcl-9. Titles in this series are co-published with the Mathematical Sciences Research Institute (MSRI).

MSRI Mathematical Circles Library, Volume 9; 2012; 127 pages; Softcover; ISBN: 978-0-8218-8985-5; List US\$39; AMS members US\$31.20; Order code MCL/9

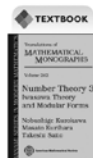


FROM STEIN TO WEINSTEIN AND BACK SYMPLECTIC GEOMETRY OF AFFINE COMPLEX MANIFOLDS

Kai Cieliebak, *Ludwig-Maximilians-Universität, München, Germany*, and Yakov Eliashberg, *Stanford University, CA*

The goal of this book is to explore symplectic geometry and its applications in the complex geometric world of Stein manifolds. It is the first book to systematically explore this connection, thus providing a new approach to the classical subject of Stein manifolds. It also contains the first detailed investigation of Weinstein manifolds, the symplectic counterparts of Stein manifolds, which play an important role in symplectic and contact topology.

Colloquium Publications, Volume 59; 2012; approximately 354 pages; Hardcover; ISBN: 978-0-8218-8533-8; List US\$78; AMS members US\$62.40; Order code COLL/59



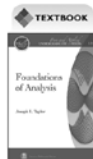
NUMBER THEORY 3

IWASAWA THEORY AND MODULAR FORMS

Nobushige Kurokawa, *Tokyo Institute of Technology, Japan*,
Masato Kurihara, *Keio University, Yokohama, Japan*, and
Takeshi Saito, *University of Tokyo, Japan*

This is the third of three related volumes on number theory. The two main topics of this book are Iwasawa theory and modular forms. It also contains a short exposition on the arithmetic of elliptic curves and the proof of Fermat's last theorem by Wiles. Together with the first two volumes, the book is a good resource for anyone learning or teaching modern algebraic number theory.

Translations of Mathematical Monographs (Iwanami Series in Modern Mathematics), Volume 242; 2012; 226 pages; Softcover; ISBN: 978-0-8218-2095-7; List US\$53; AMS members US\$42.40; Order code MMONO/242



FOUNDATIONS OF ANALYSIS

Joseph L. Taylor, *University of Utah, Salt Lake City, UT*

This book's two main goals are to develop in students the mathematical maturity and sophistication they will need as they move through the upper division curriculum, and to present a rigorous development of both single and several variable calculus, beginning with a study of the properties of the real number system. The presentation is both thorough and concise, with simple, straightforward explanations. The exercises differ widely in level of abstraction and level of difficulty. Each section contains a number of examples.

Pure and Applied Undergraduate Texts, Volume 18; 2012; 398 pages; Hardcover; ISBN: 978-0-8218-8984-8; List US\$74; AMS members US\$59.20; Order code AMSTEXT/18



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