



CMS NOTES^{de la} SMC

FROM THE VICE-PRESIDENT'S DESK

M. Ram Murty
(Queen's)

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The 2006 Fields medalists were announced at the International Congress of Mathematicians held in Madrid, Spain, from August 22 to 30, 2006. The winners were Andrei Okounkov (Princeton), Grigory Perelman (Steklov), Terence Tao (UCLA) and Wendelin Werner (Paris).

Okounkov was awarded the medal “for his contributions bridging probability, representation theory and algebraic geometry.” He was born in 1969 in Moscow and received his doctorate from Moscow State University in 1995 under Alexander Kirillov. Most notable in Okounkov’s work is his proof of a conjecture of Baik, Deift and Johansson (see J. Baik, P. Deift and K. Johansson, *On the distribution of the length of the longest increasing subsequence of random permutations*, J. AMS, **12** (4) (1999), 1119-1178). This conjecture can be explained briefly as follows. Let \mathfrak{S}_n denote the symmetric group on n letters. It is classical that the irreducible representations of \mathfrak{S}_n are in one to one correspondence with partitions λ of the integer

n . Let $\lambda = (\lambda_1, \lambda_2, \dots)$ with $\lambda_1 \geq \lambda_2 \geq \dots$ and set

$$x_i = n^{1/3} \left(\frac{\lambda_i}{2\sqrt{n}} - 1 \right), i = 1, 2, \dots$$

We define the Plancherel measure on the set of all partitions of n by setting $\mu(\lambda) = (\dim \lambda)^2/n!$ where $\dim \lambda$ is the dimension of the irreducible representation of \mathfrak{S}_n corresponding to λ . On the other hand, consider a random $n \times n$ Hermitian matrix $H = (h_{ij})$ where $h_{ij} = \overline{h_{ji}}$ such that the real and imaginary parts of h_{ij} are independent normal variables with mean zero and variance $1/2$. Since the eigenvalues Λ_i of H are real we may arrange them as

$$\Lambda_1 \geq \Lambda_2 \geq \dots$$

Introduce

$$y_i = n^{2/3} \left(\frac{\Lambda_i}{2\sqrt{n^{1/2}}} - 1 \right), i = 1, 2, \dots$$

Okounkov proves that the limit distribution (with respect to the Plancherel measure on the set of partitions of n) of the x_i ’s exists and coincides with that of the y_i ’s. See A. Okounkov, *Random matrices and random permutations*, Inter. Math. Res. Notices, **20** (2000), 1043-1095, for further details.

Grigori Perelman settled the Poincaré conjecture, which is one of the million dollar Clay problems for this century. Born on 13 June 1966 in Leningrad (now St. Petersburg), Russia, Perelman

completed his PhD at the Leningrad State University in the late 1980’s. He declined to accept the Fields medal at the ICM in Spain.

The Poincaré conjecture is not difficult to explain. It says that a closed 3-manifold which has trivial fundamental group is homeomorphic to the 3-sphere. There are several expository papers now available that explain Perelman’s work. Most notable of these are J. Milnor, *Towards the Poincaré conjecture and the classification of 3-manifolds*, Notices AMS, **50** (2003), no. 10, 1226-1233 (as well as the related article by M. Anderson, *Geometrization of 3-manifolds via the Ricci flow*, Notices AMS, **51** (2004), no. 2, 186-193) and John Morgan, *Recent progress on the Poincaré conjecture and the classification of 3-manifolds*, Bull. AMS, (N. S.), **42** (2005), no. 1, 57-78. Poincaré posed this conjecture in 1904 and subsequently, it was generalized to higher dimensions. The generalization is that every compact n -manifold which is homotopy equivalent to the n -sphere is homeomorphic to the n -sphere. For $n \geq 5$, this was settled by Smale in 1961, for which he received the Fields medal. In 1982, Freedman settled the case $n = 4$ for which he was awarded the 1986 Fields medal. The case $n = 1$ is trivial and the



MUCH ADO ABOUT LESS THAN NOTHING

I was talking to my twelve-year-old son recently about his math homework. His class is just starting on the addition and subtraction of negative numbers, and he was finding it frustrating. For each addition or subtraction he was required to illustrate the computation with a number line. He claimed – and the partially-completed assignment in front of him supported this – that he could do the arithmetic perfectly well without having to draw a picture for each problem.

Now, the number line is a valuable and beautiful image. It helps build a “number concept” in many ways. It guides our understanding of the ordering and topology of various number systems, from the natural numbers, through fractions and integers, to the reals. When we study complex numbers, the line opens out into a plane, giving a geometric interpretation to these strange new entities. Dedekind cuts and various other advanced concepts can also be visualized through number lines; for instance, flip through the pages of Steen and Seebach’s *Counterexamples in Topology* (Springer, 1978; reprinted by Dover) to see repeated variations on the theme! But, nonetheless, textbooks and curricula sometimes “sell past the deal” and present visual metaphors and manipulatives as if they were algorithms to use in the computation – which is a role that they are often unsuited to.

It may be the case, too, that negative numbers don’t need as much introduction as they used to. In the nineteenth century, arithmetic textbooks intended for high school students would literally omit all mention of negative numbers (which were “algebra”), though they might introduce Euclid’s algorithm, Fermat’s Little Theorem, and hair-raising algorithms to compute cube roots by hand. As great a mathematician as Augustus De Morgan argued against negative numbers’ very existence (though the author of *A Budget of Paradoxes* was himself considered a bit of a crackpot in his own time in this regard.)

Perhaps we are more used to negative numbers today (for which, except in the colder parts of the country, the introduction of the Celsius scale may take some credit.) Even now, though, school curricula typically introduce negative numbers two or three years after fractions – despite the fact that the arithmetic of fractions is significantly more difficult.

Older readers may be less familiar with another device used in the modern classroom to represent integers. An integer is represented by a pile of red and black counters, with two piles equivalent if one can be derived from the other by adding or taking away equal numbers of red and black counters. A pile that can be reduced to purely black counters

is a positive number; one that can be reduced to purely red counters is negative.

If students are led to think of this as an algorithm or shortcut to computing, the weaker students will be held back to the level of counting on fingers, while the stronger students will be perplexed and annoyed. However, as an aid to theoretical thinking, this device is marvelous; it gets to the very heart of the concept that the integers are a minimal extension of the natural numbers closed under subtraction. Of course, the beginner will not use these words, but all the important ideas are there. Indeed, whoever has once understood this is halfway to understanding the very deep and very general concept of a “localization” in abstract algebra. Such is the power of a good visual metaphor.

NOTES DE LA SMC

Les Notes de la SMC sont publiées par la Société mathématique du Canada (SMC huit fois l’an (février, mars, avril, mai, septembre, octobre, novembre et décembre).

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CMS NOTES

The CMS Notes is published by the Canadian Mathematical Society (CMS) eight times a year (February, March, April, May, September, October, November and December).

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ISSN :1193-9273 (imprimé/print)
1496-4295 (électronique/electronic)

BEAUCOUP DE BRUIT DE POUR MOINS QUE RIEN

Il y a quelque temps, je parlais à mon fils de douze ans de son devoir de mathématiques. À l'école, il commence tout juste à voir l'addition et la soustraction de nombres négatifs, qu'il trouve frustrantes. Pour chaque addition ou soustraction, on lui demande d'illustrer le calcul sur une ligne numérique. Il me disait – comme le prouvait le devoir non terminé qui reposait devant lui – qu'il pouvait très bien faire le calcul sans faire un dessin pour chaque problème.

Bien sûr, la ligne numérique est une image valable et très attrayante. À de nombreux égards, elle aide à préciser le concept du nombre. Elle aide à comprendre l'ordonnancement et la topologie de divers systèmes numériques, des nombres naturels aux fractions et aux entiers relatifs, en passant par les nombres réels. Lorsque l'on étudie les nombres complexes, la ligne s'ouvre sur un plan, ce qui permet une interprétation géométrique de ces nouvelles entités bizarres. On peut également illustrer les coupures de Dedekind et d'autres concepts complexes à l'aide de la ligne numérique. Il suffit d'ailleurs de parcourir l'ouvrage de Steen et Seebach intitulé *Counterexamples in Topology* (Springer, 1978; réimprimé par Dover) pour voir toutes sortes de variations sur le même thème. Toutefois, les manuels et les programmes scolaires passent parfois « à côté de la plaque » et présentent des métaphores visuelles et des manipulatives comme s'il s'agissait d'algorithmes à utiliser pour le calcul – un rôle qui, souvent, ne leur convient pas du tout.

Il se pourrait, aussi, que les nombres négatifs n'aient plus besoin d'autant de présentation qu'avant. Au dix-neuvième siècle, les manuels d'arithmétique conçus pour les écoles secondaires ne traitaient même pas des nombres négatifs (considérés comme de l'« algèbre »), même s'ils présentaient parfois l'algorithme euclidien, le petit théorème de Fermat et autres algorithmes ultra complexes servant à calculer des racines cubiques à la main. Même un mathématicien aussi célèbre qu'Augustus De Morgan niait

l'existence même des nombres négatifs (même si l'auteur de « A Budget of Paradoxes » s'est lui-même considéré comme un peu fou pour l'époque à cet égard).

Peut-être sommes nous plus habitués aux nombres négatifs aujourd'hui (un peu en raison de l'adoption de l'échelle Celsius, du moins pour les régions les plus froides du pays?). Les programmes d'études contemporains n'abordent tout de même les nombres négatifs que deux ou trois ans après les fractions – même si le calcul des fractions est considérablement plus difficile que celui des nombres négatifs.

Les lecteurs un peu plus âgés ne connaissent peut-être pas l'un des instruments d'usage courant dans les nos écoles modernes pour représenter les nombres entiers. Un entier est représenté par un paquet d'unités rouges et noires, deux paquets étant équivalents s'il est possible de passer de l'un à l'autre en ajoutant ou en enlevant un nombre égal d'unités rouges et noires. Un paquet qui, après réduction, ne compte que des unités noires est un nombre positif, et un paquet qui ne compte que des unités rouges est un nombre négatif.

Si l'on amène les élèves à penser qu'il s'agit d'un algorithme ou d'un raccourci au calcul, les élèves les plus faibles en seront réduits à compter sur leurs doigts, tandis que les plus forts seront perplexes et agacés. Toutefois, en tant qu'outil favorisant la pensée théorique, cet instrument est merveilleux; il ramène au cœur du concept selon lequel les nombres entiers sont une extension minimale des nombres naturels, fermée par rapport à la soustraction. Bien sûr, le débutant ne l'expliquera pas en ces mots, mais toutes les idées importantes y sont. En effet, toute personne qui aura compris ce concept aura déjà saisi une bonne partie du concept très complexe et très général de « localisation » en algèbre abstraite. Telle est la puissance d'une bonne métaphore visuelle.



A HOLIDAY GIFT IDEA

CRUX with MAYHEM has 64 pages per issue with useful and stimulating problems to challenge all readers, from interested high school students to senior undergraduate students, and their teachers. Readers with articles or problems and solutions for publication can send their submissions to one of the editors at www.cms.math.ca/Docs/commlist.html/#crux-board.

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ISSN: 1496-4309
(print 1706-8142)

UN CADEAU POUR LA SAISON

Chaque numéro du CRUX with MAYHEM comptera 64 pages et présentera des problèmes stimulants et utiles qui sauront susciter l'intérêt de tous les lecteurs, des élèves intéressés du secondaire aux étudiants en fin de bac et à leurs professeurs. Les lecteurs qui voudraient soumettre des articles ou des problèmes accompagnés de solutions sont priés de les faire parvenir à l'un des rédacteurs www.cms.math.ca/Docs/comliste.html/#crux-board.

Cette publication de haute qualité est maintenant disponible en version électronique au <http://journals.cms.math.ca/CRUX/>

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ISSN: 1496-4309
(print 1706-8142)

case $n = 2$ is classical and taught to undergraduates in a basic course in algebraic topology. So the case $n = 3$ was the most difficult and Perelman's work represents a culmination of efforts and is a major breakthrough.

Terence Tao was born on 17 July, 1975 in Adelaide, Australia. He completed his PhD under Elias Stein at Princeton University in 1996. One of his major contributions is his work with B. Green demonstrating that the sequence of prime numbers contains arbitrarily long arithmetic progressions. Many people are familiar with the twin prime conjecture that predicts there are infinitely many primes p such that $p + 2$ is prime. One can generalize this conjecture to consider k -tuples $p, p + a_1, \dots, p + a_k$. Unless there is a trivial divisibility condition that prevents such k -tuples from being primes (for example, for $k = 2$, $a_1 = 2$ and $a_2 = 4$ are not allowed since one of $p, p + 2, p + 4$ is divisible by three), one expects infinitely many such k -tuples. There are famous conjectures that go back to Hardy and Littlewood giving precise predictions of the number of

such k -tuples. All of these conjectures are still major open problems in analytic number theory. However, if they are true, then one consequence is that the set of prime numbers will have arbitrarily long arithmetic progressions. This consequence is the content of the theorem of Green and Tao.

Wendelin Werner was born in 1968 in Germany and obtained his PhD in 1993 under Le Gall at the Université Pierre et Marie Curie. His thesis was on planar Brownian motion and his work applies probability and conformal mapping theory to statistical physics. This seems to be the first Fields medal in the area of probability theory. He was awarded the medal "for his contributions to the development of stochastic Loewner evolution, the geometry of two-dimensional Brownian motion and conformal field theory."

Fundamental in Werner's work is the notion of fractal dimension, which in turn depends on self-similarity. For example, a square can be divided into four similar squares, and the larger square is obtained by magnifying any of the smaller squares

by a factor of 2. The dimension of the square is 2 and can be retrieved as $\log(\text{number of self-similar pieces})/\log(\text{magnification factor})$. For instance, the Sierpinski triangle is obtained by taking an equilateral triangle and subdividing it to get 4 similar triangles obtained by joining the midpoints of the opposite sides and then removing the middle triangle. One then iterates this process on each of the remaining triangles, ad infinitum. The fractal dimension of the Sierpinski triangle is then easily seen to be $\log 3 / \log 2$. Random walks and their continuous analogues, Brownian motions, are the simplest examples of stochastic processes with which the research of Werner is concerned. In 1982, Mandelbrot conjectured that the fractal dimension of the outer boundary of a planar Brownian path is $4/3$. In a series of papers, Lawler, Schramm and Werner settled this conjecture by connecting it to percolation theory, which originally began as the study of connected clusters in random graphs, but is now finding new applications ranging from mathematical biology to the study of stock markets.

EMPLOYMENT OPPORTUNITY

UNIVERSITY OF TORONTO Department of Mathematics Tenure Stream Assistant Professorships

The Department of Mathematics, University of Toronto, anticipates having a number of tenure-stream Assistant Professorships over the next several years. Applicants must demonstrate excellent accomplishments and outstanding promise in research and strong commitment to graduate and undergraduate teaching. Preference will be given to researchers in the areas of Analysis (Code: ANA), Algebra (Code: ALG), Geometric Analysis (Code: GAN), and Applied Mathematics (Code: AM). However, exceptional candidates in all fields of pure or applied mathematics are encouraged to apply (Code: OTHER).

Applicants should send a complete Curriculum Vitae, a cover letter specifying the code of the position and whether the candidate is a Canadian citizen/permanent resident and arrange to have four letters of reference, of which at least one letter primarily addresses the candidate's teaching, sent directly to the appointments committee. Candidates are also encouraged to send a research statement, a teaching statement, and the AMS cover sheet. Application material should be sent to the Appointments Committee, Department of Mathematics, University of Toronto, 40 St. George Street - Room 6290, Toronto Ontario M5S 2E4, Canada. Preference will be given to applications received by **November 15, 2006**.

The University of Toronto offers the opportunity to teach, conduct research and live in one of the most diverse cities in the world, and is strongly committed to diversity within its community. The University especially welcomes applications from minority candidates and others who may add to the further diversification of ideas.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

Call for Sessions – CMS Winter 2007 Meeting Appel de sessions – Réunion d'hiver 2007 de la SMC

LES SESSIONS COMPLÉMENTAIRES autonomes jouent un rôle important dans le succès de nos réunions. Nous vous invitons à proposer des sessions autonomes pour ce congrès qui se tiendra à l'hôtel Hilton de London, Ontario, du 8 au 10 décembre 2007. Votre proposition doit inclure une brève description de l'orientation et des objectifs de la session, le nombre de communications prévues et leur durée, ainsi que le nom, l'adresse complète, le numéro de téléphone, l'adresse courriel et les autres coordonnées de l'organisateur. Ces sessions complémentaires seront intégrées aux autres sessions du programme, dans des cases horaires prévues à cet effet par le directeur de la Réunion. Toutes les sessions seront annoncées dans les *Notes de la SMC*, sur le site Web et, si possible, dans le Bulletin de l'AMS et les publications d'autres sociétés. Les conférenciers de ces sessions complémentaires 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 au directeur de la Réunion avant la date limite indiquée ci-dessous.

ADDITIONAL SELF-SUPPORTED SESSIONS play an important role in the success of our meetings. We welcome and invite proposals for self-supported sessions for this meeting (December 8-10, 2007) at the Hilton Hotel in London, Ontario. Proposals should include a brief description of the focus and purpose of the session, the expected number of the talks, as well as the organizer's name, complete address, telephone number, e-mail address, etc. These additional sessions will be incorporated with the other sessions in time blocks allocated by the Meeting Director. All sessions will be advertised in the *CMS Notes*, on the web sites and, if possible, in the Notices of the AMS and in publications of other societies. Speakers in these additional sessions will be requested to submit abstracts which will be published on the web site and in the meeting programme. Those wishing to organize a session should send a proposal to the Meeting Director by the deadline below.

Algebraic Stacks Piles algébriques

Org: Ajneet Dhillon (UWO)

Combinatorics and its Applications to Mathematical Physics Combinatoires et ses applications en physique mathématique

Org: Michael Gekhtman (Notre Dame), Michael Shapiro (Michigan State)

Complex Analytic Geometry Géométrie analytique complexe

Org: Tatyana Foth, Finnur Larusson, Rasul Shafikov (UWO)

Computer Algebra: «Algorithmic Challenges in Polynomial and Linear Algebra»

L'algèbre informatique: «Défis algorithmiques dans l'algèbre polynomiale et l'algèbre linéaire»

Org: Stephen Watt (UWO)

Iwasawa Theory

Théorie d'Iwasawa

Org: Manfred Kolster, Reza Sharifi (McMaster)

Mathematics Education Éducation mathématique

Org: George Gadanidis (UWO)

Non-Commutative Geometry Géométrie non commutative

Organizer: Masoud Khalkhali (UWO)

Meeting Director / Directeur de la Réunion

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**Deadline: December 22, 2006
Date limite : 22 décembre, 2006**

The CRM launches its new website

www.crm.umontreal.ca/en/index.shtml

The new site includes 80 000 dynamic pages generated daily, linked to an immense database and will be updated every day, let alone the 7 500 handmade pages. The database, unique in Canadian mathematics, contains data on over 20,000 mathematicians, statisticians and physicists from around the world who have participated in CRM activities over the past ten years. The website gives access to the program of activities of the CRM from 1999 to 2007 and beyond.

Have a nice visit!

François Lalonde, Director, CRM

Le CRM lance son nouveau site web

www.crm.umontreal.ca/fr/index.shtml

Ce nouveau site contient 80 000 pages dynamiques générées chaque jour, reliées à une immense base de données et sera mis à jour tous les 24 heures, à quoi s'ajoutent 7 500 pages à la main. Cette base de données, unique au Canada en mathématiques, contient les contributions des 20 000 mathématiciens, statisticiens et physiciens du monde qui ont participé aux activités du CRM depuis dix ans. Elle donne accès à toute la programmation du CRM dans les domaines les plus variés de 1999 à 2007 et au-delà.

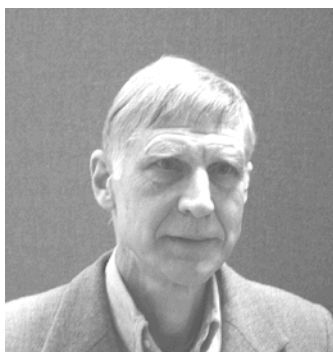
Bonne visite !

François Lalonde, Directeur, CRM

LE PRIX ADRIEN POULIOT 2006 ADRIEN POULIOT AWARD

Citation

The 2006 Adrien Pouliot Award is awarded to Peter D. Taylor (Queen's) for his outstanding contributions to the teaching and learning of mathematics in Canada. Peter's work is grounded in an innovative and evolving curriculum philosophy and an approach to mathematics which is fundamentally aesthetic. His passion for revealing the aesthetics in mathematics is perhaps best illustrated by the course Mathematics and Poetry that he teaches jointly with a colleague in the English Department at Queen's. In this course Peter immerses students in beautiful problems to reveal qualities shared by mathematics and poetry.



Peter D. Taylor
Queen's University

Présentation

Le prix Adrien-Pouliot 2006 est décerné à Peter D. Taylor (Queen's) pour sa contribution exceptionnelle à l'enseignement des mathématiques au Canada. Les travaux de Peter reposent sur sa conception d'un programme innovateur et évolutif, ainsi qu'une approche mathématique fondamentalement esthétique. Sa passion pour l'esthétisme des mathématiques ne ressort nulle part mieux que dans le cours Mathématiques et poésie qu'il donne avec un collègue du Département d'anglais de Queen's. Dans ce cours, Peter présente de superbes problèmes qui révèlent des qualités communes aux mathématiques et à la poésie.

Biography

Peter Taylor is a professor in the Department of Mathematics and Statistics at Queen's University, cross-appointed to the Department of Biology and the Faculty of Education. During his career Peter has taught and published in all three areas including two semesters in high school to prepare for the extensive curriculum writing work he continues to do with the Ontario Ministry of Education. A central thrust of his curriculum work involves the construction of problems which are investigative in nature but at the same time deliver the key ideas and techniques of the standard curriculum, particularly calculus and linear algebra. He has produced a number of books of investigative problems which are in wide circulation in the school system. He was a founding member of the Canadian Math Education Study Group (CMESG), served as chair of the CMS Education Committee from 1983 to 1987, and is a regular participant in the activities of the Fields Institute Mathematics Education Forum.

Peter has presented his innovative approach to mathematics education at many meetings of educators. These include a plenary lecture at a CMESG meeting, a plenary talk at the PIMS Changing the Culture Conference and education sessions at CMS meetings. Of particular note is a joint lecture, *Reinventing the Teacher*, with one of his graduate students, Nathalie Sinclair, at the 2000 ICME conference in Tokyo - one of two lectures singled out on the front page of the final conference newsletter. His reputation as a teacher has been recognized by the Queen's Arts and Science Teaching Award (1986), a MAA Distinguished Teaching Award (1992), and a 3M Teaching Fellowship (1994).

Dr. Taylor will receive the 2006 Adrien Pouliot Award at the CMS Winter Meeting in Toronto (December 2006).

Notes Biographique

Peter Taylor est professeur au Département de mathématiques et de statistique de l'Université Queen's tout en étant aussi affecté au Département de biologie et à la Faculté d'éducation. Durant sa carrière, il a enseigné et publié dans les trois domaines. Il a notamment enseigné deux semestres dans une école secondaire en guise de préparation à l'élaboration de programmes pour le ministère de l'Éducation de l'Ontario. Il s'attache surtout à construire des problèmes qui font appel à l'investigation tout en véhiculant les principaux concepts et techniques du programme-cadre, particulièrement en calcul différentiel et intégral et en algèbre linéaire. Il a en outre publié un certain nombre d'ouvrages sur la résolution de problèmes qui sont bien connus dans le système scolaire. Il est un membre fondateur du Groupe canadien d'étude en didactique des mathématiques (GCEDM), il a présidé le Comité d'éducation de la SMC de 1983 à 1987 et il participe activement aux activités du forum sur l'enseignement des mathématiques de l'Institut Fields.

Peter a présenté sa démarche novatrice à l'occasion de nombreuses rencontres d'éducateurs. Il a donné une conférence principale lors d'un congrès du GCEDM, une conférence plénière dans le cadre du congrès « Changing the Culture » du PIMS, et des communications dans les sessions sur l'éducation des Réunions de la SMC. Il a notamment donné une conférence intitulée *Reinventing the Teacher* avec l'une de ses étudiantes, Nathalie Sinclair, lors du congrès ICME 2000 à Tokyo, l'une des deux conférences qui ont fait la une du bulletin final du congrès. Sa réputation d'enseignant n'est plus à faire. Il a d'ailleurs reçu le Queen's Arts and Science Teaching Award (1986), le Distinguished Teaching Award de la MAA (1992) et le Prix 3M pour l'excellence en enseignement (1994).

Peter Taylor recevra le prix Adrien-Pouliot 2006 à la Réunion d'hiver de la SMC à Toronto (décembre 2006).

2006 DISTINGUISHED SERVICE AWARD

Citation

Dr. Kane has served the CMS in a number of roles, most notably as President (1998-2000), but also as Vice President, and as chair of the research, finance, and international affairs committees. He has served his university, the Royal Society, the Natural Sciences and Engineering Research Council (NSERC), and the Fields Institute in a number of roles. But his most singular contribution has been his leadership on the national stage, and in particular his contributions to building a strong research infrastructure for Canadian mathematics. He was the scientific convener of the 1996 NSERC Review of Canadian mathematics, a review prompted by a prior negative evaluation. In response, Dr. Kane led the efforts to examine the strengths and weaknesses of mathematics in Canada. Following an international evaluation this led to government recognition of the excellence of Canadian research in mathematics and of its importance to Canada, as well as to a concrete plan to build the infrastructure needed to raise this research to new heights. Continuing these efforts, Dr. Kane served as Chair of the Mathematics Steering Committee for the NSERC reallocations exercises in 1997 and 2001, and Chaired the NSERC Liaison Committee for the mathematical sciences in 2005. The direct impact of these efforts was secure and enhanced funding for mathematical research in Canada. This benefited both individual researchers, and also helped to build or enhance the infrastructure that is enabling Canada to play an increasingly significant role on the world stage – the three Canadian mathematics research institutes, the Banff International Research Station, the MITACS National Centre of Excellence (NCE), the NSERC leadership support program, and other initiatives. The success of these efforts stems from the collaborative and unified vision established by the Canadian mathematical community, a vision made possible in large part by the diplomacy, integrity, wisdom, and leadership of Dr. Richard Kane.



Dr. Richard Kane
University of Western Ontario

His research contributions were recognized by his election to the Royal Society of Canada in 1988. Other honours include being named a Fields Institute Fellow in 2002 and receiving a University of Waterloo Faculty of Mathematics Alumni Achievement Medal in 2003.

Biography

Dr. Kane received his BA from the University of Toronto in 1967 and his PhD from the University of Waterloo in 1973. He has been a member of the Department of Mathematics at the University of Western Ontario since 1980 and a full professor there since 1983, serving twice as Chair of the Department. Prior to coming to Western he taught at the University of Alberta, and held postdoctoral fellowships at Oxford and MIT. He has held visiting positions at the Institute for Advanced Study, (Princeton), the Centre de Recerca Matemàtica (Barcelona), the Max-Planck-Institut für Mathematik (Bonn), the University of Aberdeen, the University of California at San Diego, and the University of Sydney.

PRIX POUR SERVICE MÉRITOIRE 2006

Présentation

Richard Kane a occupé divers postes à la SMC, en particulier celui de président (1998-2000), mais aussi de vice-président et de président des comités de la recherche, des finances et des affaires internationales. Il a également joué divers rôles dans son université, à la Société royale, au Conseil de recherches en sciences naturelles et en génie (CRSNG) et à l'Institut Fields. C'est toutefois son leadership sur la scène nationale qui aura le plus marqué son œuvre, en particulier ses démarches pour la création d'une infrastructure de recherche mathématique solide au Canada. Il a été responsable scientifique de l'Examen des mathématiques au Canada mené par le CRSNG en 1996, examen déclenché par une évaluation négative. Richard Kane a réagi en dirigeant l'examen des forces et des faiblesses des mathématiques au Canada. Suite à une évaluation internationale, le gouvernement a reconnu l'excellence de la recherche mathématique qui se faisait au Canada et son importance pour le pays, et a pris des mesures concrètes pour mettre en place l'infrastructure nécessaire qui permettrait de porter la recherche vers de nouveaux sommets. Dans la même foulée, M. Kane a présidé le Comité de direction en mathématiques lors des exercices de réaffectation du CRSNG de 1997 et de 2001, ainsi que le Comité de liaison du CRSNG en sciences mathématiques en 2005. Les conséquences directes de ces efforts ont mené à l'obtention de garanties et à des hausses du financement consacré à la recherche mathématique au Canada. Très bénéfiques pour les chercheurs, ces mesures ont aussi contribué à bâtir et à améliorer l'infrastructure qui permet au Canada de jouer un rôle de plus en plus important sur la scène mondiale – les trois instituts de recherche mathématique canadiens, la Station de recherche internationale de Banff, le

THE INAUGURAL DAVID BORWEIN DISTINGUISHED CAREER AWARD

Citation

Dr. Richard Kane has profoundly influenced the course of mathematics in Canada through his long service to the profession, to his university, and to the CMS. He is a distinguished researcher and a dedicated teacher. His exemplary career, taken as a whole, is eminently deserving of recognition through the receipt of the inaugural Borwein award.

His research is in the area of algebraic topology, particularly the homology theory of Lie groups, an area in which he has authored four monographs and numerous journal articles. He has supervised four PhD theses. He was a lead organizer of the 1996 Fields Institute thematic program in homotopy theory, and has organized several other workshops and conferences.

Réseau de centres d'excellence MITACS (RCE), le programme de soutien au leadership du CRSNG et d'autres initiatives. Le succès de ces initiatives tient à la vision unifiée et collaborative de la communauté mathématique canadienne, vision rendue possible en grande partie grâce à la diplomatie, à l'intégrité, à la sagesse et au leadership de Richard Kane.

LE PREMIER PRIX DAVID-BORWEIN DE MATHÉMATICIEN ÉMÉRITE POUR L'ENSEMBLE D'UNE CARRIÈRE

Présentation

Richard Kane joue depuis toujours un rôle primordial dans la communauté mathématique canadienne à travers son travail soutenu pour la profession, pour son université et pour la SMC. Brillant chercheur et enseignant dévoué, il mène une carrière exemplaire qui mérite éminemment la distinction qui accompagne le premier prix David-Borwein.

Ses recherches portent sur la topologie algébrique, en particulier sur l'homologie des groupes de Lie, domaine dans lequel il a publié quatre monographies et de nombreux articles. Il a également dirigé quatre thèses de doctorat. Il a de plus été

l'organisateur principal du programme thématique de l'Institut Fields en 1996 sur la théorie homotopique et il a organisé plusieurs autres ateliers et congrès. La Société royale du Canada a d'ailleurs reconnu sa contribution à la recherche en le faisant membre en 1988. Entre autres honneurs et récompenses, il est devenu membre de l'Institut Fields en 2002 et il a reçu la médaille des anciens de la Faculté de mathématiques de l'Université de Waterloo en 2003.

Notes Biographique

Richard Kane a obtenu son baccalauréat de l'Université de Toronto en 1967 et son doctorat de l'Université de Waterloo en 1973. Membre du Département de mathématiques de Western Ontario depuis 1980 et professeur titulaire depuis 1983, il a en outre assuré la direction du département à deux reprises. Avant d'arriver à Western, il a enseigné à l'Université de l'Alberta et fait des stages de recherche postdoctorale à Oxford et au MIT. Il a été professeur invité par l'Institute for Advanced Study, (Princeton), le Centre de Recerca Matematica (Barcelone), le Max-Planck-Institut für Mathematik (Bonn), ainsi que les universités d'Aberdeen, de la Californie à San Diego et de Sydney.

PRIX DE DOCTORAT 2006 DOCTORAL PRIZE

Citation

As a graduate student of Professor Christopher Godsil, University of Waterloo, Michael Newman wrote an outstanding dissertation which presents extensions and applications of the Delsarte-Hoffman bound on the size of independent sets in graphs. The thesis interweaves the solutions of three intriguing yet ostensibly unrelated problems into a unified tapestry by virtue of their common methodological treatment. The results obtained are important and the exposition first-rate.



Michael Newman
University of Waterloo

Biography

Michael Newman received his B.Math. from the University of Waterloo in 1992 and his M.Sc. from the University of Manitoba in 2000. He completed his Ph.D. in 2005 and, since then he has held an NSERC postdoctoral fellowship at Queen Mary College in London, England.

Dr. Newman will present the 2006 Doctoral Prize Lecture at the CMS Winter Meeting, hosted by the University of Toronto in December 2006.

Présentation

Durant ses études supérieures sous la supervision du professeur Christopher Godsil de l'Université de Waterloo, Michael Newman a rédigé une dissertation exceptionnelle présentant des extensions et des applications de la borne de Delsarte-Hoffman sur la taille des ensembles indépendants dans les graphes. Sa thèse intègre les solutions de trois problèmes intrigants, mais aussi visiblement non reliés, en un seul tableau grâce à une méthodologie commune. Les résultats obtenus sont importants, et la démonstration, exceptionnelle.

Notes biographique

Michael Newman a obtenu un baccalauréat en mathématiques de l'Université de Waterloo en 1992 et une maîtrise en sciences de l'Université du Manitoba en 2000. Il a obtenu son doctorat en 2005 et poursuit depuis des études postdoctorales au collège Queen Mary à Londres grâce à une bourse de recherche du CRSNG.

Michael Newman prononcera la conférence du Prix de doctorat 2006 à la Réunion d'hiver de la SMC, qui se tiendra à l'Université de Toronto en décembre 2006.

PRIX G. DE B. ROBINSON 2006 G. DE B. ROBINSON PRIZE

Citation

The 2006 G. de B. Robinson Award is presented to Dr. Malcolm Harper for his paper entitled *$Z[\sqrt{14}]$ is Euclidean* published in the Canadian Journal of Mathematics, Volume 56 (2004), no. 1, pp. 55-70.

This paper resolves a long-standing question initially posed by Pierre Samuel. In a fundamental paper written in 1971, Samuel raised numerous questions about Euclidean rings, the most celebrated one being whether $Z[\sqrt{14}]$ is Euclidean. It is well-known that this ring is not Euclidean for the norm map, so Samuel's question is if another map exists making the ring Euclidean. Shortly after Samuel's paper, Weinberger showed that if we assume the generalized Riemann hypothesis (GRH), then the ring is Euclidean, albeit for some strange Euclidean function. In a series of papers written in the 1980's, Rajiv Gupta, Kumar Murty and Ram Murty devised new techniques to study Euclidean rings in an attempt to remove the use of the GRH from Weinberger's work. Their work ultimately led David Clark and Ram Murty to show that $Z[\sqrt{14}, 1/p]$ is Euclidean for the prime $p=1298852237$, without the use of GRH. In his doctoral thesis, Harper showed that the result of Clark and Ram Murty holds for any prime p . Later, by an ingenious use of the large sieve method, he removed the use of the auxiliary prime and established Samuel's conjecture.

Biography

Malcolm Harper completed his bachelor's degree (with distinction) in physics and his master's degree in mathematics at the University of Regina in 1994. He then moved to McGill University and obtained his Ph.D. under the direction of M. Ram Murty in 2000. The paper for which Harper is given the Robinson Award was based on his doctoral thesis.



Malcolm Harper
Champlain Regional College

Présentation

La SMC décerne son prix G. de B. Robinson 2006 à Malcolm Harper pour son article intitulé *$Z[\sqrt{14}]$ is Euclidean* publié dans le Journal canadien de mathématiques, volume 56 (2004), no 1, pp. 55-70.

Cet article résout une question posée il y a longtemps par Pierre Samuel. Dans un article fondamental écrit en 1971, Samuel soulevait plusieurs questions à propos des anneaux euclidiens, la plus célèbre étant « $Z[\sqrt{14}]$ est-il euclidien? ». Il est bien connu que cet anneau n'est pas euclidien par rapport à la fonction

« valeur absolue »; Samuel demande donc si l'anneau serait euclidien s'il existait une autre fonction. Peu après la publication de l'article de Samuel, Weinberger a montré que si l'on tient compte de l'hypothèse de Riemann généralisée, l'anneau serait bel et bien euclidien, bien qu'il s'agisse d'une étrange fonction euclidienne. Dans une série d'articles écrits dans les années 1980, Rajiv Gupta, Kumar Murty et Ram Murty ont élaboré de nouvelles techniques pour l'étude des anneaux euclidiens dans le but d'empêcher l'utilisation de l'hypothèse de Riemann généralisée avancée par Weinberger. Ces travaux ont abouti lorsque David Clark et Ram Murty ont démontré que $Z[\sqrt{14}, 1/p]$ était euclidien pour le nombre premier $p=1298852237$, sans recourir à l'hypothèse de Riemann généralisée. Dans sa thèse de doctorat, Malcolm Harper a montré que le résultat de Clark et de Ram Murty s'appliquait à tout nombre premier p . Plus tard, par un emploi ingénieux de la méthode du crible, il a éliminé l'emploi du nombre premier auxiliaire et a établi la conjecture de Samuel.

Notes biographique

Malcolm Harper a obtenu un baccalauréat en physique (avec distinction) et une maîtrise en mathématiques de l'Université de Regina en 1994. Il a poursuivi au doctorat à l'Université McGill sous la direction de Ram Murty et a terminé ses études en 2000. L'article pour lequel Malcolm Harper obtient le prix G. de B. Robinson découle de sa thèse de doctorat.

PROBLEM OF THE MONTH

*The following problem was submitted by
Dr Stan Wagon of Macalester College.*

BIG RANCH COUNTRY

Alice and Bob own roughly rectangular pieces of land on the planet Earth, which is assumed to be a perfect sphere of circumference 40000 kilometers. Alice's land is bounded by four fences, two of which run in an exact north-south direction and two of which run in an exact east-west direction. Her north-south fences are exactly 10 kilometers long; her east-west fences are exactly 20 kilometers long. Bob's land is similarly bounded by four fences, but his north-south fences are 20 kilometers long and his east-west fences are 10 kilometers long. Whose plot of land has the greater area?

Send your own favorite problems to: notes-editors@cms.math.ca
Solution for October's problem: page 12.

The International Mathematical Olympiad (IMO) is one of the most prestigious mathematical events for high school students. This competition is hosted by a different country every year, and this year, we had the chance of visiting the small beautiful nation of Slovenia. About five hundred students from ninety countries attended this year's IMO, making it one of the largest IMOs ever held. And since each country was allowed to send at most six contestants, only the strongest students from each country could come to this event. It was an honour for me to participate in IMO 2006 as a contestant, and I had a very memorable experience in Slovenia.

When I was much younger, I had always dreamed of competing in an event like the IMO. After years of practice, I was selected to represent Canada in IMO 2004 in Athens, Greece. Needless to say, I was ecstatic two years ago when I received the phone call inviting me to be on the team. I have participated in every IMO since then, and they have all given me incredible experiences. I had the chance to travel around the world and meet students with similar interests from other countries. The IMOs left me with great memories and lasting friendships. IMO 2006 was my third and last IMO as a contestant. It is significant for me as it is a finale to my unforgettable journey as a math olympian.

In Canada, in order to qualify for the six-member Canadian IMO team, one needs to perform very well on the following three olympiads: Canadian Math Olympiad, Asian Pacific Math Olympiad, and USA Math Olympiad.

Although a significant portion of our training consists of working by ourselves throughout the year on practice problems, the Canadian Mathematical Society organizes a couple of intensive training camps every year. The Winter Olympiad Training camp is held at York University every January. It lasts about a week and brings together fifteen students who are most likely to make the IMO team that year. And, after the team has been chosen, there is a two-week long summer training camp for the IMO team right before the actual competition. The atmosphere provided by these camps allows us to focus on mathematics and work with other enthusiastic students towards a common goal. The camps are always a lot of fun too!

This summer's training camp was divided into two halves: we spent the first week in Halifax, and the second week in Bohinj, Slovenia. During the first few days of the camp in Halifax, a number of local students were invited, so that they too could experience what IMO training was about. On most days, we had a lecture in the morning, a problem session or contest in the afternoon, and student presentations in the evening. The evenings were often quite entertaining, as some team members have rather hilarious presentation styles.

We spent Canada Day relaxing and touring around Halifax, and we departed for Slovenia the day after. In Slovenia, we stayed at a hostel about two hours away from Ljubljana, and spent a week there training along with the Swedish team as well as the Luxembourg team. The accommodations were comfortable. On the plus side, since we were stuck in the middle of nowhere with no television or internet, we were able to concentrate on training for the upcoming contest – which was the purpose of this camp.

After a week of additional training, we were transferred to the IMO competition site in Ljubljana, the capital of Slovenia. The planning for this year's IMO was very well done. A lot of activities were available near the IMO site, and internet access was easy to find. As well, there were a number of organized events such as sports tournaments. We could always find something to do during our free time.

After arriving at the IMO site, we met our guide Dejan Širaj, who showed us around Ljubljana. With so many other students around us, we made many new friends. We chatted and played games together, and everyone got along very well.

The opening ceremony took place on the day after we arrived in Ljubljana, and the two days of examinations followed thereafter. IMO consisted of two 4.5-hour exams, and on each day we were given three difficult problems requiring proofs. We needed to use creative approaches and make clever observations, as well as to communicate our thoughts on paper in a coherent manner. After the exams, our leaders would argue for our points based on what we have handed in.

For those who are interested, the problems and solutions of this year's IMO could

be found on the official website: <http://imo2006.dmfa.si/>. This site was maintained very well during the event – photos and news updates were uploaded everyday.

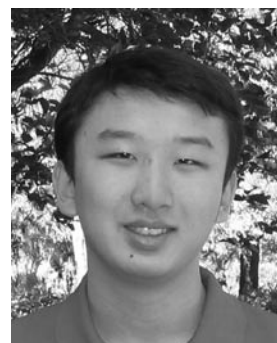
As we would all agree, the best part of IMO

comes after the exams. We were given the chance to relax and enjoy Slovenia, and we went on several organized excursions. We went to caves, beaches, and mountains, and had picnics, barbecues, and lots and lots of ice cream. During the nights, many contestants went to explore the city and experience the Slovenian nightlife. We all had lots of fun.

In the meantime, the leaders and deputy leaders were trying to argue for their students' papers in coordination sessions. Back in our residence, we saw partial results slowly updated on the bulletin board, allowing us to predict our medal standings. In the IMO, medals are only given to the top half of the students, and the numbers of gold, silver, and bronze medals are in the ratio of 1:2:3. It was a stressful time for those contestants who may be near the cutoffs, as even a single point could make a difference in the colour of their medal.

Eventually, we found out all the scores as well as the official medal cutoffs. Team Canada received five silver medals and one bronze medal. Our team ranked fifteenth in the unofficial country rankings. We were quite happy about our performance on this very difficult examination. On the last day before departure, we received our medals at the closing ceremony, and had a large celebration banquet afterwards.

The IMO has been an incredible experience, and it would not have been possible for us without the support of the Canadian Mathematical Society and its sponsors such as the Samuel Beatty Fund. As well, the help and support from our parents, teachers, coaches and teammates have all been instrumental. Thank you all for making it possible for us to go to the IMO and enjoy this unique wonderful experience.



Yufei Zhao

Don Mills Collegiate Institute
2006 Samuel Beatty Recipient

Six Degrees *The Science of a Connected Age*

Duncan J. Watts

Norton 2003 + 374 pages

MOST OF US have heard the expression “six degrees of separation,” referring to the romantic idea that any two people in the world are connected by a chain of intermediate acquaintances that is on average six people long. In a world of approximately six and a half billion people this idea seems almost paradoxical. And yet most of us have at some point found ourselves remarking on what a “small world” we live in. It is the science inspired by this idea and the theory that lies behind it that Duncan Watts explores in his book *Six Degrees: the Science of a Connected Age*.

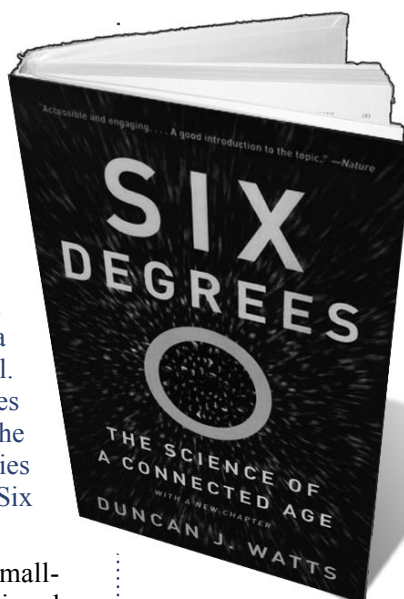
Watts begins by clarifying his approach to the small-world problem. He is not attempting to determine how “small” our world actually is, but rather would like to answer the question “What would it take for any world, not just ours ... to be small?”

Mathematical networks, or graphs, are particularly well-suited to modeling phenomena in which the emphasis is placed on connections between objects. In a world that is becoming more and more connected through things like the Internet, satellite television and air travel, the science of networks is exceedingly relevant.

A network of social connections is said to display the small-world phenomenon if any two people in the network can be linked by a short path of intermediate acquaintances. We need not look far to find other examples of large connected networks that display properties similar to the social acquaintance network. Watts shows us that the World Wide Web, power transmission systems and the neural network of the worm *Caenorhabditis elegans* are all small-world networks. Furthermore, these types of networks continue to turn up in a myriad of different contexts.

The first half of Watts’ book is devoted to developing the structure of these small-world networks. He presents various graph theoretic models that have been used in an attempt to capture the unique and elusive properties of these types of networks, in particular, high levels of clustering combined with short average path lengths. He emphasizes the different roles played by disciplines as disparate as mathematics, sociology, physics and economics and stresses that progress in this new science will only be made through collaboration among these areas.

As well as the structure of these networks, Watts is interested in investigating the efficiency with which phenomena propagate throughout the networks. This could include information, fashion trends, political or social movements, computer viruses or even disease. From the Dutch tulip fad of the 1600’s to the spread of Ebola in Africa in the 1970’s Watts explores the reasons that explain why some of these phenomena succeed



in reaching the whole network while others simply burn themselves out.

Another interesting issue examined by Watts in relation to these networks is that of robustness. Why are certain networks able to withstand large shocks while others collapse completely due to several small tremors? A perfect example of such a situation is given by Watts in the opening chapter of his book, where he describes the great power failure that occurred in the western United States in August 1996. In this case, a cascade of seemingly insignificant errors in transmission lines succeeded in

plunging millions of people into darkness. Later Watts compares this event to one that occurred in 1997 in Japan in which Toyota recovered almost immediately from one of the most devastating financial blows the Japanese transportation industry has ever seen. In terms of the network of a firm, Watts argues that the ability to cope with disaster stems from the way in which the firm is organized. Specifically if the manner in which connections exist between members of the firm which allows the firm to cope well with everyday ambiguity in problem-solving ensuring that the firm will be better-equipped to handle catastrophe.

Despite the amount of work that has been done in the new science of networks Watts concludes that most of the important questions remain largely unanswered. Progress is slow, in part because the problem itself is still in the process of being understood. However with the help of researchers from across many different fields, the reader observes that the science of networks is becoming what Watts himself hopes for at the beginning of his book: “a manifestation of its own subject matter, a network of scientists collectively solving problems that cannot be solved by any single individual or even any single discipline.”

The book is aimed at a general audience. A background in graph theory or even in mathematics is not required to appreciate the key ideas that Watts is trying to express. It is my opinion though, that a greater mathematical effort on the part of the reader is required to truly appreciate some of the intricacies of Watts’ network models. A detailed reading list is provided at the end of the book for those interested in having a more in-depth look at any of the topics touched on. The author also indicates the level of mathematics required for each item on his list.

One of the great strengths of Watts’ book is that it not only brings us up-to-date with the state of a developing science but it takes us on a personal journey for scientific truth. In a way, Watts tells the story of his quest in the same way that a grandparent would entertain a grandchild with stories of

their youth. In doing so he brings feeling to a discipline that is sometimes seen as emotionally sterile. Although Watts is always the first to point out the drawbacks, limitations and even mistakes encountered in the struggle to understand networks, his outlook remains optimistic. He believes that in science the voyage is as fundamental as the destination.

I do have two complaints to make about Watts' book. The first is that after reading several chapters of the book the reader begins to feel as though the author is attempting to view everything under the sun as a network, when perhaps this approach has the unwanted side effect of over-simplifying a problem. Much information is lost when a complex and dynamic system is stripped down to its structural components. I agree with the author that in order to understand complicated phenomena one must begin simply, but I am not convinced that the network simplification is warranted in all cases.

My second criticism is about the lack of explanation of the applications of the network models being developed. Part of the author's thesis seems to be that one of the main reasons this science is so important is that it is directly related to our everyday lives. It seems to work against him then that he fails to give a clear indication of how these models might be applied to solve real-world problems. An applied science is only useful to the extent that it can be applied. In the science of networks we are perhaps experiencing a typical example of lack of communication between industry and academe.

That said, my overall impression of the book is a good one. The book is engaging, well-written and humorous at times. I would recommend it to anyone interested in discovering more about this blossoming science.

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.

NEWS FROM DEPARTMENTS

Université de Montréal, Montréal, QC

Nominations : Jonathan Taylor (professeur agrégé – Chaire de recherche du Canada (junior) en imagerie statistique, septembre 2006); David Haziza (professeur adjoint, statistique, juin 2006).

Départs à la retraite : Au 1er juin 2006, les professeurs titulaires Anatole Joffe et Roch Roy, au 1er octobre 2006, Marie-Andrée Dion, adjointe administrative.

Décès : Narayan Chandra Giri (professeur retraité, février 2006); Roland Guy (professeur retraité, juin 2006); Maurice Labbé (professeur émérite, juillet 2006).

Doctorats Honoris Causa : Professeur Ivo Rosenberg : Die Technische Universität Wien (reçu le 8 juin 2006); Professeur Pavel Winternitz : Czech Technical University in Prague (octobre 2006).

Lauréats d'un prix ou d'une distinction : Prix Jeffery-Williams 2006 de la Société mathématique du Canada à Andrew Granville (à recevoir en décembre 2006); Prix des jeunes innovateurs 2005 : Charles Dugas (reçu en décembre 2005).

Visiteurs : Véronique Ladret (probabilités, génétiques mathématiques et statistique, depuis août 2005); Carlo Matessi (probabilités, génétiques mathématiques et statistique, août 2006); Miguel Moyers-Gonzalez (analyse numérique et rhéologie, depuis janvier 2006); David Lacasse (analyse numérique et rhéologie, depuis janvier 2006); Basak Gurel (topologie, septembre 2006); Ozgur Ceyhan (topologie, septembre 2006); Samuel Lisi (topologie, depuis août 2005); Ketty De Rezende (topologie, depuis août 2005); Fabien Ngo (topologie, septembre 2006); Nathan Jones (théorie des nombres, depuis août 2005); Pierre Charollois (théorie des nombres, depuis juin 2005); Jack Fearnly (théorie des nombres, depuis juin 2005); Habiba Kadiri (théorie des nombres, depuis juin 2005); Jason Lucier (théorie des nombres, depuis juin 2005); Dan Mangoubi (géométrie, septembre 2006); Igor Wigman (géométrie, septembre 2006); Julie Rowlett (géométrie, septembre 2006); Jianjun Chuai (géométrie algébrique, depuis août 2005); Chang Zhong Zhu (analyse, depuis octobre 2005).

SOLUTION FOR OCTOBER'S PROBLEM

Clearly a countable infinite set of 8's can be drawn. To see that there cannot be an uncountable set, note that for each 8 there is a pair (p_1, q_1) , (p_2, q_2) of points with rational coordinates, with one point on the interior of each loop. No two 8's can share such a pair of points; so any set of disjoint 8's must be at most countable.

Computational Aspects of Polynomial Identities

Alexei Kanel-Belov and Louis Halle Rowen

A.K. Peters 2005

AFTER A LONG waiting period, two books on polynomial identities have appeared almost at the same time: Alexei Kanel-Belov and Louis Halle Rowen's *Computational Aspects of Polynomial Identities* (A.K. Peters, 2005) and Antonio Giambruno and Mikhail Zaicev's *Polynomial Identities and Asymptotic Methods* (AMS, 2005). Both books reflect a current trend in the area of PI-algebras to the combinatorial approach but look very different as concerns the choice of material, the style, and a number of nuances. In this review we will try to describe the first of these books.

There are fifteen chapters in this book. Their titles are as follows:

1. Basic Results
2. Affine PI-algebras
3. T-ideals and Relatively Free Algebras
4. Specht's Problem in the Affine Case
5. Representations of S_n and their applications
6. Superidentities and Kemer's Main Theorem
7. PI-algebras in characteristic p
8. Recent Structural Results
9. Poincaré-Hilbert Series and Gelfand-Kirillov Dimension
10. More Representation Theory
11. Unified Theory of Identities
12. Trace Identities
13. Exercises
14. List of Theorems and Examples
15. Some Open Questions

Chapter 1

In Chapter 1 the authors give basic definitions and some examples. This is followed by identities of finite-dimensional algebras, specifically, *Capelli identities* and, in particular, *standard identities*, a set of which holds in every finite-dimensional algebra. Next question considered is graded algebras and the Grassman algebra (the authors write Grassman with one "n", and when one looks through the literature, it appears that people are evenly divided between those who use one "n" and those who use two!). *Grassmann envelopes* is an important tool in the study of superalgebras, in particular, in Kemer's work on the finite basis problem.

After this the authors consider another important tool of PI-theory, the *central polynomials* of matrices. It does not take very long before a couple of major results of PI-theory appear to be proven: Amitsur-Levitzki's Theorem about the standard identity of degree $2n$ in the matrix algebra $M_n(F)$ of order n over a field F and Razmyslov's Theorem on the existence of central polynomials. These theorems are given with very short proofs.

One more "popular" identity is the identity of algebraicity. This is important when we want to prove that, under some additional restrictions, a finitely generated (people often say "affine") algebra is finite-dimensional.

Soon after this we realize that this is a book for an advanced reader because a number of basic theorems appear without proofs and among them the famous Kaplansky's Theorem, Posner's Theorem, and others.

The last two topics considered in Chapter 1 are the representability of PI-algebras by matrices and the Ascending Chain Condition (ACC). The reviewer was informed that the proof of Anan'in's theorem on the representability of affine left Noetherian PI-algebras by matrices is not correct.

Chapter 2

This chapter is devoted to the combinatorial techniques arising from the famous Shirshov Height Theorem, which allows to successfully handle a number of problems about affine PI-algebras. This theorem remained unnoticed by the specialists in the area for a number of years. Once noticed, appreciated and understood it became a powerful source of applications. The name of the chapter and its first section is presumably motivated by the fact that this technique is based on the study of the spanning sets of words in the alphabet formed by a finite set of generators of an affine algebra. Shirshov's Height Theorem says that if an affine PI-algebra A over a field F is generated by l generators a_1, \dots, a_l and satisfies a nontrivial identity of degree d then there exists a number (the height) $h = h(l, d)$ such that A is spanned as a vector space by the words $w_1^{k_1} \dots w_h^{k_h}$ where $k_1, \dots, k_h \geq 0$ and each w_i is a word in the original alphabet, of length at most d . A key lemma in the proof of this theorem also bears Shirshov's name. This is often applied by itself. In this chapter the authors give three different proofs of Shirshov's Lemma.

In Section 3.2 the authors formulate what they call "The Shirshov program", an approach to prove theorems about PI-algebras:

1. Prove a special case of the theorem for representable algebras
2. Given an affine algebra $A = F\{a_1, \dots, a_l\}$, adjoin to F the characteristic coefficients (in the sense of Hamilton-Cayley Theorem) of all words of length $\leq d$ in the a_i , thereby making the algebra finitely generated over a commutative affine algebra, in view of Shirshov's Height Theorem.
3. Reduce the theorem to an assertion in Commutative Algebra.

As a part of this program (Step 2) the authors introduce the "trace ring". The remaining part of the chapter is devoted to the proof of celebrated Razmyslov-Kemer-Braun theorem about the nilpotence of the Jacobson radical of an affine PI-algebra over a field. A number of results about Capelli identities used in the proof of this theorem are of independent interest.

Chapter 3

This is a very short chapter devoted mainly to several important definitions such as T-ideals (or ideals of identities), relatively free algebras, that is, algebras determined by identical rather than defining relations and the formulation of the Finite Basis Problem for associative algebras, known since 1950 as Specht's Problem. As an example it is shown that the identities of the Grassmann algebra all follow from a single one: $[[x_1, x_2], x_3] = 0$.

Chapter 4

This chapter deals with the solution by Kemer of Specht's problem in the case of finitely generated algebras over a field of characteristic zero. One of the basic ideas is Kemer's PI-representability Theorem which states that the set of identities of a finitely generated PI-algebra over a field of characteristic zero equals to the set of identities of a finite-dimensional algebra. The proof of the finite basis property for finite-dimensional algebras is quite technical and occupies with some additional technical remarks the remaining 40 pages of this chapter.

Chapter 5

In this chapter the authors recall some facts of the representation theory of the symmetric group and give applications to the study of polynomial identities, including the famous Regev's theorem which states that the tensor product of two PI-algebras is a PI-algebra; this theorem opened the whole area in the PI-theory. For this we refer the reader to a recent book of A. Giambruno and M. Zaicev quoted above. In Remark 5.44 the authors mention a remarkable Giambruno-Zaicev's theorem about the integrality of the exponent of a PI-algebra. They also write that finding the exponent of a given PI-algebra may be difficult. Actually, Giambruno-Zaicev's method gives an efficient way to finding the exponents for a wide class of finite-dimensional algebras. In the same chapter the authors discuss identities associated with Young diagrams of various types, in particular, so called hooks, introduced by Amitsur and Regev, and also one type of identities that generalize Capelli identities. These latter are called the "sparse identities".

Chapter 6

This chapter is devoted to Kemer's solution of Specht's problem for arbitrary, not necessarily affine, algebras over any field of characteristic zero. Here an important role is played by associative superalgebras and their Grassmann envelopes. In this context, ordinary identities are viewed as a particular case of super-identities, that is, identities in two groups of variables: even and odd. Ordinary associative algebras become even parts of more general superalgebras. Given a superalgebra $A = A_0 \oplus A_1$ and the Grassmann algebra $G = G_0 \oplus G_1$ one can always construct an algebra $G(A) = A_0 \otimes G_0 \oplus A_1 \otimes G_1$. Kemer's theorem says that the set of polynomial identities of an algebra A equals to the set of polynomial identities of the Grassmann envelope of a suitable finitely generated (=affine) superalgebra. In its turn, the set of superidentities of a finitely generated superalgebra is the same as the set of superidentities

of a finite-dimensional superalgebra. These results are true if the characteristic of the base field of coefficients is zero. In order to apply these results to the solution of Specht's problem, the authors discuss the structure of finite-dimensional simple superalgebras, Wedderburn decomposition, etc. The results are given without references to their origin, like C.T.C. Wall's Theorem on the structure of simple superalgebras or E. Taft's Theorem on Wedderburn decomposition of finite-dimensional algebras with the action of a group of automorphisms. In the end of the chapter the authors discuss the consequences of Kemer's solution of Specht's Problem for the structure of T-ideals of relatively free algebras.

Chapter 7

This chapter contains a collection of fairly new results concerning Specht's problem in characteristic $p > 0$. First of all, the author's mention Kemer's result that any PI-algebra in characteristic $p > 0$ satisfies all multilinear identities of a matrix algebra of an appropriate order. Then they exhibit examples of system of identities that do not admit finite bases. These examples are due to Belov, Grishin, and Shchigolev, with some improvements by Gupta-Krasil'nikov. Here Grassmann algebras and their generalisations serve as "test" algebras.

Chapter 8

In the first half of this chapter the authors prove the first author's result saying that every Noetherian PI-algebra over any commutative Noetherian ring is finitely presented. In the second section they give a very sketchy approach to the polynomial identities of group algebras and enveloping algebras.

Chapter 9

In this chapter the authors continue the study of analytical and numerical characteristics of affine PI-algebras such as the Poincaré-Hilbert series and Gelfand-Kirillov (GK) dimension. The main questions of interest are the rationality of Poincaré-Hilbert series and the integrality of Gelfand-Kirillov dimension. It is pointed out that GK-dimension is always bounded from above by Shirshov's height and even more precise upper bounds are found, in terms of so-called Kemer index studied earlier in Chapter 4. The integrality of GK-dimension is shown for representable algebras, otherwise there is an example of an affine PI-algebra with non-integral GK-dimension. Finally, the authors study the rationality of Poincaré-Hilbert series and prove some positive results in this direction.

Chapters 10 and 11

A ten-page Chapter 10 is devoted to recalling some facts from the representation theory of the General Linear Group $GL(V)$ and its connections to the study of homogeneous identities.

Chapter 11 is another small chapter with a sketchy survey of various types of identities in various, even nonassociative algebras.

Chapter 12

This chapter is devoted to the trace identities of associative algebras and the proof of the celebrated Razmyslov-Procesi Theorem on finite generation of trace identities of matrix algebras.

Chapters 13 and 14

In Chapter 13 the authors produce sets of exercises for each chapter. The reader should be warned, however, that the “exercises” are additional fragments of the theory, which did not fit into the main text for various reasons.

In Chapter 14 the authors give the list of theorems, examples and other claims proved in this book.

The book concludes with Bibliography and Index. In my opinion the bibliography has some omission. For example, the authors quote in Chapter 5 an important result of Giambruno-Zaicev about the integrality of the exponent of any PI-algebra over a field of characteristic zero but the two papers of these authors published in *Advances in Mathematics* (1998, 1999) where this result was proved are missing.

Chapter 15 contains some open problems.

As a summary, the book contains a wealth of contemporary material about polynomial identities in associative algebras. It can be recommended to an advanced reader with substantial experience in the theory of PI-algebras.

Few words about the above-mentioned book of Giambruno-Zaicev. This can be recommended to an advanced undergraduate and graduate student. The stress of this book is on the extensive use of the methods of Representation Theory of the Symmetric Group with its rich combinatorics. The approach to identities of algebras with additional structure (algebras with involution, graded algebras and superalgebras, etc) is much more systematic. Many more results in the book belong to the authors. But Kemer’s solution of Specht’s problem and counterexamples to Specht’s problem in characteristic $p > 0$ can be found only in Belov-Rowen (apart from Kemer’s original monograph “Ideals of Identities of Associative Algebras,” AMS Translations of Monographs, Vol. 87, 1988). Finally: Grassmann has two “n’s” in the end!

EMPLOYMENT OPPORTUNITY

UNIVERSITY OF TORONTO Department of Mathematics Ted Mossman Chair in Mathematics

Thanks to a generous gift from James Mossman, the Department of Mathematics, University of Toronto, is proud to announce a search for the Ted Mossman Chair in Mathematics. The appointment is at the level of Professor with tenure, and the Chair holder is expected to be an outstanding mathematician, whose research and teaching will make a major contribution to the quality and stature of the department. The appointment is effective July 1, 2007.

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The Department of Mathematics, University of Toronto, invites applications for Limited Term Assistant Professorships (non tenure stream). Applicants must demonstrate significant research promise and strength in teaching. Applicants should send a complete Curriculum Vitae including a list of publications, a cover letter specifying the code CLTA and whether the candidate is a Canadian citizen/permanent resident and arrange to have four letters of reference, of which at least one letter primarily addresses the candidate’s teaching, sent directly to the appointments committee. Candidates are also encouraged to send a research statement, a teaching statement, and the AMS cover sheet. Application material should be sent to the Appointments Committee, Department of Mathematics, University of Toronto, 40 St. George Street - Room 6290, Toronto Ontario M5S 2E4, Canada. Preference will be given to applications received by **December 15, 2006**.

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The appointments are effective July 1, 2007 and are contractually-limited term appointments for a term of three years. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

Non-Unique Factorizations, Algebraic, Combinatorial and Analytic Theory

by Alfred Geroldinger and Franz Halter-Koch
Chapman & Hall/CRC 2006, xxi + 700 pp.

The theory of non-unique factorizations has its origins in the theory of algebraic numbers. An integral domain is called factorial or a unique factorization domain if every non-zero non-unit has a unique factorization into prime elements. It was an important observation by the mathematicians of the nineteenth century that, in general, the ring of integers O_K of an algebraic number field K is not factorial (in contrast to the ring of rational integers). More precisely, it was proved that O_K is factorial if it is a principal ideal domain. Since then it is traditional in algebraic number theory to say that the ideal class group $O(O_K)$ measures the deviation of O_K from being factorial. Although not factorial, O_K has, like every noetherian domain, the property that every non-zero non-unit has a factorization into irreducible elements, but, in general, it has many distinct such factorizations. It is the main purpose of the theory of non-unique factorizations to describe and to classify the various phenomena of non-uniqueness of factorizations occurring in an integral domain R in terms of the algebraic invariants of R . In particular, for the ring O_K it turns out that the ideal class group is, indeed, the only invariant which is responsible for all these phenomena.

In this book the authors present the current state of the theory of non-unique factorizations together with a broad discussion of algebraic, combinatorial and analytic fundamentals. It begins with a basic introduction and moves on to the algebraic and arithmetic theory of monoids, the structure of the sets of lengths, additive group theory, arithmetical invariants, and the arithmetic of Krull monoids. Also included are a self-contained introduction to abstract number theory and W. Narkiewicz's analytic theory of non-unique factorizations. The only prerequisite is a knowledge of standard basic algebra. The book will be useful for advanced undergraduate courses in algebra.

Differential Forms on Singular Varieties, De Rham and Hodge Theory Simplified

by Vincenzo Ancona and Bernard Gaveau
Pure and Applied Mathematics 273,
Chapman & Hall/CRC 2006, xix + 312 pp.

The theory and applications of differential forms have been the central themes in algebraic and analytic geometry for the last two centuries. They began with Abel's definition and classification of integrals of differential forms of the type $R(x, y)dx + S(x, y)dy$, where R and S are rational functions and x and y are variables related by a polynomial in x, y . In modern terminology these Abelian integrals are meromorphic 1-forms on a projective curve. The properties and the explicit construction of these forms "attached" to a curve were studied extensively and classified as forms of the 1st, 2nd and 3rd species depending on the nature of the singularities. These gave rise to Abel-Jacobi theorem, Riemann-Roch theorem,

x, y theory of line bundles, etc. With the developments of exterior differential calculus by Goursat and E. Cartan, and of algebraic topology by H. Poincaré and S. Lefschetz, further research led to theorems on projective manifolds and De Rham theorems on compact manifolds, stating that the De Rham cohomology (the closed forms modulo the exact forms) is dual to the singular homology by integration of forms on cycles. It became possible to relate the topology of a compact manifold to its metric properties, roughly speaking, positive curvature implies a vanishing of cohomology. This was generalized to forms with coefficients in a vector bundle. In the 1930's and 40's applying the methods of harmonic forms to the case of compact complex Kählerian manifolds, W.V.D. Hodge proved that the cohomology of such a manifold can be decomposed in a direct sum of subspaces of harmonic forms of well-defined types. Hodge's theorem led to many other interesting results by Dolbeault, Kodaira, Chern et al. Later the introduction of sheaves by Jean Leray (who invented them while a prisoner of war in Austria) allowed a rapid development of differential geometric notions in analytic spaces with singularities. Far reaching generalizations of the theory of differential forms were achieved by Alexander Grothendieck, Pierre Deligne and others.

The authors of the present book have made many original contributions to the subject. In this book they give a complete treatment of the Deligne theory of mixed Hodge structures on the cohomology of singular spaces. The claim to a simplified presentation is based on recursive arguments on dimension; the authors do not need the introduction of spaces of higher dimensions and discussion of cohomological descent theory. The treatment is self-contained and brings together information that allows readers to follow and understand this difficult but important subject without jumping from one reference to another.

Real Infinite Series

by Daniel D. Bonar and Michael J. Khoury
Classroom Resource Materials, MAA 2006, xii + 264 pp.

This is an introductory treatment of infinite series of real numbers. An up-to-date presentation is given, from basic definitions to advanced results, making the subject accessible, interesting and useful to students, teachers and researchers.

One chapter offers 107 gems (concise, crisp, surprising results) on infinite series.

Recognizing the interest in problem solving that abounds with students, a chapter is devoted to problems on infinite series, with solutions, that have appeared on the annual William Lowell Putnam mathematical competitions.

The lighter side of infinite series is treated in the concluding chapter where three puzzles, eighteen visuals (look-see diagrams in the terminology of Martin Gardner) and several fallacious proofs are provided. Three appendices deal with (i) a listing of true or false statements, (ii) answers to why the harmonic series is so named and (iii) a list of published works concerning infinite series.

A. D. Alexandrov: Selected Works, Part II Intrinsic Geometry of Convex Surfaces

*Edited by S. S. Kutateladze and translated from Russian
by S. Vakhrameyev
Chapman & Hall/CRC 2006, xiii + 426 pp.*

Intrinsic geometry investigates the properties of surfaces and of figures on it within the limits of the surface similar in the way plane geometry studies the plane without regard to the fact that it may be located in some space. A. D. Alexandrov (1912-1999) is considered by many to be the father of intrinsic geometry second only to Gauss in surface theory. The present book is a translation of his masterpiece, now made available in its entirety for the first time since its publication in Russian in 1948.

The treatise begins with an outline of the basic concepts, definitions and results relevant to the subject. It reviews the general theory, then presents the requisite general theorems on rectifiable curves and curves of minimum length. Proofs of some of the general properties of the intrinsic metric of convex surfaces are given. The study then splits into two almost independent lines: further exploration of the intrinsic geometry of convex surfaces and the proof of the existence of a surface with a given metric. The final chapter reviews the generalization of the entire theory to convex surfaces in Lobachevskii space and in the spherical space, concluding with an outline of the theory of nonconvex surfaces.

Smooth Homogeneous Structures in Operator Theory

*by Daniel Beltiță
Monographs and Surveys in Pure
and Applied Mathematics 137
Chapman & Hall/CRC 2006 xv + 302 pp.*

Geometric ideas and techniques play an important part in operator theory and the theory of operator algebras. Homogeneous spaces are sets transitively acted on by groups; they are just orbits of group actions. As such they show up in operator theory. Unitary orbits of operators, functionals, representations, etc are homogeneous spaces of the unitary groups under consideration. What is more interesting is that these unitary orbits are often smooth manifolds and carry differential geometric structures that encode a lot of operator theoretic information.

In this book the author first provides an elementary introduction to the theory of infinite dimensional Lie groups. Then he describes the differential geometric setting that is related to a number of problems in operator theory. In the final sections the notion of an equivariant monotone operator is introduced and certain symmetry properties of abstract reproducing kernels are studied. Pre-requisites are moderate familiarity with functional analysis and topology. Open questions and an extensive bibliography highlight interesting new research opportunities.

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The theme this month is assessment. We begin with a report from Maureen Tingley at the University of New Brunswick in Fredericton that discusses a new common Grade 12 examination based on the course at that level. This was established in the wake of the abolition of the grade 11 provincial examination. While its use is voluntary (at least for now), much of its promise resides in the collaboration of teachers at the secondary and tertiary levels. Then we turn to a couple of publications of the Mathematical Association of America on our topic.

THE NB ADVANCED MATHEMATICS 120 COMMON EXAMINATION PROJECT

Maureen Tingley, UNBF

www.math.unb.ca/~maureen/NBMath120Exam

Background

Discussions about a common Math 120 exam began two years ago, when the Province cancelled its annual common examination on grade 11 mathematics, the “Grade 11 PE”. The long-term objective is to have a grade 12 level exam (based on the NB course Advanced Math 120) that would again be province-wide, but developed in cooperation by faculty at UNB and teachers in New Brunswick high schools.

Most students taking Advanced Math 120 are planning to register in a program of post-secondary study requiring that course. Students, teachers and post-secondary institutions in NB will all benefit if the same curriculum is followed at all schools, and if students have an opportunity to see how they are doing relative to their peers. There is an added incentive for prospective university students to participate in the common assessment: students who do well (70% or higher) are exempted from writing the Mathematics Placement Tests at UNB (both campuses), Mount Allison University and Saint Mary’s University.

The Department of Mathematics and Statistics at UNBF has a long record of looking for ways to communicate with high school mathematics teachers. These communications benefit both parties, and their students. For example, high school teachers can tell university teachers whether our expectations are realistic; university professors can tell high school teachers which material is fundamental, and which is not so essential. Valuable opportunities were lost when the Grade 11 PE was cancelled, but workshops to prepare the common exam have reopened channels of communication.

The goals of the project are simple: to provide a forum where teachers can participate in preparation of an examination (and grading scheme) which they consider appropriate to use - in their own schools - as the final examination in Advanced Math 120; to provide feedback to students, in June, about their readiness for post-secondary mathematics; to provide feedback to teachers.

The Assistant Deputy Minister and other senior officials have encouraged the project and the ministry is providing partial financial support. On their advice, the project has started on a voluntary basis for interested schools. The first pilot phase

of the project, in 2005, involved only a few schools and a few dozen students. This was successful and in 2006 the numbers of schools and students greatly expanded. Discussions for 2007 are now beginning and it is hoped that still more schools and students will participate.

The 2006 exam

A workshop to prepare the 2006 exam and grading scheme was held on February 23-24 at UNBF. Sixteen teachers attended, from 6 school districts. At the end of the workshop, there were three draft papers, each with criticisms written in by workshop participants. The final exam paper was assembled from these three versions, and worked carefully by UNB faculty and by teachers at the two Fredericton high schools. Several small editorial changes were made, and three alternative versions were prepared, since larger schools would have students writing the exam on different days. (These changes were minor, and papers were printed on different coloured paper.) A practice exam, with solutions, was posted on the web site.

All participating teachers were shown copies of the final paper, either at their school, at UNBF, at the Euclid marking session on April 28, or at the Subject Council meeting in Moncton on May 5. The exam was written in participating schools during the period Friday June 9-Friday June 16. Exam questions and solutions were posted on the web site on Monday, June 19.

Our records show that 579 exam papers were distributed to 15 schools in 6 school districts. We know that the exam was written by 508 students in 13 schools in 6 districts. A total of 160 cover sheets were returned, for students who qualified for and requested exemption from, the Mathematics Placement Test at UNB, Mount Allison or Saint Mary’s. One teacher reported that a further 3 students qualified for exemption, but do not plan to attend one of the three listed universities, so their cover sheets were not returned. Another teacher reported “several” such students. Of the 160 cover sheets received (all students who earned 42/60 or higher), 40 earned 90% or higher, including 3 perfect marks. See the graphical tallies below.

The complete list of teacher comments appears on the web site, along with one response from UNB. The most serious issue raised by teachers’ comments was that we need to supply more alternative solutions to problems - with appropriate grading schemes.

Discussion

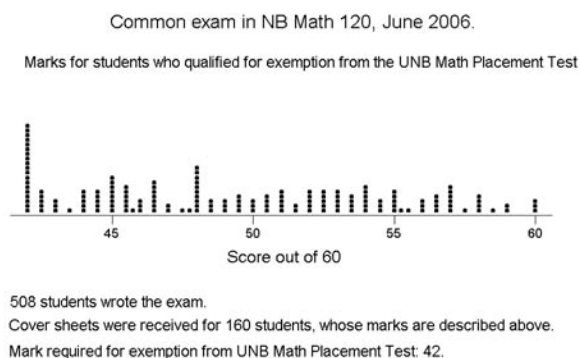
UNB discussed, in earlier presentations to the NB Department of Education and to School District Superintendents, the roles of the UNB Mathematics Placement Test (September) and the common exam in Advanced Mathematics 120 (June). The role of the Placement Test is to identify students who have very little chance of passing university level calculus. Such students are required to take either a slower paced calculus course or - for extremely weak performance - a preparatory course that reviews high school mathematics. (Since no test is perfect, students are permitted two attempts at the Placement Test.) One role of the common exam in Advanced Mathematics 120 is to identify students who are

well-prepared for MATH1003, and who should be spared the tedium of writing the Placement Test.

Clearly, a large group of students fall between these two extremes: they can pass the Placement Test but their mark on the common Math 120 exam is below 70%. The majority of these students will find university mathematics difficult, and we hope that they will spend some time in the summer reviewing high school mathematics. To this end, UNB has made several resources available through www.math.unb.ca/ready/ (linked to the above site). UNB also operates a Math Help Centre throughout the year, to help students who are experiencing difficulties.

Records indicate that an exemption rate of approximately one in three should identify students who have an excellent prospect of passing two terms of university mathematics. So, given the exemption rate (163+/508) and the positive teacher feedback, we are very pleased with the results of the 2006 common exam in Advanced Math 120.

This project received financial support from the NB Department of Education, six NB school districts, most especially School District 18, AARMS (Atlantic Association for Research in the Mathematical Sciences) and the University of New Brunswick.



Assessment at the Tertiary Level

I have in hand two volumes from the Mathematical Association of America on assessment of students in university. They can be ordered from the Association by phone (1-800-331-1622) or electronically (www.maa.org).

Supporting assessment in undergraduate mathematics, Lynn A. Steen (editor)

MAA, 2006: vii + 239 pages

ISBN: 0-88385-820-7

Catalogue Code: SAUM US\$49.50 (Members \$39.50)

In 2001, the MAA garnered a grant of a half million dollars from NSF to support a three-year project, *Supporting assessment in undergraduate mathematics*, designed to encourage and support the designing and implementing of effective assessment

of student learning in undergraduate programs. In an opening essay, Bernard Madison describes the “tensions and tethers” attendant on creating alternatives to the traditional way of going about things. Lynn Steen then focuses on the questions that should inform changes that are implemented. An interesting essay is from Peter Ewing, a nonmathematician from the National Center for Higher Education Management Systems, who was the evaluator of the project and provided an outsider’s perspective.

The bulk of the volume contains 30 case histories under the headings Developmental, Quantitative Literacy, and Precalculus Programs; Mathematics-Intensive Programs; Mathematics Programs to Prepare Future Teachers; and Undergraduate Major in Mathematics.

An earlier publication looks at the particular issue of assessing calculus students:

Student assessment in Calculus

A report of the NSF Working Group on Assessment in Calculus

MAA, 1997: xi + 124 pages

ISBN: 0-88385-152-0

This report arises out of a 1992 Workshop on Assessment in Calculus Reform Efforts and a meeting that looked at calculus courses in general in the following year. Its goal is to describe the current state of affairs and indicate directions of activities that will allow a deeper understanding of the state of student learning. It is directed to calculus instructors, educational scholars with an interest in assessment and those who do research in mathematical thinking and learning. Any regime of assessment should be based on a deliberately articulated framework that takes into account (A) the overarching philosophical and pedagogical goals of the program; (B) the content on which the instruction focuses; (C) the kinds of thinking processes students are expected to learn to use and to demonstrate; (D) the kinds of products students are expected to produce to demonstrate competency; (E) the kinds of situations students are expected to deal with; (F) issues of diversity and access; (G) the circumstances under which students produce the work by which they are assessed; (H) other issues such as the intellectual integrity of the tasks, retention rates and performance in other courses. Three chapters deal in turn with what is known about assessment in general, assessment issues faced by calculus projects and a research and development agenda. An important observation that the mode of assessment is the key to what one really values in a course, so it is important to articulate one’s goals and align one’s assessment with these. The remainder of the volume provides a critique of seven different assessment tasks: a computational item; a report recommending a solution to a chase-and-capture problem for a space probe; several laboratory tasks; a sequence of examples on convergence of a sequence or series of functions; a one-sitting final examination; a 2-day take-home examination.

There were some concerns that I did not see specifically addressed in these volumes. It has now become so customary as to be taken for granted that the final grade of a student is

made up of many components and so accumulates during the entire run of a course, so that the credit for performance on a final examination is reduced. It seems to me that one benefit of a final examination is that it forces a student to look over an entire course and, in this way, get a sense of how its parts fall together and gain a perspective of it as a whole. This “packing down” of a body of facts, theorems and techniques into a few key components can be beneficial, and might not occur without some kind of goad. To be sure, one might be able to achieve the same effect with a large capstone project. However, an assessment regime should include some occasion for a student to go through this summative process.

A final mark should be more than the sum of its individual components. I prefer to think of the tasks assigned to a student during the year as a gathering of evidence about that person’s learning that is subject to tuning as the year progresses. After all, students learn at different rates and in different ways, and, in particular, a student who comes late to a mastery of the material should not be penalized by a poor performance earlier in the year. While one can understand the increasing number of constraints on the assigning of marks as a response to high-handed or careless behaviour of some lecturers of the past, they may in the long run inhibit rather than promote justice in the evaluation of students.

A second issue that affects the effectiveness of evaluation is that of grade inflation. Students are under great pressure to get high grades to retain scholarships or qualify for employment or admission to programs, and this pressure is in turn transmitted to their lecturers, sometimes through the administration. This runs the risk of wiping out a lot of the discriminatory power of grades and their ability to give reliable advice to students as they proceed through their education. There is, after all,

not much point to giving grades if one loses the ability to distinguish those students best capable of capitalizing on opportunities or of encouraging students into directions where they are most likely to succeed.

Models that work

Models that work: Case studies in effective undergraduate mathematics programs is the 38th volume in the MAA Notes series, published in 1995 by the Mathematical Association of America (ISBN 0-88385-09606). The decreasing number of undergraduate mathematics specialists has led many departments to review their programs and environment for undergraduate students. This volume, edited by Alan C. Tucker, discusses how to retain and attract college students in mathematics, as well as how to reach high school students. This is not an abstract discussion; it is informed by experiences in the field. Indeed, the volume contains reports of site visits to ten U.S. colleges and universities that have been successful.

The University of Chicago, in particular, is singled out as being particularly successful in preparing students for advanced study. Many of the universities and colleges with such success provide some kind of research opportunity for their senior students; all are blessed with effective teachers and encourage students to participate in the intellectual life of the department. Miami University in Oxford, OH and the University of New Hampshire are cited for the effectiveness of their teacher preparation programs; the need for excellent working relations between the mathematics department and the education faculty is underlined.

It would be nice to have reports on Canadian examples in these *Notes*.

MITACS - CALL FOR PROPOSALS

The MITACS Network of Centres of Excellence hereby solicits proposals for scientific networking events (workshops, conferences, summer schools, short courses etc) that involve applications of the mathematical sciences to areas having a significant industrial, economic or social impact on Canada.

MITACS is particularly interested in entertaining proposals that have at least one of the following features:

- they directly relate to a MITACS theme area (see www.mitacs.ca);
- there is a strong training component for senior undergraduate or graduate students, post-doctoral fellows, or young researchers (examples include summer schools and short courses); and
- there is a strong potential to engage participants from non-academic (private or public sector) research or other partner organizations.

Joint funding applications with other organizations are welcome, although the proposal must indicate clearly all confirmed or potential sponsors as well as levels of financial support.

DEADLINES.

MITACS accepts networking proposals three times annually, on February 1, June 1, and October 1 of each year. Proposers are *strongly* encouraged to discuss their ideas with the MITACS Associate Scientific Director (asd@mitacs.ca) as early as possible, preferably at least three weeks prior to submitting a proposal. MITACS may also consider

proposals submitted outside these deadlines, as funding permits.

PROPOSAL SUBMISSIONS.

Proposals should be submitted by e-mail to events@mitacs.ca in plain text, MS Word, or PDF format. You should receive a confirmation that your proposal was received within one week of submission.

EVALUATION PROCEDURE.

All proposals are initially reviewed by the MITACS Head Office to ensure that they satisfy submission format guidelines (below) and lie within the MITACS mandate. You may be contacted at this point for further information or clarification.

Proposals which meet the guidelines are forwarded to the MITACS Research Management Committee (RMC) for scientific review. The RMC will normally take about one month’s time from the deadline date to review proposals, after which their decision will be communicated.

PROPOSAL FORMAT.

All of sections 1-11 below are required, and incomplete proposals will be returned.

1. Title of event.
2. Proposed dates and location.
3. Type of activity (conference, workshop, summer school, etc).
4. Organizing Committee (names, affiliations, complete contact

information). Identify the primary contact.

5. Executive summary of scientific and other objectives in lay terms (max. 100 words) which may appear in public announcements.
6. Other details of the scientific objectives, including:
 - * intended audience,
 - * history or background of the proposed topic,
 - * recent progress, and
 - * possible future directions.
7. Explain the relevance to MITACS.
8. Participants (tentative list of invited speakers and participants, including affiliations).
9. Budget (itemize each main meeting expense, and clearly identify the funding required from MITACS).
10. Other sources of financial support, including the amount requested or committed.
11. Organizational services being requested of MITACS (see below).

ORGANIZATIONAL SERVICES.

MITACS has some capacity to assist proposers with the organization of their event. These services include, but are not limited to:

- assistance with budgeting;
- negotiating with conference venues to secure meeting rooms and/or accommodations;
- registration (including credit card services);
- design, advertising and promotion;
- business development for the purposes of attracting non-academic speakers or other participants; and
- fund-raising and sponsorship.

If any such services are being requested of MITACS, then this should be clearly indicated in the proposal under item 11.

MITACS - APPEL DE PROPOSITIONS

Le Réseau de centres d'excellence MITACS sollicite par la présente des propositions d'événements de réseautage scientifique (ateliers, conférences, écoles d'été, mini-cours, etc.) favorisant l'application des sciences mathématiques dans des domaines ayant une grande incidence industrielle, économique ou sociale au Canada.

MITACS s'intéresse particulièrement aux propositions ayant au moins une des caractéristiques suivantes :

- elles se rapportent directement à l'un des thèmes de MITACS (voir <http://www.mitacs.ca>);
- elles incorporent une solide composante de formation à destination des étudiants en dernière année de premier cycle ou des étudiants des cycles supérieurs, aux boursiers postdoctoraux ou aux jeunes chercheurs (par exemple, les écoles d'été et les mini-cours);
- elles risquent fortement d'attirer des participants provenant d'organismes de recherche non universitaires (du secteur privé ou du secteur public) ou d'autres organismes partenaires.

Les demandes de financement faites conjointement avec d'autres organismes sont les bienvenues à condition que la proposition indique clairement tous les commanditaires confirmés ou éventuels ainsi que les niveaux de soutien financier.

DATES LIMITES

MITACS accepte les propositions de réseautage trois fois par an avec les dates limites suivantes : 1er février, 1er juin et 1er octobre. Les auteurs de proposition sont vivement encouragés à discuter le plus tôt possible de leurs idées avec le Directeur scientifique associé de MITACS à l'adresse asd@mitacs.ca, de préférence au moins trois semaines avant de soumettre une proposition. Il se peut que MITACS puisse examiner des propositions déposées après ces dates limites, selon la disponibilité de fonds.

SOUMISSIONS DE PROPOSITION

Les propositions doivent être envoyées par courriel à l'adresse events@mitacs.ca en format texte en clair, MS Word ou PDF. Vous devriez recevoir confirmation de la réception de votre proposition dans les sept jours.

PROCÉDURE D'ÉVALUATION

Toutes les propositions reçues sont initialement examinées par le siège de MITACS afin de s'assurer qu'elles sont conformes aux lignes directrices relatives au format des soumissions (ci-dessous) et entretiennent un rapport avec le mandat de MITACS. Il est possible que l'on communique alors avec vous afin d'obtenir des renseignements supplémentaires ou des clarifications.

Les propositions qui respectent ces lignes directrices sont transmises au Comité de gestion de la recherche (CGR) de MITACS à des fins d'évaluation scientifique. Le CGR complète normalement ces évaluations dans les trente jours suivant la date limite de dépôt des propositions après quoi il communique sa décision.

FORMAT DES PROPOSITIONS

Toutes les sections 1-11 ci-dessous doivent être abordées; les propositions incomplètes seront retournées.

1. Nom de l'événement.
2. Dates et endroit proposés.
3. Type d'activité (conférence, atelier, école d'été, etc.).
4. Comité organisateur (noms, affiliations, coordonnées complètes). Prière d'identifier la principale personne-ressource.
5. Résumé, en langage de profane, des objectifs scientifiques et autres (max. de 100 mots) qui pourrait figurer dans des annonces publiques.
6. Autres détails relatifs aux objectifs scientifiques, notamment
 - * le public cible,
 - * un historique ou de l'information générale sur le sujet proposé,

- * les récentes avancées
- * les orientations futures possibles.

7. Justification de la pertinence pour MITACS.
8. Participants (liste provisoire des conférenciers et participants invités, y compris leur affiliation).
9. Budget (ventiler chaque grande dépense de l'événement et dégager clairement le financement demandé auprès de MITACS).
10. Autres sources de soutien financier, y compris le montant demandé et/ou engagé.
11. Services organisationnels que vous souhaitez obtenir de MITACS (voir ci-dessous).

SERVICES ORGANISATIONNELS

MITACS a certaines capacités qu'il peut mettre au service des auteurs de propositions pour l'organisation de leur événement. Les services incluent, entre autres, les suivants :

- assistance en matière de budgétisation.
- négociation avec les établissements d'accueil des conférences en vue d'obtenir des salles de réunion et/ou des services d'hébergement.
- inscription (y compris les services liés aux cartes de crédit).
- conception graphique, publicité et promotion.
- relations avec les entreprises dans le but d'attirer des conférenciers et d'autres participants des milieux non universitaires.
- levées de fonds et parrainage.

Si vous comptez utiliser un ou plusieurs des services offerts par

MITACS, vous devez l'indiquer clairement dans votre proposition (à l'article 11).

The three 2006 Fields medalists that were announced at the opening ceremony of the 2006 International Congress of mathematicians (ICM) (August 22 -30 2006) are all related to CRM's thematic programmes.

Terence Tao, 31, the youngest Fields medalist, was one of three 2006 Aisenstadt Chairholders at CRM during its programme on *Analysis in number theory* held last year, and organized by Andrew Granville (Montreal), Henri Darmon (McGill) and Chantal David (Concordia). The two other CRM Aisenstadt Chairholders were K. Soundararajan, and M. Bhargava who gave a plenary lecture in Madrid.

The two other Fields medalists are Andrei Okounkov (Princeton) and Wendelin Werner (Paris-Sud) who were both contacted by CRM's

scientific committee for our 2008-2009 programme entitled *Probabilistic methods in mathematical physics* now at an advanced stage of preparation. The CRM's scientific committee for this 2008-2009 programme has been set up by the CRM director and includes a large number of scientists across the world, under the direction of Pavel Bleher (IUPUI), John Harnad (Concordia & CRM) and Steve Zelditch (Johns Hopkins). CRM has asked PIMS to collaborate on the probabilistic aspects of this thematic programme with David Brydges (UBC), Gordon Slade (UBC) and Yvan Saint-Aubin (Montreal) as main organizers.

Furthermore, three of the four Canadian speakers at the ICM are also directly related to the CRM: Vinayak Vatsal (UBC) was awarded the CRM Aisenstadt Prize in 2004, Henri Darmon

(McGill) is a regular member of the CRM working at the CRM for the past five years, and Francois Lalonde is CRM director.

The Centre de recherches mathématiques (CRM) of the Université de Montréal was founded in 1969. Currently under the direction of François Lalonde, the Centre's mandate is to serve as a national centre for fundamental research in mathematics and their applications. The CRM's scientific personnel includes more than one hundred members and 20 postdoctoral fellows. Furthermore, the CRM hosts from year to year 1500 guest researchers.

Contact information:

Centre de recherches mathématique
514-343-7501

www.crm.umontreal.ca

Les récipiendaires de la médaille Fields 2006 tous

reliés aux programmes du Centre de recherches mathématiques (CRM) François Lalonde, directeur CRM

Les trois récipiendaires des médailles Fields 2006 remises à la cérémonie d'ouverture du Congrès International des mathématiciens - ICM2006 (22 - 30 août 2006) sont étroitement reliés aux programmes thématiques du CRM.

Terence Tao, 31 ans, le plus jeune médaillé Fields, est un des trois titulaires de la Chaire Aisenstadt 2006 du CRM ayant participé au programme thématique *Analyse en théorie des nombres* tenu l'an dernier et organisé par Andrew Granville (Montréal), Henri Darmon (McGill) et Chantal David (Concordia). Les autres titulaires de la Chaire Aisenstadt ont été K. Soundararajan, et M. Bhargava qui ont donné une conférence plénière à Madrid.

Les deux autres médaillés Fields sont Andrei Okounkov (Princeton) et Wendelin Werner (Paris-Sud) avec qui le comité scientifique du CRM a pris contact pour notre programme

thématique 2008-2009 intitulé *Les méthodes probabilistes en physique mathématique* présentement à un stade de préparation avancé. Le comité scientifique du CRM pour le programme de l'année 2008-2009 a été mis sur pied par le directeur du CRM et comprend un grand nombre de scientifiques du monde entier, sous la direction de Pavel Bleher (IUPUI), John Harnad (Concordia & CRM) et Steve Zelditch (Johns Hopkins). Le CRM a demandé au PIMS de collaborer aux aspects probabilistes du programme thématique avec David Brydges (UBC), Gordon Slade (UBC) et Yvan Saint-Aubin (Montréal) comme principaux organisateurs.

De plus, trois des quatre conférenciers canadiens au ICM sont directement reliés au CRM soit, Vinayak Vatsal (UBC) récipiendaire du Prix André-Aisenstadt en 2004, Henri Darmon (McGill) un membre régulier du CRM qui y travaille depuis cinq ans, et

Francois Lalonde (Montréal), directeur du CRM.

Le Centre de recherches mathématiques (CRM) de l'Université de Montréal a vu le jour en 1969. Présentement dirigé par le professeur François Lalonde, il a pour objectif de servir de centre national pour la recherche fondamentale en mathématiques et leurs applications. Le personnel scientifique du CRM regroupe plus d'une centaine de membres réguliers et une vingtaine de boursiers postdoctoraux. De plus, le CRM accueille d'année en année environ 1500 de chercheurs invités.

Source:

Centre de recherches mathématique
514-343-7501

www.crm.umontreal.ca

CALL FOR NOMINATIONS - 2007 DOCTORAL PRIZE APPEL DE MISES EN CANDIDATURE - PRIX DE DOCTORAT 2007

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 2007**.

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.

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, 2007**.

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.

Président du Comité de sélection du Prix de doctorat
Chair, Doctoral Prize Selection Committee
Société mathématique du Canada / Canadian Mathematical Society
577 King Edward
Ottawa, Ontario Canada K1N 6N5

OBITUARY: ROBERT BARRINGTON LEIGH 1986-2006

by Andy Liu



Robert Barrington-Leigh

Robert was born on March 19, 1986 in Edmonton. He attended in succession Westbrook Elementary School, Vernon Barford Junior High School, Old Scona Academic High

School and the University of Toronto, and was about to enter the final year of his undergraduate studies when he passed away on August 13, 2006.

I first knew Robert when he was about ten years old. His father brought him to my attention, and wanted to enroll him in my Mathematics Club which was intended for junior high school students. The program for that year was already winding down. So we had a few preliminary meetings and Robert formally registered for the Club the following year when he was in Grade 6.

He struck up an instant friendship with Richard Travis Ng who was a year older and lived in St. Albert. Together they worked on a problem from a Hungarian mathematics competition, and found an elegant solution which required very little technical background. This led to their first joint publication, a paper titled *Zigzag* which appeared in the Australian journal *Mathematics Competitions*. This paper was later translated into Hungarian and republished under the title *Cikcakk* in the journal *Abacus*.

Two years later, the two teamed up again and wrote a paper titled *Minimizing Aroma Loss*, which was published in the *College Mathematics Journal* in the United States. This led to an ill-fated television appearance on Access Channel in Alberta, and a successful public lecture during the Home-coming Weekend at the University of Alberta.

An important activity in my Mathematics Club is the participation in the International Mathematics Tournament of the Towns, a prestigious competition organized by a group of mathematicians in Moscow. Robert had won a coveted Diploma every year from Grade 6 to Grade 12.

Robert was equally successful in other competitions. He won the Edmonton Junior High Mathematics Contest in both Grade 7 and Grade 9, the first round of the Alberta High School Mathematics Competition in Grade 12 and the second round in both Grade 11 and Grade 12. He placed third in the Canadian Mathematical Olympiad in Grade 12.

He was on the Canadian Team for the International Mathematical Olympiad in Glasgow, 2002 and Tokyo, 2003, earning a Bronze Medal on each occasion. In 2003, he also made the Canadian Team for the International Physics Olympiad in Taipei, earning a Silver Medal.

At the University of Toronto, he distinguished himself by placing in the top ten in the William Lowell Putnam Mathematics Competition in each of his first two years, and in the top fifteen in his third.

Through competitions, Robert became very close to Alex Fink of Calgary. David Rhee, now at the University of Waterloo, and Jerry Lo, a Taiwanese student now finishing his high school in Edmonton, had both attended Vernon Barford Junior High School, and looked to Robert as a role model. In 2003, Robert stayed with Jerry in Taipei before the Physics competition.

Robert was the joint author with me and three other colleagues of a paper submitted for publication, and the joint author with me of a book as yet unfinished. It is now my painful task to complete it alone.

Robert was a soft spoken and mild mannered young man. Everyone who met him for the first time was always struck by his sweet smile and bashful politeness. While this might be a persona he was cultivating, the warmth underneath was genuine. Robert was kind hearted, and he always put other people's concerns before his own.

Robert might have looked frail, but he had good athletic abilities. He had a passion for nature. He was also quite learned in music and art. Robert was a well-rounded person, not just a one-dimensional math-whiz.

In Robert's passing, the human race has tragically lost a very nice and extremely intelligent young person. There was no doubt, based on his accomplishments so far, that he would have been a prominent mathematician of his time.

DU BUREAU DU VICE-PRÉSIDENT M. Ram Murty (Queen's)

Les lauréats de la médaille Fields 2006 ont été annoncés au Congrès international des mathématiciens (CIM) qui s'est tenu à Madrid (Espagne) du 22 au 30 août 2006. Les nouveaux médaillés sont Andrei Okounkov (Princeton), Grigory Perelman (Steklov), Terence Tao (UCLA) et Wendelin Werner (Paris).

Andrei Okounkov a reçu la médaille pour ses travaux concernant « l'interaction entre la théorie des probabilités, la théorie de la représentation et la géométrie algébrique ». Né en 1969 à

Moscou, il a obtenu son doctorat de l'Université d'État de Moscou en 1995 sous la direction d'Alexander Kirillov. Sa preuve d'une conjecture de Baik, Deift et Johansson constitue le point culminant de son travail (voir J. Baik, P. Deift et K. Johansson, *On the distribution of the length of the longest increasing subsequence of random permutations*, J. AMS, **12** (4) (1999), 1119-1178). Brièvement, cette conjecture s'explique comme suit. Il est bien connu qu'il existe une correspondance bi-univoque

entre les représentations irréductibles du groupe symétrique à n éléments \mathfrak{S}_n et les partitions λ de l'entier n . Écrivons $\lambda = (\lambda_1, \lambda_2, \dots)$ avec $\lambda_1 \geq \lambda_2 \geq \dots$ et posons

$$x_i = n^{1/3} \left(\frac{\lambda_i}{2\sqrt{n}} - 1 \right), i = 1, 2, \dots$$

On définit la mesure de Plancherel sur l'ensemble de toutes les partitions de n par $\mu(\lambda) = (\dim \lambda)^2 / n!$ où $\dim \lambda$ est la dimension de la représentation

irréductible de G_n qui correspond à λ . D'autre part, considérons une matrice Hermitienne arbitraire $H=(h_{ij})$ de format $n \times n$ où $h_{ij}=h_{ji}$ et les parties réelles et imaginaires de h_{ij} sont des variables normales et indépendantes dont la moyenne est zéro et la variance est $1/2$. Comme les valeurs propres Λ_i de H sont toutes réelles, on peut les ordonner comme suit

$$\Lambda_1 \geq \Lambda_2 \geq \dots$$

Posons

$$y_i = n^{2/3} \left(\frac{\Lambda_i}{2\sqrt{n^{1/2}}} - 1 \right), i=1,2,\dots$$

Okounkov montre que la distribution limite (par rapport à la mesure de Plancherel sur l'ensemble des partitions de n) des x_i existe et qu'elle est égale à celle des y_i . Plus de détails se trouvent dans l'article de A. Okounkov, *Random matrices and random permutations*, Inter. Math. Res. Notices, **20** (2000), 1043-1095.

Grigori Perelman a résolu la conjecture de Poincaré, l'un des sept problèmes associés à un prix d'un million de dollars de l'Institut Clay. Né le 13 juin 1966 à Leningrad (aujourd'hui Saint-Petersbourg, en Russie), il a fait son doctorat à l'Université d'État de Leningrad à la fin des années 1980. Il a refusé la médaille Fields au dernier CIM.

La conjecture de Poincaré n'est pas difficile à expliquer. Elle prédit que si le groupe fondamental d'une variété compacte fermée V à 3 dimensions est trivial, alors V est homéomorphe à la sphère de dimension 3. Plusieurs articles ont été écrits sur les travaux de Perelman. Mentionnons particulièrement ceux de J. Milnor, *Towards the Poincaré conjecture and the classification of 3-manifolds*, Notices AMS, **50** (2003), n° 10, 1226-1233 (ainsi qu'un autre article connexe de M. Anderson, *Geometrization of 3-manifolds via the Ricci flow*, Notices AMS, **51** (2004), n° 2, 186-193) et de John Morgan, *Recent progress on the Poincaré conjecture and the classification of 3-manifolds*, Bull. AMS, (N.S.), **42** (2005), n° 1,

57-78. Henri Poincaré a formulé cette conjecture pour la première fois en 1904 et l'a généralisée par la suite.

La généralisation dit que chaque variété compacte de dimension n qui est homotopiquement équivalente à la sphère de dimension n est homéomorphe à cette sphère. Cette généralisation de la conjecture a été réglée par Smale en 1961. Smale a reçu la médaille Fields pour ce travail. En 1982, Freedman a reçu la médaille Fields pour sa résolution du cas $n = 4$. Le cas $n = 1$ est trivial et le cas $n = 2$ est classique; on l'étudie dans un premier cours sous-gradué en topologie algébrique. Le cas $n = 3$ était le plus difficile et le travail de Perelman représente le point culminant des efforts et constitue une percée majeure.

Terence Tao est né le 17 juillet 1975 à Adelaide (Australie). Il a fait son doctorat sous la direction d'Elias Stein à Princeton en 1996. L'une de ses plus importantes contributions s'est fait en collaboration avec B. Green, soit une démonstration que la suite des nombres premiers contient des progressions arithmétiques de longueurs arbitraires. La conjecture des nombres premiers jumeaux qui prédit l'existence d'un nombre infini des nombres premiers p tels que $p + 2$ est premier est bien connue. Cette conjecture peut être généralisée à un k -uplets $p, p + a_1, \dots, p + a_k$. On peut s'attendre à un nombre infini des tels k -uplets à moins qu'il existe une condition triviale de divisibilité qui empêche des tels k -uplets d'être premiers (par exemple, pour $k = 2$, $a_1 = 2$ and $a_2 = 4$ et $a_2 = 4$ n'est pas permis comme un de $p, p + 2, p + 4$ est divisible par trois). Des conjectures célèbres remontant à Hardy et à Littlewood prédisent avec précision le nombre de tels k -uplets. Toutes ces conjectures demeurent des problèmes ouverts en théorie analytique des nombres. Toutefois, si elles sont vraies, on peut déduire comme conséquence qu'il existe des progressions arithmétiques de longueurs arbitraires dans l'ensemble des nombres premiers. Cette conséquence constitue essentiellement le contenu du théorème de Green et de Tao.

Wendelin Werner est né en 1968 en

Allemagne. Il a obtenu son doctorat en 1993 sous la direction de Le Gall à l'Université Pierre et Marie Curie. Il a rédigé sa thèse sur le mouvement brownien planaire et son travail constitue une application des théories des probabilités et des transformations conformes à la physique statistique. Il semble être le premier médaillé dans le domaine de la théorie des probabilités. L'Institut Fields lui a décerné sa médaille pour sa contribution au développement de l'évolution stochastique de Loewner, à la géométrie du mouvement brownien planaire et la théorie conforme des corps.

Le principe fondamental dans le travail de Werner est la notion de dimension fractale, qui dépend, de son côté, de l'auto-similarité. Par exemple, un carré peut être partitionné en quatre carrés semblables, et le carré le plus grand est obtenu en magnifiant n'importe lequel des petits carrés par un facteur de 2. La 2-dimension du carré est 2 et peut être exprimée comme \log (nombre de pièces auto-similaires)/ \log (facteur de magnification).

Par exemple, le triangle de Sierprinski est obtenu en partitionnant un triangle équilatéral en 4 triangles semblables obtenus en joignant les points milieux des côtés opposés et enlevant ensuite le triangle du milieu. Ce processus est alors répété un nombre infini de fois. On peut facilement voir que la dimension de fractale du triangle de Sierprinski est $\log 3 / \log 2$. Les marches aléatoires et leurs analogues continues, les mouvements browniens, sont les exemples les plus simples des processus stochastiques dans la recherche de Werner.

En 1982, Mandelbrot a conjecturé que la dimension de fractale de la frontière externe d'un chemin brownien planaire est $4/3$. Dans une série d'articles, Lawler, Schramm et Werner ont confirmé cette conjecture en la reliant à la théorie de percolation, dont l'origine est l'étude des faisceaux connexes dans les graphes aléatoires, mais qui se trouve maintenant dans plusieurs nouvelles applications s'étendant de la biologie mathématique à l'étude des marchés financiers.

CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

NOVEMBRE 2006 NOVEMBRE

27-Dec.1 Workshop on Cryptography: Underlying Mathematics, Provability and Foundations (Fields Institute, Toronto) www.fields.utoronto.ca/programs/scientific/06-07/crypto/crypto_foundations/

1-5 CCA 2006 Third International Conference on Computability and Complexity in Analysis (University of Florida, Gainesville, FL) <http://ccanet.de/cca2006/>

DECEMBER 2006 DÉCEMBRE

9-11 **CMS Winter 2006 Meeting / Réunion d'hiver 2006 de la SMC Toronto, ON** www.cms.math.ca/events_meetings@cms.math.ca

4-8 Finding and Keeping Graduate Students in the Mathematical Sciences (AIM Research Conference Center, Palo Alto, CA) <http://aimath.org/ARCC/workshops/keepinggrads.html>

13-15 Workshop on "Geometry of vector distributions, differential equations, and variational problems" (International School for Advanced Studies (SISSA), Trieste, Italy) www.sissa.it/~zelenko/CEIHomepage.html

16-18 The 5th International Conference on Differential Equations and Dynamical Systems (University of Texas-Pan American, Edinburg, TX) xzliu@uwaterloo.ca, www.watam.org/deda06.html

JANUARY 2007 JANVIER

4-7 Joint Mathematics Meetings: AMS, MAA, AWM, etc. www.ams.math.org

10-11 International Symposium on Mathematical Programming for Decision Making: Theory and Applications (Indian Statistical Institute, Delhi Centre) <http://www.isid.ac.in/~ismpdm07/>

MARCH 2007 MARS

4-8 Twelfth International Conference on Approximation Theory (Menger Hotel, San Antonio, TX) www.math.vanderbilt.edu/~at07/at07.html

19-23 Representation of Surface Groups (AIM Research Conference Center, Palo Alto, CA) www.aimath.org/ARCC/workshops/surfacegroups.html

MAY 2007 MAY

18-20 The 2007 Midwest Geometry Conference (MGC 2007) (University of Iowa, Iowa City, IA) www.emis.de/journals/SIGMA/

20-24 The CAIMS Annual Meeting (Banff Conference Centre)

22-26 Extremal problems in complex and real analysis (Peoples Friendship University of Russia, Moscow, Russia) www.albany.edu/~pb6916/, stessin@math.albany.edu

30-Jun.2 **CMS-MITACS Joint Conference 2007, Host: University of Manitoba Delta Hotel, Winnipeg, Manitoba** www.cms.math.ca/events_meetings@cms.math.ca

JUNE 2007 JUIN

18-23 Combinatorics and Optimization 40th Anniversary Conference (University of Waterloo, Waterloo, ON) www.math.uwaterloo.ca/Cand_Dept/Conference/40thConference.shtml

24 - Jul.1 45th International Symposium on Functional Equations (Bielsko-Biala, Poland) romanger@us.edu.pl, knikodem@ath.bielsko.pl

JULY 2007 JUILLET

2-6 Design Theory of Alex Rosa, a meeting in celebration of Alex Rosa's 70th birthday (Bratislava, Slovakia) www.dumn.edu/~dfroncek/alex/index.htm

16-20 6th International Congress on Industrial and Applied Mathematics (Zurich, Switzerland) www.iciam07.ch

16-22 The 8th International Conference on Fixed Point Theory and its Applications (Ching Mai Univesity, Thailand) www.math.science.cmu.ac.th/ICFPTA2007/

31-Aug 3 First Joint International Meeting between the AMS and the Polish Mathematical Society (Warsaw, Poland) www.ams.org/amsmtgs/internmtgs.html

DECEMBER 2007 DÉCEMBRE

8-10 **CMS Winter 2007 Meeting Host: University of Western Ontario, Hilton Hotel, London, Ontario** www.cms.math.ca/events_meetings@cms.math.ca

12-15 First Joint International Meeting between the AMS and the New Zealand Mathematical Society (NZMS) (Wellington, New Zealand) www.ams.org/amsmtgs/internmtgs.html

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