

CMS

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FROM THE EXECUTIVE DIRECTOR'S DESK



Graham Wright
Annual Report 1999

In 1979, when I took over as the Society's Executive Director from Dr. John McNamee, it would have been very difficult to predict the role and scope of Society's activities some twenty years later. Also, I did not expect that, in July 1999, having finished twenty years as Executive Director I would be commencing another term. Fortunately, the duties of the Executive Director are made much more manageable because of the crucial support received from the officers, directors, committee members, editors, Executive Office staff, and others.

The Society offers a wide array of research and educational activities and it is beginning 2000 (the "next millennium" minus one year!) from a position of strength. The 1999 Annual Reports

from the various standing committees amply demonstrate the many ways in which the Society supports the Canadian mathematical community.

The Society's semi-annual meetings (Memorial - June 1999 and Montreal - December 1999) were extremely well attended and the meeting directors and organizers are to be congratulated on putting together an extensive programme of excellent sessions and activities and obtaining a tremendous level of support from the host university, the various research institutes as well as other sponsors.

In May, the 1999 Canadian Undergraduate Mathematics Conference (CUMC) took place just before the CMS Meeting and the first CMS Job Fair took place the day after the CMS Meeting in December. It is hoped that future CUMC conferences will take place just before or after the CMS summer meeting and that a CMS Job Fair will be held at either the winter or summer meeting. The on-going commitment from the three research institutes through the National Program Committee will help provide important financial support for each CMS semi-annual meeting, including support for graduate student travel.

As has been the case for several years, the Society's ability to fund the research and educational activities, in large part, is due to the revenue generated from our various publication activities, particularly the Canadian Journal

(see ANNUAL—page 13)

CMS NOTES
NOTES DE LA SMC

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EDITORIAL



S. Swaminathan

Readers may have noticed that we are restructuring the meeting announcements published in the *Notes* to eliminate repetition. Instead of the Preliminary announcements, a short advertisement will appear in the May issue for Winter meetings and the December issue for Summer meetings. The main announcement (called the First Announcement) will be published in the February issue for Summer meetings and the September issue for Winter meetings. This will include details about the plenary lectures, special sessions (including speakers), registration (with a registration form), accommodation information and a block schedule. Updated information will appear in the April issue for Summer meetings and the November issue for Winter meetings.

The issues of March and October will not contain any information about Summer or Winter meetings of the CMS. Thus, if readers want to obtain information, register, etc., regarding the MATH 2000 meeting of the CMS, they should refer to the February *Notes* (Vol.32 (1)). One may also refer to the website: www.cms.math.ca/Events/math2000 for complete information.

The *CMS Notes* has been made available on line since September 1998. The issues are posted on CAMEL, <http://camel.math.ca/CMS/Notes/> as soon as the final version is ready. Have

you looked into the *Notes* on line? If so, we would appreciate hearing from you.

We invite your reactions on the above.

Comme nos lecteurs l'auront sûrement remarqué, nous avons revu l'horaire de publication des annonces des Réunions dans *les Notes*, afin d'éliminer les répétitions. Au lieu des annonces préliminaires, nous publierons à l'avenir une brève annonce dans le numéro de mai pour les Réunions d'hiver, et dans le numéro de décembre, pour les Réunions d'été. L'annonce principale (appelée Première annonce) de la Réunion estivale paraîtra dans le numéro de février, et celle de la Réunion hivernale, dans le numéro de septembre. Cette annonce comprendra des renseignements sur les conférences principales, les séances spéciales (y compris les conférenciers), l'inscription (avec formulaire d'inscription) et l'hébergement, ainsi qu'une grille-horaire. Une mise à jour de ces renseignements paraîtra dans le numéro d'avril pour la Réunion d'été, et dans le numéro de novembre, pour la Réunion d'hiver.

Les numéros de mars et d'octobre ne contiendront donc aucune information sur les Réunions de la SMC. Ainsi, pour obtenir des renseignements ou pour vous inscrire à MATH 2000, consultez *es Notes* de février (vol.32 (1)) ou rendez-vous sur le Web au www.cms.math.ca/Events/math2000.

Les Notes de la SMC vous sont offertes en ligne depuis septembre 1998. Les numéros sont consultables sur CAMEL (<http://camel.math.ca/CMS/Notes/>) dès que la version finale est prête. Avez-vous déjà consulté *les Notes* sur le Web? Si oui, faites-nous le savoir.

Tous les commentaires à ce sujet seront les bienvenus!

1999 CMS DOCTORAL PRIZE LECTURE

On the Caccetta-Häggkvist conjecture and some related conjectures

Jian Shen, Queen's University

Abstract

In 1978, Caccetta and Häggkvist conjectured that the length of a shortest cycle in a digraph of order n with minimum outdegree r is at most $\lceil n/r \rceil$. The conjecture has been proved for r less than or equal to 5 by the work of various researchers. The general conjecture remains open.

After examining two trivial cases of the Caccetta-Häggkvist conjecture, we discuss a particularly interesting special case of the conjecture concerning the existence of a directed triangle in a digraph. Then we provide some recent results for the general conjecture. In particular, we show that, for each given r , the number of counterexamples to the conjecture, if any, is finite. Finally, we discuss some related conjectures.

1. Introduction

Let $G = (V, E)$ denote a digraph on n vertices. Loops are permitted but no multiple arcs. A *cycle* in a digraph is a directed cycle. If G has at least one cycle, the minimum length of a cycle in G is called the *girth* of G , denoted $g(G)$. For each vertex u , the *outdegree* $\deg^+(u)$ (resp. *indegree* $\deg^-(u)$) of u is the cardinality of the out-neighbourhood $\Gamma^+(u) = \{v : (u, v) \in E\}$ (resp. in-neighbourhood $\Gamma^-(u) = \{v : (v, u) \in E\}$) of u . Let $\delta^+(G)$ (resp. $\delta^-(G)$) denote the minimum outdegree (resp. indegree) of G . A digraph is called *r -regular* if $\deg^+(u) = \deg^-(u) = r$ for each vertex u in G . The following problem has received much attention in recent years.

Problem 1. Determine the minimum number, $f(r, g)$, of vertices in an r -regular digraph with girth g .

The function $f(r, g)$ has been studied by various authors. For example, Behzad, Chartrand and Wall (1970) showed $f(r, g) \leq r(g-1) + 1$ by the following construction: Let $G = \text{Cay}(\mathbf{Z}_{r(g-1)+1}, \{1, 2, \dots, r\})$ be the digraph whose $r(g-1) + 1$ vertices are labelled v_i , $1 \leq i \leq r(g-1) + 1$, such that $(v_i, v_j) \in E$ if and only if $j = i+1, i+2, \dots, i+r$, where addition is taken modulo $r(g-1) + 1$. Clearly this digraph is r -regular with girth g . They further conjectured that $f(r, g) = r(g-1) + 1$. This is equivalent to Conjecture 1 below, which is called the BCW conjecture. No general result on the BCW conjecture is known. Instead two stronger conjectures arose later.

Conjecture 1 (Behzad-Chartrand-Wall, 1970) Let G be an r -regular digraph of order n . Then $g \leq \lceil n/r \rceil$.

Conjecture 2 Let G be a digraph of order n with $\min\{\delta^+(G), \delta^-(G)\} \geq r$. Then $g \leq \lceil n/r \rceil$.

Conjecture 3 (Caccetta-Häggkvist, 1978) Let G be a digraph of order n with $\delta^+(G) \geq r$. Then $g \leq \lceil n/r \rceil$.

Conjecture 1 has been proved for $r = 2$ by Behzad (1973), for $r = 3$ by Bermond (1975) and for vertex-transitive digraphs by Hamidoune (1981). Conjecture 2 has been proved for $r \leq 4$ by Hamidoune (1982). Of the three conjectures,

the Caccetta-Häggkvist Conjecture 3 is the strongest. It has been proved for $r = 2$ by Caccetta and Häggkvist (1978), for $r = 3$ by Hamidoune (1987) and for $r = 4, 5$ by Hoáng and Reed (1987).

2. Two trivial cases of the Caccetta-Häggkvist conjecture

We first show that the Caccetta-Häggkvist conjecture holds when $\lceil n/r \rceil = 2$. To see this, we may suppose G contains no loops. Since $\delta^+(G) \geq r \geq n/2$, by using an averaging argument, there exists a vertex u with both outdegree and indegree at least $n/2$. Thus

$$|\Gamma^+(u) \cap \Gamma^-(u)| = |\Gamma^+(u)| + |\Gamma^-(u)| - |\Gamma^+(u) \cup \Gamma^-(u)| \geq$$

$$\frac{n}{2} + \frac{n}{2} - (n-1) = 1.$$

This implies that $g = 2$.

We now examine another trivial case of the Caccetta-Häggkvist conjecture. Using a lemma of Dirac below, Hamidoune (1981) showed that the conjecture holds when the strong connectivity κ of G is at least r .

Lemma 1 (Dirac, 1963) Suppose A and B are two vertex subsets in a digraph G . If $\kappa = r$, then there are r pairwise internally-vertex-disjoint directed paths from A to B .

To see that the conjecture is true when $\kappa \geq r$, we choose $A = B = \{u\}$. Then, by Lemma 1, there are r pairwise internally-vertex-disjoint cycles passing through the unique common vertex u . Since each cycle contains at least g vertices, these r cycles contain at least $r(g-1) + 1$ distinct vertices in total. Thus $n \geq r(g-1) + 1$; that is, $g \leq \lceil n/r \rceil$.

3. A special case of the Caccetta-Häggkvist conjecture

In this section, we suppose all digraphs are *oriented graphs*, that is, digraphs with no loops or digons. A cycle of length 3 in a graph (resp. digraph) is called a *triangle* (resp. *directed triangle*). Recall from the previous section that the Caccetta-Häggkvist conjecture is trivial if $\lceil n/r \rceil = 2$. However, it is quite surprising that the conjecture is still open even for $\lceil n/r \rceil = 3$.

Conjecture 4 (Special Case) *Any digraph on n vertices with $\delta^+(G) \geq n/3$ contains a directed triangle.*

Conjecture 4, if true, is a digraph version of some well-known results on the existence of triangles in graphs. For example, the Mantel-Turán theorem states that any graph with order n and more than $n^2/4$ edges contains a triangle. This theorem suggests the following problem for digraphs:

Problem 2. Find a “good” condition such that any digraph satisfying this condition contains a directed triangle.

A digraph with vertex set $V = \{1, 2, \dots, n\}$ is called a *transitive tournament* if $(i, j) \in E$ whenever $i < j$. A transitive tournament contains no directed triangles and has the maximum number of arcs a digraph of the same order can have. So a digraph with a condition relying only on $|E|$ may contain no directed triangles. Conjecture 4 tries to solve Problem 2 in the direction of considering the minimum outdegree of a digraph. As a comparison, we mention a similar result for graphs by Bondy (weak version): If the minimum degree of a graph G of order n is at least $n/2$, then G is either a complete bipartite graph with equal vertex partition size, $K_{n/2, n/2}$, or G contains a triangle.

Short of proving Conjecture 4, many people have considered the following problem in recent years.

Problem 3. Find a value c as small as possible such that every digraph on n vertices with $\delta^+(G) \geq cn$ contains a directed triangle.

Conjecture 4 predicts that $c = 1/3$. In 1978, Caccetta and Häggkvist showed that $c \leq (3 - \sqrt{5})/2 \approx 0.382$ by using an inductive argument. Bondy (1997) reduced the upper bound of c to $(2\sqrt{6} - 3)/5 \approx 0.379$ by using some counting arguments on 4-vertex induced subdigraphs. By combining Bondy’s idea with a technique of Brualdi and Li, we recently (1998) showed that $c \leq 3 - \sqrt{7} \approx 0.3542$. However, there is still a big gap between the best known value $3 - \sqrt{7}$ and the conjectured value $1/3$.

4. General case of the Caccetta-Häggkvist conjecture

Recall from Section 1 that the Caccetta-Häggkvist conjecture was proved for $r \leq 5$ by the contributions of various people.

One proof technique is to examine a minimum counterexample to the conjecture, assuming that it fails. Hoáng and Reed (1987) proved that a minimum counterexample would contain no more than $3r^2$ vertices. The next theorem shows that any counterexample to the conjecture must contain less than $2r^2 - 3r + 1$ vertices.

Theorem 1 (Shen, 1997) *Suppose G is a digraph with n vertices and $\delta^+(G) \geq r$. If $n \geq 2r^2 - 3r + 1$, then*

$$g \leq \lceil n/r \rceil.$$

As observed by many authors in the literature, a digraph with minimum outdegree $\delta^+(G) \geq r$ contains a spanning subdigraph in which each vertex is of outdegree exactly r . Thus in order to prove the Caccetta-Häggkvist conjecture, one may assume that each vertex in G has the same outdegree r . This assumption makes the structure of G simpler. However, it also makes it very difficult to use induction. The challenge in proving the conjecture is to find an appropriate induction hypothesis. Our strategy in proving Theorem 1 is as follows. In order to take advantage of induction, we do not assume that all vertices in G have the same outdegree. Instead we try to prove a more general statement which implies Theorem 1. We do this by relaxing the minimum outdegree condition $\delta^+(G) \geq r$. For digraphs G with $\delta^+(G) \geq 1$ (this condition is necessary, otherwise G may not even contain a cycle), define the following parameter.

$$t(G, r) = \sum_{u: \deg^+(u) < r} (r - \deg^+(u)).$$

We use this parameter to measure the outdegree information in G , and use induction on r to prove

$$n \geq r(g - 1) + 1 - t(G, r)$$

when an extra condition $g \geq 2r - 1$ holds. This statement is to say that, for any digraph with $\delta^+(G) \geq 1$,

$$g \leq \max \left\{ 2r - 2, \left\lceil \frac{n + t(G, r)}{r} \right\rceil \right\}.$$

Then Theorem 1 follows from the above stronger statement since if $\delta^+(G) \geq r$ and $n \geq 2r^2 - 3r + 1$, then $t(G, r) = 0$ and $\lceil n/r \rceil \geq 2r - 2$. Furthermore, we have the following nice consequence.

Corollary 1 *For each given r , the number of counterexamples to the Caccetta-Häggkvist Conjecture, if any, is finite.*

Since the Caccetta-Häggkvist conjecture is still open, it is worth mentioning the following result of Chvátal and Szemerédi (1983): If G is a digraph of order n with $\delta^+(G) \geq r$, then $g \leq n/r + 2500$. The additive constant was later reduced to 304 by Nishimura (1988). Recently, we reduced the additive constant further to 73.

Theorem 2 (Shen, 1997) *If G is a digraph of order n with $\delta^+(G) \geq r$, then*

$$g \leq n/r + 73.$$

The proof of Theorem 2 follows the basic ideas (but in a more careful way) of the argument of Chvátal and Szemerédi. Our major improvement results from the following refinement (Theorem 3) of another interesting result of Chvátal and Szemerédi (1983): If G is a digraph of order n with $\delta^+(G) \geq r$, then $g \leq 2n/(r + 1)$. This is roughly twice the conjectured bound.

Theorem 3 (Shen, 1997) *If G is a digraph of order n with $\delta^+(G) \geq r$, then*

$$g \leq 3 \left\lceil \left(\ln \frac{2 + \sqrt{7}}{3} \right) \frac{n}{r} \right\rceil \left(\approx 1.312 \frac{n}{r} \right).$$

5. Some related conjectures

Attempts to prove the Caccetta-Häggkvist conjecture have led to several stronger conjectures in recent years. Many people believe that the Caccetta-Häggkvist Conjecture cannot be proved without the proof of some more general result.

Recall from Section 2 that if the strong connectivity of G is κ , then, for each vertex u , there are κ cycles C_i passing through u such that $C_i \cap C_j = \{u\}$, $1 \leq i < j \leq \kappa$. It follows that $n \geq \kappa(g - 1) + 1$ and so the Caccetta-Häggkvist conjecture holds if $\kappa \geq r$. This leads to the following conjecture of Seymour which is stronger than the Caccetta-Häggkvist conjecture.

Conjecture 5 (Seymour, 1995) *Any digraph has a vertex u and $\deg^+(u)$ cycles C_i such that $C_i \cap C_j = \{u\}$, $1 \leq i < j \leq \deg^+(u)$.*

We note that the Seymour conjecture is also stronger than the following conjecture by Alon, McDiarmid and Molloy.

Conjecture 6 (Alon et. al. 1996) *Any r -regular digraph contains at least $\binom{r+1}{2}$ arc-disjoint cycles.*

It is known that any regular digraph has an arc-disjoint cycle decomposition. However, different decompositions may have different numbers of arc-disjoint cycles. One may wish to have a decomposition into as many arc-disjoint cycles as possible. This is the motivation of Conjecture 6. By using a probabilistic method, Alon et. al. (1996) showed that any r -regular digraph contains at least $c \cdot \binom{r+1}{2}$ arc-disjoint cycles for some positive value c independent of r .

Another interesting aspect of Conjecture 6 is that, for regular digraphs, it implies a much shorter proof of the result of Chvátal and Szemerédi (1983) mentioned in Section 4: If G is an r -regular digraph of order n , then $g \leq 2n/(r + 1)$. To see this, suppose Conjecture 6 holds. Then $|E| \geq g \cdot \binom{r+1}{2}$

since each of these $\binom{r+1}{2}$ arc-disjoint cycles contains at least g arcs. Since G is r -regular, we have $|E| = rn$. Thus

$$rn = |E| \geq g \cdot \binom{r+1}{2} = g \frac{r(r+1)}{2},$$

from which $g \leq 2n/(r + 1)$ follows.

Now we return to the Seymour Conjecture 5. In 1985, Thomassen used the following construction to disprove a conjecture of Hamidoune and another conjecture of Seymour. We notice that his construction also disproves Conjecture 5.

Lemma 2 (Thomassen, 1985) *For each natural number r , there exists a digraph H_r of minimum outdegree r such that, for any vertex u , H_r does not contain three cycles having precisely u in common pair by pair.*

In proving Lemma 2, H_1 can be any cycle. Suppose H_r ($r \geq 1$) exists. Thomassen formed a digraph H_{r+1} having H_r as an induced subdigraph as follows.

For each vertex v in H_r , create three new vertices v_1, v_2, v_3 and arcs $v \rightarrow v_1, v_1 \rightarrow v_2, v_2 \rightarrow v_3, v_3 \rightarrow v_1$ as well as arcs $v_i \rightarrow w$ for each $w \in \Gamma^+(v)$ and each $i = 1, 2, 3$. Then the minimum outdegree of H_{r+1} is $r + 1$. If H_{r+1} contained a vertex u and three cycles having precisely u in common pair by pair, then u would appear in H_r and so H_r would have contained three cycles having precisely u in common pair by pair. Thus Lemma 2 follows by using induction.

We conclude with the following conjecture, called Seymour's second neighbourhood conjecture. This conjecture implies the BCW Conjecture 1.

Conjecture 7 (Seymour, 1995) *Any oriented graph has a vertex u such that*

$$|\Gamma_2^+(u)| \geq |\Gamma^+(u)|,$$

where $\Gamma_2^+(u)$ is the second out-neighbourhood of u , that is, the set of vertices with distance exactly 2 from u .

This conjecture was proved for tournaments by Fisher (1996). Recently, Havet and Thomassé (1999) gave a shorter proof of Fisher's result.

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La Réunion d'hiver 1999 de la SMC et son premier Carrefour-emploi

Michel Delfour, Université de Montréal

Il me semble qu'il n'y a pas si longtemps Anthony Geramita (Queen's University) et moi, alors membres de l'Exécutif de la SMC, défendions avec conviction l'élargissement du programme et des activités des réunions de la SMC devant le Comité de la Recherche. Le sort voulut qu'il se vit confier la très réussie réunion d'hiver 1998 alors que j'héritais de celle de 1999. Comme lui et ses collègues, j'étais persuadé que l'on pourrait battre des records de participation en offrant aux participants un programme de qualité riche et varié et en impliquant un grand nombre de volontaires et d'organismes.

Pour offrir ce type de programme nous avons été à la limite des capacités du Centre de conférences de l'Hôtel du Parc et utilisé toutes les salles disponibles : huit symposia, une session et un forum sur l'enseignement, un séminaire des étudiants aux cycles supérieurs, un atelier sur TeX et la toile mondiale, et neuf conférences plénières dont le Prix Coxeter-James, la Conférence grand public, et le Prix de la meilleure thèse de doctorat. Il va sans dire que cela a été un sérieux défi pour la présidente du Comité d'organisation local, Véronique Hussin, et les membres du Département de Mathématiques et de Statistique qui ont participé de près ou de loin à l'organisation. J'aimerais aussi souligner le courage de Christiane Rousseau qui, à l'invitation de Richard Kane, a accepté d'organiser le premier Carrefour-emploi de la SMC en pleine période d'examen! Enfin un très gros merci au CRM et à son directeur, Jacques Hurtubise, qui ont invité tous les participants de notre Réunion d'hiver à leur magnifique réception qui clôturait les célébrations du trentième anniversaire du CRM.

La Réunion de Montréal a attiré 355 participants inscrits et le Carrefour-emploi 115. En ajustant ces chiffres pour tenir compte des 31 personnes qui ont assisté aux deux événements, nous sommes heureux de pouvoir dire que nous avons atteint le nombre record de 439 participants. Le défi lancé par Queen's en 1998 avec 395 inscrits a été relevé, mais nous

sommes conscients que ce nouveau record ne résistera probablement pas longtemps au grand enthousiasme et au nouveau talent d'entrepreneur des membres de la communauté mathématique canadienne.

Pour permettre une analyse plus précise de la Réunion d'hiver, Monique Bouchard a eu la gentillesse de nous donner quelques statistiques préliminaires qu'il serait peut-être intéressant de compiler et de publier pour chaque réunion.

distribution des inscriptions	
Canada	82%
USA	12%
autres	6%
membres de la SMC	41%
femmes	19%

Notre clientèle est donc très majoritairement canadienne, mais 59% de celle-ci n'est pas membre de la SMC. De ces chiffres 314 ont assisté au lunch des participants et 161 au banquet.

distribution des inscriptions canadiennes	
province	%
Québec	37%
Ontario	28%
autres	17%
total pour le Canada	82%

On constate que 65% des participants proviennent bien naturellement de la région immédiate de la réunion (Québec et Ontario). De même pour les 37% du Québec qui se divisent en 25% de Montréal et 12% d'autres régions.



Tous les récipiends du prix Adrien Pouliot

La réunion de Montréal a eu le bonheur de recevoir le soutien financier et parfois logistique d'un nombre record d'organisations. Nous avons d'abord été heureux d'avoir le parrainage de trois symposia par le Centre de recherches mathématiques, l'Institut Fields et le PImS. Nous avons ensuite été comblés de recevoir également le soutien des organisations montréalaises et québécoises ce qui a eu pour effet de doubler le budget provenant des instituts. Le Réseau pour le Calcul et la Modélisation Mathématique (RCM₂) et le Laboratoire de Combinatoire et d'Informatique Mathématique (LaCIM) (avec le CRM) ont chacun parrainé deux symposia. L'Institut des Sciences Mathématiques (ISM) a parrainé le Séminaire des étudiants aux cycles supérieurs et Alexandra Haedrich a accepté d'en coordonner l'organisation avec les étudiants et les professeurs impliqués. L'ISM a aussi parrainé l'organisation du Forum sur l'enseignement de l'algèbre linéaire et en a rendu l'accès gratuit à tous les professeurs du CEGEP et du secondaire. Enfin le Laboratoire universitaire Bell Canada a parrainé la Conférence grand public de Jennifer Chayes.

L'évènement a attiré les médias. En effet une nouvelle chaîne privée, le Canal Z, s'est installée dans l'hôtel pour préparer une série d'émissions dont la diffusion a commencé

au début de février 2000, c'est-à-dire il y a à peine une semaine. La série s'appelle *C'est mathématique!*. Ils ont fait passer des entrevues à Jean-Pierre Francoise, Robert Rousarie, Kevin Atteson, Philip Holmes et bien sûr Jennifer Chayes et son mari de Microsoft, mais aussi à des étudiants comme Paul Libbrecht (UQAM) l'un des organisateurs du Séminaire des étudiants aux cycles supérieurs.

Il y a bien évidemment des limites à la croissance de nos réunions, mais, si la tendance se maintient, il faudra sans doute voir plus grand et s'assurer de choisir des hôtels de plus grande capacité offrant des salles de bonne qualité avec un bon système de sonorisation et de visualisation. La qualité du programme est une condition nécessaire au succès de nos réunions, mais la qualité des installations devient un facteur important lorsque le nombre de participants devient grand. La tendance à des réunions plus vastes soulève évidemment beaucoup de questions et rend leur organisation plus compliquée. Il faudra peut-être se poser des questions fondamentales comme par exemple. Est-ce que, comme l'AMS, la SMC devrait confier toute l'organisation matérielle de ses réunions semi-annuelles à des professionnels plutôt qu'à une rotation de nouveaux volontaires? Est-il désirable de consacrer deux heures à des activités purement administratives comme la "Réunion annuelle de la SMC" pour approuver les rapports et les bilans? Est-ce que le niveau scientifique de nos réunions n'est pas trop influencé par les organismes et les individus périodiquement évalués par le CRSNG au détriment d'une clientèle plus large mais moins riche? Peut-on de façon réaliste et veut-on vraiment attirer cette dernière?

En terminant merci à tous ceux et celles qui ont participé à l'organisation, qui ont donné des conférences, ou qui sont tout simplement venus pour participer aux activités. Merci aussi à ceux et celle qui ont pris la parole au banquet et en particulier à Sabin Lessard, directeur du Département de Mathématiques et de Statistique, qui a fait preuve d'un humour que nous ne lui connaissions pas. C'est votre présence à tous qui finalement fait le succès d'une réunion de la SMC.

AWARDS / PRIX

Killam Research Fellowships

François Lalonde, UQAM, and Keith J. Worsley, McGill, are among twenty-four Canadian researchers who have been awarded a total of \$1.6 million in the 32nd annual competition for Killam Research Fellowships, administered by the Canada Council for the Arts.

Among Canada's most distinguished research awards, the Canada Council for the Arts Killam Research Fellowships are made possible by a bequest of Mrs. Dorothy J. Killam and a gift she made before her death in 1965. The awards support scholars engaged in research projects of outstanding merit in

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Killam Research Fellowships enable Canada's best scientists and scholars to devote up to two years to full-time research and writing. The recipients are chosen by the Killam Selection Committee, which comprises 15 eminent scientists and scholars representing a broad range of disciplines.

Lalonde's fellowship supports work entitled "Systèmes dynamiques et géométrie presque complexe en topologie symplectique," and Worsley's for "Statistics of brain mapping".

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EDUCATION NOTES

Ed Barbeau, Column Editor

PREPARATION OF TEACHERS

Simon Fraser University

The Math 190 course at Simon Fraaser University for elementary teachers was designed in the early 1980s by Harvey Gerber. Initially, there were two courses, Math 190 that covered topics from elementary number theory, fractions and percentages, and Math 191 that covered negative and irrational numbers and geometry. Since students were required to take only one such mathematics course before entering the Professional Development Program (PDP), the second one had a very small enrolment. So, Math 190 was redesigned and changed from a 3 to 4 credit course with topics from elementary number theory, fractions, percentage, negative numbers and geometry, and Math 191 disappeared. Until about a year ago, the textbook used was *Mathematics for elementary school teachers* by Harvey Gerber; this is now out of print.

While the prerequisite for the course is BC Grade 11 algebra, students have quite a variety of backgrounds, with some of them twenty years away from their high school mathematics. Many of the students are extremely uncomfortable with mathematics, if not terrified of it. Their mathematical background is usually weak, and they do not feel that they have any ability at all. Even though the mathematics is at a reasonably low level, the majority of the students find the course extremely difficult. This makes the course very challenging to teach, but also extremely rewarding. The students are usually highly motivated and are prepared to work hard; they need it to enter PDP and some of them realize that a stronger understanding of mathematics will help them to become better teachers.

Necessarily, the main function of the course is remedial in nature. A big part is addressing students' attitudes, both towards mathematics and towards themselves. A noncredit remedial course is available for those who need to improve their mathematical background, and so is a free Workshop on Overcoming Math Anxiety.

Typically, there are between 50 and 120 students, all in one section for two two-hour classes each week. Students receive additional support through the Basic Mathematics Workshop, a drop-in centre staffed with graduate students. Open every day for this and other courses, this Workshop is well patronized. Many comment that this is the first place where they had a positive experience with mathematics and people teaching mathematics. This may be partly because the teaching assistants are instructed not only to assist the students, but to be supportive and understanding.

In addition to homework consisting of "regular" textbook problems, most instructors of this course expect students to enrich their mathematical experience through projects. These were introduced many years ago by Kathy Heinrich and Malgorzata Dubiel to help students experience some of the excitement of mathematics. The students are provided with a list of topics and present their work either as a poster or as a journal. Unfortunately, diminishing resources means that no longer do students receive tutorials on *Geometer's SketchPad* and submit an electronic project.

As the course evolved towards the use of projects, the traditional approach taken by Gerber in introducing mathematical concepts seemed less appropriate, so a new text was sought. None seemed to reflect our approach to the course. The 1998 text was *Mathematics for Elementary School Teachers* by Billstein, Libesking and Lott, but it was not satisfactory. Currently, it is *Mathematics for Elementary School Teachers* by Musser, Burger and Petersen, which is passable. One problem is that it is written for a yearlong course, and the instructor is forced to select parts of chapters and even parts of sections. This confuses students who feel overwhelmed by the book and are not sure what they really need to know.

One possibility is to redesign the course in such a way as not to have to rely on a textbook. Failing an alternative, those involved in the course will have to create their own textbook. A first step towards this is already happening; a distance-education version of the course is under development with material designed by David Pimm, with the advice of Tom O'Shea and Malgorzata Dubiel.

Here are two examples of projects considered by the students:

- Consider a 5×5 grid. How many different squares can be drawn on the grid with the vertices on the grid? How many on a 6×6 grid? 7×7 grid? Can you generalize your findings to a $N \times N$ grid?
- On squared paper, draw a $n \times k$ rectangle. Investigate how many grid squares are crossed by the diagonal.

Malgorzata Dubiel

Enrichment Mathematics for Senior Grades

I am grateful for a copy of the first of a two volume set devoted to enrichment topics for grades 7 and 8 sent by Leo Jonker of Queen's University (whose email address is leo@mast.queensu.ca). For over fifteen years, he has been visiting a local elementary school and leading enrichment sessions for some of the students in a mathematics club.

He covers quite a lot with the pupils, the topics being spread over a two-year cycle. The first volume deals with numbers - patterns, operations, classification, counting, probability; the second will cover geometry. As Prof. Jonker points out, the students keep coming back, so the material seems to work.

In the preface to the book, the author describes his fascination with both poetry and mathematics. On the face of it, mathematics should be simpler, requiring less experience of the complexity of life for its full enjoyment. This does not accord with public perception. The reason is that “because of the relative simplicity of mathematics it is easier in mathematics to know that you have missed the point. I believe it is this missing the point again and again that induces the widespread mathematics anxiety about which so much has been written. Paradoxically then, the relative simplicity of mathematics gives it the reputation of being difficult. In response to this concern for students who have difficulty with mathematics, the tendency is to teach mathematics very well and very carefully. While this sounds good, and is probably the right thing to do if a student must be taught certain mathematical ‘tools’ to function in society, for the student who is ready to be excited by mathematics, the resulting curriculum is too slow and far too sanitized.” The goal of Prof. Jonker is to feed the students who are ready to move on from the regular curriculum, to give them a “sense of the rich variety of the subject” and to let them “have the experience of solving a difficult problem after persistent effort”.

Professor Jonker would welcome discussion with others involved in this enrichment mathematics. You can obtain a copy of the book, *Enrichment Mathematics for the Senior Grades (Part I)* (vii + 153 pages, spiralbound) for \$15 (postage and packaging included) from MSTE Group, A233 McArthur Hall, Queen’s University, Kingston, ON K7L 3N6 (Attention: B. Knox (Enrichment Math Book)). Enquiries may be directed to Mrs. Knox at 613-533-6221/6584 or at knoxb@educ.queensu.ca. Incidentally, MSTE stands for Mathematics, Science and Technological Education Group.

Ed Barbeau

Key Problems

I would like to introduce, as a regular feature in this section, a sequence of problems that any graduate of grade 9 mathematics should be capable of solving. Much has been written about core knowledge, skills and problem-solving in the curriculum, but it seems difficult to move from rhetoric to a regime that many will be satisfied with. To help bring our

views as a community into focus, it might be worthwhile to look at specific problems.

Accordingly, I invite readers to submit a problem suitable for the Grade 7-9 range that reflects some essential mathematical skill and understanding, explain why the problem is selected and, if the problem has been actually used with pupils at this level, what happened. The style of the problem can vary - a puzzle, a good exercise, a situation to be analyzed, an extended investigation. It can involve technology or not, be worked at individually or in a group, and be pure or applied mathematics. The only restriction is that it be suitable for the whole class and not just for enrichment. You are also invited to comment on the problems submitted by others.

I will kick off with a problem that I learned from Andre Toom and represents the sort of thing that Russian pupils get:

Ada lives in Hightown and Zelda in Lowtown; the two towns are connected by a single road. One morning, at exactly the same time, each lady sets out walking to the town of the other, each at her own steady pace. They pass at noon. Ada reaches Lowtown at 4 pm while Zelda reaches Hightown at 9 pm. At what time in the morning did they start?

Ratio and proportion is a key part of the elementary curriculum; prices, rates, percentages, scale are examples of topics involving proportionality. Since a lot of everyday mathematics involves this and since it serves as a foundation for understanding linearity, teachers at the elementary level should ensure that pupils are comfortable with it. This problem requires clear thinking and can be approached in a number of ways. It also has appeal as a sort of puzzle. Since the distances are not provided, it is not just a simple “rule-of-three” question and the pupils will have to apprehend it on a structural level, which makes it pretty difficult.

The most direct approach is to appreciate that, with constant speed, the distance travelled is proportional to the time taken. Relating the time taken by each lady on the two legs of the journey to the distances, we obtain the proportionality $T : 4 = 9 : T$ where T is the time each crone walks before noon. At this point, the solution should be obtainable by inspection. Note that the time T is the geometric mean of the times taken by the ladies in the afternoon. The problem could also be represented by plotting time-location graphs and treating it as an exercise in similar triangles. Alternatively, it can be approached by trial-and-error. Pupils should realize that, because Ada is the faster walker, they will meet closer to Lowtown and the time taken on the walk before noon will lie somewhere between 4 and 9 hours.

Ed Barbeau

DU BUREAU DU DIRECTEUR ADMINISTRATIF

Un passé dont nous sommes fiers et un avenir stimulant

Quand j'ai remplacé le professeur John McNamee au poste de directeur administratif de la Société, en 1979, jamais je n'aurais pu prédire le rôle que jouerait la Société ni la portée de ses activités quelque vingt années plus tard. Je ne m'attendais pas non plus, après vingt ans au service de la SMC, à entreprendre un nouveau mandat en juillet 1999. Heureusement, les tâches et les fonctions rattachées à mon poste sont maintenant bien plus faciles à gérer, grâce au soutien inestimable des membres du comité exécutif, du conseil d'administration et des comités, des rédacteurs et du personnel du bureau administratif et de bien d'autres personnes encore.

La Société offre une vaste gamme d'activités scientifiques et éducatives et entreprend l'année 2000 (le «nouveau millénaire» mois un an!) en position de force. Comme en font foi les rapports annuels des divers comités permanents, la Société soutient la communauté mathématique canadienne de mille et une façons.

Les Réunions semestrielles de la Société (Memorial - juin 1999 et Montréal - décembre 1999) ont été extrêmement populaires. Nous nous devons de féliciter les directeurs et les organisateurs de ces Réunions d'avoir élaboré des programmes de conférences et d'activités de si grande envergure, et d'avoir réussi à obtenir autant de soutien des universités hôtes, des instituts de recherche et des autres commanditaires.

En mai, le Congrès canadien des étudiants en mathématiques (CCEM) a eu lieu juste avant la Réunion de la SMC, et le premier carrefour emploi de la SMC s'est déroulé le jour suivant la Réunion de décembre. Nous espérons que les étudiants tiendront encore leur congrès dans les jours qui précèdent ou suivent la Réunion d'été de la SMC, et qu'un carrefour emploi pourra à nouveau être organisé dans

le cadre d'une de nos deux Réunions. L'engagement continu des trois instituts de recherche, via le comité du programme national, constituera une source importante de financement de chacune des Réunions semi-annuelles de la SMC. Ces fonds serviront notamment à subventionner les déplacements des étudiants diplômés.

Comme c'est le cas depuis plusieurs années, la Société finance ses activités scientifiques et éducatives grâce aux recettes tirées de ses diverses publications, particulièrement le Journal canadien de mathématiques (JCM) et le Bulletin canadien de mathématiques (BCM), et à l'appui des nombreux rédacteurs et des universités hôtes. En juillet 1999, les fonctions de rédacteur-gérant sont passées au Robert Quackenbush (Manitoba), qui occupera le poste de rédacteur-gérant jusqu'au 30 juin 2002.

Nos publications continuent d'être de grande qualité, à la fois quant au contenu scientifique et à la qualité de production. En 1999, les numéros du JCM, du BCM, de CRUX with MAYHEM et des Notes ont été publiés très près des dates d'expédition prévues, et chaque numéro a été publié en ligne pour les abonnés des versions électroniques environ une semaine avant leur version papier. La nouvelle collection d'ouvrages de la SMC, en collaboration avec Springer-Verlag, va bon train; les premiers ouvrages devraient d'ailleurs paraître au début de cette année. Même si l'entente actuelle conclue avec l'American Mathematical Society sur la publication de la collection des comptes rendus de conférences de la SMC prendra fin l'an prochain, nous avons amorcé des discussions dans le but de conclure une nouvelle entente concernant la publication d'une nouvelle collection, qui pourrait s'appeler «Notes de conférences de la SMC». Trois livrets éducatifs de la collection ATOM (Aime-t-on les math-

ématiques) ont été publiés à ce jour, et plusieurs autres en sont à diverses étapes de production.

Les rapports annuels du Comité d'éducation et du Comité des concours mathématiques (anciennement le Comité des olympiades mathématiques) font état d'un vaste éventail d'activités éducatives soutenues par la Société. Toutes ces activités d'enrichissement, et particulièrement notre nouveau programme de camps régionaux et nationaux de mathématiques, sont rendues possibles grâce à l'appui inestimable de nos membres, des professeurs et des élèves du pays.

Le programme de camps mathématiques, qui réunit des départements universitaires, des professeurs et des élèves de la 9^e à la 1¹e année, offre une excellente occasion de montrer que les mathématiques peuvent être agréables, stimulantes et valorisantes. Trois de ces camps ont été organisés en 1999 (Calgary, Western Ontario et Waterloo). Dans le cadre de l'an 2000, année internationale des mathématiques, et d'une aide accrue de la Fondation philanthropique Pétrolière Impériale, le programme des camps de mathématiques sera grandement augmenté en l'an 2000. Même si nous avons déjà reçu des sommes importantes, il nous en faudra encore davantage pour réaliser toutes les activités souhaitées.

En 1999, presque 5 000 jeunes ont participé au Défi ouvert canadien de mathématiques, comparativement à près de 3 800 l'année précédente. Dans plusieurs départements de mathématiques, les résultats obtenus au Défi constituent désormais un important critère de sélection pour l'obtention de bourses d'admission. Si cette pratique se répand, il se pourrait fort bien que le nombre d'inscriptions à ce concours augmente considérablement au cours des années à venir.

Compte tenu du grand nombre d'élèves qui prennent part chaque an-

née au Défi et aux autres activités de la Société, et des six élèves choisis annuellement pour représenter le Canada à l'Olympiade internationale de mathématiques, on peut affirmer avec certitude que le Canada compte une foule de jeunes mathématiciens talentueux.

Le Groupe de travail sur les finances et la collecte de fonds, le Groupe de travail sur le soutien à la communauté mathématique et le Comité spécial d'examen des services électron-

iques et de Camel ont remis leur rapport à la fin de 1999. Ces rapports, ajoutés à ceux de groupes de travail constitués plus tôt, ont déjà entraîné un certain nombre de changements et l'adoption de recommandations visant à améliorer divers aspects des activités de la Société. Les rapports reçus à ce jour et ceux des autres groupes de travail, qui doivent être remis au cours de l'année, nous aideront à bâtir une structure solide pour l'orientation de

la SMC. J'aimerais remercier tous les membres qui ont fait ou font encore partie des groupes de travail de leur grande contribution à cet important exercice de planification.

Les 20 dernières années ont été et passionnantes et gratifiantes. Forts de l'appui indéfectible de nos membres et d'un bon soutien des secteurs public et privé, nous pouvons croire à un avenir très prometteur.

AMERICAN MATHEMATICAL SOCIETY

Conference Proceedings, Canadian Mathematical Society

This series is published for the Canadian Mathematical Society by the AMS. It consists of the proceedings of internationally attended conferences on pure and applied mathematics sponsored by the CMS. **CMS members may order at the AMS member prices.** (ISSN 0731-1036) Softcover.

Stochastic Models
Luis G. Gorostiza
Centro de Investigación y de Estudios Avanzados, Mexico City, Mexico,
B. Gail Ivanoff
University of Ottawa, ON, Canada,
 Editors

This book presents the refereed proceedings of the International Conference on Stochastic Models held in Ottawa (ON, Canada) in honor of Professor Donald A. Dawson. Contributions to the volume were written by students and colleagues of Professor Dawson, many of whom are eminent researchers in their own right.

A main theme of the book is the development and study of the Dawson-Watanabe "superprocess", a fundamental building block in modelling interaction particle systems undergoing reproduction and movement. The volume also contains an excellent review article by Professor Dawson and a complete list of his work.

This comprehensive work offers a wide assortment of articles on Markov processes, branching processes, mathematical finance, filtering, queueing networks, time series, and statistics.

Conference Proceedings, Canadian Mathematical Society, Volume 26; 2000; 450 pages; Softcover; ISBN 0-8218-1063-4; List \$99; Individual member \$59; Order code CMSAMS/26CMS00

Algebras and Modules II
Idun Reiten, Sverre O. Smalø, and Øyvind Solberg
Norwegian University of Science and Technology, Trondheim,
 Editors

This volume contains 43 research papers based on results presented at the Eighth International Conference on Representations of Algebras (ICRA VIII) held in Getranger, Norway. The papers, written by experts in the field, cover the most recent developments in the representation theory of artin algebras and related topics.

Volume 24; 1998; 569 pages; Softcover; ISBN 0-8218-1076-6; List \$99; Individual member \$59; Order code CMSAMS/24CMS00

Geometric Control and Non-holonomic Mechanics
V. Jurčević and R. W. Sharpe
University of Toronto, ON, Canada,
 Editors

Control theory, a synthesis of geometric theory of differential equations enriched with variational principles and the associated symplectic geometry, emerges as a new mathematical subject of interest to engineers, mathematicians, and physicists. This collection focuses on several distinctive research directions having origins in mechanics and differential geometry, but driven by modern control theory.

The first of these directions deals with the singularities of small balls for problems of sub-Riemannian geometry and provides a generic classification of singularities for two-dimensional distributions of contact type in a three-dimensional ambient space.

The second direction deals with invariant optimal problems on Lie groups exemplified through the problem of Dublins extended to symmetric spaces, the elastic problem of Kirchhoff and its relation to the heavy top. The results described in the book are explicit and demonstrate convincingly the power of geometric formalism.

The remaining directions deal with the geometric nature of feedback analyzed through the language of fiber bundles, and the connections of geometric control to non-holonomic problems in mechanics, as exemplified through the motions of a sphere on surfaces of revolution.

This book provides quick access to new research directions and also demonstrates the effectiveness of new insights and methods that control theory brings to mechanics and geometry.

Conference Proceedings, Canadian Mathematical Society, Volume 25; 1996; 239 pages; Softcover; ISBN 0-8218-0795-1; List \$49; Individual member \$29; Order code CMSAMS/25CMS00

Algebras and Modules I
Idun Reiten, Sverre O. Smalø, and Øyvind Solberg
 Editors

This volume contains recent results on geometric aspects of representations of algebras, a thorough treatment of the theory of quantified algebras, new developments on infinite dimensional representations of finite dimensional algebras, a bridge between representation of algebraic groups and representation theory of finite dimensional algebras, and recent discoveries on modular representation theory. In addition, the volume contains two papers devoted to some of Maurice Auslander's many contributions both in the representation theory of finite dimensional algebras and in commutative ring theory.

A general background in noncommutative algebra including rings, modules and homological algebra is required. Given that, parts of this volume would be suitable as a textbook for an advanced graduate course in algebra.


Volume 23; 1996; 198 pages; Softcover; ISBN 0-8218-0850-8; List \$39; Individual member \$23; Order code CMSAMS/23CMS00

Trends in Ring Theory
Vlastimil Dlab
Carleton University, Ottawa, ON,
László Márki
Hungarian Academy of Sciences, Budapest,
 Editors

The Ring Theory Conference (University of Miskolc, Hungary) successfully accomplished its two goals: 1) to reflect contemporary trends in the subject area and 2) to offer a meeting place for a large number of Eastern European algebraists and their colleagues from around the world. Particular emphasis was placed on recent developments in the following four areas: representation theory, group algebras, PI algebras, and general ring theory. This book presents 13 of the invited lectures.

Volume 22; 1998; 239 pages; Softcover; ISBN 0-8218-0849-4; List \$49; Individual member \$29; Order code CMSAMS/22CMS00

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AMERICAN MATHEMATICAL SOCIETY

Bridging the Gap

Book Review by S. Swaminathan, Dalhousie University

Serge Lang, Math Talks for Undergraduates

Springer-verlag, 1999

121 pages

Many teachers and mathematicians agree that the traditional topics in mathematical courses of the North American undergraduate curriculum do not lead to an appreciation of the finer aspects of mathematics. In general, students participate in a passive fashion and, due to lack of independent intellectual activity, they are hardly able to solve their assignment problems. From time to time, committees are formed to seek measures to remedy this situation. One such was the Committee on the undergraduate programme in mathematics, supported by the NSF and the MAA, which made recommendations for the improvement of college and university mathematics curricula in the mid 1960s. It is not clear how far these recommendations were helpful in improving curricula. Talks by well known researchers and teachers to undergraduates aimed at bridging the gap between traditional programme and contemporary mathematics would help to a certain extent. The book under review presents one series of such talks.

Serge Lang has written books at various levels of school, college and university programmes presenting mathematical topics in close relation to contemporary mathematics. The present book is a collection of talks by him on themes which, while using the notions and theorems of basic courses,

go deeper in certain directions. The style of presentation is informal including conversation with mature students at some interesting junctures in the first two talks. Lang says in the Foreword, "Such talks could be given by faculty, but even better, they may be given by students in seminars run by students themselves. Such talks have been given at Yale, for instance."

Six themes are discussed.

1. Prime Numbers. After talking about the Prime Number Theorem, the Riemann Hypothesis is introduced through a discussion of the error term in it. Then follows a discussion of an asymptotic estimate for the number of twin primes and the Bateman-Horn conjecture on the constant involved in the logarithmic integral formula for the estimate.

2. The *abc* Conjecture. This talk presents "a simple and yet powerful result on polynomials discovered only in the early 1980's, late into the twentieth century." The result is the Mason-Stothers inequality concerning degrees of polynomials. Formulation of this result into a statement about integers leads to the *abc* conjecture. This talk is illustrative of the fact that "history did not follow a straight line, but went through detours and analogies."

3. Global Integration of Locally Integrable Vector Fields. This topic investigates conditions under which a vector field on a connected open set U in the plane has a potential field over all of U .

4. Approximation Theorems of Analysis. It is first shown that a bounded piecewise continuous func-

tion f on \mathbf{R} can be approximated uniformly on compact sets by a sequence of convolutions of f with Dirac sequences (sequences of continuous functions satisfying three simple conditions). Then the following are shown to be consequences of this general approximation theorem: (a) Weierstrass approximation theorem, (b) Theorem of Fejer-Cesaro regarding partial sums of Fourier Series, (c) Poisson approximation theorem and (d) Theorems on periodic functions satisfying the heat equation. The section concludes with a discussion of theta functions.

5. Bruhat-Tits Spaces. This topic consists of three parts and Lang suggests that it can be given as a series of talks. The first part is on the semi-parallelogram law. A Bruhat-Tits space is a complete metric space which satisfies this law. A fixed point theorem is proved for such spaces. The second part deals with a metric on the space of real positive definite matrices. The third part proves that this space satisfies the semi-parallelogram law. The second and third parts provide examples of differential geometry, quite different from the usual ones emphasizing curves and surfaces.

6. Harmonic and Symmetric Polynomials. This talk illustrates how concepts from linear algebra are used in the study of two important subsets of the ring of real polynomials in several variables.

The book can be profitably read and used by instructors of undergraduate courses who may recommend it to their mature mathematics majors.

(ANNUAL—continued from page 1)

of Mathematics (CJM) and the Canadian Mathematical Bulletin (CMB), and the support received from the many editors

and host universities. In July 1999, my duties as Managing Editor were transferred to Robert Quackenbush (Manitoba) who has been appointed as the Managing Editor to June 30, 2002.

Our publication activities continue to be of a high standard, both scientifically and with respect to production quality. In 1999, the respective issues of the CJM, the CMB, CRUX with MAYHEM and the CMS Notes were published very close to the projected shipping date and each issue was also available on-line for subscribers approximately one week beforehand. The new CMS Book Series with Springer-Verlag is progressing well and books in this series should be available early in 2000. Although the current agreement with the American Mathematical Society to publish the CMS Conference Proceedings Series will be ending next year, discussions are underway to establish a new agreement for the publication of a different series, perhaps a CMS Lecture Notes Series. Three books in the ATOM (A Taste of Mathematics) Series of educational booklets have been published and several others are in various stages of preparation.

The Annual Reports of the Education Committee and the Mathematical Competitions Committee (formerly the Mathematical Olympiads Committee) indicate the broad range of educational activities supported by the Society. All of these enrichment activities are possible because of the crucial assistance received from our members and teachers and students across Canada. This is certainly true for one of our new programs - Regional and National Math Camps.

The Math Camps Program brings together university departments, school teachers and young students (grades 9 through 11) and offers an excellent way to show that mathematics can be fun, challenging and rewarding. Three such camps took place in 1999 (at the University of Calgary, the University of Western Ontario and the University of Waterloo). As part of World Math Year 2000, and with increased support from the Imperial Oil Charitable Foundation, the

Math Camps Program is being expanded significantly in 2000. Although significant support has been received more is needed if the program is to reach its potential.

Participation in the 1999 Canadian Open Mathematics Challenge was almost 5000, up from nearly 3,800 in 1998. Several university mathematics departments are now using the results from the Open as a major factor in determining entrance scholarships. If this practice is widely adopted, it likely the number of students participating will increase significantly in future years.

From the large number of students who each year participate in the Open and the Society's other activities, to the six students who are chosen to represent Canada at the International Mathematical Olympiad, it is clear there is a lot of good young mathematics talent in Canada.

The Final Reports of the Task Force on Finances and Fundraising, the Task Force on Support of the Mathematics Community and the Ad-hoc Committee on Electronic Services and Camel were received at the end of 1999. These reports, together with those of earlier Task Forces have already resulted in a number of changes and recommendations adopted to improve in various aspects of the Society's operations. The reports received to-date and the reports of the remaining Task Forces due in 2000, will help to provide the vital framework for the future direction of the CMS. I wish to thank all members of past and current Task Forces for their many contributions to this important planning exercise.

The past 20 years have been exhilarating and rewarding. With continued support from the membership as well as good support from the public and private sectors, the future looks very promising.

FROM THE INSTITUTES

PIMS Initiatives

In connection with WMY2000, two new PIMS initiatives were announced by Director Nassif Ghossoub.

- A poster campaign under the theme "Mathematics is everywhere" will feature the ever growing importance of mathematics in modern society: From the art of Tying Knots and Risk Management to Genome Sequencing and Quantum Computing! Watch for posters in public transport systems (initially selected buses in Vancouver and Victoria) and also to appear in schools, exhibitions, calendars, etc. This campaign joins the math posters campaign in the Montreal Metro from January 4 to January 31 being sponsored by the Centre de Recherches Mathématiques.

- A semi-annual magazine entitled "Pi in the sky" as a forum for dialogue between academic mathematical scientists, educators, students and the public at large. PIMS will be distributing this magazine to high schools in BC and Alberta.

Legacy of John Charles Fields Symposium

The Fields Institute for Research in Mathematical Sciences will be presenting the symposium "The Legacy of John Charles Fields", as part of the events surrounding World Mathematical Year 2000. The Symposium will feature lectures by nine Fields Medallists, as well as two historical lectures on the development of mathematics over the past seventy years from the perspective of the medallists, and the role of the Canadian mathematician whose vision and leadership was instrumental in establishing the Fields Medal. The lectures will be held at the Royal Ontario Museum from June 7 to 9, 2000. For details and updates, please visit <http://www.fields.utoronto.ca/jcfields-legacy.html> or contact us at jcfields@fields.utoronto.ca.

MATH 2000
McMaster University
Hamilton, Ontario
June 10 - 13, 2000

Programme Update

The most up-to-date information concerning the programmes, including scheduling, and electronic registration is available at the following world wide web address:

<http://www.cms.math.ca/Events/math2000>

Meeting registration forms, abstract forms, and hotel accommodation forms can be found in the February 2000 issue of the *CMS Notes*, in other society publications, and are also available on the web site.

Updates on Symposia Speakers

There have been a number of additions to the list of invited speakers. Please refer to the web site for the most up-to-date information.

Abstracts will also appear on the web site as they become available.

Related Activities

Here are some revised announcements:

MITACS Annual General Meeting: The inaugural Annual General Meeting of MITACS will be held on June 6 and 7 at the University of Toronto. For complete information and registration visit the MITACS website: <http://www.mitacs.math.ca/AGM2000/>, or contact MITACS head office by email: agm@mitacs.math.ca

CMS Job Fair: The 2nd CMS Job Fair will be held on June 6 and 7, in conjunction with the MITACS Annual General Meeting, at the University of Toronto. For complete information regarding registration and submission of resumés, visit the MITACS website: <http://www.mitacs.math.ca/AGM2000/>, or contact MITACS head office by email: agm@mitacs.math.ca

Important Reminders

Early registration fee: Please note that payment must be received on or before May 15 in order to qualify for reduced rates.

Tickets for lunch on campus: The delegates' luncheon on Saturday is for all delegates. However, since limited catering facilities are available at McMaster University, luncheon tickets may be purchased for Sunday, Monday and Tuesday. These tickets must be prepaid and will not be available on-site, so please make your purchases prior to going to Hamilton.

Shuttle service from Pearson Airport: Airways Transit runs a Shuttle Service from Pearson International Airport in Toronto to Hamilton. A conference rate of \$29 Cdn one-way (including GST) is available to those who reserve ahead of time. Fares are one-way. Please pay the driver.

Reservations can be made in several ways:
 telephone - 905-689-4460
 email - infohamilton@airwaystransit.com
 web - <http://www.airwaystransit.com/reservation.html>

Correction !! The web site address given in the first announcement contained an error. Please use the above web site to make your reservation.

More detailed information about this service can be found at both the CMS and the Airways Transit web sites.

MATH 2000
Université McMaster
Hamilton (Ontario)
10-13 juin 2000

Mise à jour du programme

Vous trouverez l'information la plus récente sur les programmes, y compris les horaires et le formulaire d'inscription électronique, à l'adresse Web suivante :

<http://www.cms.math.ca/Events/math2000>

Les formulaires d'inscription, de résumé et de réservation d'hôtel seront aussi publiés dans le numéro de février 2000 des *Notes de la SMC*, ainsi que dans les publications des autres sociétés participantes. Vous les trouverez également sur notre site web.

Liste de conférenciers

Il y a eu quelques additions à la liste de conférenciers. Veuillez consulter le site Web pour l'information la plus récente.

Les résumés de conférences paraîtront sur le site dès que nous les recevrons.

Activités connexes

Voici quelques annonces révisées :

Assemblée générale annuelle du projet MITACS : L'assemblée générale inaugurale du Réseau de centres d'excellence (RCE) en mathématiques des technologies de l'information et des systèmes complexes (MITACS) aura lieu les 6 et 7 juin à l'Université de Toronto. Pour de plus amples renseignements et pour vous inscrire, veuillez visiter le site Web de MITACS: <http://www.mitacs.math.ca/AGM2000/>, ou contacter le bureau de MITACS par courriel : agm@mitacs.math.ca

Carrefour emploi de la SMC : Le deuxième Carrefour emploi de la SMC aura lieu les 6 et 7 juin à l'Université de Toronto, dans le cadre de l'AGA du projet MITACS. Pour de plus amples renseignements concernant l'inscription et l'envoi de curriculum vitae, veuillez visiter le site Web de MITACS: <http://www.mitacs.math.ca/AGM2000/>, ou contacter le bureau de MITACS par courriel: agm@mitacs.math.ca

Rappels importants

Date limite pour tarifs réduits : Le paiement doit nous parvenir au plus tard le 15 mai pour que vous ayez droit aux tarifs réduits.

Billets pour les lunches sur le campus : Tous les participants recevront un billet pour le lunch des participants, qui aura lieu le samedi. Par contre, puisque la capacité d'accueil à l'Université McMaster est limitée, nous vous prions de vous procurer des billets pour les lunches du dimanche, du lundi et du mardi midi. Ces billets ne seront pas disponibles sur place, donc, n'oubliez pas d'acheter vos billets avant de partir pour Hamilton.

Service de navette de l'aéroport L. B. Pearson : La société Airways Transit offre un service de navette qui relie l'aéroport international L. B. Pearson de Toronto à Hamilton. Ceux et celles qui réserveront à l'avance auront droit à un tarif spécial de 29 \$ CAN (aller simple, TPS incluse). Veuillez payer le chauffeur.

Pour réservations :

Téléphone - 905-689-4460

Courriel - infohamilton@airwaystransit.com

Web - <http://www.airwaystransit.com/reservation.html>

Correction !! Il y avait une erreur dans l'adresse du site Web donné dans la première annonce . Veuillez utiliser l'adresse ci-dessus pour faire votre réservation.

Pour de plus amples renseignements concernant ce service, consultez les sites Web de la Réunion et de Airways Transit.

MATH 2000 – Participating Societies

- Canadian Mathematical Society (CMS)
- Canadian Applied and Industrial Mathematics Society (CAIMS)
- Canadian Operational Research Society (CORS)
- Canadian Society for History and Philosophy of Mathematics (CSHPM)
- Canadian Undergraduate Mathematics Conference (CUMC)
- 14th Canadian Symposium on Fluid Dynamics

Sociétés participantes – MATH 2000

- la Société mathématique du Canada (SMC)
- la Société canadienne de mathématiques appliquées et industrielles (SCMAI)
- la Société canadienne de recherche opérationnelle (SCRO)
- la Société canadienne d'histoire et de philosophie des mathématiques (SCHPM)
- le Congrès canadien des étudiants en mathématiques (CSEM)
- le Quatorzième Symposium sur la Dynamique des Fluides

MATH 2000

Hamilton (Ontario)

Revised Schedule - Horaire révisé

Up-to-date information can be found at our web site. / Pour l'information la plus récente, consulter notre site

Web. <http://www.camel.math.ca/CMS/Events/math2000/>*Unless otherwise indicated, events are to be held in Hamilton, Ontario**A moins d'avis contraire, tous les événements auront lieu à Hamilton (Ontario).*

Saturday / samedi June 10 juin	Sunday / dimanche June 11 juin	Monday / lundi June 12 juin	Tuesday / mardi June 13 juin
CUMC CSHPM SESSIONS	CSHPM SESSIONS EXHIBITS/EXPOSITIONS	CSHPM SESSIONS EXHIBITS/EXPOSITIONS	SESSIONS
AM CUMC sessions AM SESSIONS 1, 4, 7, 10, 13, 15, 16, 17, 19 8:30 Opening/ouverture 9 CARL POMERANCE 10 Coffee / café 10:15 EUGENE MYERS	AM SESSIONS 1, 2, 3, 4, 7, 10 12, 15, 16, 19 10 Coffee / café 10:15 JAMES ARTHUR 11:15 RAYMOND PIERREHUBERT 11:30- IMO 3pm Lunch / déjeuner- Toronto 12:15- Dept Chairs' Lunch 2pm Lunch des chefs de départements 12:15- 2pm Lunch / déjeuner	AM SESSIONS 1, 3, 6, 7, 8, 10, 11,12, 14, 16, 19 10 Coffee / café 10:15 LAWRENCE SHAMPINE 11:15 DUSA McDUFF 12- 2pm CSHPM/SCHPM business meeting 12:30 - CAIMS GM 2pm CMS AGM 12:15- 2pm Lunch / déjeuner	AM SESSIONS 1, 2, 11, 19 10 Coffee / café 10:15 Lecture / conférence Krieger-Nelson C. KANTA GUPTA 11:15 FRANCIS CLARKE 12:15- 2pm Lunch / déjeuner
PM SESSIONS 1, 4, 7, 9, 10, 11, 13, 15, 16, 17, 19 2-3 MAURICE QUEYRANNE 3-4 DAVID MUMFORD 6-7:30 Graduate Poster Session and Reception / Présentations des étudiants diplômés 7:30 CAIMS Council 7:30 CUMC Banquet	PM SESSIONS 1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 14, 15, 17, 19 2-3 SHING-TUNG YAU 3-4 IOANNIS KARATZAS 6-7 Reception 7-8 Public Lecture / Conférence publique JAMES STEWART	PM SESSIONS 1, 2, 3, 5, 6, 7, 10, 11, 12, 14 2-3 EFIM I. ZELMANOV 3-4 LOU VAN DEN DRIES 6:30 Reception 7:30 Banquet	PM SESSIONS 1, 6 2-3 CAIMS / SCMAI Doctoral Prize Prix de doctorat

The programme for June 6-9 is detailed on previous page. / Pour le programme du 6-9 juin, svp voir la page précédente.

CALL FOR NOMINATIONS / APPEL DE CANDIDATURES

Coxeter-James / Jeffery-Williams / Krieger-Nelson Prize Lectureships

Prix de conférence Coxeter-James / Jeffery-Williams / Krieger-Nelson

The CMS Research Committee is inviting nominations for three prize lectureships.

The Coxeter-James Prize Lectureship recognizes outstanding young research mathematicians in Canada. The selected candidate will deliver the prize lecture at the Winter 2000 Meeting in Vancouver, British Columbia. Nomination letters should include at least three names of suggested referees.

The Jeffery-Williams Prize Lectureship recognizes outstanding leaders in mathematics in a Canadian context. The prize lecture will be delivered at the Summer 2001 Meeting in Saskatoon, Saskatchewan. Nomination letters should include three names of suggested referees.

The Krieger-Nelson Prize Lectureship recognizes outstanding female mathematicians. The prize lecture will be delivered at the Summer 2001 Meeting in Saskatoon, Saskatchewan. Nomination letters should include three names of suggested referees.

The deadline for nominations is **September 1, 2000**. Letters of nomination should be sent to:

Le Comité de recherche de la SMC invite les mises en candidatures pour les trois prix de conférence de la Société, la

Conférence Coxeter-James, la Conférence Jeffery-Williams et la Conférence Krieger-Nelson.

Le prix Coxeter-James rend hommage à l'apport exceptionnel des jeunes mathématiciens au Canada. Le candidat choisi présentera sa conférence lors de la réunion d'hiver 2000 à Vancouver (Columbia Britannique). Les lettres de mises en candidatures devraient inclure les noms d'au moins trois répondants possibles.

Le prix Jeffery-Williams rend hommage à l'apport exceptionnel des mathématiciens d'expérience au Canada. La Conférence sera présentée lors de la réunion d'été 2001 au Saskatoon (Saskatchewan). Les lettres de mises en candidature devraient inclure les noms d'au moins trois répondants possibles.

Le prix Krieger-Nelson rend hommage à l'apport exceptionnel des mathématiciennes au Canada. La Conférence sera présentée lors de la réunion d'été 2001 au Saskatoon (Saskatchewan). Les lettres de mises en candidatures devraient inclure les noms d'au moins trois répondants possibles.

La date limite pour les mises en candidatures est le **1 septembre 2000**. Les lettres de mises en candidatures devraient être envoyées à :

Dr. Ian Putnam

CMS Research Committee / Comité de recherche de la SMC

Department of Mathematics and Statistics

University of Victoria

P.O. Box 3045, Station CSC

Victoria, British Columbia V8W 3P4

ATTENTION GRAD STUDENTS

Bob Paré, Dalhousie University

I strongly believe that it is important for graduate students (and mathematicians generally) to hear talks that are not necessarily in their specialty. They see things they would not normally see and get a different point of view. One never knows what will come in handy. As Wittgenstein is said to have said, "I do not know what I do not know". My point is that all students are expected to attend the departmental colloquium. Of course a student may not understand much, but it is a good idea to sit at the back and work on your thesis or as-

signments. During the first term we had a number of excellent talks at Dalhousie. The material was understandable to advanced undergraduates. You could feel the speaker's passion for what he was doing and it was contagious (don't worry, it only lasts a day or so). Open problems were mentioned too. There were also some dreadful talks. But that's life, and that's not contagious!

So mark the colloquium times on your calendar and plan to be there.

NEWS FROM THE AMS

E-journals Enhanced

The AMS has released enhanced versions of its electronic journal publications. These AMS ejournal upgrades improve usefulness and relevance for both journal authors and journal subscribers.

- Refereed articles are posted online before the print version is available.
- Citation service: Authors published in AMS journals can add bibliographic information to their articles noting other citations of that work.
- Secure manuscript tracking: Authors can track the status of any or all of their own papers accepted for publication while those manuscripts are processed through the AMS production system.
- Enhanced abstracts: Journal abstract pages now contain complete lists of article references which link to MathSciNet reviews (for subscribers to MathSciNet). Abstract pages also have links to lists of similar articles available in AMS journals.
- More PDF linking options: New linked PDF elements provide enhanced navigation throughout articles. Linked PDF options now include bookmarks, references, and more.
- Faster searching: Quick Search and Advanced Search options are now available.
- Expanded browsing: New browsing options have been added. Subscribers can choose to view recently posted articles, most recent issue, previous issue, next issue, or all issues.

- AMS author packages: AMS Journals offer author packages with various TeX options that can be downloaded in a single Zip file.

For more information, visit <http://www.ams.org/journals>.

MR Lookup

Authors can now access the MR Database to verify and create references that can link to reviews and original sources. Authors input basic reference data in the form at www.ams.org/mrlookup and Mathematical Reviews (MR) delivers electronic publication-ready references with live links to reviews in MathSciNet and to original articles.

The MR Lookup tool enables authors and publishers of source articles to build links in a simpler, single, consistent format—free of charge. Readers are therefore able to navigate from any reference in two clicks, first to the MathSciNet entry and then to the original paper (when it is accessible electronically). The older literature from the past 60 years becomes part of the web immediately through reviews of the papers. And, as those older articles become available online on JSTOR or other publisher sites, new links will be added automatically from the review on MathSciNet to original articles, without any action by those source publishers.

John Ewing, AMS Executive Director, states "The American Mathematical Society believes that using MathSciNet for linking to original papers fosters linking of the electronic literature, now and in the future. We hope the community will make a commitment to add these links to all new papers, and will encourage publishers to include links in all electronic literature."

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 CMS Executive Office.

Les rédacteurs des *Notes* acceptent les lettres en français ou en anglais portant sur un sujet d'intérêt mathématique, mais ils se réservent le droit de les compresser. Les lettres acceptées paraîtront dans la langue dans laquelle elles nous sont parvenues. Les lecteurs pourront nous joindre au bureau administratif de la SMC ou à l'adresse suivante: notes-lettres@smc.math.ca.

NEWS FROM DEPARTMENTS

Carleton University, Ottawa, ON

Appointments: Bin Han (Assistant Professor, Wavelet Theory, July 2000).

Retirement: Retirement: J. N. K. Rao (July 2000).

McGill University, Montreal, PQ

Appointments: M. Gander (Assistant Professor, June 1999, Applied Mathematics, Numerical Analysis), E. Goren (Assistant Professor, August 1999, Arithmetic Algebraic Geometry, Number Theory).

Promotions: O. Kharlampovich (Professor, September 1999), J.J. Xu (Professor, February 2000).

Retirements: M. Barr, A.M. Mathai, D. Sussman, J.C. Taylor - all retired December 1999.

Awards/Distinctions: J. Toth (Alfred P. Sloan Research Fellow, September 2000 to September 2002).

Simon Fraser University, Burnaby, BC

Appointments: Jinko Graham (Assistant Professor, September 1999, Statistics), Brad McNeney (Assistant Professor, September 1999, Statistics), Steven Ruuth Assistant Professor, September 1999, Applied Mathematics), Julia Wirch (Assistant Professor, September 1999, Actuarial Science).

Promotions: Michael Monagan (Associate Professor, September 1999).

Retirements: Anadi Das (August 1999), David Eaves (August 1999), Harvey Gerber (August 1999), Steve Thomason (January 2000).

Resignation: Katherine Heinrich (August 1999).

Death: Edward Shoemaker, Professor in Dept. Math and Stats 1965-1994. B.S.(Hons), M.S. and Ph.D.(1955) Carnegie Tech., Pennsylvania. He died suddenly January 22, 2000. A charter faculty member at SFU, Ed pursued with his customary passion the mechanics of glaciers and their effects on landforms, mastery of the string bass, and the perfect golf swing. He was Acting Head of the Department for a good part of the period between Fall 1968 and Summer 1971 and remained active in research following his retirement in 1994.

Post Doctoral Fellows: Baltensperger, Richard (Sept 1999 -Aug 2000), Bradean, Radu Petru (Sept 1999 - Aug 2000), Carretero, Ricardo (Oct 1999 - Sept 2000), Kortezov, Ivaylo (July 1999 -June 2000), Rousson, Valentin (Jan 1999 -Mar 2000), Stevens, Brett (Sept 1999 -Aug 2000), Szanto, Agnes (Sept 1999 -Aug 2000).

Visitors: Geddes, Keith (Jan 2000- Apr 2000), Kim, Taekyun (Taylor) (June 1999 -Dec 2000), Lester, June (July 1999 - June 2000), Shayganmaneshi, A. (Sept 1999 -Aug 2000), Yuanyao, Ding Sept (1999 -Aug 2000).

University of British Columbia, Vancouver, BC

Retirements/Resignations: Robert Adams, Priscilla Greenwood (June 2000).

Awards/Distinctions: Changfeng Gui: Aisenstadt Prize, David Boyd: Jeffery-Williams Prize

University of Northern British Columbia, Prince George, BC.

Promotion/Tenure: Jennifer Hyndman, tenure, July 2000.

Appointments: Pranesh Kumar, One-year position as statistician, (1999/2000), Vladimir Vinogradov, Adjunct position, Fall 1999, David Casperson, joint Mathematics and Computer Science tenure track position, July 1999.

Resignations: Ross Niebergall, Vladimir Vinogradov and Robb Fry

Awards/Distinctions: Jennifer Hyndman and Sam Walters received NSERC grants.

Other News concerning our outstanding graduates.

- Jennifer deKleine has received an NSERC award to do graduate work at Simon Fraser University in Computational Algebra. (Fall 1999.)
- Matt Reid has also won an NSERC award for \$17,300/year to do his MSc. in Electrical Engineering at the University of Alberta for two years. (Lately, we heard that he's the top student in his class, receiving the maximum grade of "9" three times.)
- Shunlai Lee has just recently been awarded a fellowship of \$23,000 to do his PhD in Mathematical Economics at Rochester University (including tuition waver and \$500 in research funding).

Université de Sherbrooke, Sherbrooke, PQ

Promotion: Tomasz Kaczynski, (Professeur titulaire, juin 1999).

University of Western Ontario, London, ON

Appointment: David Riley (Adjunct Professor, May 1999 - April 2002).

Other News: The Department of Mathematics and the Department of Applied Mathematics at the University of Western Ontario are pleased to announce the creation of the Imperial Oil Postdoctoral Fellowships in Mathematics. These fellowships have been created as part of a contribution by Imperial Oil to a new Mathematics Education program, which is to be jointly run by the two departments and the Faculty of Education. The Imperial Oil Fellowships have been funded for an five year period beginning July 1, 2000.

CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

APRIL 2000

15 50th Algebra Day (Carleton University, Ottawa)
vllab@math.carleton.ca

MAY 2000

5–7 Unified Congress of Mathematical Associations and Groups of Quebec (Université Laval), a WMY2000 event
pallascio.richard@uqam.ca

26–27 Western Canada Linear Algebra Meeting (University of Manitoba, Winnipeg.)
www.math.uregina.ca/tsat/wclam/wclam00.html

JUNE 2000

Canadian Mathematics Education Study Group Meeting (UQAM, Montreal) *Dates to be announced*

4–7 Annual Meeting of the Statistical Society of Canada (Ottawa, Ontario) *André Dabrowski: adrsg@uottawa.ca*

4–8 Canadian Annual Operator Algebra Symposium (Fields Institute, Toronto, Ontario) *elliott@math.utoronto.ca; choi@math.utoronto.ca*

8–9 Symposium on the Legacy of John Charles Fields (The Royal Ontario Museum, Toronto); a WMY2000 event
www.fields.utoronto.ca

10–13 MATH 2000 (McMaster University, Hamilton, Ontario – includes the CMS Summer Meeting)

Participating Societies include the Canadian Mathematical Society (CMS), the Canadian Applied and Industrial Mathematics Society (CAIMS), the Canadian Operational Research Society (CORS), the Canadian Symposium on Fluid Dynamics (CSFD), the Canadian Society for the History and Philosophy of Mathematics (CSHPM) and the Canadian Undergraduates Mathematics Conference (CUMC). A WMY2000 event

www.cms.math.ca/Events/math2000

11–18 38th International Symposium on Functional Equations (Noszvaj, Hungary) *pales@riesz.math.klte.hu*

12–15 Integral Methods in Science and Engineering (Banff, Alberta) *Peter.Schiavone@ualberta.ca*

JULY 2000

10–14 Third European Congress of Mathematics (Barcelona)
3ecm@iec.es; http://www.iec.es/3ecm/info.htm

11–25 41st International Mathematical Olympiad (Korea)

AVRIL 2000

17–22 XIII International Congress on Mathematical Physics (Imperial College, London) *http://icmp2000.ma.ic.ac.uk*

30–Aug 5 7th International Conference on Radicals - ICOR 2000 (Innsbruck) *Rainer Mlitz mlitz@umbriel.tuwien.ac.at*

31–Aug 7 International Congress on the Teaching of Mathematics (ICME-9)(Tokyo/Makuhara)
http://www.ma.kagu.sut.ac.jp/icme9/

AUGUST 2000

7–12 AMS Meeting (Los Angeles); a WMY2000 event
www.ams.org/meetings/

21–24 International Conference on Geometry, Analysis, and Applications (in honour of late Professor V.K.Patodi). (Banaras Hindu University, Vaninasi, India)
rspathak@banaras.ernet.in

SEPTEMBER 2000

22–24 American Mathematical Society Central Section Meetings (University of Toronto)
http://www.ams.org/meetings/

NOVEMBER 2000

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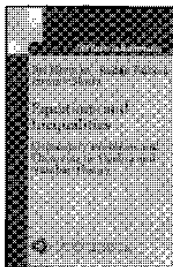
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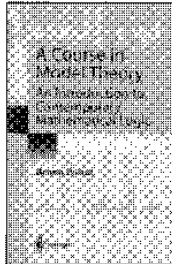
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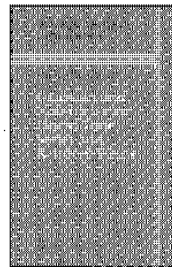
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