L O C A L S P A C E S

UBC Department of Mathematics *May 2003*

Message from the Head

There are many words that come to mind when I reflect back on my first Winter Terms as Head; the word "boring" is not one of those.

The most challenging event of this year was, of course, the TA strike. I felt caught in between two conflicting goals: to support our graduate students and to continue serving our undergraduates. I did not want to undercut the effect of the strike, and so I did little to help make up for those who chose not to work. However, I did cross a picket line in order to carry out my responsibilities to the department on the many matters of importance for graduate students, undergraduate students, faculty and staff.

I very much appreciate all the constructive comments and suggestions that I received during the strike. In particular, I was impressed with the high level of honest, thoughtful and respectful dialogue in my two meetings with our graduate students. Now, that the strike is over, I hope that we will focus our energies on the one thing that has brought us here together in the first place: our love of mathematics.

Other than the strike, the one area that has demanded most of my attention has been faculty recruitment. I am happy to say that we have four excellent young mathematicians, who will be joining our ranks as assistant professors, including one junior level Canada Research Chair. In addition, currently we are working on three joint appointments and a senior level Canada Research Chair.

Also, we have a large number of new postdocs and graduate students who will join us this fall. As our faculty grows, it is critical for us to expand our graduate program and postdoc program. This presents challenges on several fronts, in particular office space, we are working on these now, and I am confident that we will find good solutions.

In April, we had several faculty meetings on a wide variety of topics. We are reviewing several aspects of our graduate and undergraduate programs, and I expect that we will be acting on several proposals for change. These include the possibilities of adopting an entry requirement for the undergraduate Math major, enforcement of course prerequisites, changes in graduate admission procedure and revision of qualifying exams for graduate students. You will hear more about these changes in the summer and fall.

As we transition from the academic year to summer, I want to wish you all the best in your research work here and elsewhere, teaching in the summer terms and your travels. I look forward to a slightly less interesting (hopefully not "boring") summer and the challenges, yet to come, of the next academic year.

Brian Marcus

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Please send your questions, comments or submissions to newsletter@math.ubc.ca

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Pathways to the Future

by Charles Lamb, Undergraduate Chair

The Department of Mathematics offers Major programs in the Faculties of Arts and Science, and Honours programs in the Faculties of Applied Science, Arts and Science. There are also possibilities for Double Major, Minor and Co-operative Education programs in the Faculties of Arts and Science. The Major programs give students considerable flexibility in designing their studies and provide excellent foundations in the analytic skills essential to many careers, while the Honours programs are more intense and demanding, and are recommended for students intending to proceed to graduate study.

Since 1998/1999 there has been a dramatic increase in the enrollment in both Majors and Honours programs. This has resulted in an overall increase in Majors programs of almost 200% and in Honours programs of approximately 60%. Naturally such increases have presented many challenges for the Department, and explain the large class sizes that have become the norm in many of our upper level courses.

The Mathematics Department is constantly alert to the need to improve its course and program offerings, and to adapt to the rapidly changing university environment. This year a new course titled Algebra, Coding Theory, and Cryptography (MATH 342) and a new Honours course in Number Theory (MATH 437) have received formal approval from the University. Discussions are presently underway on revising many of the courses taken by students in the Faculty of Applied Science, and significant changes are expected in the near future.

The Department gives approximately 14,000 student-courses per year with around 1,500 of these taking place in the summer term. In spite of these somewhat daunting numbers, it is the desire of the Department to continue to provide the kind of personal contacts that university graduates remember long after they have completed their formal education. To this end the Department operates an extensive system of advising. Specialized advisors are provided for students majoring in programs other than mathematics, separately for 2nd, 3rd and 4th year Major/Minor students and 2nd, 3rd and 4th year Honours students. Advising is also provided for the actuarial profession, transfer credit problems, the Putnam contest and the Co-op program. There is an active Mathematics Club located in Math Annex 1119 which plays the role of a social centre for Mathematics students. It organizes lecture series, study sessions, mentoring and various social functions, and has a library, telephone and refrigerator. Membership cost is nominal.

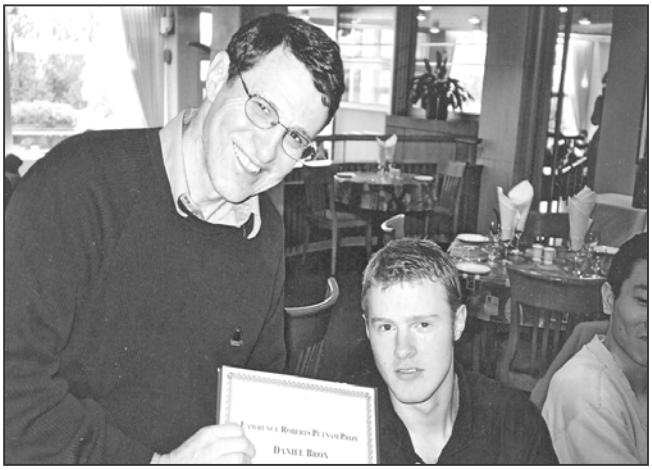
All undergraduate mathematics students are encouraged to get involved with mathematics and the mathematical community here at UBC. The Department wishes you the best for your studies in mathematics, and for your future careers.

UBC Putnam Team Ranks 3rd in Canada

by Lon Rosen, Putnam Advisor

The results of the 63rd W. L. Putnam Mathematical Competition have been announced. A total of 3,349 students from 476 universities wrote the contest on December 7, 2002. Perennial winner Harvard won again, followed by Princeton, Duke, Berkeley and Stanford. The UBC team did very well, placing 14th in North America and 3rd in Canada, behind Toronto and Waterloo, both of whom were in the top ten. The twelve questions on the challenging six-hour exam were arguably "easier" in 2002, as indicated by a median score of 3/120, up from the traditional median of 1!

Of the thirteen UBC students who participated, several achieved excellent individual results, notably: Daniel Brox (48th for "honorable mention"), Wayne Grey (104), Miranda Holmes (210) and Bruce Krayenhoff (222). For further details, consult the Putnam coaches, Greg Martin or myself. The official contest Announcement of Winners is also posted in the coffee lounge in the Math Annex.



Brian Marcus presenting a Putnam Prize to Daniel Brox.

The UBC Putnam team celebrating their achievement at the University Centre.

Graduate Teaching Awards Announced

The Faculty of Science recognized three graduate students with Graduate Teaching Awards. The winners were Bruce MacKay (Chemistry), Katherine Dixon (Physics and Astronomy) and Janet Martin (Mathematics).

Janet Martin is a 2nd year student in the Faculty of Education. She taught Math 230 and Math 335 this year for the Mathematics Department. A student who nominated Janet describes her as *"an outstanding teacher who makes a scary subject not so scary."* Janet will graduate with her Masters degree in Education this May and hopes to teach Grade 11 or 12 Mathematics.

The University annually awards teaching prizes to eleven UBC Teaching Assistants. The prize includes both a certificate and $1,000.00. We congratulate Janet for a job well-done and wish her continued success in her future endeavours!

Graduate Seminars - A Huge Success!

by Theodore Kolokolnikov

The graduate student seminar this semester was a huge success -- and not only due to pizza, courtesy of the math department. The topics covered reflected the diverse interests of the graduate students. Some of the topics covered included lie algebras, fluid dynamics, numerical methods, number theory, banach spaces, set theory, and PDEs.

While some speakers talked about their own research, many others simply picked a topic of which they considered fascinating and they have certainly been able to affect others with their enthusiasm. For some speakers, the seminar provided a valuable opportunity to practice for future conferences. Others participated simply to interact with fellow students and talk mathematics. The talks on average were well-attended and there were always enough speakers.

We are looking forward to continuing this seminar series next term!

Curiosities *(answer to column from January issue)*

by Greg Martin

It turns out that the infinite sequence $\{d_n\}$ does give the binary expansion of $1/\pi$ exactly! To see why, let's think of how we would compute this expansion on a non-fancy base-10 calculator.

First we would compute $1/\pi$ and see whether it was between 0 and ½, in which case the first bit in the binary expansion equals 0, or between ½ and 1, in which case the first bit in the binary expansion equals 1. Then we would multiply by two and subtract 1 if necessary; whether the result is between 0 and ½ or between ½ and 1 would dictate whether the second bit equals 0 or 1. In fact, we can forget about having to subtract 1 if we only consider the fractional part of the result.

In general, at every stage we multiply the previous result by 2 and look whether the fractional part of the result was between 0 and ½ or between ½ and 1. In other words, the *n*th bit in the binary expansion of $1/\pi$ is 0 or 1 depending on whether the fractional part of $2^{n-1}/\pi$ is between 0 and ½ or between ½ and 1.

The next thing to notice is that the function $f(x) = \tan(\pi x)$ is a very good "fractional part detector": the value of $f(x)$ is positive or negative depending precisely on whether the fractional part of x is between 0 and ½ or between ½ and 1. Therefore, the *n*th bit in the binary expansion of $1/\pi$ is 0 or 1 depending on whether $f(2^{n-1}/\pi) = \tan(2^{n-1})$ is positive or negative.

But now we suddenly recall the double-angle formula for the tangent function,

$$\tan(2t) = \frac{2\tan t}{1-(\tan t)^2},$$

which looks suspiciously like the function that recursively generates the x_n! With this formula in front of us, it is easy to prove by induction that $x_n = \tan(2^{n-1})$, and the connection between the sequence $\{d_n\}$ and the binary expansion of $1/\pi$ is established. (This actually provides an easier way to see that the infinite sequence $\{x_n\}$ is well-defined: we only need to observe that 2^{n-1} is never a multiple of $\pi/2$, which follows from the fact that π is irrational.)

Unfortunately this doesn't give us a fast algorithm to compute the binary expansion of $1/\pi$. The problem is that some of the x_n could be very close to 0, making it difficult to decide whether d_n should be 0 or 1. We could overcome this difficulty if we knew $x_1 = \tan 1$ to enough decimal places of accuracy …but computing the decimal expansion of tan 1 is no faster than computing the binary expansion of $1/\pi$! In the reformulation this circularity (no pun intended) is even more evident: deciding whether the fractional part of $2^{n-1}/\pi$ is between 0 and ½ or between ½ and 1 is essentially equivalent to knowing the binary expansion of π to *n* bits of accuracy.

CURRICULUM REPORT

by Philip Loewen, Curriculum Chair

This has been a busy year for the Department's Curriculum Committee—Richard Anstee, Ian Frigaard, Charles Lamb, Greg Martin and myself. Any one of us would be happy to discuss these items further, or to contemplate new initiatives.

New Courses
Two new courses have been designed and added to the 2003/04 edition of the UBC Calendar. Stephanie Van Willigenberg sponsored Math 342, "Algebra, Coding Theory, Cryptography," in which the theory of groups, rings, and fields will be put to work in the design of linear codes, RSA cryptosystems, and other topics that are both mathematically sophisticated and eminently applicable. Students need only a first course in linear algebra to enrol. Greg Martin designed Math 437, "Number Theory," to provide Honours students with an rapid overview of the basics of this subject, leading to a discussion of deeper topics that will allow them to engage recent results in this dynamic field. This course requires one of Math 320 or Math 322 as a corequisite. Both new courses will be taught by their designers in the 2003/04 academic year: Math 437 in Term 1, and Math 342 in Term 2.

Computing Requirement
All but one of the Bachelor's degree programs we offer include a 6-credit Computing Requirement. The contents of this requirement will change significantly in September, thanks to a recent makeover of lower-level Computer Science Courses. Students who have already finished their Computing Requirement will be unaffected by this change, while students who haven't started work on their Computing Requirement should, of course, follow the new rules. But students who are halfway through the process should act promptly: CPSC 126 (the sequel to CPSC 124) will be offered for the last time this summer, CPSC 128 (the sequel to CPSC 122) will be offered for the last time starting in September 2003, CPSC 124 is not a suitable prerequisite for CPSC 128, and MATH 210 will not be offered next year.

A New Role for MATH 220
UBC's MATH 220 got a new title this spring: "Mathematical Proof." Its official description was adjusted too, to express more clearly that the course is intended not just to introduce students to the basics of analysis, but also to provide them with some formal instruction in rigorous logical thinking. MATH 220 (or a good score in MATH 226) has always been a degree requirement in Mathematics, but now its importance is further emphasized by making it an explicit prerequisite for MATH 308, 309, 312, and 322.

Differential Equations
The science sequence MATH 215/316 has been brought closer in content to the corresponding Applied Science sequence MATH 255/257 by taking the Laplace Transform out of MATH 316 and putting it into MATH 215 instead. This change takes effect in September 2003.

The 30-Credit Rule
Honours students are required to complete at least 30 credits in every winter session. The program description in the UBC Calendar has been adjusted to reiterate this important point.

Calculus Advice
We offer an impressive smorgasbord of Calculus—to the point where students need some guidance about which flavour they might like best. A new web page entitled, "Which UBC Calculus Course is Best for Me?" addresses these concerns. (Look for "First-Year Calculus Choices" in the section headed "Undergraduates" on the Department's home page.) Also in the interests of clarity for students, we added the word "Honours" to the titles of MATH 120 and MATH 121 and imposed a high-school calculus prerequisite for these courses.

Prerequisites
The Registrar's Office now keeps course requirements in a database of sorts, and users of the Faculty Service Centre can use the Restrictions Viewer to download class lists that show whether each student meets the prerequisites. The Curriculum Committee is working on a set of policies and procedures for using these capabilities to improve learning in all Math classes.

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C O N G R A T U L A T I O N S !!

Award Winners

NSERC has granted PGS-A awards to Alain Prat and Pascal Tomecek. Graduate students Dennis The and Edwin Yu have also received NSERC awards for their PhD studies. The Faculty of Graduate Studies has announced that Roger Donaldson and Mark Holmes have both won University Graduate Fellowship (UGF) awards.

May Graduation

We would like to congratulate the following students on successfully completing their degrees and wish them the very best in their future endeavors!

MSc Students
Matthew Bolton
Gillian Clegg
Hamidreza Farhadi
Nathan Krislock
Margaret Liang
Gabriel Mititica
Miguel Moyers-Gonzalez
Eva-Marie Nosal
Catherine Webster

PhD Students
Fatemah Alqallaf
David Burggraf
Mihail Cocos
Xiaosong Kang
Colleen Robles
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