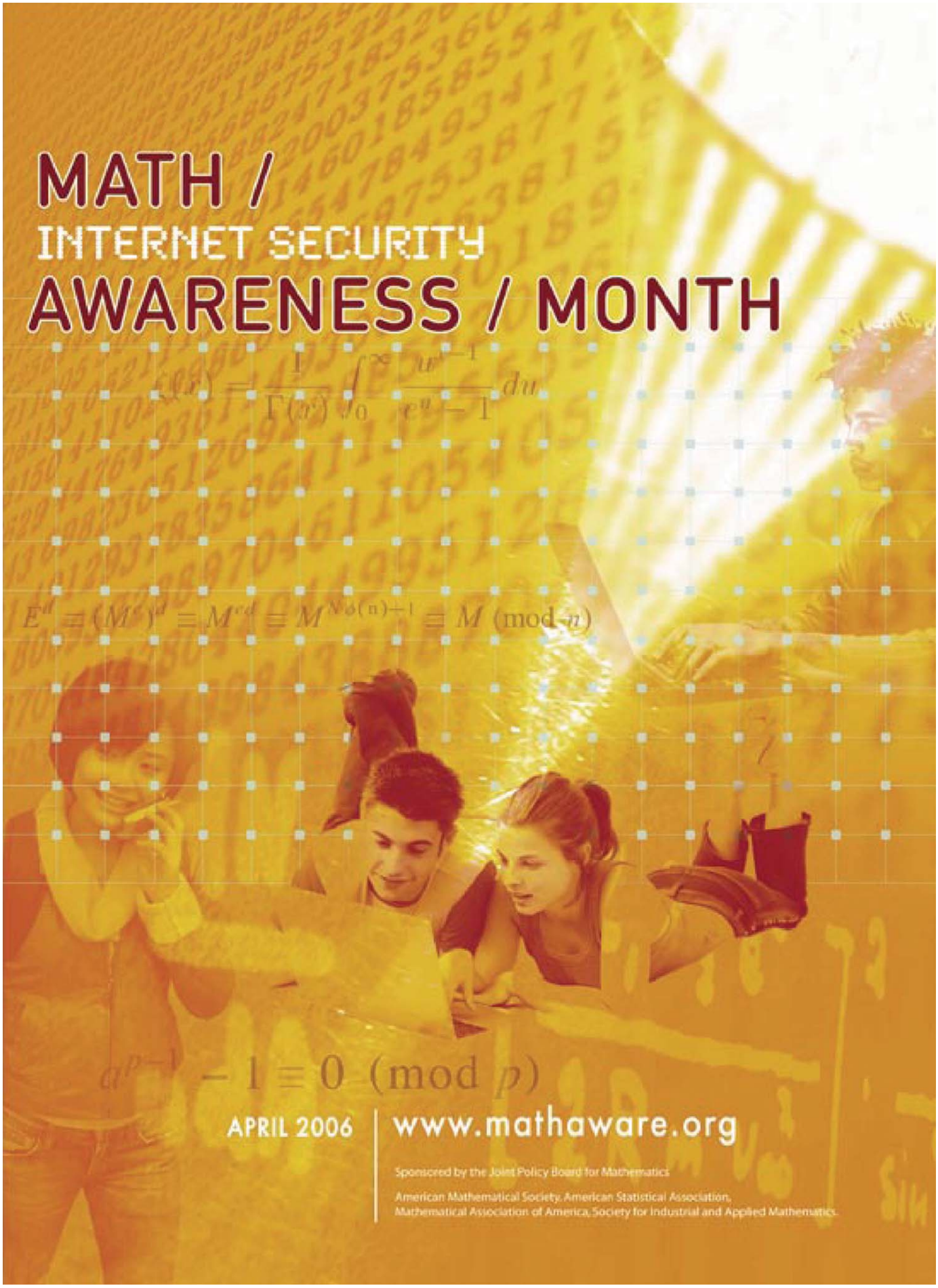
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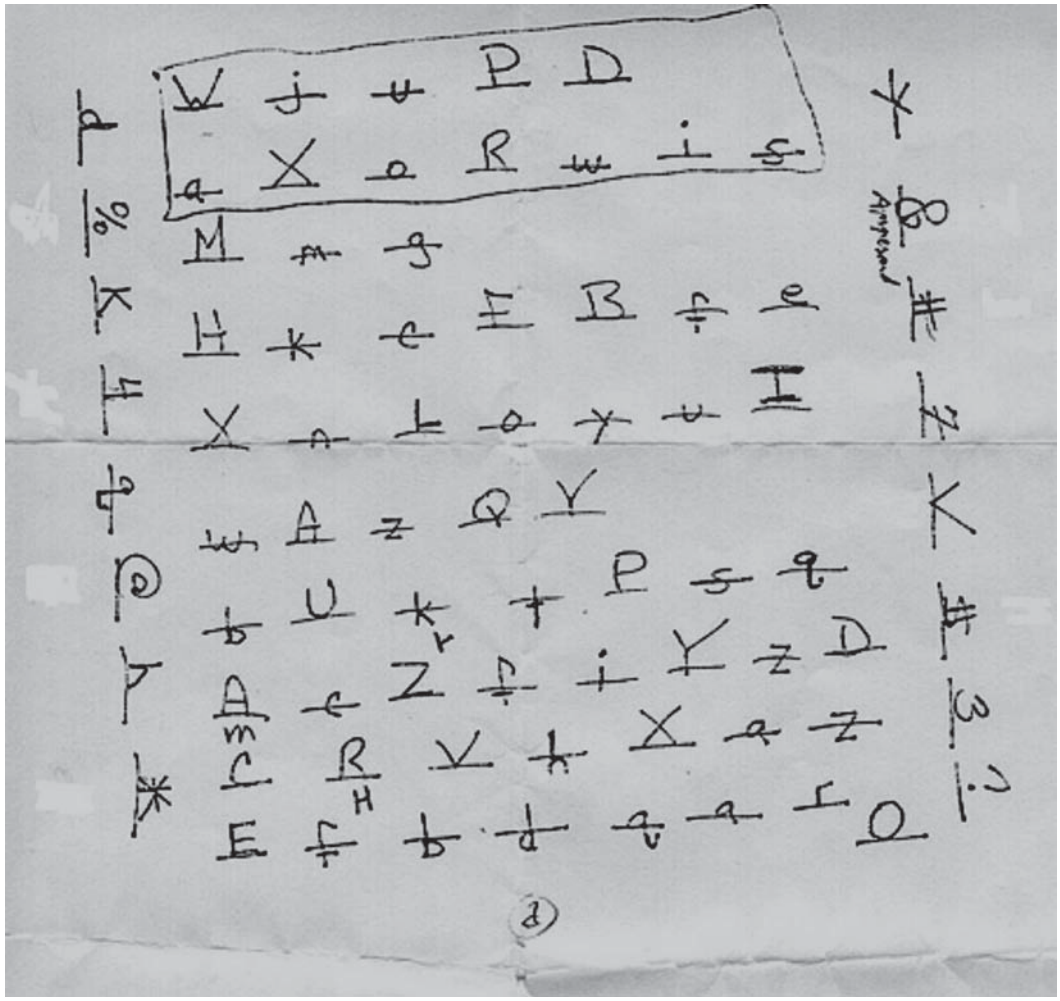
Can You Break This Code?
Mathematics Awareness Month 2006 Focuses on Internet Security

By Keith Devlin



No, it's not a prop from the TV series NUMB3RS, although it could have been. The note shown in the picture was sent to internationally known computer security expert Bruce Schneier, who posted it on his website "Schneier on Security" in January. (See http://www.schneier.com/blog/archives/2006/01/.)

Schneier says that the person who sent the alleged cryptogram to him claimed that it had been left behind by a man who had murdered his wife and stepson and then hung himself in the basement of their house. The sender wanted to know what the message said.

Chances are, the cryptogram is a hoax, although the double murder and suicide the sender referred to was a real case. In any event, neither Schneier nor anyone else has managed to break the code, if code there is, and from a glance it seems that, even if there is a real message there, without additional information it would not be possible to break the code.

Code making and code breaking are major activities these days, as more and more aspects of our lives are dependent on the security of electronic communications — email, Internet shopping, online banking, mobile phones, border security, etc.

The secret sauce of all modern codes — and all attempts to crack them — is mathematics. As Schneier himself has observed: "Cryptographic security comes from mathematics, not from people and not from machines. Mathematical security is available to everyone, both the weak and the powerful alike, and gives ordinary people a very powerful tool to protect their privacy."

It is therefore both appropriate and timely that the theme for this year's Mathematics Awareness Month, to take place in April, is *Mathematics and Internet Security*.

For details, including many resources you can draw upon in designing MAM activities at your own institution, visit the Mathematics Awareness Month website at http://www.mathaware.org.

Mathematics Awareness Month is held each year in April. Its goal is to increase public understanding of and appreciation for mathematics. MAM is organized by The Joint Policy Board for Mathematics (JPBM), which is a collaborative effort of the American Mathematical Society (AMS), the American Statistical Association (ASA) , the Mathematical Association of America (MAA) , and the Society for Industrial and Applied Mathematics (SIAM).

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FOCUS

Volume 26 Issue 3

Inside

On the cover: Rachell Ashley, Aisosa Ayela-Uwangue, Carol Callesano, and Frances Cabrera celebrate winning one of the prizes at the Undergraduate Poster Session in San Antonio. All four are students at the Rochester Institute of Technology (RIT). They participated in an MAA National Research Experience for Undergraduates Program at RIT last summer. The title of their winning poster was "Tiling with 4 x 6 and 5 x 7 Rectangles." (Photograph by Darren Narayan.)

FOCUS Deadlines

	August/September	October	November
Editorial Copy	July 8		September 16
Display Ads	July 10	August 20	September 24
Employment Ads	June 11	August 13	September 10

Project ACCCESS
Advancing Community College Careers: Education, Scholarship and Service

The American Mathematical Association of Two-Year Colleges (AMATYC) and the Mathematical Association of America (MAA) will soon be seeking applications for the third cohort of Project ACCCESS (Advancing Community College Careers: Education, Scholarship, and Service). Now in its third year, this project is a mentoring and professional development initiative for two-year college faculty funded through a three-year grant from the ExxonMobil Foundation. The deadline for applications is **June 30, 2006.**

Project ACCCESS is a program for new faculty interested in advancing the teaching and learning of mathematics in two-year colleges. Its goal is to develop a cadre of new two-year college mathematics faculty who are effective members of their profession. The four objectives of the project are to assist the selected faculty to gain knowledge of the culture and mission of the two-year college and its students, acquire familiarity with the scholarship of teaching, commit to continued growth in mathematics, and participate in professional communities.

The program has selected two cohorts, totaling 60 Project ACCCESS Fellows. In November, both groups of Fellows convened at the 2005 AMATYC annual conference in San Diego to participate in workshops designed specifically for each cohort. The 2004 Fellows concluded their formal ACCCESS activities at the conference, while the 2005 Fellows will continue their activities until the AMATYC 2006 annual conference.

Project ACCCESS Fellows attend two consecutive AMATYC Conferences where they participate in pre-conference workshops as well as regular conference activities. In the intervening year, Fellows attend an MAA Section NExT meeting near their home institution where they participate in both regular and specially designed activities. For the duration of the program, an electronic network links Project ACCCESS Fellows with each other and with a group of distinguished mathematics educators.

Approximately 30 faculty will be selected as 2006-07 Project ACCCESS Fellows. Applicants for the third cohort must be two-year college mathematics faculty in their first three years of a full-time, renewable position (i.e. Fellows selected for the third cohort may be new to community college teaching or beginning their second or third year in fall 2006). Project ACCCESS Fellows will be selected on the basis of breadth of interests, motivation for participation, plans for implementing project goals, and evidence of institutional support.

Visit the MAA website to check when applications will be available. Application deadline is June 30, 2006. More information about Project ACCCESS may be found at the MAA web site http://www.maa.org/ProjectACCCESS and also at the AMATYC web site http://www.amatyc.org/ProjectACCCESS.

Project NExT: New Experiences in Teaching

Project NExT (New Experiences in Teaching) is a professional development program for new and recent PhDs in the mathematical sciences (including pure and applied mathematics, statistics, operations research, and mathematics education). It addresses all aspects of an academic career: improving the teaching and learning of mathematics, engaging in research and scholarship, and participating in professional activities. It also provides the participants with a network of peers and mentors as they assume these responsibilities. Each year, about sixty faculty members from colleges and universities throughout the country are selected to participate in a workshop preceding the Mathematical Association of America (MAA) summer meeting, in activities during the summer MAA meetings and the Joint Mathematics Meetings in January, and in an electronic discussion network. Faculty for whom the 2006-2007 academic year will be the first or second year of full-time teaching (post-PhD) at the college or university level are invited to apply to become Project NExT Fellows. The application deadline is April 17, 2006.

For more information, visit the web site at http://archives.math.utk.edu/projnext. Project NExT is a program of the MAA. It receives major funding from the ExxonMobil Foundation, with additional funding from the Dolciani-Halloran Foundation, the American Mathematical Society, the Educational Advancement Foundation, the American Statistical Association, the National Council of Teachers of Mathematics, Texas Instruments, the Association of Mathematics Teacher Educators, the Association for Symbolic Logic, the Maryland/DC/Virginia Section and Metropolitan New York Sections of the MAA, and the Greater MAA Fund.

Call for Suggestions for Gung and Hu Award

The Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics is the most prestigious award for service offered by the MAA. This service may have been in mathematics or in mathematical education. It may comprise one or more activities. The period of service may have been short or long.

The Selection Committee maintains a list of individuals worthy of consideration for the award, and annually solicits suggestions of additions to this list. Suggestions should be sent to the Association at the address below to be forwarded to the selection committee. Names suggested by March 30 will receive current consideration; others will be considered in future cycles.

Individuals suggested for consideration should be widely known and respected throughout the MAA and the mathematical profession for the national scope and beneficial impact of their professional work and service. For this reason, suggestions should be short (at most two double spaced pages, in 12 point font) highlighting the most important aspects of the person's career and impact. It is helpful to include one or two URL's for relevant websites; it is not helpful to include multiple letters of recommendation.

Gung and Hu Awards Committee
Mathematical Association of America
1529 Eighteenth Street NW
Washington DC 20036

The 2006 Beckenbach Prize

The Beckenbach Book Prize, established in 1986, is the successor to the MAA Book Prize which was established in 1982. This prize is awarded to an author of a distinguished, innovative book published by the MAA. The Beckenbach Prize committee decided that their full citation for the winning book should be published in FOCUS, both as a form of historical record and to inform the members of the Association.

Proofs That Really Count: The Art of Combinatorial Proof
By Arthur Benjamin and Jennifer Quinn

Few mathematicians are immune to the limpid charms of a clever counting argument; in *Proofs That Really Count* Arthur Benjamin and Jennifer Quinn will charm you over and over again. The authors claim that counting arguments make the most compelling, natural and memorable proofs. It is hard to disagree with them after dipping into this lovely volume. Benjamin and Quinn begin by noting that the number of ways to tile a 1xn array of squares with tiles that are either 1x1 or 2x1 is exactly the (n+1)-th Fibonacci number. This elementary observation becomes the key to discovering and proving just about every Fibonacci identity you've ever heard of by simple counting of tilings.

There's something here for every fan of counting. For example, do you know how many odd numbers there are in the 76th row of Pascal's Triangle? Do you know what happens when you reverse the order of the terms in a finite continued fraction? *Proofs That Really Count* illustrates in a magical way the pervasiveness and power of counting techniques throughout mathematics. It is one of those rare books that will appeal to the mathematical professional and seduce the neophyte.

The Beckenbach Book Prize is awarded to "distinguished, innovative MAA books" that are "truly outstanding." The Prize Committee can think of no better adjectives to describe *Proofs That Really Count* except, possibly, charming.

Special Notice about *Mathematical Adventures for Students and Amateurs*

The Bay Area Mathematical Adventures is a series of talks aimed at bright high school students and their teachers organized by Tatiana Shubin of San Jose State University and Peter Ross of Santa Clara University. *Mathematical Adventures for Students and Amateurs* comprises nineteen of these lectures reconfigured as expository articles. The exposition is extraordinary and the mathematics is beautiful and bewitching. The authors run the gamut from familiar famous expositors (Ron Graham, Sherman Stein, Joe Gallian) to captivating new voices (Richard Scott, Zdezdelina Stankova, Helen Moore). It's hard to put this book down; after finishing an article one is simply compelled to turn to the next one. The Beckenbach Book Prize Committee recommended, and the Board of Governors approved, that the Association should recognize the editors, the authors, the lecture series organizers and everyone who helped in the production of this terrifically enjoyable book.

Chauvenet Prize: Call for Nominations

The Chauvenet Prize is the premier prize given by the MAA for an expository paper or survey article published in a North American journal. The prize to be given in January of 2007 will be awarded for an article published in 2002, 2003, or 2004. The Chauvenet Prize Committee invites members to call to their attention any article that they have found engaging and inspiring. Send your suggestions to Ken Ross, Chair of the Chauvenet Prize Committee, at ross@math.uoregon.edu.

Geometry in the Amazon

By Harry Waldman

Humans are apparently born with the ability to grasp geometrical concepts, say researchers who tested an indigenous group of people called the Mundurukú, who live in the Amazon. Their findings were reported in the January 20, 2006 issue of *Science*.

Stanislas Dehaene of the Collège de France led the research effort. He and his team tested 14 Mundurukú children and 30 adults. They then compared their findings against test results of American children and adults. To test the subjects, Dehaene's team designed arrays of six images, five of which were the same. One image varied slightly. Participants were asked, in their own language, to identify which one didn't belong or looked "weird" or "ugly." It turned out that even six-year-olds scored above what would be expected by chance. The average score was nearly 67 per cent — the same as American children. American adults performed better, which seems to lend credence to the idea that formal education enhances understanding.

These results imply that geometrical concepts are universal across humanity, with cultural factors such as maps or language enriching understanding, the researchers said. "The spontaneous understanding of geometrical concepts and maps by this remote human community provides evidence that core geometrical knowledge, like basic arithmetic, is a universal constituent of the human mind," the study's authors said. The Mundurukú children and adults, living along the Cururu River in the Amazon region of Brazil, "made use of basic geometric concepts such as points, lines, parallelism, or right angles to detect intruders in simple pictures," the researchers concluded.

Dehaene and his coworkers had previously investigated the arithmetical abilities of the Mundurukú. Their studies suggested that without language it is difficult to develop a sense for numbers above 3 or 4, in agreement with earlier studies by linguist Daniel Everett with another tribe, the Pirahã. Everett describes Dehaene's new results as "very significant," but cautions that one must be careful about their interpretation. Other scholars are more skeptical.

Dehaene is the author of *The Number Sense*, a study of "how the mind creates mathematics" that argues that mathematics is to some extent "hardwired" in the human brain.

President Announces "American Competitiveness Initiative"

In his State of the Union address and in several speeches in the days following, President Bush announced an "American Competitiveness Initiative" that will attempt to encourage innovation and research and to increase American competitiveness in the global economy. The initiative includes an initial commitment of $5.9 billion in the 2007 fiscal year, with continuing funding adding up to more than $136 billion over 10 years.

Arguing that continued competitiveness depends on basic research and technological innovation, the President outlined a series of measures intended to support such research. Some of the measures try to encourage more private investment in R&D, while others focus on public funding. The proposal includes a plan to double the total overall funding for the National Science Foundation, the Department of Energy's Office of Science, and the Department of Commerce's National Institute of Standards and Technology. Also included is support for mathematics and science education, including a program to encourage an expansion of Advanced Placement and International Baccalaureate courses and two programs called *Math Now for Elementary School Students* and *Math Now for Middle School Students*. These aim "to promote promising and research-based practices in math instruction, prepare students for more rigorous math courses, and diagnose and remedy the deficiencies of students who lack math proficiency."

The direct impact of these plans on the president's proposed NSF budget can be seen in the February 6 budget proposal. The FY 2007 budget request for the Mathematical and Physical Sciences Directorate of the NSF is $1.15 billion, an increase of $64.85 million, or 6.0%, over the FY 2006 budget. Unfortunately, the increase for the Division of Mathematical Sciences is much less, only 3.2%. The budget for the Education and Human Resources Directorate gets an increase of 2.5%, which is the overall effect of a large increase for Human Resource Development coupled with a 7% decrease in the budget for the Division of Undergraduate Education. The main cuts are in the Math and Science Partnership (MSP) program and the Course, Curriculum, and Laboratory Improvement (CCLI) program.

For more information on the President's initiative, see the press release at http://www.whitehouse.gov/news/releases/2006/01/20060131-5.html. For details on the NSF budget proposal, see http://www.nsf.gov/about/budget/.

Archives of American Mathematics: Photographic Mystery Update

By Kristy Sorensen

As you may remember, the December 2005 issue of FOCUS featured a "mystery photo" from the Mathematical Association of America Records at the Archives of American Mathematics. Many of you were kind enough to write or call with information on these photos. While some questions remain, your responses have helped to flesh out the story behind these images.

These photographs appear to be from the production of the film *Mathematical Induction*, shot in San Francisco and released in 1961. The film was part of the Committee on Educational Media's *Mathematics Today* series, and was shown on public television in New York City and in high schools.

The original cover image appears here as the second photo in the second row of the contact sheet. The man on the left, who was the featured mathematician in this film, is Professor Leon Henkin. A Professor Emeritus at UC Berkeley, Henkin currently lives in Oakland, California, with his wife, Ginette. Henkin also made the *Mathematics Today* film *Mr. Simplex Saves the Aspidistra* around 1962. Julian Henkin, Leon's son, notes that Henkin got involved in the film after meeting R. L. Wilder in the early 1950s at the University of Southern California.

Harold Kuhn (Henkin's brother-in-law) noted: "A major part of Leon's career has been spent in trying to increase the representation of minorities on the Berkeley campus. In his honor, the University has established a Leon Henkin Award for the faculty member who has shown outstanding activity in those areas. Aside from being a world class symbolic logician, I know that Leon would like to be remembered for his efforts to increase the diversity of our universities."

The man on the right in the December 2005 cover photo is Dr. Leon Cohen. Before moving to the University of Maryland around 1958, Cohen worked reviewing grant proposals in the field of mathematics for the National Science Foundation.

The identity of the man in the center of the cover photo is still uncertain, although it was suggested that he might be the film's director. Any more information on the identity of this person would be greatly appreciated.

A critical perspective on the film is provided by Professor Marcia Ascher, Professor Emerita, Ithaca College: "In the mid-60s, as a faculty member at Ithaca College, I was very enthusiastic when I read of the MAA film series. We rented the film *Mathematical Induction*. My enthusiasm was based on the fact that the students would hear and see Dr. Henkin, renowned for his work in logic and foundations of mathematics. They would hear his perspective and presentation on mathematical induction, a topic that they encountered but which still seemed to puzzle them, and use of the film medium could do things we could not do in the classroom. We arranged for all of our College Algebra and Calculus I students to be at an auditorium showing of the film. I was exceptionally disappointed. The reasons for my disappointment are captured in the photo on page nine, which seems to show the filming of the presentation. For most of the presentation, the speaker had his back to the audience and covered what he had just written on the board. No advantage was taken of the film medium, and the contents of the presentation were much the same as our usual presentation. And, notice in particular, an oversized eraser on the blackboard ledge. For some reason, perhaps due to the camera focus on it, each time the eraser was used, the audience broke into unrestrainable laughter."

The Archives of American Mathematics is located at the Research and Collections division of the Center for American History on the University of Texas at Austin campus. Persons interested in conducting research or donating materials or who have general questions about the Archives of American Mathematics should contact Kristy Sorensen, Archivist, k.sorensen@mail.utexas.edu, (512) 495-4539.

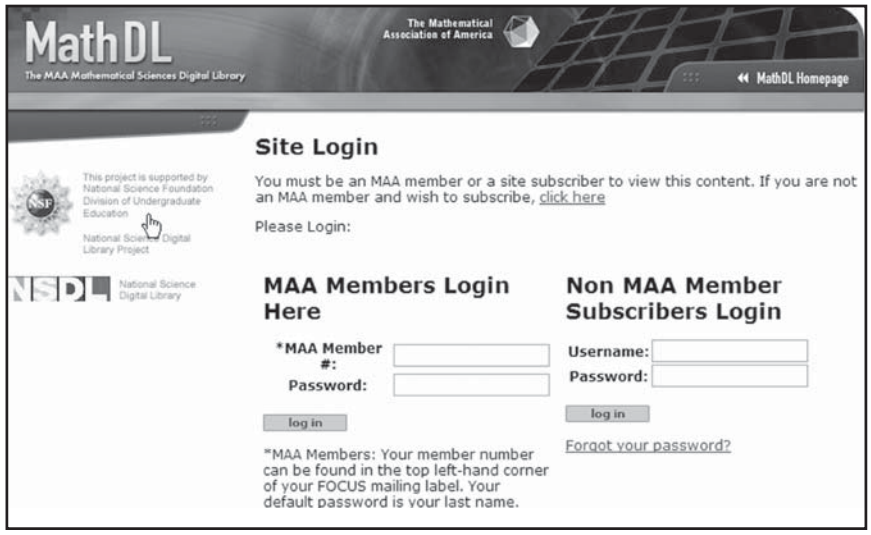
A contact sheet of photographs from the 1961 production of "Mathematical Induction," a film in the Mathematics Today series featuring Dr. Leon Henkin. From the Mathematical Association of America Records, Archives of American Mathematics, Center for American History, The University of Texas at Austin.

What's Your Number?

The Key To New Resources in MathDL

By Lang Moore

You know that number that appears in the upper left corner of the mailing address for FOCUS — the one that you need to pay your dues online or order from the MAA Bookstore? (It has the form 000XXXXX, where each X can be any digit.) Now it is more useful than ever. It will give you access to the two new components of the MAA's Mathematical Sciences Digital Library (MathDL): *MAA Reviews* and *Classroom Capsules and Notes*. These components are available to MAA members as a privilege of membership.

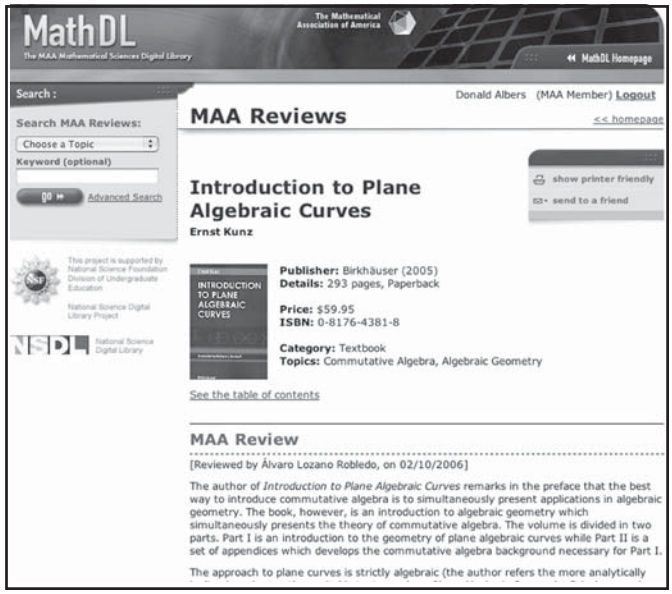


Both of these new components are also available to non-members by subscription, for $25 per year.

MAA Reviews, edited by Fernando Gouvêa, is the MAA's new bibliographic and reviews database, and it incorporates the MAA's Basic Library List as well. Created with the intention of replacing the old "Telegraphic Reviews" with an online service, *MAA Reviews* in fact goes far beyond anything the old TRs could offer. It includes a database of almost all recently-released mathematics books, a large percentage of those with reviews. Those books that have been recommended for purchase by undergraduate libraries by the MAA's Basic Library List committee are marked. The database is searchable, and the "advanced search" engine allows one to quickly find the books one wants.

To access *MAA Reviews*, go to the MAA home page, http://www.maa.org, click on MathDL on the menu, and select *MAA Reviews* from the list. Once at the *MAA Reviews* home page, click on Login. You'll see the "Site Login" page above. Fill in your MAA member number and password on the left hand side (or, if you're a non-member subscriber, fill in username and password on the right hand side). Click on "log in" and you should be back at the *MAA Reviews* home page. Now you are ready to read one of the featured reviews or use the Search or Advanced Search to find a book or books on a particular subject.

The screen shot on the right below shows a typical book page. The cover image and publication details appear, including a



"category" classification and an attempt to describe the topics covered in the book. Below, the beginning of the MAA Review of that book can be seen. (Some books will say a review is planned, and some that no review is planned.) When possible, a link allows you to access the table of contents. A "printer friendly" button is available if you want to print the table of contents and review. At the bottom of the page, there is a link that allows you to submit your own review of the book. This gives members a chance to play the game themselves, and to disagree with a reviewer when necessary. (Reviews are not posted without approval of the editor, of course.)

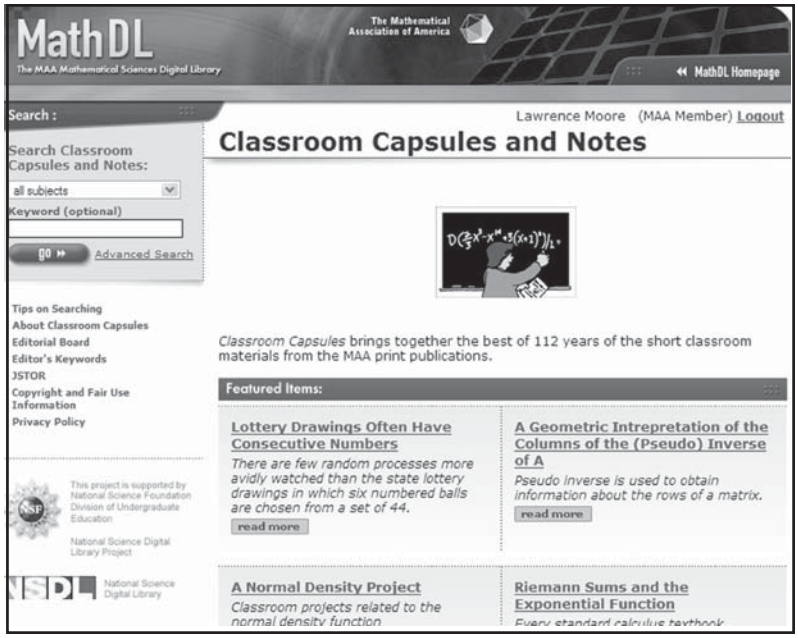
In time, we hope *MAA Reviews* will become *the* place to go for listings and reviews of mathematics books. The editor is always looking for volunteer reviewers, so you can do your part to help that happen.

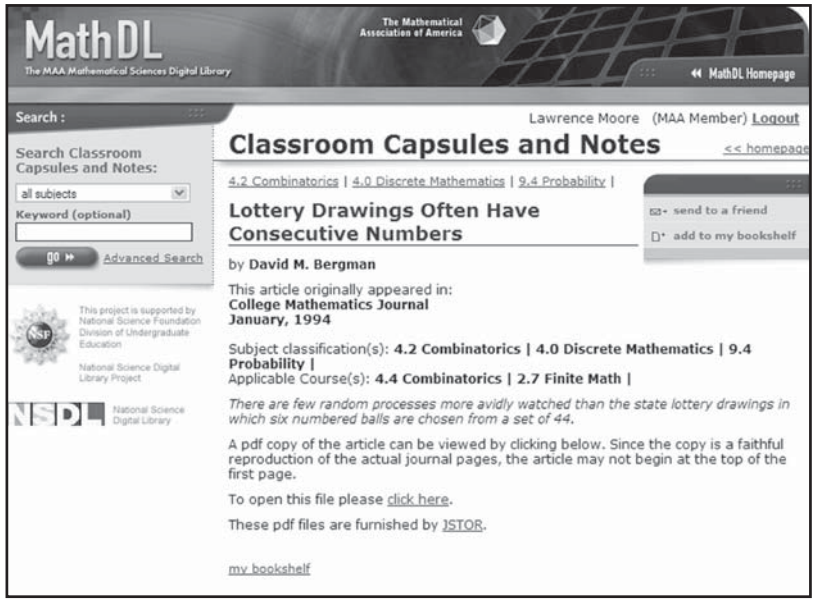
Classroom Capsules and Notes, edited by Wayne Roberts, provides online access to the short classroom materials that have appeared in the Association's print journals over the last 100+ years. All of us see from time to time a short article suggesting something we think we could use in the classroom: a little proof that gives unusual insight; a quick application, or connection to another area of mathematics, a question that could be used to challenge the good student. We may even remember them after we see them, or perhaps remember that we saw them. The trick is to find those items when it's time to actually use them!

Or perhaps we have come to a point in a course where we don't recall having seen something new, but we sure wish we had. Perhaps there's a cleaner proof of a theorem, or an idea to enliven the presentation. But if it appeared in the *Monthly* in the 1920s, we weren't likely to find it by random search. Well, now we can access a properly vetted searchable selection of such materials.

Materials in *Classroom Capsules and Notes* are classified by courses, by subject, by keywords, by author, and by source, and are intended to help you quickly find the perfect enhancement to your classroom presentation.

To access materials from *Classroom Capsules and Notes* go to the MAA home page, http://www.maa.org, click on MathDL on the menu, and select *Classroom Capsules and Notes* from the list. Once at the *Classroom Capsules and Notes* home page, click on Login. If you have not already logged in while looking at *MAA Reviews,* you will need to login. The login procedure is the same for both new components, and you only need to do it once per visit to MathDL. Once you have logged in, you should see the *Classroom Capsules and Notes* home page (top right). Now you can click on one of the featured materials or use the Search or Advanced Search to find materials of interest.

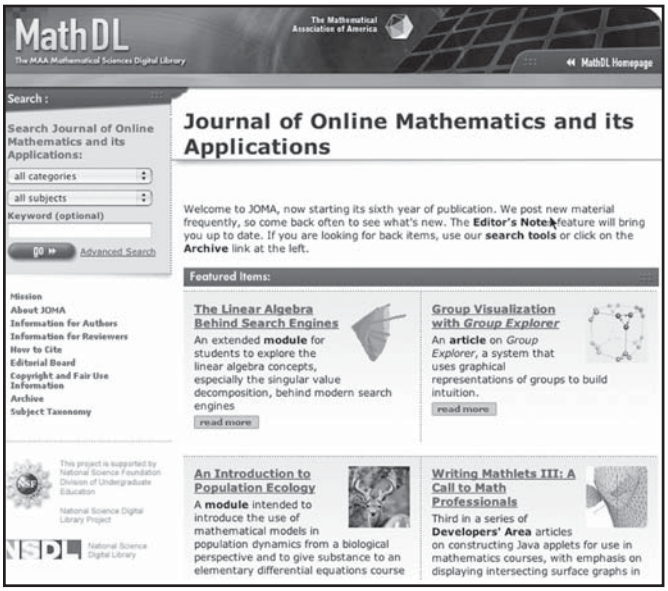


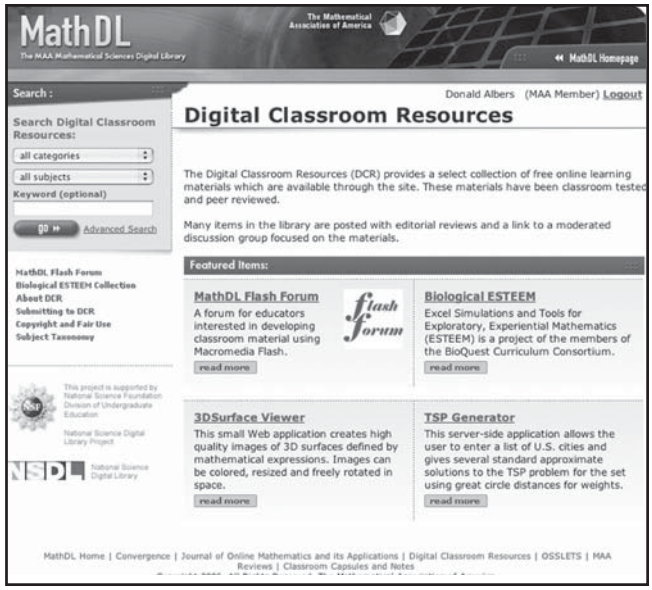


Clicking on one of the featured materials or one obtained by a search brings you to a page like this second one on the right. Now clicking on **click here** brings up pdf copies of the pages containing the original article. These pages are provided to us by JSTOR.

There is also news to report on three existing components of MathDL: *The Journal of Online Mathematics and its Applications* (JOMA), *Digital Classroom Resources* (DCR), and *Convergence*. Currently, all of the existing components are freely available. However, *Convergence* does require registration.

JOMA. Kyle Siegrist has taken over as editor from founding editor, David Smith. David guided JOMA for five years — from its initial issue in January 2001 through Volume 5 completed

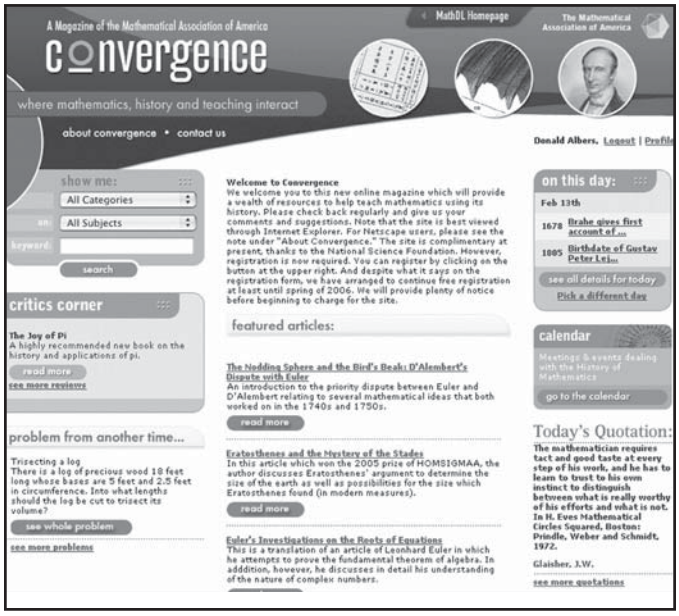




at the end of 2005. Kyle, former chair of the Mathematics Department at the University of Alabama in Huntsville, is creator of the extensive and innovative online digital library, Virtual Laboratories in Probability and Statistics.

Check out the new JOMA article by Amy Langville, *The Linear Algebra Behind Search Engines*, or the article by Nathan Carter and Brad Emmons, *Group Visualization with Group Explorer*.

DCR. Doug Ensley continues as Editor of *Digital Classroom Resources*. Together with Barbara Kaskosz, Doug has created the MathDL Flash Forum as a new feature of DCR. The Flash Forum provides sample material, source code, and instructions for customizing Flash-based mathematics teaching material. The goal of the **FlashForum** is to use this shared material along with related discussion threads to build a community of developers and users of *Flash*.



A second new project is the posting of materials from the Biological ESTEEM Project. This is a project of the members of the BioQuest Consortium and provides Excel simulations and tools for using mathematics in the study of biology. Additional Excel spreadsheets and guidelines for use will appear over the next several months.

Convergence. Victor Katz and Frank Swetz continue to edit this online magazine devoted to the use of the history of mathematics in the teaching of mathematics. So far this publication has been supported by a separate NSF grant. Now, as the grant funds run out, the editors are anticipating the need to move to a subscription model. Currently, only registration is required to access the articles, reviews, and features. Go to the site and read the review by Frank Swetz of David Blatner's *The Joy of Pi* or Robert Bradley's fascinating discussion of the dispute between Euler and D'Alembert, *The Nodding Sphere and the Bird's Beak: D'Alembert's Dispute with Euler*.

MathDL was created with the support of NSF Grant DUE – 0085861 and, since 2004, has been delivered by a content management system created for the MAA by Lucidea. They are also creating a content management system to support the new MAA digital library project, *The Math Gateway*. This NSF-supported project will create a portal within the National Science Digital Library to online undergraduate mathematics materials. Although the direct cost of adding *MAA Reviews* and *Classroom Capsules and Notes* to MathDL was paid by MAA, it was made possible by the simultaneous development of Math Gateway. The Math Gateway itself is expected to debut by the end of March at mathgateway.maa.org.

So, find your number and use it to check out *MAA Reviews* and *Classroom Capsules and Notes*. Then go on to look at new materials in JOMA, DCR, and Convergence – and keep an eye out for more information on The Math Gateway.

In FOCUS: The 2006 Joint Mathematics Meetings

The 2006 Joint Mathematics Meetings were held in San Antonio, Texas, on January 12–15, 2006. About five thousand mathematicians from all over the world converged on the city for those few days. The program was, as usual, extremely full, with many simultaneous events scheduled at any given moment. In this and the following pages, we report on some of these events. We hope we will stir up fond memories in those who attended and a sense of "I want to do this" in those who did not!

On pages 14–17, you will find a selection of photographs from the meeting. Most of these were provided by Rich Hamilton of the MAA staff and by the editor of FOCUS. We hope they will give our readers a sense of what the meeting and the place were like. We've also tried to include photos of people whose names you might now: authors of MAA books, editors of MAA journals, officers of the Association.

As always, the meeting provided an opportunity for the MAA to take care of business. The Board of Governors met on January 11, and many committees met during the meeting days. And, of course, there was an MAA Business Meeting on January 15. We have reported on some of what happened at these meetings.

The next meeting of the Association is MathFest, to be held in Knoxville, Tennessee on August 10–12. Next year's Joint Mathematics Meetings will be held in New Orleans on January 5-8, 2006. Please visit http://www.maa.org for more information, including a joint statement from the MAA and AMS about the practicalities of meeting in New Orleans next year.

Things I Learned at the Joint Meetings

By Fernando Q. Gouvêa

There are two types of number theorists: those who like to multiply primes, and those who like to add primes. Ben Green likes to add primes.
(From Green's talk on "Patterns of Primes")

"Educators show way to climb math mountain"
(Headline, *San Antonio Express-News*, January 15, 2006)

"Visiting math gurus have their pi, eat it 2"
(Internal headline, *San Antonio Express-News*, January 14, 2006)

"Hip $2B^2$"
(First page headline, *San Antonio Express-News*, January 14, 2006)

"If you mix opera singer and art dealer you get algebraic number theorist."
(Hendrik Lenstra, on Emil Artin and his parents)

There seem to be a lot more babies at winter meetings than at MathFest. Could this be due to the availability of child care?
(My own two eyes)

"It's OK to like math."
(On a t-shirt)

MAA has "partnered" with Maplesoft to produce online placement tests.
(Flyer included in the registration packet)

"The computer algebraist of the future should know infinite Galois theory."
(Hendrik Lenstra explains what you should tell people you learned in San Antonio)

Alexander Jones recently argued that Euclid and the *Elements* should be dated a hundred years later than has usually been thought.
(Glen van Brummelen, in passing)

Past issues of the *American Mathematical Monthly*, *Mathematics Magazine*, and the *College Mathematics Journal* are now available, through JSTOR, in over 140 countries.
(Don Albers, report to the Board of Governors)

This year's MathFest will include a "meet the editors" panel featuring the editors of MAA journals — potential authors take note!
(Council on Publications meeting)

Somewhere someone has "a stuffed pink pig named Stroyan"!
(It's in my notes, but there's no further information.)

"There are infinitely many three-and-a-half term arithmetic progressions of primes."
(Ben Green summarizes a theorem of Heath-Brown, in his talk on "Patterns of Primes")

A stroll through the Convention Center revealed "more long bushy beards than might be found in the average population, most folks looked pretty normal. And not a single pocket protector was in sight."
(Amy Dorsett, in the *San Antonio Express-News*, January 14, 2006)

San Antonio 2006: The Undergraduate Poster Session

By Diana Thomas

All of the winners from the undergraduate poster session.

This year's poster session was a tremendous success, with over 130 posters presented and judged by 140 professional mathematicians. The poster session was well attended and continues to attract a large audience at the Joint Mathematics Meetings.

I attended my first poster session as an advisor in 1998; there were fewer than 20 posters presented. It has grown in size to the event we see today largely due to the efforts of the organizer, Mario Martelli. Many changes came with my first year as organizer of the session. The submission of abstracts and judge information was electronicized. This could not have been done without the time and effort of Hal Nesbitt, Program Coordinator of the MAA. During this transition, I received much needed support from Suzanne Lenhart, the Chair of the MAA-CUPM Subcommittee on Undergraduate Research, Betty Mayfield, Chair of the MAA Committee on Undergraduate Student Activities and Chapters (CUSAC) and Michael Pearson, Director of Programs and Services of the MAA.

A lot of time and effort goes into the poster session, from evaluating student abstracts to assigning judges to posters. Special thanks goes to Suzanne Lenhart (University of Tennessee, Knoxville) for arranging the prizes donated by the American Mathematical Society, the Association for Women in Mathematics, the Council on Undergraduate Research, the Educational Advancement Foundation and the Society for Industrial and Applied Mathematics. I would also like to thank Mike O'Leary (Towson University) for assigning judges to posters. I'd like to also thank the students from the University of Tennessee, Knoxville and Towson University who helped set up and assist us in variety of jobs on the day of the poster session.

The tremendous enthusiasm from past and new judges was very much appreciated. Of special note were the standby judges, on whom I relied to judge posters on a variety of topics. Because of the large number of poster presentations, we required many new judges. Past judges helped spread the word to recruit new judges. As usual, Project NeXT came through with new recruits. Aparna Higgins was especially diligent in obtaining judges at the last hour. Thanks to all of you who do this wonderful service and I hope to count on you next year!

Finally, the poster session would not be as successful as it is if it were not for the students and their advisors. Many past judges and attendees commented on the exceptional quality of posters and their corresponding presentations this year. Of special note was Truman State University with two prize winners, Kensey L. Riley and Bach Quang Ha.

I hope to see the same large turnout of students next year in New Orleans. Save the date and apply early. A list of this year's poster session prize winners can be found at http://www.maa.org/students/undergrad/06winners.html. News for next year's poster session will be posted on the MAA website: http://www.maa.org.

Diana Thomas is Assistant Professor of Mathematics at Montclair State University, in New Jersey. Visit her home page at http://csam.montclair.edu/~thomasd.

San Antonio Joint Mathematics Meeting

Somewhere, between the rainbows, was the MAA's booth in the exhibit hall.

Clara Orbe at the Welcome Reception for Undergraduate Students.

An engaged audience at the MAA Short Course on "Experimental Mathematics in Action."

Despite being MAA's Second Vice-President Deanna Haunsperger is still smiling.

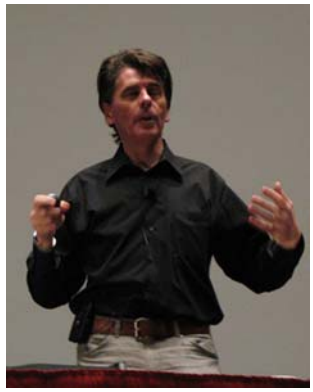
Secretary Martha Siegel, President Carl Cowen, and Executive Director Tina Straley at the Board of Governors meeting.

The view from above: the tables at the networking center were always busy.

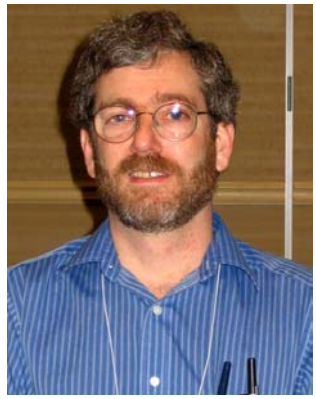
A portion of the exhibit of mathematical art.

Good books at good prices: SIAM held a "trunk sale."

Three presidents: Ron Graham, Ann Watkins, and Carl Cowen.



Keith Devlin spoke on mathematics and linguistics.

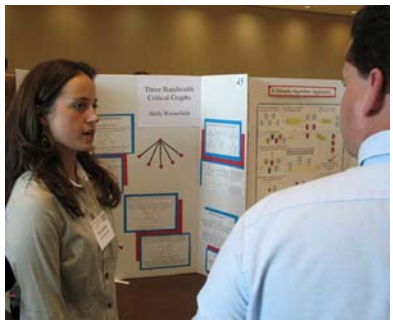


Dan Velleman, editor-elect of the American Mathematical Monthly.

It wasn't only books! T-shirts and leather goods for sale in the exhibit hall.

At the MAA Booth: Jenny Quinn, Art Benjamin, and Carol Baxter.

Steven Maurer and Don Albers mug for the camera while discussing the future of the MAA Notes series. Steve is the new chair of the Notes Editorial Board.



Holly Waterfield presents her poster on "Three Bandwidth Critical Graphs."

Francis Su speaks on "Preference Sets, Graphs, and Voting in Agreeable Societies."

Howdy!

MAA Directors strategize at the Board of Governors meeting: Tina Straley, Michael Pearson, Steve Dunbar, Jim Gandorf, and Roseann Brown.

Lang Moore, executive editor of MathDL and the force behind the Math Gateway.

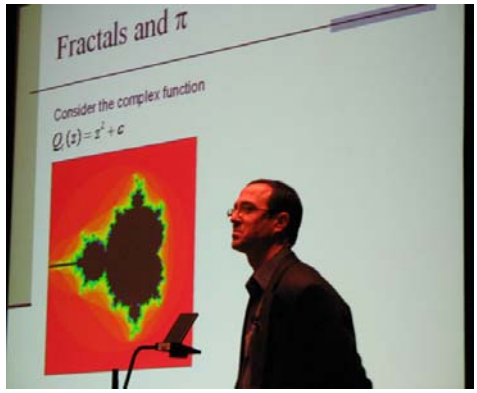
Mario Martelli was honored for his long time work with the student poster session at the Joint Meetings.

The other half of the Board of Governors meeting.

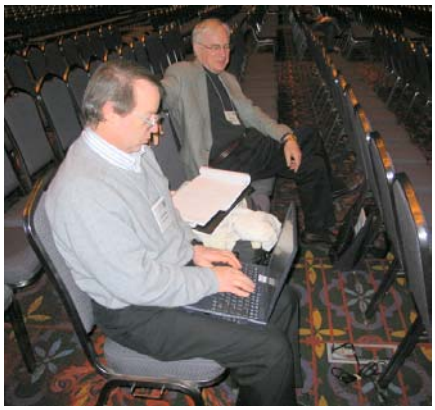
One half of the Board of Governors meeting.

Reception for undergraduate students in the Student Hospitality Center.

The fullest room in the conference center: trying to get into The Great Pi/e Debate.



Is that a Mandelbrot set I see? Marc Chamberland connects fractals and pi at the student lecture on "The Many Faces of Pi."

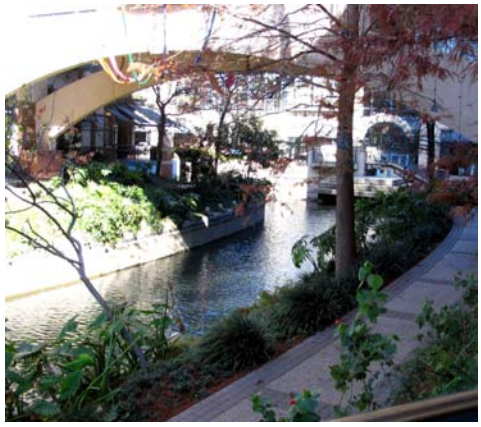


It may be far away from everything, but wherever the outlet is must be the best seat in the house.

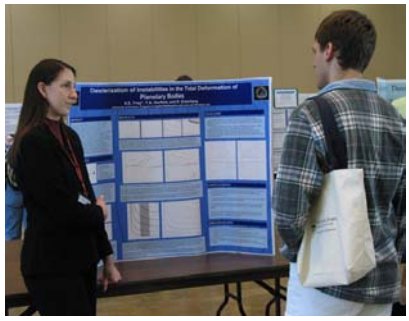
The undergraduate poster sessions during judging. Did the participants know which ones were judges and which were just interested visitors?

Director of Programs and Services Michael Pearson is shocked, shocked.

Opening day in the JMM Registration area.

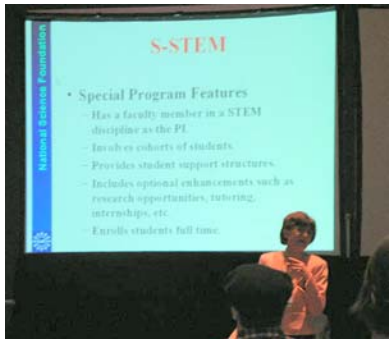


A view of the Riverwalk.

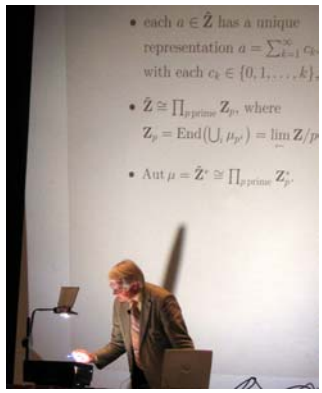


Sarah Frey discusses her poster at the session ono NSF-sponsored projects.

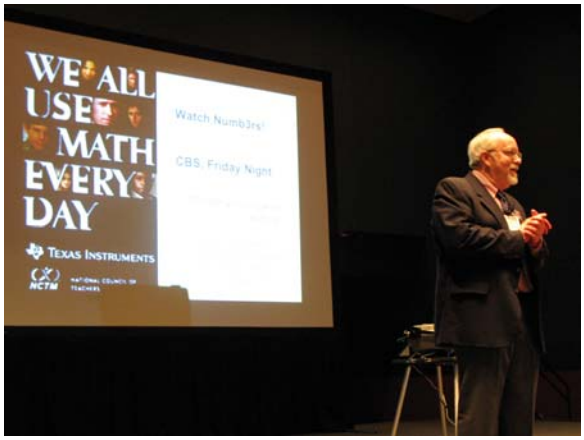
Having breakfast togehter: the MAA Departmental Liaisons and the PME/MAA Student Chapters.



Elizabeth Teles at the NSF Panel Discussion.



Hendrik W. Lenstra, Jr. giving the Colloquim Lectures.



What's your NUMB3R? Johnny Lott, past-president of NCTM, reminds us "We all use math every day."

Christopher Powell answers questions after his HOM-SIGMAA talk on the geometry of Mayan art.

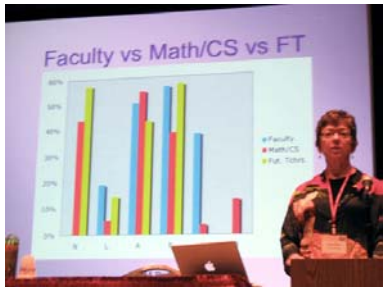
Allen Schwenk, new editor of Mathematics Magazine.

At the MAA Booth.

Fred Rickey at the MAA minicourse on Teaching a Course on the History of Mathematics.

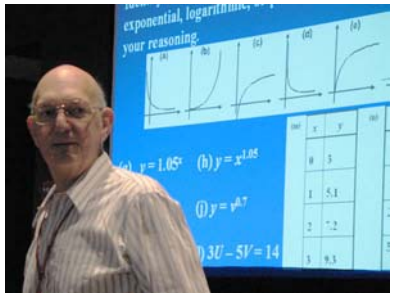
Judy L. Walker, Haimo winner, at the MAA Presentations by Teaching Award Recipients.

Keith Stroyan, Haimo winner, at the MAA Presentations by Teaching Award Recipients.

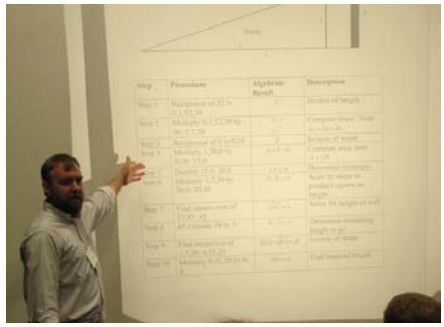


Jacqueline Dewar, Haimo winner, at the MAA Presentations by Teaching Award Recipients.

San Antonio himself!



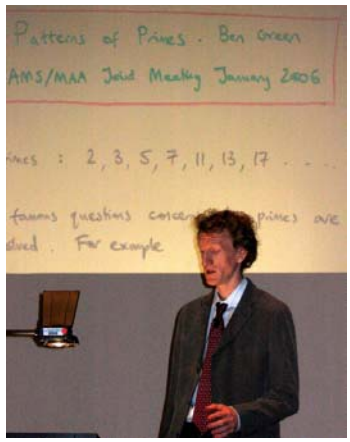
Sheldon Gordon integrates mathematics with other disciplines.



Duncan Melville explains how to engineer an ancient Babylonian siege ramp.

MAA Executive Director Tina Straley catches up with Rodger Hammond.

Ken Ross and Martha Siegel at the Liaisons Breakfast.



Ben Green spoke on "Patterns of Primes."

At the reception following the Joint Session on Awards and Prizes.

Mathematical Experiences in Business, Industry and Government

By Phil Gustafson

Applications of mathematics to projects in business, industry and government (BIG) offer a wealth of exciting problems for mathematicians. Examples of BIG topics were presented at the MAA Contributed paper session entitled "Mathematics Experiences in Business, Industry and Government," during the Joint MAA-AMS meetings in San Antonio. This article discusses highlights of the BIG projects presented at the session. The paper session was sponsored by the Business, Industry and Government Special Interest Group of the MAA (BIG SIGMAA), and was organized by Phil Gustafson of Mesa State College and Michael Monticino of the University of North Texas.

Omayra Ortega, a graduate student at the University of Iowa, described her work in Cairo, Egypt, performing a cost analysis of treating infant rotavirus. This project was conducted in cooperation with Mark Riddle and John Sanders of the U.S. Navy Medical Research Unit 3. Rotavirus is a significant cause of morbidity and mortality in Egyptian children aged 0-5 years. The Egyptian Ministry of Health and Population (MoHP) is the main payer of health care and responsible for administering the Expanded Program on Immunization within the country. The cost-benefit analysis was conducted to evaluate the economic impact of introducing a rotavirus vaccine to the current national immunization schedule. In the base-case model, it is estimated that a vaccination program would prevent 1,074,799 episodes of diarrhea, 413,133 outpatient visits, 44,770 hospitalizations and save 2,707 lives, resulting in direct medical costs savings to the MoHP of over 13.5 million dollars. The analysis predicted that the vaccine would cost the MoHP close to 32.5 million dollars. This equates to a benefit-cost ratio of 0.0726:1 and an incremental cost of $30.22 per infection prevented.

Michael Monticino of the University of North Texas spoke on a consulting project modeling teller staffing in retail banks. This project was conducted in cooperation with Travis Cogdill, a graduate student at the University of North Texas. Approximately seventy-four percent of retail bank employees are tellers, and their salaries are a bank's chief source of labor costs. Overstaffing tellers unnecessarily increases labor costs, while understaffing affects customer service and employee morale. Thus getting the right number of tellers in a branch at the right times is essential to controlling costs, retaining customers and employees, and growing a bank's revenue. This talk discussed the development of a Teller Staffing product for retail banks by ARGO Data Resources, Inc.

ARGO specializes in data delivery and integration technology for the financial services industry. ARGO currently has a fifty percent market share of the top ranking 30 U.S. banks where over five million financial transactions every hour are processed with ARGO systems. The Teller Staffing product combines mathematical methods with state of the art information technology, allowing banks to capture minute-by-minute transaction and service time data to make branch level staffing recommendations based on individual branch transaction volume patterns and teller service time statistics. This talk outlined the mathematical and practical challenges, as well as the collaboration between academics and business in developing the product.

Greg Coxson of Technology Service Corporation discussed ionospheric dispersion of linear frequency modulation (LFM) pulses in radar applications. Most radars are active sensors, transmitting energy in order to see targets. Radars typically have an advantage in enhancing the detectability of the often weak return signals, since the form of the transmitted signal is known. Radar receiver matched filters exploit this to optimize signal-to-noise ratio. However, the process does not always go smoothly. For example, detection of some especially demanding radar targets involve both the need for wide bandwidth and propagation through the ionosphere. The ionosphere exacts a penalty on wide-bandwidth signals in the form of a frequency-dependent time delay. The result is that the return signal may look very different from what was transmitted. A commonly used wide-bandwidth signal involves trains of LFM pulses. This talk examined two ways of dealing with ionospheric dispersion of LFM pulses, the first being to form the transmit pulse so that the return pulse is in a LFM format, and the second being to send out an LFM pulse and anticipate the form it will have on return.

Ellina Grigorieva of Texas Woman's University spoke on optimal control theory applied to the interaction between a

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manufacturer and a retailer. She and Evgenii Khailov (Moscow State University) modeled the process of production, storage and sales of a perishable consumer good as a cooperative game between a manufacturer and a retailer. The model consisted of a pair of differential equations that incorporated many variables, including the quantity of the product in the market, the retailer's inventory of the product, the rates of production and purchasing of the product, and the rate of reselling of the product. Also incorporated were parameters such as the coefficient of spoilage, the cost of storage of unsold product units, the price at which the retailer buys the product from the manufacturer and the price at which the retailer resells it. In this model, both parties seek to maximize their cumulative profits. The problem was solved with the use of Pontryagin's Maximum Principle.

In this article we have seen several different applications of mathematics to problems in business, industry and government. In a variety of settings, mathematics is a key component to many important projects in the world around us. Who uses math? The answer includes many of the BIG mathematicians whose contributions help improve the quality of our everyday lives.

Phil Gustafson is Associate Professor of Mathematics at Mesa State College in Grand Junction, CO, and is Vice Chair for Programs for BIG SIGMAA. He gratefully appreciates the input provided by the speakers for the content appearing in this article, and thanks them for their participation in the paper session.

Have You Moved?

The MAA makes it easy to change your address. Please inform the MAA Service Center about your change of address by using the electronic combined membership list at MAA Online (http://www.maa.org) or call (800) 331-1622, fax (301) 206-9789, email: maaservice@maa.org, or mail to the MAA, PO Box 90973, Washington, DC 20090.

Robert Balles and the Tensor Foundation Inducted into the Icosahedron Society

MAA President Carl Cowen inducted Robert P. Balles and the Tensor Foundation, represented by Marie McKellar, into the Icosahedron Society at the President's Reception with nearly 100 people in attendance at the 2006 Winter Meeting in San Antonio.

Carl Cowen, MAA President, Robert Balles, James W. Daniel, Ann Trump Daniel, Karenna Sterrett, Andrew Sterrett, Marie McKellar, and Tina Straley, MAA Executive Director.

Robert Balles has established the Robert P. Balles Annual Mathematics Awards which includes the Robert P. Balles Mathematics Scholar award (awardees are the 6 IMO team members) and the Robert P. Balles Distinguished Mathematics Student award (awardees are the 12 USAMO winners). The continuation of these awards after his death has been provided for through the gifting to the MAA of a retirement plan. This restricted gift will be used to create the permanently endowed fund to be known as the Robert P. Balles Memorial Endowed Fund which will continue to support these established awards.

Since 1995, the Tensor Foundation has awarded over 130 grants for projects designed to encourage college and university women or high school and middle school girls to study mathematics. The objective of this program is to encourage mathematics faculty to develop projects to increase participation of women in mathematics. Marie, formerly a faculty member at Mercy College in New York, has supported the MAA in many ways; an office at the MAA Headquarters is named in honor or her parents, Viola D. And Bernard J. Hank.

As members of the Icosahedron Society, they received the magnificent crystal icosahedron as a gift in appreciation of their contribution.

The Icosahedron Society was formed in 2000 to recognize individuals who have made significant contributions to the Association. Donations of this type are extraordinary and make it possible for the MAA to continue to promote its mission: to advance the mathematical sciences, especially at the collegiate level.

For further information about contributing to the Association or about The Icosahedron Society, contact Lisa R. Kolbe, Development Manager, at 202-293-1170 or lkolbe@maa.org

The Members of the Icosahedron Society

Year 2000

Henry L. Alder
Edith Ross and Edward Brinn
Deborah Tepper Haimo
Mary Alice and Marvin Schaefer

Year 2001

Akamai Foundation
ExxonMobil Foundation
Microsoft Corporation
Andrew Sterrett, Jr.

Year 2002

Ann Trump Daniel and James W. Daniel

Year 2003

Paul and Virginia Halmos
Mary P. Dolciani Halloran Foundation

Year 2006

Robert P. Balles
Tensor Foundation

Joint Meetings Short Takes

Compiled by Fernando Q. Gouvêa

Code of Ethics and Whistleblower Policy

In response to the Sarbanes-Oxley Act of 2002, the Board of Governors adopted an MAA "Code of Ethics", including a "Whistleblower Protection Policy." Members can read the new policy statement at http://www.maa.org. (Go to "About MAA" and then select the "Statements and Policies" flyout menu.)

Dues Restructuring

The Board approved a plan to restructure MAA dues so as to bring them closer to the true cost of journals and member services. The new plan also simplifies the dues structure and, we hope, makes it easier to understand. More details will appear in the May issue of FOCUS.

Meetings Scheduled

Locations and dates have been chosen for MathFests up to 2010 and for winter meetings up to 2013. (See the sidebar on this page.) Also set is the location (Washington, DC) and the dates (August 5–8) of the MAA Centennial Meeting in 2015. For more information on what's being planned for that special meeting, visit the MAA Centennial Meeting web site at http://www.maa100.org/. The site also offers members a chance to make suggestions for events to celebrate one hundred years of the MAA.

MAA 2005 Best Sellers

So which MAA books have sold the most in 2005? Here they are: *Mathematics for Business Decisions*, by Richard Thompson and Chris Lamoureaux; *Martin Gardner's Mathematical Games*, by Martin Gardner; *R. L. Moore: Mathematician and Teacher*, by John Parker, *Math through the Ages, Expanded Edition*, by William P. Berlinghoff and Fernando Q. Gouvêa, *A Tour Through Mathematical Logic*, by Robert S. Wolf, *Game Theory and Strategy*, by Philip D. Straffin, and *Geometry Revisited*, by H.S.M.Coxeter and S.L.Greitzer. It's interesting to note that two of these are electronic books: *Mathematics for Business Decisions* is a text aimed at business and management students, and *Martin Gardner's Mathematical Games* is a collection, on CD-ROM, of all 15 of Gardner's mathematical games books. Also notable is that the books by Straffin and by Coxeter and Greitzer are selling well despite having been published, respectively, 12 and 38 years ago!

Basic Library List Will Be Updated

The new *MAA Reviews* site (see page 10) will include all of the books recommended for undergraduate libraries in the MAA's "Basic Library List." The web-based format will allow the Basic Library List committee to keep the list updated, and reviewers will suggest that worthy new books be added. As we go to press, we are still early in this process, but we are working hard at entering data.

MAA Reviews Wants Reviewers

Fernando Gouvêa spent a lot of time talking to publishers at the Joint Meetings, making sure they will send review copies of their latest books to *MAA Reviews*. He expects to be swamped with new books, and so is eager (not to say desperate) to enlarge his courageous corps of reviewers. Top needs right now are reviewers willing to take on elementary textbooks and more advanced books in Applied Mathematics, Analysis, Probability, and Statistics.

Strategic Planning

The MAA has decided to have a continuous planning process. Each year, one or two aspects of the work of the Association are examined by a specially-chosen committee with a view to assessing what has been done and planning for the future. During 2005-06, planning efforts are focusing on Professional Development, American Mathematics Competitions, and Revenue; in 2006-07, they will focus on Membership, Students, and Governance.

Mario Martelli Honored

For many years, Mario Martelli organized the Undergraduate Poster Session at the Joint Mathematics Meetings. He has now passed on the torch, and the Board of Governors honored Mario with a Certificate of Appreciation, saying that Mario should be "recognized for his outstanding service to the many students who have been given the extraoridnary opportunity to share their work through the MAA Undergraduate Poster Session, the faculty who have had the pleasure to serve as judges, and the Association whose meetings have been so enriched." A photograph of Mario receiving his certificate is on page 16.

National Meetings of the MAA

MathFest

Knoxville, TN, August 10-12, 2006
San Jose, CA, August 3-5, 2007
Madison, WI, July 31-August 2, 2008
Portland, OR, August 6-8, 2009
Pittsburgh, PA, August 5-7, 2010

Joint Mathematics Meetings

New Orleans, LA, January 4-7, 2007
San Diego, CA, January 6-9, 2008
Washington, DC, January 7-10, 2009
San Francisco, CA January 6-9, 2010
New Orleans, LA January 5-8, 2011
Boston, MA, January 4-7, 2012
San Diego, CA, January 9-12, 2013

MAA Honors Ed Ahnert of ExxonMobil

Truman Bell, Program Officer, ExxonMobil Foundation, Tina Straley, Executive Director, MAA, Ed Ahnert, Former President, ExxonMobil Foundation, Carl Cowen, President, MAA.

MAA president Carl Cowen awards an MAA Certificate of Appreciation to Ed Ahnert, who served as President of the ExxonMobil Foundation for fourteen years. Ed, along with Robert Witte and Truman Bell, helped launch and fund Project NExT. Since 1994, the ExxonMobil Foundation has provided nearly 1.3 million for NExT. In 2001, the MAA inducted the ExxonMobil Foundation into its Icosahedron Society (see page 21). MAA and AMATYC are now collaboratively sponsoring project ACCCESS (see page 5), and ExxonMobil has once again stepped up with its support. Other programs funded by ExxonMobil under Ed's leadership include the Guidelines for Programs and Departments in Undergraduate Mathematics, ARUME (The Association for Research in Undergraduate Mathematics Education), and the MET (Mathematical Education of Teachers) Summit.

Spelman College: Strength in Diversity and Strength in Numbers

Six Spelman faculty and four students, together with several graduates of the program, attended the Joint Meetings. Back row: Lee Lorch of York University, Toronto (who recently turned 90, and received an Honorary Degree from Spelman in 1999), Jeffrey Ehme, Erica Fields '04 and Emille Davie '01 (both currently in graduate school at the University of Georgia), Yewande Olubummo, Sylvia Bozeman, and "Card Colm" Mulcahy. Front row: Spellman junior Victoria Frost, Mohammed Tesemma, Nagambal Shah, and MAA Undergraduate Poster Session prize winner, senior LaNita Ward. (Photo taken by Prof. Joe Gallian)

Increasing the Number of Mathematics Majors

By William Yslas Vélez

The last couple of decades have seen a decline in the number of undergraduates pursuing degrees in mathematics. During the same time, quantitative methods have been increasingly present in the sciences, necessitating a more rigorous mathematical training for students interested in pursuing a research career. It is perfectly reasonable to suggest that future researchers in the sciences should be majoring both in mathematics and in the sciences. Moreover, an undergraduate mathematics major, coupled with computing skills and a knowledge of basic science, is an employable combination. When thinking of students majoring in mathematics, the fact that such students can be employed with an undergraduate degree must be uppermost in our minds. We must not think of the undergraduate degree in mathematics as the first step towards the doctorate.

If we are to increase the number of students in this country that are more mathematically literate, then we must address the question of how we are to entice these students to include more mathematics in their undergraduate curriculum. One activity that readily comes to mind is *outreach*. By this I mean activities by mathematics departments to reach out to pre-college students. The purpose of these activities is to acquaint these students with the importance of mathematics and to introduce them to the possibility of choosing mathematics as their major when they arrive in college. These activities are certainly important. I would like to see a more concerted outreach activity, specifically aimed at those students taking calculus in high school. Some of these students have mathematical talent and an interest in mathematical thinking, but if no one informs them of the possibility of majoring in mathematics, they will choose other majors. Students who begin their university studies by enrolling in second or third semester calculus have the added benefit that they can complete the requirements for the mathematics major in less than four years. This gives these students the opportunity to either broaden their undergraduate education by selecting another major if they so choose, or to take graduate courses in mathematics as undergraduates, thereby making them more competitive when they apply for graduate programs in the mathematical sciences.

My own department began an outreach project that we call *The High School Calculus Visitation Project*. Our goal is to visit every high school calculus class in the city of Tucson at least once each year. The visitation team includes a faculty member, a graduate student and an undergraduate. The visit consists of presenting an interesting application of calculus. The team takes overheads showing the schedule of mathematics classes that a mathematics major might take in college. This is important because it shows the students that a mathematics major can be completed by only taking one or two mathematics classes each semester. The undergraduates chosen for these visits have had summer internships and they talk about their summer travels and activities.

I believe that high school calculus classes represent an important reservoir of students that could be attracted to the study of mathematics. Students who take calculus in high school have the option of not taking any mathematics when they arrive in college. These advanced students are given the opportunity to opt out of college level mathematics. If the mathematics community does not reach out to these high school calculus classes to inform them of the benefits of a mathematical education, then we will continue to ignore this important population. I would like to see mathematicians develop materials and programs specifically aimed at these students and their teachers.

David Bressoud has been looking into the number of high school students taking calculus and evaluating the impact that this could have on our college calculus courses. He conservatively estimates [private communication] that there are currently over 500,000 high school students enrolled in calculus, approximately equal to the number of college students enrolled in first semester calculus. Of those who took the AP Calculus BC exam, just under 12,500 were in 8th, 9th, 10th, or 11th grade. Of those who took the AB exam, just under 34,000 were in 8th, 9th, 10th, or 11th grade. These students, when they arrive in college, could easily complete the requirements for the mathematics major in three years, giving them time to either have a double major or to take graduate mathematics courses.

Compare these high school numbers with the output of our undergraduate programs. Approximately 11,000 students graduate as mathematics majors each year. The amount of mathematical talent in high schools that these numbers represent is enormous. If we could tap into the talent of these high school students, we could easily double the number of mathematics majors graduating from our colleges. This pool of students is simply too large to ignore and I again ask the mathematical community to develop outreach efforts to these high school calculus classes.

There are many different kinds of outreach activities that mathematics departments can sponsor. Certainly departments should have a varied portfolio of such activities. This is particularly important for mathematics departments that have graduate programs. Having graduate students involved in outreach should be part of the training of our future professors and researchers.

Though outreach is an important activity, it is time-consuming and requires faculty to travel outside of the university. Many faculty members are resistant to participating in such activities. There is an even more important activity that can serve to increase the number of mathematics majors, and that is *inreach*. We should be reaching into our own mathematics classes and encouraging the students that are sitting in front of us to pursue mathematics as a major. Mathematics holds a unique place

in undergraduate studies. Students entering our universities as engineering or science majors must take courses in mathematics. We have a ready made pool of students taking our courses. Why can't we encourage those students to add mathematics as another major? If every calculus or differential equations class resulted in just a few more mathematics majors, we would quickly double the number of mathematics majors.

In the late 1980s, I began my own inreach efforts. I had a very modest goal: I wanted to help minority students succeed in their first semester calculus course. This course is critical for students pursuing engineering and science degrees. As I worked with minority students, my own view of this interaction began to change. Yes, I still wanted them to succeed, but I also wanted these students to take more mathematics, and to consider majoring in mathematics. This initial work evolved into my *Calculus Advising Program for Minority Students*.

Each semester I obtain a listing of all minority students enrolled in our three-semester calculus sequence. Students from this list are called and asked to come in to see me for a twenty-minute appointment. These advising sessions begin about two weeks before the semester starts. Now that email is available, I send these students a one-page letter with a list of calculus resources. The letter lists the websites for the course syllabi, the homework assignments and the lists of final exam questions for the calculus courses. The final exam questions I find particularly useful. Many students take calculus in high school and I am often asked by the student whether or not they should skip the first or second semester calculus course. My suggestion is to work on the final exam questions for these courses (which are on-line). If they can do more than 70% of these problems then this is a good indication that they could skip the course.

In the twenty minutes that I have with the students, I inquire as to their career plans, go over their schedule of courses, suggest changes, and introduce them to university resources. I encourage them to create a résumé. For this purpose I have created a sample résumé that I send them by email as a template for them to create their own résumé. I also show the students our website that contains summer internship information. I want students to begin thinking about applying for summer internships as soon as possible. I also mention the fact that if the student is interested in pursuing an advanced degree, then as long as their grades are good, funding is available, and I give examples of the type of funding. It is surprising how many students are unaware of the fact that summer internships pay them, and not the other way around.

I use these advising sessions as a recruitment tool for the mathematics major. If a student walks into my office enrolled in calculus and has not declared a major, then with high probability that student leaves my office as a mathematics major. Over the last few years about 15% of our mathematics majors have been minority students. In 2005, five Native Americans received undergraduate degrees in mathematics.

In August 2003 I accepted the position of Associate Head for Undergraduate Affairs in our department. I am now in charge of our entire undergraduate mathematics major program. I am applying the lessons that I learned in working with minority students to all of our students.

The work that I have done with minority students has taught me important lessons.

- Provide timely information to students. Help them to understand the system and future opportunities. Even good students need attention and advice.
- The transition from high school to university is brutal. Examine ways to ease this transition.
- Students oftentimes choose engineering because they liked mathematics in high school. These students should also be mathematics majors.
- There are amazing students arriving at our universities and we are not paying attention to them.
- If students are majoring in X, then by adding mathematics as another major, X becomes more flavorful.
- We, as mathematicians, need to take the initiative to communicate the necessity of studying mathematics.

In my new position, I have access to student records. I look over enrollments in our classes and I pay particular attention to first year students. When I see a first year student enrolled in third semester calculus or our sophomore level course in linear algebra, I send that student a message. "I see that you are majoring in X. That is wonderful. Since you are advanced in your mathematics, you could easily add mathematics as another major and still graduate in four years. Stop by my office to talk about this so that I can explain the benefits of being a mathematics major." I have created various templates for these purposes that allow me send out messages without having to create individual messages.

When grades are posted I do the same thing. I look over grades and look for students who have done well. I send them messages suggesting that they add mathematics as another major. I also suggest that they enroll in some particular mathematics course and I invite them to stop by my office to talk.

I also look at enrollments in all of our senior level courses. All of our courses are taught in sections of fewer that 35 students. I look at individual students and I go over their grades and course selection since they arrived at our university. For those non-mathematics majors who are doing well, I send them a message praising them for their progress, describing the remaining courses that they need in order to complete the mathematics major. Of course, there are also students who are not doing well. I often send them a message, suggesting a different sequence of mathematics courses that they might take and inviting them come in and see me.

One of the tools that I use to entice students to major in mathematics is the structure of the mathematics major that I inherited. There are seven options in the mathematics major. Some

of these options are designed for help students go on to graduate school in the mathematical sciences, while others prepare students for the workforce or for graduate school in other sciences. These options are very similar, but having them announces to the students the wide applicability of mathematics.

Another important tool that I use is summer internships. For the last two summers over 30 of our undergraduate students have held some form of paid summer internship. Helping students find internships is critical. Maintaining contact with previous graduates who are now in the workforce is important in finding summer positions for undergraduates. Having an updated resume is a necessary ingredient for this.

A new important source of support for mathematics majors comes from the biological sciences. There are growing opportunities for mathematics majors in laboratories on your campuses and I would recommend establishing contact with faculty in the biological sciences to find positions for mathematics majors.

I had a modest goal of doubling the number of mathematics majors when I took on this new position. Our department has had about 300 mathematics majors each year for the last ten years. As of December 2005, we had over 450 mathematics majors. In December 2005 we looked over our undergraduate majors. Over 100 of these students had GPAs over 3.5. Of these, 57 had perfect GPAs of 4.0! These are good students. It is also impressive how many of these students have double majors. All of our senior level courses are now running at capacity. In fact, in fall 2005, we had to run two sections of abstract algebra and real analysis.

Students want to study mathematics, but they need to know that the mathematics major is a viable option. Mathematics departments need to take on the responsibility of presenting this information to their students.

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William Yslas Vélez teaches at the University of Arizona in Tucson. This article is based on the James R.C. Leitzel Lecture that he gave at the 2005 MathFest.

International Conference in Aveiro, Portugal

The 2006 International Conference in Mathematics, Sciences and Science Education (ICMSE 2006) will be held at the University of Aveiro in Portugal from June 11 to 14. The conference "provides opportunities for mathematics and science teachers, educators and researchers to contribute and listen to research presentations and be actively involved in special interest groups developed around the conference theme of Mathematics Education, Science Education and History of Science." Speakers will include Nuno Crato of Portugal on *Measuring the World with Geometry*, Bernard Cornu of France asking *How to Integrate Information and Communication Technologies into Education, in a Networked Digital Knowledge Society?*, Ernst Homburg of the Netherlands on *The Historical Relations Between "Popular Chemistry" and "School Chemistry"*, and Ubiratan d'Ambrosio of Brazil on *Is Integrating Science and Mathematics a Promising Option?* For more information, visit http://gag.mat.ua.pt/ICMSE/ or email icmse@mat.ua.pt.

Baseball, Statistics, and the Role of Chance in the Game: A Summer Short Course

The Ohio Section of the MAA is sponsoring a summer short course entitled "Baseball, Statistics, and the Role of Chance in the Game," to be held on June 7-9, 2006 at Mount Union College, in Alliance, Ohio. Aimed both at mathematicians and statisticians who are baseball fans and at those interested in using baseball applications to teach probability and statistics, the course will be taught by James Albert, professor of Mathematics and Statistics at Bowling Green State University, author of *Teaching Statistics Using Baseball*, and coauthor of *Curve Ball: Baseball, Statistics, and the Role of Chance in the Game*. Topics will include exploring baseball data, searching for the ultimate batting statistics, looking for clutch ability, modeling run production with Markov Chains, and comparing great players from different eras. For more information, go to http://www.muc.edu/~zwilliml/shortcourse/.

TORUS: The Texas-Oklahoma Regional Undergraduate Symposium

By Brett Elliott and Karla Oty

Four institutions in southern Oklahoma and northern Texas have organized TORUS, the Texas-Oklahoma Regional Undergraduate Symposium. The institutions involved are Cameron University in Lawton, Oklahoma, East Central University in Ada, Oklahoma, Midwestern State University in Wichita Falls, Texas, and Southeastern Oklahoma State University in Durant, Oklahoma. The first TORUS was held on February 26, 2005 at Cameron University and by the time this article is in print, the 2006 TORUS will have been held at Southeastern Oklahoma State University. The conference is supported by the MAA Regional Undergraduate Mathematics Conferences program through an NSF grant (DMS 0241090; visit http://www.maa.org/rumc for details on the program). This article describes our experiences in organizing TORUS and will hopefully help anyone else who is considering such an undertaking.

First off, do it. There were some stressful moments, but the experience for the undergraduates was worth it. For the first TORUS conference, there were 20 undergraduate talks with 61 attendees from 7 different institutions. The conference evaluations were overwhelmingly positive. One student commented "I thought it was fun and informational. I thought it was a great opportunity to practice giving talks without there being too much pressure" and another said "It was interesting to hear different ideas and thoughts from other students."

We started planning during the Fall 2004 semester and we modeled our conference on the Pikes Peak Regional Undergraduate Mathematics Research Conference (See the August/September 2004 issue of FOCUS). Our conference began with a keynote speaker and continued with undergraduate talks followed by a break for lunch. The afternoon session started with a graduate student panel presentation followed by more undergraduate talks.

We knew that it was important to find a great keynote speaker. We were fortunate that Paul Goodey from the University of Oklahoma was willing to talk on *Probability and Pi: The Mathematics of Lying*. With the help of a not so random choice of an audience member, Goodey presented an amusing list of events in the history of , focusing primarily on the Buffon needle problem and certain experiments that were supposedly based on it.

LeeAnn Rayburn speaks at TORUS 2005.

The graduate panel was one of the more popular events of the conference. We had recruited four graduate students at different stages from three of the comprehensive universities in our region. The day before the conference, one of panelists informed us she was sick and would not be participating. We did not have time to recruit another graduate student so we convinced one of our younger colleagues to sit in as a phony graduate student. (You might look at the picture and see if you can spot him.) Each of the panelists spoke for about 10 minutes on their experiences and the things they wished they had known before going to graduate school followed by questions from the audience. Our impostor worked out well - he was able to answer questions that the other three could not. We were again fortunate that Goodey was in attendance; he was able to answer questions about the admissions process to graduate school. In a future graduate panel, we will include a faculty member from one of the graduate institutions to address the admissions process. This year we are including a break between the panel session and the beginning of the undergraduate talks to give the attendees time to talk to the panelists individually. The 2006 panel session is on *The Real World*; we have recruited four mathematicians from industry as our panelists. And, we have back up plans just in case one of them can't make it!

The most stressful part for us was recruiting students to give talks. We sent out mass emails to faculty in our region asking them to recruit their students and we recruited our own students as well. Some of the students gave very polished talks while others were obviously more nervous. Nevertheless, we think the experience was great for all of the undergraduates and we hope that the students who participate in the next conference will also have a positive experience.

We conclude with advice regarding food. We elected to pay for lunches for the students and campus catering provided a buffet style luncheon. Unfortunately, the serving size estimate was not the same as that of a hungry undergraduate getting a free meal! Next time, we will either order individual lunches or multiply what the catering service says we need by a hungry undergraduate factor.

For more information on the TORUS conference, go to http://www.sosu.edu/departments/math and click on 2006 TORUS Conference. If you are considering planning a conference and would like more advice, please contact one of us at either belliott@sosu.edu or koty@cameron.edu.

Letters to the Editor

Error on the Cover

I thoroughly enjoyed Robin Wilson's article "The Sudoku Epidemic" in the January 2006 issue of FOCUS. However, the partial solution of the puzzle depicted on the cover contains at least one error. The entry in row 6 column 4 must be a 1 rather than the 4 that is depicted.

I know that in the publishing business the members of the art department do not always understand the important aspects of the subjects that they are illustrating resulting in photographs like the current cover that contain errors.

Thanks for continuing a great publication. The article has inspired our Math Club to sponsor some Sudoku parties during the semester.

Michael J. Bradley
Merrimack College

Art department! I wish! FOCUS is a much more artisanal production than that. That said, note that the cover depicts a solution in process, with many bits of eraser on the page. You can't see it, but the pencil on the bottom of the photograph has been broken in frustration. Some of us are beginners at this game!

Exotic Sudoku?

I noted with pleasure Robin Wilson's article "The Sudoku Epidemic" in the January issue. It is surely a pandemic by now!

It seems to me that there is an (interesting) Sudoku-like puzzle for each perfect power n^m of "major" boxes, where each "major" box has n^m "minor" boxes. But let's stay in Flatland and leave hyperspace ($m > 2$) to multidimensional chess and checker players. Then ordinary Sudoku is n^2-Sudoku with $n = 3$. Now, e.g., 5^2-Sudoku might be especially interesting if one picks characters from languages whose alphabets have nearly 25 letters, such as the Roman, Greek, Hebrew, and Cyrillic alphabets. Indeed, one could then try to maximize the number of "hidden cryptograms' embedded in the puzzle. Of course, for each n^2-Sudoku puzzle one could consider the combinatorial questions analogous to the ones Wilson discusses in his article.

Anyone for Sudoku in Hilbert space? (Ichi ban)

Albert A. Mullin
Madison, AL

Do We Need a Uniform Curriculum?

In recent years, several articles in *Focus* and other mathematics publications have discussed the relationship between K-12 educators and professional mathematicians. Many of these articles have focused on conflicts (and attempts to resolve them) concerning the nature of what is to be taught and how. Opinions are many and varied, but they all seem to take for granted the assumption that there should be uniform standards for the pre-college mathematics curriculum. I believe that this assumption is the root cause of the intensity of the debate.

When curriculum standards are introduced, it places a great deal of power in the hands of those designing the standards. This can, and often does, create a power struggle; one need only look to the ongoing political power plays for control of the (elected) Kansas State Board of Education and resulting control of the biology curriculum for an example of how intense this can become. Perhaps "both sides" of the mathematical community should perform self-examination to see to what extent we are engaging in our own struggle for power over the K-12 curriculum.

Uniform curriculum standards can present other problems as well. Uniformity, by definition, reduces diversity. If we value diversity in race, gender, and other areas, why is it we do not value diversity in educational preparation? As many have said, why calculus in high school instead of statistics, discrete mathematics, or something else? The more we standardize, the more we lose our ability to be innovative and adaptive.

Perhaps the real debate should be over whether we should have uniform curriculum standards at all.

Bryan Dawson
Union University

On the *Common Ground* Initiative

As the convener of the team of research mathematics and mathematics educators who are the authors of "Finding Common Ground in K-12 Mathematics Education (FCG)," I felt it was necessary to comment on the Anthony Ralston's article in the January issue. Speaking for the other authors, I must thank Ralston for his in-depth analysis of our document. We will certainly consider his remarks as we continue and expand our work. They are very helpful.

However, I must comment on the last two paragraphs in his piece. As for finding "significant agreement," FCG is an existence proof that such agreement can be developed from mutual understanding starting with a good diversity of expert opinions. When I convened the group, many confided that they thought the group would agree on very little; after defining terms and working on the issues, however, the group agreed on almost everything. Will research mathematicians and mathematics educators agree on everything? No, they will not. Not all research mathematicians (or mathematics educators) agree on everything, but it is the dialogue and development of what they can agree upon that is the key. It is my belief that there is enough significant agreement that as a group, we can move forward in educating our youth in mathematics, which is a crisis area for the United States and is one that cannot wait to be solved.

Finally, from what I have seen, there is a lot more respect between both communities than I was led to believe when I started this work. I have witnessed a

great deal of cooperation and understanding to solve the common problems of K-12 mathematics education. It is interesting that on the same page as the two paragraphs, there is an advertisement for the Institute of Advanced Studies' Park City Mathematics Institute. If you look at the participants and organizers, you get a glimpse of the broad spectrum of participation around the education theme of "Knowledge for Teaching Mathematics." Thus the small group I led does not represent the only ongoing discussion aimed at bringing the community together to find areas of agreement and to approach disagreement amicably and respectfully. Such conversations are ongoing and expanding. The community must continue to move beyond questions of respect to get the job done.

Richard Schaar

Should We Teach *Less*?

Once again, in his article in the January issue of FOCUS, Anthony Ralston makes his argument for not teaching our students so much arithmetic. He seems to assume that if the students are not taught as much arithmetic, they will spend their time learning other things that are more important and more interesting. I doubt that. Rather, it seems to me that our students are bored out of their skulls from being fed pabulum when they want steak.

Ralston says, "At most a small fraction of students have ever become fluent with [the long division] algorithm." I seem to remember that everyone in my small town grade school became fluent with the long division algorithm. Have things changed so much since then? Have they changed for the better?

Ralston says that he does not understand the danger of using calculators too much, too soon. The danger is that students won't learn the long division algorithm, or even the multiplication table.

I do, however, agree with Ralston on one point. I would be much happier if my students saved calculus until college. I would rather they learned some geometry.

We have a two tiered education system. The children of the upper class are taught well. They all learn long division. The children of the lower class are taught poorly. American students taught in our "good" schools, or home schooled, do as well as any students anywhere in the world. American students who are unfortunate enough to go to one of our "bad" schools are taught less than students in the Balkans.

The result is predictable, a division of our population into those who do not graduate from college, who on the average work for low wages, and those who do graduate from college, who receive much higher wages. If anyone is taught less arithmetic, which group do you think it will be? And what effect will an inability to do arithmetic have on that groups' chance of success in college math?

Rick Norwood
East Tennessee State University

Anthony Ralston Responds

Prof. Norwood's letter implies that he has read other things I have written on math education. The problem is that he hasn't read them very carefully.

Never have I argued that we should not be "teaching our students so much arithmetic". I have argued only against teaching so much *pencil-and-paper* arithmetic (in "Let's Abolish Pencil-and-Paper Arithmetic", *J. of Computers in Mathematics and Science Teaching*, **18** (1999), 173–194, online at http://www.doc.ic.ac.uk/~ar9/abolpub.htm), but in the context of a mental arithmetic, calculator-based curriculum. Prof. Norwood may be correct that "students are bored out of their skulls from being fed pabulum" but no one who has read my paper could possibly believe that I favor anything but a rigorous, demanding school mathematics curriculum.

Also I have never written that I do not see any "danger of using calculators too much, too soon". When they are used by teachers as a way of avoiding teaching real mathematics, of course they are dangerous. But when used by knowledgeable, effective teachers, they can be a boon in any classroom.

I must also comment on Prof. Norwood's claim that "everyone in my small town grade school became fluent with the long division algorithm". As a quondam numerical analyst, I recognize the danger of generalizing from small samples. Does Prof. Norwood? Perhaps he even believes his hyperbole that "all [upper class] children learn long division". My suggestion is to test this claim on some of your non-mathematician, non-engineer neighbors.

Anthony Ralston

Election for Section Governors in 2006

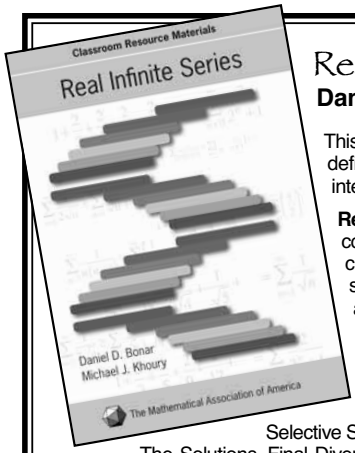
Following the success of the electronic voting option for the 2005 National Election of Officers and Section Governor Election, this option will be available again for the 2006 Section Governor election.

Members of the Kansas, Missouri, New Jersey, Northeastern, Ohio, Pacific Northwest, Seaway, Southeastern, and Southwestern Sections will have the option of voting electronically for a new Section Governor for three year terms beginning July 1, 2006.

A mailing in early February 2006 to these Sections contained information on all the Governor candidates, a paper ballot, and a reply envelope for those who opt to use the U.S. mail instead of the web to cast their vote.

New Textbooks!

From the Mathematical Association of America:



Real Infinite Series

Daniel D. Bonar & Michael J. Khoury

This is a widely accessible introductory treatment of infinite series of real numbers, bringing the reader from basic definitions and tests to advanced results. An up-to-date presentation is given, making infinite series accessible, interesting, and useful to a wide audience, including students, teachers, and researchers.

Real Infinite Series presents the theory of real infinite series, including elementary and advanced tests for convergence or divergence, the harmonic series, the alternating harmonic series, and closely related results. One chapter offers 107 concise, crisp, surprising results about infinite series. Recognizing the interest in problem solving that abounds with students of mathematics, the authors devote a chapter to problems on infinite series, and solutions, which have appeared on the annual William Lowell Putnam Mathematical Competition.

From the Contents: Introduction to Infinite Series: Definitions, Special Series, Intuition and Infinity, Basic Convergence Tests, General Series. More Sophisticated Techniques: The Work of Cauchy, Kummer's Results, The Tests of Raabe and Gauss, Logarithmic Scales, Tests of Abel, Appendix: Proofs of Bertrand's Tests. The Harmonic Series and Related Results: Divergence Proofs, Rate of Growth, The Alternating Harmonic Series, Selective Sums, Unexpected Appearances. Intriguing Results: Gems. Series and the Putnam Competition: The Problems, The Solutions. Final Diversions: Puzzles, Visuals, Fallacious Proofs, Fallacies, Flaws and Flimflam, Answers to Puzzles. True or False Questions. Harmonic Series Article. References: Books on Infinite Series, Books

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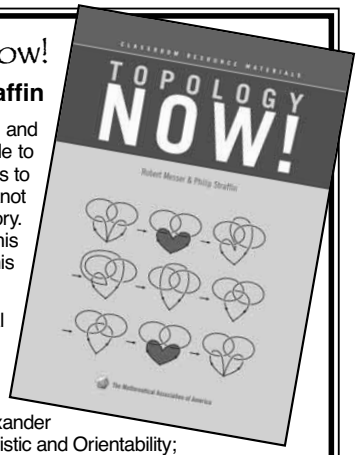

Topology Now!

Robert Messer & Philip Straffin

Topology is a branch of mathematics packed with intriguing concepts, fascinating geometrical objects, and ingenious methods for studying them. The authors have written this textbook to make this material accessible to undergraduate students without requiring extensive prerequisites in upper-level mathematics. The approach is to cultivate the intuitive ideas of continuity, convergence, and connectedness so students can quickly delve into knot theory, the topology of surfaces and three-dimensional manifolds, fixed points, and elementary homotopy theory. The fundamental concepts of point-set topology appear at the end of the book when students can see how this level of abstraction provides a sound logical basis for the geometrical ideas that have come before. This organization exposes students to the exciting geometrical ideas of topology now(!) rather than later.

Students using this textbook should have some exposure to the geometry of objects in higher-dimensional Euclidean spaces together with an appreciation of precise mathematical definitions and proofs. Multivariable calculus, linear algebra, and one further proof-oriented mathematics course are suitable preparation.

From the Contents: Deformations: Equivalence; Bijections; Continuous Functions; Topological Equivalence; Topological Invariants; Isotopy. Knots and Links: Knot Diagrams; Reidemeister Moves; Colorings; The Alexander Polynomial; Skein Relations; The Jones Polynomial. Surfaces: Cut and Paste Techniques; The Euler Characteristic and Orientability; Classification of Surfaces; Surfaces Bounded by Knots. Three-dimensional Manifolds: The Euler Characteristic; Gluing Polyhedral Solids; Heegaard Splittings. Fixed Points: Continuous Functions on Closed Bounded Intervals; Contraction Mapping Theorem; Sperner's Lemma; Brouwer Fixed-Point Theorem for a Disk. The Fundamental Group: Deformations with Singularities; Algebraic Properties; Invariance of the Fundamental Group; The Sphere and the Circle; The Poincaré Conjecture. Metric and Topological Spaces: Metric Spaces; Topological Spaces; Connectedness; Compactness; Quotient Spaces.

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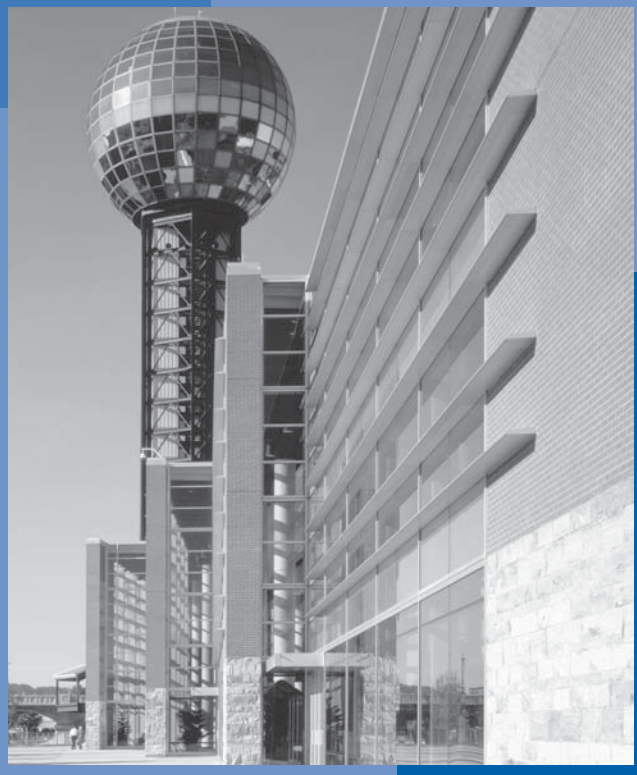

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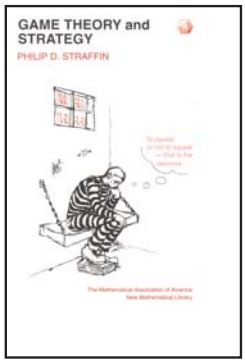

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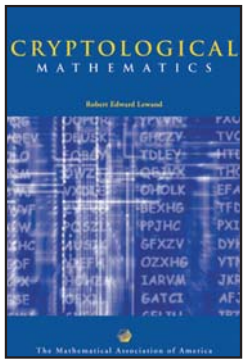

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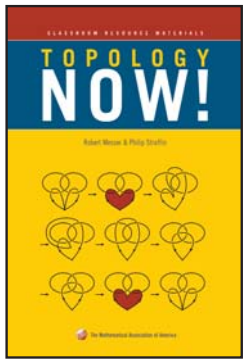

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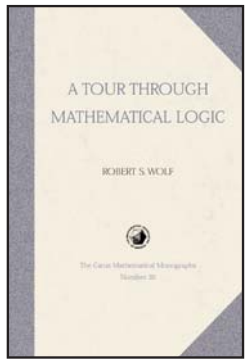

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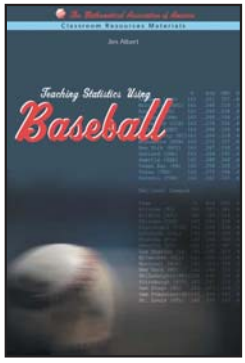

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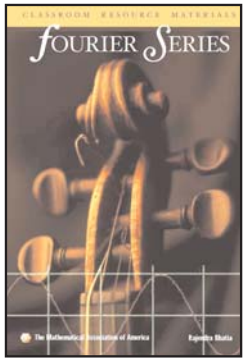

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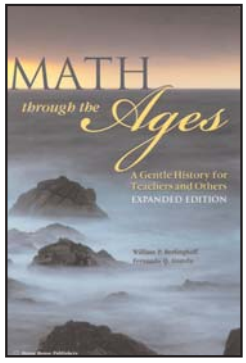

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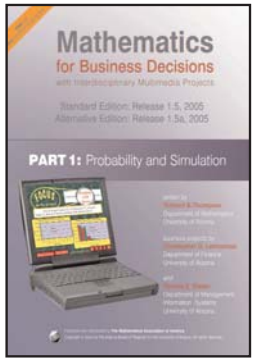

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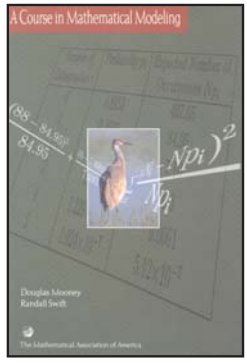

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