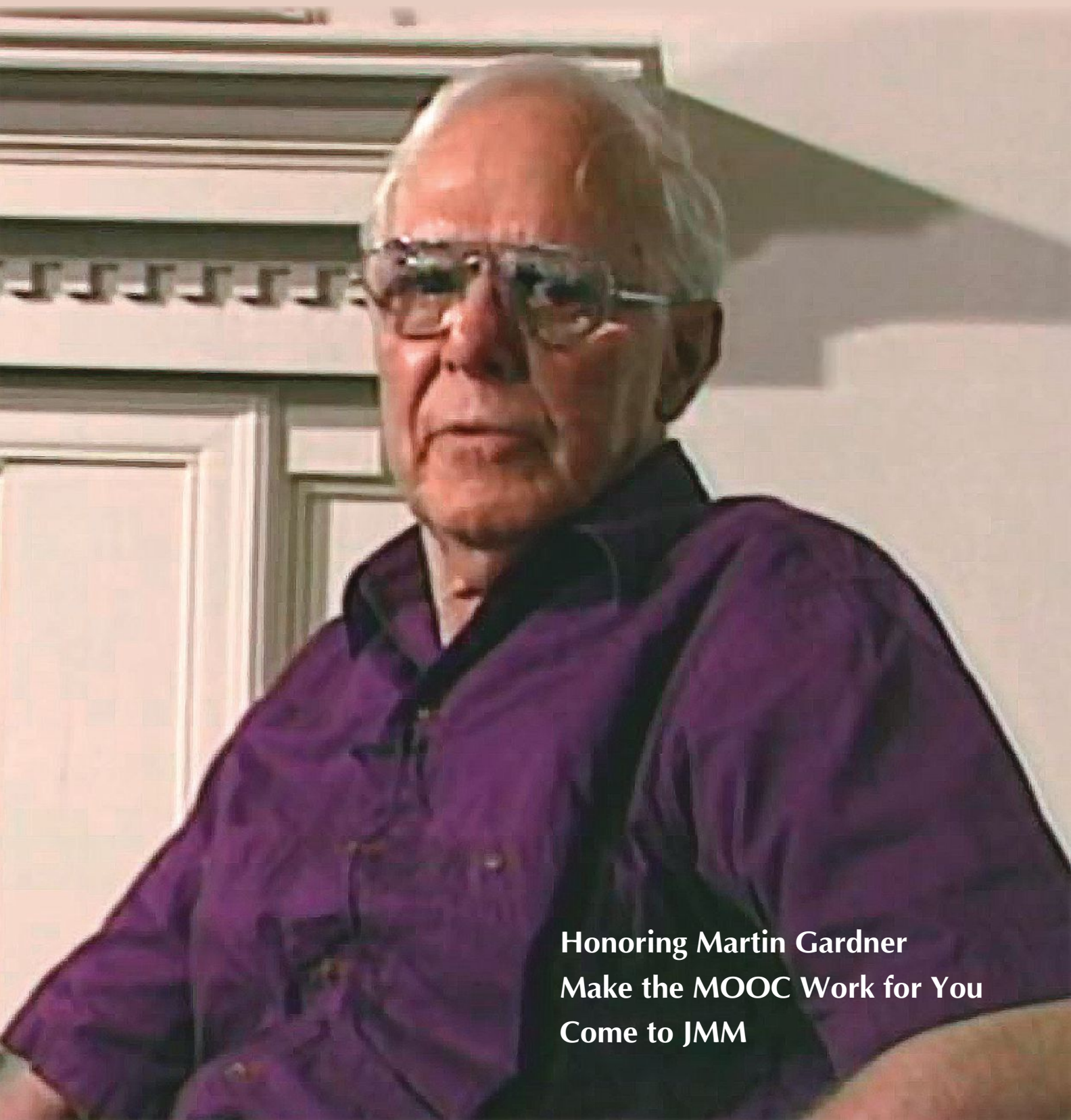


MAA FOCUS

NEWSMAGAZINE OF THE MATHEMATICAL ASSOCIATION OF AMERICA, VOL. 34, NO. 5, OCTOBER/NOVEMBER 2014



**Honoring Martin Gardner
Make the MOOC Work for You
Come to JMM**



MAA FOCUS is published by the Mathematical Association of America in February/March, April/May, June/July, August/September, October/November, and December/January.

Advertising inquiries: advertising@maa.org

MAA FOCUS Staff

Editor: Ivars Peterson, ipeterson@maa.org
Managing Editor: Lois M. Baron, lbaron@maa.org
Art Director: Lois M. Baron, lbaron@maa.org
Writer: Katharine Merow, kmerow@maa.org

MAA Officers

President: Robert L. Devaney
President-Elect: Francis Edward Su
First Vice President: Jenna Carpenter
Second Vice President: Karen Saxe
Secretary: Barbara T. Faires
Treasurer: Jim Daniel

Executive Director

Michael Pearson

MAA FOCUS Editorial Board

Donald J. Albers, Janet L. Beery, David M. Bressoud, Susan J. Colley, Brie Finegold, Joseph A. Gallian, Jacqueline B. Giles, Fernando Q. Gouvêa, Jacqueline A. Jensen, Colm Mulcahy, Adriana J. Salerno, Amy Shell-Gellasch, Francis E. Su, Laura Taalman, Gerard A. Venema

Letters to the editor should be addressed to Ivars Peterson, Mathematical Association of America, 1529 18th Street, NW, Washington, DC 20036, or by email to ipeterson@maa.org.

Subscription and membership questions should be directed to the MAA Customer Service Center, 800-331-1622; email: maaservice@maa.org; 301-617-7800 (outside U.S. and Canada); fax: 301-206-9789. MAA Headquarters: 202-387-5200. Copyright © 2014 by the Mathematical Association of America (Incorporated).

Educational institutions may reproduce articles for their own use, but not for sale, provided the following citation is used: "Reprinted with permission of *MAA FOCUS*, the newsmagazine of the Mathematical Association of America."

Periodicals postage paid at Washington, D.C., and additional mailing offices. Postmaster: Send address changes to *MAA FOCUS*, Mathematical Association of America, P.O. Box 90973, Washington, DC 20090-0973. ISSN: 0731-2040 (print). ISSN 2161-704X (online). Printed in the United States of America.



17th Annual
JANUARY 23-25, 2015

Nebraska Conference for Undergraduate Women in Mathematics

A national showcase for the research of undergraduate women in the mathematical sciences

PLENARY SPEAKERS



Dr. Maria Klawe
Harvey Mudd College



Dr. Karen E. Smith
University of Michigan

REGISTRATION INFORMATION

www.math.unl.edu/~ncuwm/17thAnnual

Registration opens October 1, 2014 for presenters, and Oct. 6 for non-presenters, and closes when capacity is reached.

For undergraduate participants, most local expenses are covered and some travel support is available.

The University of Nebraska-Lincoln is an equal opportunity educator and employer.

UNL Department of Mathematics
203 Avery Hall
University of Nebraska-Lincoln
Lincoln, NE 68588-0130



When you order on
maa-store.hostedbywebstore.com,
use the discount code **BMEMB4R4**
to receive your
MAA member discount.

MAA FOCUS

NEWSMAGAZINE OF THE MATHEMATICAL ASSOCIATION OF AMERICA • VOL. 34, NO. 5 • OCTOBER/NOVEMBER 2014

Features

MAA MathFest 2014

- Portland Comes Up Roses ... 4
- Rare Double Win for Writer ... 6
- Teaching Award Winners ... 8
- Report of the MAA Secretary ... 10

Honoring a Century of Martin Gardner ... 12

Ivars Peterson

Make the MOOC Work for You ... 14

Katharine Merow

Aparna Higgins: An Appreciation ... 16

Joe Gallian

Project NEXt Terms End for Covington and Schlicker ... 17

Aparna Higgins and Gavin LaRose

How You Can Make a Difference ... 19

Joint Mathematics Meetings ... 32

San Antonio, Texas
January 10-13, 2015



29

About the Cover



Martin Gardner, JPBM video, 1994.

On this page: Geometric definitions from the first printed edition of Euclid's *Elements* in 1485 (*Convergence*, August 2012) (Source: Beinecke Library, Yale University).

Departments

- 21 MAA Section Meetings
- 25 MAA Books Beat | Steve Kennedy
Stories at the Heart of Teaching
- 26 Archives Spotlight | Carol Mead
Mysteries: Answers, Corrections,
and New Questions
- 27 Dear MAA |
Willing to Volunteer
- 31 Puzzle Page | Laura Taalman, Editor
Dice Letter Puzzles
by Phillip Poplin

News

- 20 November *Monthly Showcases*
Mathematical Biology
- 20 Call for Suggestions for Mary P.
Dolciani Award
- 22 Team USA Takes Second in
Cape Town
- 29 Online Journal *Convergence*
Celebrates 10 Years

MAA MathFest 2014: Portland Comes Up Roses

By Ivars Peterson

Portland, awash in summer sunshine, welcomed more than 1,650 mathematicians to the Oregon city's bridges, fountains, coffee shops, bookstores, and more. It was the largest attendance ever at MAA MathFest, shattering the record set in 2010 in Pittsburgh.

For many attendees, the meeting started on Wednesday evening with the gala opening reception in the exhibit hall. For others, it began on the following day with a bracing early-morning walk or group run along Portland's scenic riverfront, part of the three-day wellness strand sponsored by Pearson. Some, however, had arrived even earlier in the week, to participate in meetings of the MAA Executive Committee and Board of Governors or special sessions for the 82 new Project NExT fellows.

A large crowd greeted Keith Devlin (Stanford University), who led off the invited addresses with an impassioned argument for designing video games to enable mathematical learning. The three Earle Raymond Hedrick lectures on undecidability, presented by Bjorn Poonen (Massachusetts Institute of Technology), also attracted considerable attention and much corridor chatter afterward. Indeed, the entire suite of invited lectures

presented throughout the meeting, on topics ranging from mathematical models of the retina to undergraduate research, gave attendees much to ponder and pass on to others.

One highlight of the MAA prize session was the presentation of two writing awards to Susan H. Marshall (Monmouth University) as coauthor of a winning paper in *Mathematics Magazine* ("Feedback, Control, and Distribution of Prime Numbers") and another in the *American Mathematical Monthly* ("Heronian Tetrahedra Are Lattice Tetrahedra") (see p. 6). A well-attended panel session later in the meeting gave all the editors of MAA journals and magazines a chance to describe what it takes to get published in their periodicals.

This MathFest featured the debut of a new sort of competition, the Estimathon, orchestrated by Andy Niedermaier (Jane Street Capital). Attendees organized themselves into teams, then attempted to come up with answers to a series of estimation questions, giving a number and range for each one. Example: Estimate the number of coffee shops in Portland, Oregon. Target answer: 1,426. Despite a complicated scoring scheme (and a ban on the use of any technological aids), participants



Above: The closing banquet. Middle, top: Two of the record attendees chat in the exhibit hall. Middle, bottom: James Tanton and Bud Brown. Right: Informal discussions. PHOTOS: L. MCHUGH.



enjoyed the contest, quickly becoming engrossed in the challenges of making estimates in unfamiliar settings, mathematical or otherwise.

Anniversaries played a prominent part in MathFest proceedings. Pi Mu Epsilon, the national honor society for undergraduate students, celebrated its 100th anniversary starting with a student reception featuring temporary PME tattoos and Portland's famous Voodoo doughnuts. In the Jean Bee Chan and Peter Stanek lecture for students, Jack Graver (Syracuse University) spoke about the founding of Pi Mu Epsilon. Keith Devlin presented the J. Sutherland Frame lecture after the PME banquet, which included singing the PME centennial anthem.

An exhibit hall booth called attention to the 100th anniversary of the birth of math popularizer Martin Gardner. Visitors to the booth could try some fiendish puzzles or collect a listing of the top 10 things to know about Martin Gardner—fashioned into a Möbius strip. In a special public lecture, Persi Diaconis (Stanford University) reminisced about his longstanding relationship and correspondence with Gardner.

Fittingly, the closing banquet was also about anniversaries. Walter Stromquist, editor of *Mathematics Magazine*, and Dan Kemp (South Dakota State University) were recognized for reaching the 50-year mark as MAA members, as were the many others present who had been members for 25 years or more.

This sets the stage for 2015, the centennial of the MAA itself, highlighted by a special edition of MathFest in Washington, D.C., with a full extra day of sessions and events. I hope you'll be there for the festivities. 🎉

Ivars Peterson is MAA publications director.



Rare Double Win for Writer

It's impressive to win an MAA prize for writing an article. To win two in the same year makes people blink. MAA President Bob Devaney acknowledged the accomplishment by saying, "And yes, this is Susan's second award of the day" when he called Susan Marshall up for the second time at the MAA MathFest prize session.

Marshall won the Carl B. Allendoerfer Award and the Paul R. Halmos–Lester R. Ford Award. She had different coauthors for each winning article.

Marshall won the Allendoerfer Award, bestowed upon authors of articles of expository excellence published in *Mathematics Magazine*, for a paper she coauthored with Monmouth University colleague Donald Smith. In "Feedback, Control, and Distribution of Prime Numbers" (*Mathematics Magazine*, 86, no. 3 [June 2013]: 189–203; <http://bit.ly/ZgKTGn>), the pair applies the mathematical modeling technique of feedback and control to the number-theoretic mystery of how the primes are distributed.

The authors' collaboration began when they served on a search committee together and Smith, a professor of business whose training is in operations research, mentioned to Marshall, a number theorist, a differential equation that seemed to model the density of primes. The equation captures the apparent self-regulation of the primes, their seeming tendency to compensate for being too numerous in one interval by being subsequently sparser. This behavior gives the primes the appearance of a feedback and control system, and Marshall and Smith decided to investigate this resemblance further.

The paper that grew out of the pair's shared interest not only shows the derivation of the differential equation that models the density of primes, but, in the process,

also gives readers a lively introduction to the theory of feedback and control.

"In this engrossing article," reads the award citation, "descriptions and arguments are interspersed with history, which serves to round out a satisfying tour through both prime density and mathematical modeling."

Marshall's other prize-winning paper also has an interesting backstory. Marshall went to graduate school with both her husband, David, and Louisiana State mathematician Alexander Perlis. At a 2010 get-together the three talked about a 2001 result, written up in the *Monthly*, about Heronian triangles. Heronian triangles are those whose side lengths and area are integers. Marshall and Perlis thought they could generalize the 2001 result to three dimensions, and they set to work.

The resulting paper, "Heronian Tetrahedra Are Lattice Tetrahedra" (*American Mathematical Monthly* 120, no. 2 [February 2013]: 140–149; <http://bit.ly/1rGBOgM>) won the Paul R. Halmos–Lester R. Ford Award, which recognizes articles of expository excellence published in the *Monthly*.

"Thank you again to the MAA," said Marshall upon accepting the award. "And I just want to say this is especially meaningful to share this with a very dear friend who since our grad student days together has taught me a lot of mathematics, a lot about doing mathematics, and a lot about writing mathematics."

Writing mathematics has been an iterative process for Marshall. The feedback and control paper was rejected twice, and it underwent many, many revisions before arriving at its final form. Marshall says that the paper never would have gone to press without *Mathematics Magazine* editor Walter Stromquist's enthusiastic and



From left: Alexander Perlis, Bob Devaney (twice), Susan Marshall (twice), Donald Smith.

compassionate support for the project.

Marshall and Perlis's initial submission to the *Monthly* reflected both their concern about length and their perception that such a prestigious journal demands a certain formality. At the suggestion of a referee and with the help of editor Scott Chapman, however, the pair ended up reworking their terse and technical text into one that laid out concrete examples in familiar language.

"It was nice to discover that what the *Monthly* was looking for was what we would enjoy reading," Marshall said.

"It was nice to discover that what the *Monthly* was looking for was what we would enjoy reading."

Although Marshall says the 2014 prizewinning articles make a nice track record, she doesn't claim to have mastered some magic formula for mathematical exposition. "Part of me is worried that this is all beginner's luck," she admits.

Would-be authors should expect to do lots of revisions, Marshall says, but advises that they try to shorten the process by soliciting feedback before submitting a manuscript. "Try to get someone to read it," she says. "Someone who will tell you, 'I have no idea what this word means.'"

No doubt Marshall will herself seek out readers when her latest crop of papers nears completion. She and Perlis are still studying Heronian triangles and tetrahedra, currently puzzling over how many integer placements a particular triangle or tetrahedron will have, and Marshall says Smith is cooking up a project to renew their collaboration. Marshall won't be disappointed, though, if the fruits of her next research and expository labors fail to garner her more prizes.

"I'll just be happy to get more things published," she says. "But it would be nice to get an award. So I have something to shoot for." 🎯

—Katharine Merow

Online Extra



Citations: <http://bit.ly/1rBzxmU> and <http://bit.ly/1xEgRf9>.

Snaps at MAA MathFest



Innovative math activities kept attendees busy.



Looks like another interesting student poster session.



Keith Devlin spoke about video games and learning math.

Teaching Award Winners at MAA MathFest

**Lara Pudwell, Valparaiso University:
In Math, New Is Relative**

Though the Alder Award recognizes her excellence in teaching, Lara Pudwell (Valparaiso University) devoted part of her Alder Award address at MAA MathFest 2014 to a story about an experience she had as a student.

As an 11th-grader at White Station High School in Memphis, Tennessee, Pudwell entered her precalculus class one day expecting a paper-and-pencil quiz asking her to match the equations of 15 functions—quadratic, absolute value, exponential, inverse sine, and so on—to their graphs. Instead, she got a graph taped to her back and instructions to identify it by circulating the room and asking her classmates yes-or-no questions.

“I thought, ‘I can do this quickly,’” Pudwell recalled. “I know my math. I will ask questions that divide [the set of possibilities] about in half every time, and I’ll be done in three or four questions.”

But no. Pudwell’s inquiries about her graph’s asymptotes, intercepts, and extrema quickly ruled out all the functions on the list she’d studied.

When the time came for each student to name his or her graph, Pudwell—who had entered the classroom that day with a 108 percent average—could only confess perplexity.

At her teacher’s prompting, Pudwell recounted everything she’d found out about her graph.

“Would you like to guess what graph was on my back?” Pudwell asked her MathFest audience. “What 11th-grader is going to say Dirichlet’s function?”

Dirichlet’s function, Pudwell explained, is the indicator

function for the rational numbers, defined on the real line to be 1 for all rational numbers and 0 for all irrationals. Dirichlet’s function is continuous nowhere.

It had never occurred to the teenage Pudwell that such a thing was even possible. In her Alder Award address, Pudwell said that she remembers her first exposure to Dirichlet’s function as if it were yesterday.

Looking back as an instructor herself, Pudwell is impressed at how her precalculus teacher, Nancy Gates, crafted an activity that not only met different students at different levels but transformed what could easily have been a dry topic into something extraordinary. Gates introduced Pudwell that day to the joy of discovery.

“Was it discovery in the same way as research?” Pudwell asked listeners in Portland. “No, because it wasn’t new mathematics, but it was discovery of mathematics that was new to me. And I think that, in certain classes, that’s just as important if not more important.”

Pudwell



The Henry L. Alder Award

In January 2003 the MAA established the Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member to honor beginning college or university faculty whose teaching has been extraordinarily successful and whose effectiveness in teaching undergraduate mathematics is shown to have influence beyond the faculty member’s own classrooms. An awardee must have taught full time in a mathematical science in the United States or Canada for at least two, but not more than seven, years since receiving a doctoral degree. See a list of past winners at maa.org/awards/alder.html. For this year’s award citations, see <http://bit.ly/1r8STpi>.

Dominic Klyve, Central Washington University: Make Math Matter

To motivate your students, Dominic Klyve (Central Washington University) stressed in his Alder Award address at MAA MathFest 2014, subject them to the judgment of strangers. Or fake strangers, in a pinch.

Students will try harder—and learn more—when they feel their work matters, Klyve said, and instructors must do what they can to create at least the illusion of importance. But how?

Klyve had some suggestions.

Grades can motivate students, as can the desire to please the professor. Many instructors try to impress upon students the need to learn mathematical material by emphasizing its usefulness. Klyve cautioned against overstating the case.

“GPS systems are based on all sorts of math, it’s true,” Klyve noted, “and probably most of our students will never ever build GPS systems.”

Better, Klyve said, to make students accountable to one another or—better yet—to a stranger. A student might study more at home to avoid looking foolish during in-class group work, for example.

The idea that the judgment of strangers—even fake ones—can spur students to expend extra effort underlies MAA’s 2004 book *Writing Projects for Mathematics Courses* (by Annalisa Crannell, Gavin LaRose, Thomas Ratliff, and Elyn Rykken; <http://bit.ly/1r7jOBZ>), Klyve said.

The writing assignments in the book prompt students to respond to letters, such as a note from a university development officer requesting help with minimizing construction costs.

“Students know it’s a fake stranger,” Klyve said, “and it doesn’t really matter.” The mere suggestion that someone outside the classroom might see their work makes all the difference, Klyve said. “We’re enchanted by the judgment of strangers.”

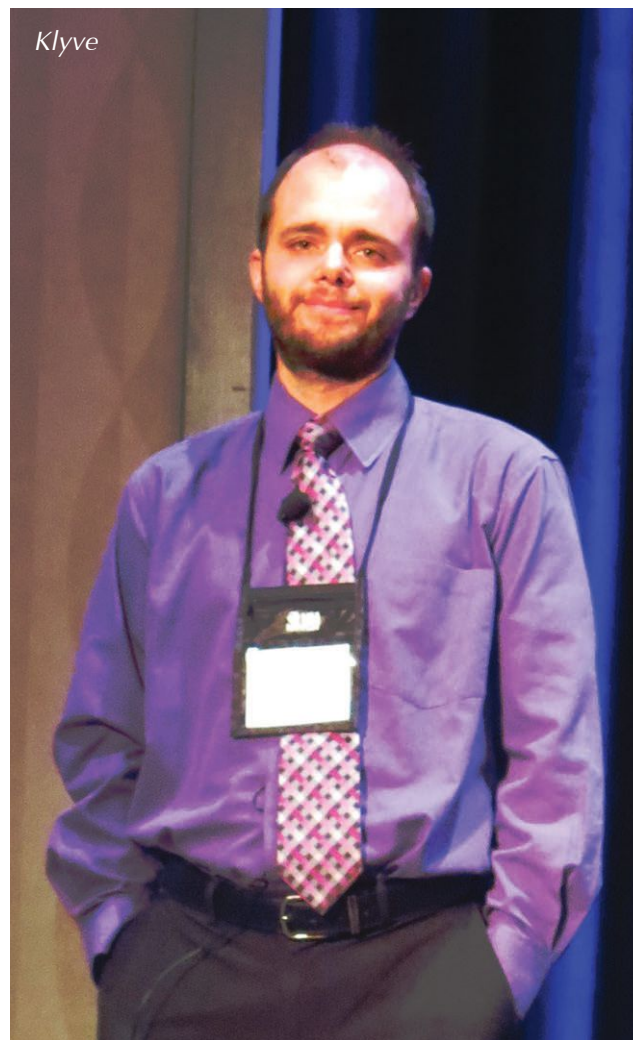
Encouraging students to publish research inherently involves judgment by strangers, but Klyve has devised other means of harnessing this powerful motivator. He has had students write code to be posted to the On-Line Encyclopedia of Integer Sequences. When he was teaching calculus at Carthage College the term that WolframAlpha went live, Klyve and his students created a website about how to use the answer engine to do calculus homework responsibly.

Klyve sees the most promise in activities that allow students to help the strangers who are judging them. He

has had statistics undergrads analyze data for natural sciences graduate students, and he recommends asking students for help in assessing new teaching materials. Know a colleague who’s writing a textbook? Give it to your students, Klyve said. Tell them that almost no one has read the book and that they can be among the first. Tell them that the comments they make could change the book before it is published.

“I’m not going to end this by telling you that you should go change the world,” Klyve said as he concluded his Alder address. “I’m not going to end this by saying you should tell your *students* they should go and change the world. I’ll tell you something much less strong. I strongly believe if they’re trying to change the world, they’re much more motivated. A motivated student is an engaged student, and an engaged student simply learns more.” 🍷

—Katharine Merow



Report of the Secretary of MAA

By Barbara Faires

MAA MathFest 2014 in Portland, Oregon, opened on Wednesday, August 6, with a grand reception and a big thank-you to Aparna Higgins, Judith Covington, and Steve Schlicker for their leadership of Project NExT. At its meeting earlier on the same day, the MAA Board of Governors approved citations of appreciation to Aparna and Judith for long service, with Aparna completing her term as director of Project NExT. (See p. 16 for more about these departing leaders.)

The board welcomed new mem-

bers including two governors-at-large who began their terms February 1, 2014: Bob Megginson (University of Michigan) as a second governor-at-large for minority interests and Chuck Garner (Rockdale Magnet School for Science and Technology) for high school teachers.

Others who joined the board on February 1, but for whom this was their first meeting as governors are council chairs and new officers: Jimmy Buchanan (Hiram College), chair of the Council on Meetings

and Professional Development; Chris Stevens (AMS), chair of the Council on Prizes and Awards; President-Elect Francis Su (Harvey Mudd College); First Vice President Jenna Carpenter (Louisiana Tech); and Second Vice President Karen Saxe (Macalester College).

Every year approximately a third of the sections elect new governors; those who began three-year terms on July 1, 2014, are listed in the box below.

Each year the board elects one of its members to serve on the Audit

New Section Governors

Allegheny Mountain

Golden

Indiana

Kentucky

Metropolitan New York

Nebraska-SE South Dakota

Oklahoma-Arkansas

Rocky Mountain

Wisconsin

John Thompson, University of Pittsburgh at Johnstown

Shirley Yap, California State University East Bay

John Lorch, Ball State

John Wilson, Center College

Abraham Mantell, Nassau Community College

Jennifer Langdon, Wayne State College

Lisa Mantini, Oklahoma State University

William Emerson, Metropolitan State College of Denver

Mark Snavely, Carthage College



Among those at the MAA MathFest 2014 Board of Governors Meeting were (from left) Associate Treasurer Hortensia Soto-Johnson, University of Northern Colorado; Eastern Pennsylvania & Delaware Section Governor Annalisa Crannell, Franklin & Marshall College; and President-Elect Francis Su, Harvey Mudd College.

Committee; Sharon Robbert (Trinity Christian College) begins a two-year term on February 1, 2015. Current members of the Audit Committee are chair Jenny McNulty (University of Montana), Allen Hibbard (Central College), and Mary Shepherd (Northwest Missouri State).

In other action, the board approved Erica Flapan (Pomona College) as a Pólya lecturer for the academic years 2015–2016 and 2016–2017. In any given year, there are two Pólya lecturers; for 2014–2015, the lecturers are William Dunham (Muhlenberg) and Ruth Charney (Brandeis). We are grateful to Ravi Vakil who just completed two years as a Pólya lecturer.

The board approved Hendrick Lenstra (Leiden University) to give the three Hedrick lectures for MAA MathFest 2016 in Columbus, Ohio. Karen Smith (University of Michigan) is the Hedrick lecturer for our centennial celebration MathFest 2015 in Washington, D.C., and the board approved David Bressoud (Macalester) to give the Leitzel lecture at this centennial celebration.

The board approved prizes and awards that will be given at the JMM 2015 prize session and elected the following with terms beginning February 1, 2015:

- Jennifer Quinn (University of Washington Tacoma) as chair of the Council on Publications and Communications;
- Betty Mayfield (Hood College) as chair of the Committee on Sections;
- Lloyd Douglas (University of North Carolina at Greensboro) as governor-at-large for business, industry, and government; and
- Elizabeth Burroughs (Montana State) as governor-at-large for teacher education.

The board approved the Executive Committee's recommendation that the 2015 slate for membership on the

Nominating Committee consist of Rick Cleary (Babson), Susan Colley (Oberlin), Lloyd Douglas, and Magnhild Lien (California State University, Northridge). Two will be elected to four-year terms during the national election in spring 2015.

The 2015 CUPM curriculum guide has been a topic of discussion at the last two meetings of the board with supporting materials provided in advance by Martha Siegel, chair of the Committee on Undergraduate Programs in the Mathematical Sciences (CUPM), Carol Schumacher, and Paul Zorn. The small group discussions at the MathFest 2014 meeting of the board focused on the future of the curriculum guide, and the board approved motions to reaffirm support for the principles of the 2004 curriculum guide and to support the cognitive and content recommendations of the 2015 CUPM *Curriculum Guide for Majors in the Mathemat-*

cal Sciences.

Another discussion topic at the board meeting focused on governance. Jenny Quinn led the board in considering efficiency and effectiveness of MAA governance; she is chairing the Governance and Communication Task Force (other members of the task force are James Epperson, Rick Gillman, Michael Pearson, and Karen Saxe).

The board approved the dissolution of the Committee on Short Courses with our expression of appreciation to members of this committee. Bylaws were approved for several sections. Finally, the board approved the *Mathematics Magazine* editorial board as proposed by editor-elect Michael Jones. With this we say thank you to Walter Stromquist for his good service as editor of *Mathematics Magazine*; he completes his term on December 31, 2014. 🍷



Invited speaker Erika Camacho of Massachusetts Institute of Technology and Arizona State University with Talithia Williams, Harvey Mudd College.

Honoring a Century of Martin Gardner

By Ivars Peterson

The foyer of the historic building that houses MAA headquarters in Washington, D.C., features a unique floor tiling made up of identical pentagons. Discovered in 1995 by Marjorie Rice and adapted for use in the lobby by Doris Schattschneider (Moravian College), this distinctive tiling pattern also serves as a tribute to renowned mathematics writer Martin Gardner.

This year marks the centennial of Gardner's birth. He died in 2010 after a long career, penning more than 100 books, which ranged from annotated editions of *Alice's Adventures in Wonderland* to strong attacks on pseudoscience. His popular and influential "Mathematical Games" column, which ran from 1956 to 1981 in *Scientific American*, introduced a wide audience to flexagons, polyominoes, John H. Conway's Game of Life, Penrose tilings, public-key cryptography, the art of M. C. Escher, fractals, and much more of mathematical interest.

The story of MAA's floor tiling begins with Gardner's July 1975 column, "On Tessellating the Plane with Convex Polygon Tiles." Tiles in the shape of regular pentagons, for example, fail to cover a flat surface without leaving gaps. However, by easing angle and length constraints, certain types of convex pentagons (such as pentagons having a pair of parallel sides) do fit together to cover the plane. In his article, Gardner described the eight known classes of convex, plane-tiling pentagons and noted that this list was thought to be complete.

Marjorie Rice, a homemaker in San Diego and avid Gardner fan, regularly read her son's copies of *Scientific American* and took particular note of Gardner's original article and its December follow-up, which announced the surprise discovery of a ninth class of plane-tiling pentagons.

Inspired by the articles, Rice began her own search for additional pentagonal tilings. She developed a unique notation and procedure for systematically investigating the possibilities and eventually discovered four addi-

tional types and more than 60 distinct tessellations by pentagons.

Rice sent her discoveries to Gardner, and Gardner's mathematical grapevine—an extensive network of experts and amateurs with whom Gardner regularly exchanged information and checked out ideas—helped spread the word. Schattschneider was one of those who received news of Rice's findings and, as time went on,

began to correspond directly with Rice to follow her progress and provide advice and pertinent references.

Schattschneider herself had also become interested in the problem and, after presenting a talk on tiling with convex pentagons at a recreational math conference, was invited to write an article on the topic for *Mathematics Magazine*. The final version of her article, published in the January 1978 issue, included



A close-up of the tiling in the foyer of MAA headquarters inspired by a Martin Gardner column about convex polygon tiles.

up-to-the-minute news of Rice's discoveries and other advances. The article itself, "Tiling the Plane with Congruent Pentagons," went on to win the Carl B. Allendoerfer Award for expository writing.

Rice continued exploring pentagonal tessellations and subsequently came up with the variant that became the basis of the floor pattern displayed in the lobby of MAA headquarters. Schattschneider was instrumental in arranging for the fabrication and installation of the custom tiles.

Appreciation of just such highly productive, column-inspired interactions led the MAA in 1976 to award Gardner an honorary life membership in the association. In its resolution, the MAA Board of Governors lauded Gardner for "the substantial contributions he has made to the public appreciation of mathematics by his superb exposition." The citation continued, "The enjoyment and humor which he conveys have been an inspiration to many and are a model for all."

Gardner was not present to receive his plaque, but he provided a written response. "It is true that I never took

a college course in math—my major was philosophy—but math was my favorite subject in high school, and I never lost that enthusiasm and love for math that is characteristic of the amateur,” he wrote. “If the Association feels that my scribblings have contributed to a better public understanding of the beauty and usefulness of math, then I am pleased beyond measure.”

Nearly two decades later, Gardner was again honored, this time receiving the Joint Policy Board for Mathematics Communications Award. He couldn’t attend the award ceremony, so JPBM sent a delegation to Gardner’s home in Hendersonville, North Carolina, to present the award and to interview him on camera.

Recently unearthed video footage of that visit reveals a relaxed, playful, characteristically modest Gardner. He couldn’t resist showing off a few of his favorite magic tricks and talked at length about his work.

Asked about the value of recreational math in teaching and learning, Gardner noted, “I’ve always thought that the best way to get students interested in mathematics is to give them something that has a recreational flavor—a puzzle or a magic trick or a paradox, or something like that. I think that hooks their interest faster than anything else.”

On the subject of writing about mathematics for the public, Gardner said, “It’s good not to know much about mathematics. . . . I have to work hard to understand anything that I am writing about, so that makes it easier for me to explain it, perhaps, in a way that the general public can understand.”

In passing, Gardner also made particular mention of the *American Mathematical Monthly* and *Mathematics Magazine* as important sources of new material for his writing.

The year 1994 saw not only the JPBM award but also Gardner’s first article for *Math Horizons* (“Delicious Dissections”). His 1997 article “The Square Root of Two = 1.41421 35621 73095...” received the Trevor Evans award for expository writing. Along with Fan K. Chung and Ronald L. Graham, his name was on another award-winning article, “Steiner Tiles on a Checkerboard,”

published in *Mathematics Magazine*.

Over the years, the MAA republished a number of Gardner’s books, including a special CD-ROM edition of the books containing all of his *Scientific American* columns.

In his autobiography, *Undiluted Hocus-Pocus* (Princeton University Press, 2013), Gardner commented on the years during which he wrote his column. “One of the pleasures in writing the column was that it introduced me to so many top mathematicians, which of course I was not,” he wrote.

Gardner’s correspondents included Solomon Golomb,

Piet Hein, John Horton Conway, Raymond Smullyan, Donald Knuth, Benoit Mandelbrot, Ronald L. Graham, and Roger Penrose, among many others. Again and again, he had the pleasure of introducing one mathematician and his or her ideas to another—to the benefit of all. Indeed, Gardner was at the center of a wonderfully productive beehive of mathematical activity and research.



Gardner in a 1994 interview filmed in his home.

Gardner also influenced careers. Many of an entire generation of mathematicians attribute their current positions (and passions) to a Gardner spark.

In a special public address at MAA MathFest in Portland in celebration of the Gardner centennial, Persi Diaconis (Stanford University) spoke about the role that Gardner played in his life and career. As a 13-year-old, Diaconis first met Gardner in New York City at a cafeteria where magicians liked to hang out. From then on, the two talked and corresponded regularly, and Diaconis often turned to Gardner for advice, especially as he made the transition from a life as a magician on the road to statistics professor.

Some years ago, Diaconis wrote the following blurb for one of Gardner’s books: “Warning: Martin Gardner has turned dozens of innocent youngsters into math professors and thousands of math professors into innocent youngsters.”

That legacy continues. 🍷

Ivars Peterson is director of publications at MAA.

Make the MOOC Work for You

By Katharine Merow

The very elements of Robert Ghrist's calculus MOOC (massive open online course) that engage students likely intimidate instructors. Watch the introductory video for Calculus: Single Variable, and you can't help but notice the colors, the animations, the penmanship—and marvel at the time and care it must have taken to produce the course's 58 lectures.

But don't despair. You don't have to take a year out of your life or build a sound closet in your home or spend 20 hours—that's three hours for design; seven hours for drawing; six hours for animation; and one hour each for video recording, audio recording, video/audio processing, and uploading/checking—creating a 15-minute lecture on integration by parts (and then one on l'Hôpital's rule, and then probability densities, and then . . .).

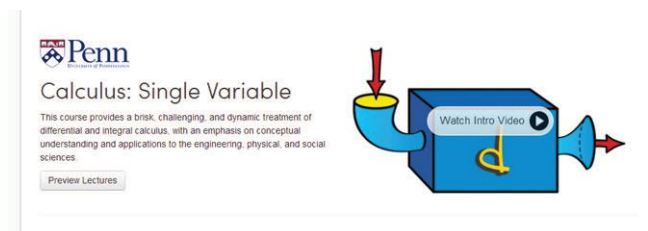
Robert Ghrist (University of Pennsylvania) has already done that. All you have to do is see what—if anything—is in it for you.

And that part's easy. Although Ghrist's course is distributed through the Coursera platform, he has made all the lectures publically available—no registration, no account, no nothing—in what is called “preview mode.” Just visit the course site (coursera.org/course/calcsing), click on the “Preview Lectures” button on the top left, and browse away.

You'll find substance beneath the slick exterior. Ghrist's MOOC not only beautifies calculus, but also broadcasts a radical reenvisioning of the course that is largely independent of the delivery method. Get over your hang-ups, open your mind, and you just might gain a new and broader perspective on single variable calculus.

Novel Sequencing

One novel aspect of Ghrist's approach to calculus—in both the classroom and his MOOC—is how he sequences topics. Calculus: Single Variable is intended for those



who have had calculus, so Ghrist assumes that students know how to integrate and differentiate. He tackles Taylor series right off the bat, though not in a rigorous way. This gets students' attention, Ghrist says, and, despite scaring them a little, is well within their reach. Another benefit: As students compute Taylor expansions and start reasoning about which terms dominate, they begin to get an inkling of why previously mysterious maneuvers—like l'Hôpital's rule—work.

From Taylor series, Ghrist turns to asymptotic or big O notation. Students initially find this difficult, Ghrist reports, but it equips them with the language they need to explain why certain integrals converge or diverge or why higher order derivatives behave the way they do.

Ghrist then recapitulates all of calculus: limits, derivatives, integrals definite and indefinite. Each step of the way, students see the utility of the Taylor series and big O language mastered earlier in the course.

Ghrist concludes with a unit on what he calls “discrete calculus.” He revisits the topics covered at the outset of the course, but this time attends to such details as convergence radii. Having seen and worked with series from the start, students are, by semester's end, motivated to bring rigor to their manipulations. Rather than tune out, they dig in.

“I find that I get a lot better student interest and retention in that last section by having front-loaded the reasons why we want to learn this stuff,” says Ghrist.

BLOOD FLOW

POISEUILLES LAW

$$\bar{v} = \frac{\int v dA}{\int dA} = \frac{\int_0^R v 2\pi r dr}{\int_0^R 2\pi r dr}$$

$$= \frac{2}{R^2} \frac{P}{4\mu l} \int_0^R (R^2 - r^2) r dr$$

$$= \frac{2}{R^2} \frac{P}{4\mu l} \left(\frac{R^2 r^2}{2} - \frac{r^4}{4} \right) \Big|_0^R$$

P PRESSURE
 μ VISCOSITY
 l LENGTH

EXAMPLE

COMPUTE

VOLUME OF A VASE FORMED BY ROTATING

ABOUT THE Y-AXIS $0 \leq y \leq 2\pi$

$$dV = \pi x^2 dy = \pi \left(\sin y + \frac{y}{\pi} \right) dy$$

$$V = \int dV = \int_{y=0}^{2\pi} \pi \sin y + y dy = -\pi \cos y + \frac{1}{2} y^2 \Big|_{y=0}^{2\pi} = 2\pi^2$$

Ghrist creates his own slides and animation—and has made the material publically available.

Emphasis on Applications

The 58 lectures that make up Ghrist's MOOC are grouped into five chapters, one of which is "Applications." Ghrist says that the emphasis on applications both serves the population targeted by the course—students in engineering and the physical sciences—and makes sense in light of calculus's history.

"Calculus was invented for a reason," he says. "For many reasons having to do with applications. The reason why we want so many students at a university to take at least some calculus is because it's useful for solving problems."

When building his MOOC, Ghrist challenged himself not only to expose students to nonstandard applications, but also to draw examples from disciplines further afield than physics, such as economics and biology. The lectures on differential elements and averages include calculations of present value (how much tomorrow's money is worth today) and rate of blood flow, respectively.

Dynamic Presentation

As anyone who has taught integral calculus can testify, students have a hard time visualizing the solid generated by rotating a curve around an axis, let alone the discs or cylindrical shells used to calculate that solid's volume. Which is where animation comes in.

Ghrist told MAA Director of Publications Ivars Peterson in a September 2013 interview (<http://bit.ly/1Abr01w>) that animation allows mathematical principles to be explained "more beautifully than has ever been done before." Having wielded that explanatory power, however, he now finds returning to a traditional lecture format difficult.

"When I'm trying to teach calculus at a chalkboard," he says, "I'm perennially frustrated because I want animations to appear and move around. That's what I see in my head, and that's what I want to communicate to the students."

Ghrist thinks the visual presentation of mathematical concepts will make them more widely comprehensible. "Could you imagine teaching abstract algebra using a very visual medium?" he asks. "Or complex analysis? Or dynamical systems? It could open up all the treasures that we have hidden to so many people for whom it's currently inaccessible."

Future

For now, however, Ghrist is sticking to calculus. At the University of Pennsylvania this fall, he is experimenting with a blended model that pairs the video-based lectures from his MOOC with after-the-fact in-person

facilitation. A handful of high schools incorporated Ghrist's lectures into their calculus courses during the 2013–2014 school year and are continuing to explore how Ghrist's by all accounts excellent materials might best serve their needs.

Though Abbi Smith of Philadelphia prep school Friends Select covered Ghrist's entire online course with a group of advanced students last year, she recommends



Ghrist front-loads his course with reasons for students to want to learn the details later.

it even to instructors who don't see themselves flipping or blending anytime soon. Ghrist provides an excellent opportunity for professional development, she says.

"The manner in which he makes calculus cohesive certainly informs my approach now," she reports, "and his emphasis on applications has given me a wealth of new examples to bring to my lessons. Connecting calculus concepts back to Taylor series makes sense, and is a useful and elegant way in which to develop the ideas. The manner in which I teach Taylor series has completely changed!" 🗨️

Katharine Merow is MAA FOCUS staff writer and MAA online editor.

Aparna Higgins: An Appreciation

By Joe Gallian

Aparna Higgins concluded her 16th year as a member of the Project NExT leadership team by sending a heartfelt letter to the 1560 fellows and hundreds of consultants expressing her gratitude for the opportunity to serve the MAA and the mathematics community.

Aparna's involvement in Project NExT began in 1995 when she was asked by Project NExT founders Jim Leitzel and Chris Stevens to offer a four-hour course on engaging undergraduates in research at the Project NExT workshop. That decision was a bold and farsighted one. The notion that research by undergraduates was a good idea was not widely accepted then. Aparna's energy, enthusiasm, and passion made the course an instant hit, and it has remained a highly popular course ever since.

Aparna was appointed as a codirector of Project NExT when Jim Leitzel died in 1998. Her knowledge of the math community, attention to details, and dedication ensured that Project NExT would maintain the level of excellence that it had already achieved.

Project NExT is a complex program that involves selecting fellows, presenters, panelists, consultants, breakout session topics, group discussion themes; managing multiple email lists; arranging social events, meals, and banquets; scheduling rooms; extensive correspondence; tracking budgets; writing reports; and frequent interactions with the MAA officers and staff.

Since its inception, Project NExT has made it a priority to balance gender, ethnicities, types of institutions, MAA sections participation, and teaching interests. All of this has to be done by people who have academic jobs with heavy responsibilities. Project NExT's great success is the result of the great leadership of Leitzel, Stevens, and Higgins. Most amazing to me is their ability to remember the names, affiliations, and even research areas of the fellows. Aparna's retirement from Project NExT ushers in a new group of leaders who will build on the program's successes, and it opens up the possibility for new leadership opportunities for Aparna after a well-deserved rest!



Aparna is known for embracing the moment with gusto, even when she's standing on a table (right).

Outside of Project NExT

Besides Project NExT, Aparna has served mathematics in many other significant ways. She has been one of the people most responsible for the increasingly important role that undergraduate research in mathematics has played over the last 25 years. She was codirector of an NSF-REU in 1990–1991 and an internally funded REU in 1989.

In addition to her Project NExT course on getting undergraduates involved in research, Aparna has presented the same material at 17 MAA four-hour minicourses at the January Joint Mathematics Meetings. Together, enrollments in the Project NExT courses and the JMM courses have exceeded 1,300.

These courses consistently receive high praise from the participants. Typical comments on the evaluation forms are: “inspiring,” “lots of good info and resources,” and “I’m not afraid to launch into undergraduate research now.” She has given one- or two-hour courses on the same topic at numerous MAA section meetings, work-

shops, and conferences.

Aparna was on the MAA Committee on Undergraduate Student Activities and Chapters (CUSAC) for 10 years, including five years as chair. That committee sponsors the poster session, the Hospitality Center, sessions for student talks, social opportunities for undergraduates at the JMM, and established an annual invited 50-minute Student Lecture for undergraduates. She also served one term on the MAA subcommittee for Research by Undergraduates. These two committees play a key role in making the Joint Meetings attractive for undergraduate students. They create promotional material, plan the program for students, organize the poster session for undergraduate research, and sponsor contributed paper sessions on maintaining and sustaining undergraduate research programs. The work of these committees is in large part responsible for the



undergraduate student attendance at the Joint Mathematics Meetings rising from 71 in 1993 (the first year of CUSACs existence) to 923 in 2014. Participation in the poster session doubled from 1998 to 1999 when Aparna and Mario Martelli took over as organizers. And

doubled again the next year. The number of posters at the Joint Meetings went from 19 in 1994 to 287 in 2014.

From 1999 until 2005 she hosted the award ceremony for the poster session. Her enthusiasm and dynamic personality brought a unique excitement to the event. Seeing her standing on a table announcing the winners was one of the highlights of the Joint Meetings. While she was on the Student Chapters committee they also organized MAA paper sessions for the summer meetings, selected the prize winning presentations, and made travel awards.

Other MAA committees on which Aparna has served include the Leitzel Lecture, Alder Award, JMM program, sections, summer meetings, site selection, *MAA FOCUS*, nominating, position searches, professional development, and membership. Aparna has served on three organizing committees for national conferences on promoting research by undergraduates. The proceedings of all three were published and are available free to the public. She has also written several articles about involving undergraduates in research.

Aparna has received the Distinguished Service Award Ohio Section, been president of Ohio MAA Section, and received the MAA's Haimo Award for Distinguished Teaching.

For the past 20 years it has been my great fortune to have been Aparna's co-Project NExT leadership team member, co-presenter, coauthor, co-PI, co-committee member, colleague, and friend. Her enthusiasm, energy, passion, dedication, wisdom and judgment have inspired me and hundreds of others. One thing I look forward to when I attend a national meeting is Aparna's huge smile and big hug. I think many others feel the same way. 🐻

Joe Gallian is a former president of the MAA.

Project NExT Terms End for Covington and Schlicker

By Aparna Higgins and Gavin LaRose

Judith Covington and Steve Schlicker completed their terms on the leadership team of Project NExT in August 2014. Both served Project NExT and its fellows with dedication and passion as they helped new faculty in their professional development at the start of their careers.

Longest-Serving Leader

Judith Covington has the distinction

of being the longest-serving member of the Project NExT leadership team (for 17 years), and of having been associated with Project NExT since its first year. She was one of the 66 fellows in the inaugural 1994–95 cohort.

Judith's education—elementary through doctoral—was entirely in Louisiana, and she took her first airplane trip, to Minneapolis, to join the other “red dots” (each cohort of

fellows has a color assigned to it).

She entered Project NExT as a topologist, but soon turned to mathematics education and the education of future K-12 teachers. It is from that perspective that some of her greatest influence in Project NExT and the mathematics profession as a whole has been felt.

Chris Stevens (cofounder of Project NExT along with Jim Leitzel) says,

“In 1997, at the invitation of Jim Leitzel and me, Judith became the member of the Project NExT ‘team’ who focused on teacher preparation.” Chris says that, each year, the new fellows saw in Judith someone who had been struggling, just a few years earlier, with the issues of teacher preparation with which they were wrestling, and that Judith was unflinching in her encouragement of their efforts.



Aparna Higgins, Steve Schlicker, and Judith Covington at MAA MathFest 2014.

Judith has created workshops connecting Project NExT fellows with local teachers at MAA MathFests, run courses on the education of future K-12 teachers for Project NExT fellows, and generally been the communication hub that has joined fellows from all years interested in the education of teachers.

At the intense two-and-a-half day workshop just preceding MathFest each year, the fellows also discovered that Judith is an excellent teacher. Teaching awards from her university, local NCTM affiliate, and MAA Section, and a 2015 Haimo Award attest to this as well.

Judith’s presence through years of Project NExT has been instrumental to its development as a community.

In the last decade or so Judith has become involved with inquiry-based learning (IBL) advocates and practitioners, and she has been a catalyst in the interaction of the IBL and Project NExT communities.

Judith’s leadership portfolio in the Project NExT team increased significantly two years ago, when Project NExT had its first search for leadership positions, and tasks previously done by departing team

members (Joe Gallian and Gavin LaRose) needed to be covered.

Appropriately, Judith took over a number of community-building tasks, including the management of the Project NExT lists and matching consultants with fellows. She also worked with the new team members to integrate them into the leadership structure, providing support and background as they grew into their own roles.

Judith’s wonderful smile and welcoming nature made her the ideal person to greet incoming fellows at the Project NExT registration desk at each summer workshop, and she was, appropriately, many fellows’ first impression of the Project NExT program.

Exemplary Team Member

Steve Schlicker was appointed to the leadership team two years ago, after the first search to fill Project NExT leadership positions. At Grand Valley State University, where he has worked since 1991, Steve supported the Project NExT applications of several new faculty during the six years he served as chair.

In fact, when Steve joined the team, GVSU was the institution with the largest number of Project NExT Fellows, although some were fellows before they came to GVSU. Steve also served as a consultant for Project NExT prior to joining the leadership team.

Immediately following his appointment, Steve threw himself into any activity he was assigned, working with a thoroughness and a sense of responsibility that the team appreciated very much. Steve was a quick learner, and contributed tremendously, especially by providing thoughtful and insightful answers to policy questions.

Steve was an exemplary professional in all aspects of his service to Project NExT, gracious and diplomatic. Everything he said and did was for the good of the project. Team member Julie Barnes praised his great demeanor, how he was always working for the benefit of others and never looking for praise or attention.

Judith Covington and Steve Schlicker served Project NExT through their stewardship of the program and unflinching support of its fellows. Their work remains as an essential part of the enduring fabric of Project NExT. 🍷

Aparna Higgins, University of Dayton, is a former director of Project NExT. Gavin LaRose, University of Michigan, is a 1994–95 Project NExT fellow and former associate director of Project NExT.

The Next 100 Years: How You Can Make a Difference

The year 2014 brings MAA's first century of service to the mathematical community to a close. We're reaching out today to ask you to join with your colleagues to support MAA as we enter our Second Century.

Your continued membership is essential to our success. But dues fund only a small portion of MAA's budget. That's why we have launched the MAA Second Century Campaign.

For 100 years, MAA has led the mathematical sciences community's efforts to improve the undergraduate program in mathematics, building bridges between the frontiers of mathematical research and the classroom.

As a reader of *MAA FOCUS*, you are already familiar with—and value—MAA publications, meetings, camaraderie, programs, the MAA American Mathematics Competitions and Curriculum Inspirations, the Putnam Competitions, Project NExT, advocacy, curriculum review, lectures, web-based resources, outreach to underserved constituencies, and other professional development activities that exemplify our vision.

MAA members contribute expertise through service on editorial boards, planning national and section meetings, developing and leading reports on curriculum and other key issues facing faculty and departments, constructing contests for MAA's American Mathematics Competitions, and contributing to a variety of professional development programs.

Your contribution will help us strengthen the valuable services we provide to you, your colleagues and students, and future generations of mathematicians and mathematics educators.

Your tax-deductible donation can be made securely on the MAA website by clicking on the "Give" button to the right of the new MAA Centennial logo, or by submitting your gift in the enclosed envelope.

Thank you for joining us and investing in a MAA's Second Century.



Robert L. Devaney

Robert L. Devaney
MAA President



Thank you for your generous support!

President's Circle

(\$5,000 or above)

Recognition: Invitation to exclusive MAA events and a limited-edition, 3D crystal representation of the Helaman Ferguson sculpture *Umbilic Torus N.C.* as well as Grand Benefactor benefits.

Grand Benefactor

(\$2,000–\$4,999)

Recognition: Recently published MAA book as well as Benefactor benefits.

Benefactor

(\$1,000–\$1,999)

Recognition: Name inscribed on the Honor Roll of Donors displayed in the lobby of MAA headquarters in Washington, D.C., in addition to Partner benefits.

Partner

(\$500–\$999)

Recognition: Listing on the Honor Roll of Donors published annually in *MAA FOCUS*, the MAA MathFest and Joint Mathematics Meetings programs and donor recognition boards; invitations to the President's Receptions at national meetings; as well as Supporter benefits.

Supporter

(\$100–\$499)

Recognition: Gift with MAA logo.

Your gift is tax deductible under Section 501(c)3 of the Internal Revenue Code.

Monthly Showcases Mathematical Biology

Maybe you don't usually read papers about microorganism motility in fluids. Or phylogenetics. Or cancer modeling. This November, however, you'll want to do so.

Three guest editors—Elizabeth Allman (University of Alaska Fairbanks), Fred Adler (University of Utah), and Lisette de Pillis (Harvey Mudd College)—have assembled for your edification a special November issue of the *American Mathematical Monthly*: seven articles on topics at the intersection of mathematics and biology.

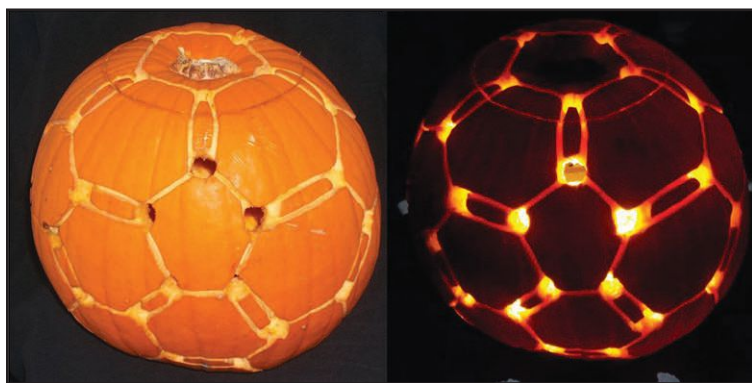
While mathematical biology is a rapidly growing research area, the *Monthly* receives few math-bio manuscripts. A special issue, thought *Monthly* editor Scott Chapman, would be an excellent means of introducing the journal's readership to the burgeoning field.

Allman, Adler, and de Pillis—who all taught at the

Park City Mathematics Institute's 2005 summer school in mathematical biology—collected papers that reflect the excitement and diversity of a field that applies mathematical methods and curiosity to everything from finding control methods for AIDS to reconstructing the evolutionary relationships between species.

Authors address computational neuroscience, animal territory pattern formation, gene regulatory networks, and synthetic biology.

The editors have high expectations for their opus. "Whatever your area of mathematical expertise," they write in their introduction, "we hope that you find this special issue in mathematical biology provocative and informative, like a good novel—hard to put down initially and then awarded a special place on your bookshelf for future examination." 🍎



MAA Found Math: Buckypumpkin

Tom Leathrum (Jacksonville State University) sent this photo of his pumpkin in 2012. He wrote that the "buckypumpkin" represents a C₆₀ buckminsterfullerene molecule. The molecule, popularly called a buckyball, takes the form of a truncated icosahedron. The discoverers of the C₆₀ form of carbon named the molecule after architect and visionary Buckminster Fuller, who used geodesic dome shapes in his work.

On the pumpkin, the locations of the carbon atoms are represented by holes drilled completely through the pumpkin flesh at the vertices of the truncated icosahedron. The carbon-carbon bonds are represented by lines cut only partially through the flesh, with double bonds indicated by double lines. Ordinarily, a truncated icosahedron would be most familiar as the shape of a traditional soccer ball (sewn together from black pentagonal patches and white hexagonal patches). The pattern goes all the way around the pumpkin.

Did you use math to carve your pumpkin this year? Send photos to foundmath@maa.org, and we'll add them to our gallery. 🍎

Call for Suggestions for Dolciani Award

The Mary P. Dolciani Award recognizes a pure or applied mathematician who is making a distinguished contribution to the mathematical education of K-16 students in the United States or Canada. This award is given annually at MAA MathFest. Nominations for the 2015 award should be sent by November 1, 2014, to the MAA secretary, Barbara Faires, at secretary@maa.org. Guidelines for nominations and a nomination form can be found on the MAA website (maa.org/dolciani-award-guidelines). A nominee must have received a Ph.D. in pure or applied mathematics, have published research in pure or applied mathematics, and have a record of distinguished contributions to K-16 mathematics education.

MAA Section Meetings

Eastern PA & Delaware

October 25
University of the Sciences in
Philadelphia
Philadelphia, PA

Indiana

October 18
Trine University
Angola, IN

Iowa

October 24–25
Clarke University
Dubuque, IA

MD-DC-VA

November 7–8
Bowie State University
Bowie, MD

Northeastern

November 21–22
Southern Connecticut State
University
New Haven, CT

Ohio

October 31–November 1
Wittenberg University
Springfield, OH

Seaway

October 10–11
Alfred University
Alfred, NY

Southern California-Nevada

November 1
Pomona College
Claremont, CA

renew your membership
maa.org

MATHEMATICS AT THE NATIONAL SECURITY AGENCY

Rise Above the Ordinary



A career at NSA is no ordinary job. It's a profession dedicated to identifying and defending against threats to our nation. It's a dynamic career filled with challenging and highly rewarding work that you can't do anywhere else but NSA.

You, too, can rise above the ordinary. Whether it's producing valuable foreign intelligence or preventing foreign adversaries from accessing sensitive or classified national security information, you can help protect the nation by putting your intelligence to work.

NSA offers a variety of career fields, paid internships, co-op and scholarship opportunities. Learn more about NSA and how your career can make a difference for us all.

KNOWINGMATTERS

Excellent Career Opportunities for Experts in the Following:

- Number Theory
- Probability Theory
- Group Theory
- Finite Field Theory
- Combinatorics
- Linear Algebra

>> **Plus** other opportunities



NSA

www.NSA.gov/Careers

APPLY TODAY

WHERE INTELLIGENCE GOES TO WORK®



Search NSA to Download

U.S. citizenship is required. NSA is an Equal Opportunity Employer.

Team USA Takes Second in Cape Town

You're 17 years old, seven hours ahead of your native time zone, and running on roughly a third of the recommended amount of sleep. The USA6 on your name tag serves as a constant reminder that you're representing your country in what's only the most prestigious international mathematics competition at the high school level, the International Mathematical Olympiad (IMO).

"At the IMO," says U.S. contestant James Tao, "at least half of the challenge is a psychological one."

Tao and his five teammates met challenges—mathematical and otherwise—and took second place (behind China) at the 55th IMO, held July 3–13 in Cape Town, South Africa. The U.S. squad also brought home six individual medals, five gold and one silver (see box). More than 500 students from more than 100 countries took part.

The oldest and largest scientific Olympiad, the IMO is a rigorous two-day math competition held each summer in a different location around the globe. Each day participants take a 4.5-hour, three-question exam featuring deceptively simple-looking problems that in fact require considerable ingenuity to solve.

All Olympiad problems can be solved using only elementary mathematics, but IMO veteran Tao (he won a gold medal at the 2013 IMO) reports that awareness of such areas as abstract algebra and differential geometry proves useful.

"It's not surprising to me that ideas from higher math can help," Tao says, "because some Olympiad problems arise as elementary sub-problems of research problems." Problem 6 on the 2014 IMO turned out to have such a research connection (see box, facing page).

The IMO had never been to Africa

2014 IMO Team Members

Joshua Brakensiek – silver (*home school, Arizona College Prep–Erie Campus, Chandler, Arizona*)

Allen Liu – gold (*Penfield Senior High School, Penfield, New York*)

Yang Liu – gold (*Ladue Horton Watkins High School, St. Louis, Missouri*)

Sammy Luo – gold (*North Carolina School of Science and Mathematics, Durham, North Carolina*)

Mark Sellke – gold (*William Henry Harrison High School, West Lafayette, Indiana*)

James Tao – gold (*Illinois Mathematics and Science Academy, Aurora, Illinois*)

before, and neither had any of the U.S. contestants. Thankfully, even with the math and the killer jet lag, the team did get a chance to absorb the scenery. Along with most of the Spanish contingent and a Chinese participant, Team USA rode a cable car to the top of Table Mountain and hiked down.

Even more than being impressed by the stunning backdrop, though, members of the 2014 U.S. IMO team relished interaction with their international peers. Contestants in Cape Town connected over games of foosball and compared notes about clever solutions to the contest problems.

"Even in the brief time I was there," says U.S. team member Joshua Brakensiek, "I was able to have fun with people from countries such as Japan, New Zealand, Mexico, the Netherlands, and China."

Tao, too, remarks on the camaraderie. "Mathematical ideas," he says, "have a way of overcoming the language barrier." 🍷

—Katharine Merow

IMO 2014 Country Results

China - 201
United States - 193
Taiwan - 192
Russia - 191
Japan - 177
Ukraine - 175
South Korea - 172
Singapore - 161
Canada - 159
Vietnam - 157
For more results, see
<http://bit.ly/1o93qc4>.



Connecting Competition Problems and Research

Fifteen years after he won a silver medal at the 1999 IMO, U.S. Team Leader Po-Shen Loh (Carnegie Mellon University) talked to young competitors about the leap from Olympiad math to mathematical research.

Problem 6 (see below) gave him his chance. Even as the IMO's

professional Problem Selection Committee proposed the exercise, they were unsure whether the \sqrt{n} bound could be improved. Team leaders have a say in final problem selection, and, as his counterparts deliberated about which six would make the cut, Po-Shen knocked out a definitive (affirmative)

answer to the question about the bound. He raised it to $\sqrt{(n \log n)}$.

Then, after the competition, Po-Shen gave a talk to IMO contestants about the connection between research combinatorics and the problem they had just tackled.

Despite the late hour—he ended up speaking from 11 p.m. to midnight—about 100 students showed up to hear Po-Shen explain the probabilistic combinatorial techniques he used to improve the bound sought. (Determining the best possible bound remains an open problem.)

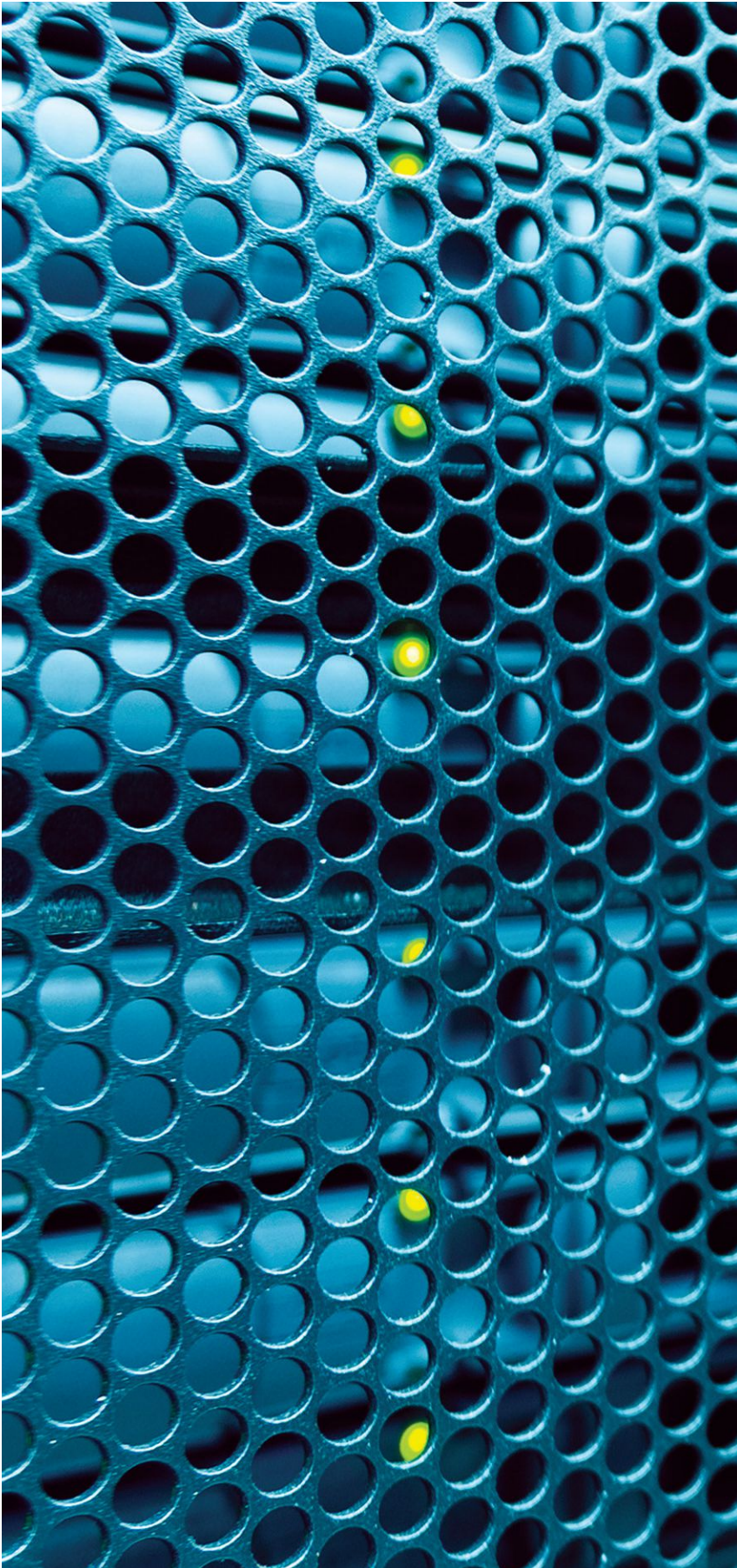
Making this connection explicit “was widely considered to be a success,” Po-Shen said afterward, “and this action has nudged the IMO in a new direction, somewhat more closely aligned with mathematical research.”

Problem 6. A set of lines in the plane is in *general position* if no two are parallel and no three pass through the same point. A set of lines in general position cuts the plane into regions, some of which have finite area; we call these its *finite regions*. Prove that for all sufficiently large n , in any set of n lines in general position it is possible to color at least \sqrt{n} of the lines blue in such a way that none of its finite regions has a completely blue boundary.

Note: Results with \sqrt{n} replaced by $c\sqrt{n}$ will be awarded points depending on the value of the constant c .

The USA team in front of the competition hall.





Who knows how
big data will impact
the world of business?

We do.

Every day, members of the Society of Actuaries (SOA) work to analyze collections of big data from around the globe, using state-of-the-art predictive modeling tools to help their employers make informed decisions on pricing models, target marketing, healthcare economics, risk management and more.

The world is full of unknowns.
That's why we're here.

With unmatched research and education, and a global network of almost 25,000 of the highest-skilled actuarial professionals, organizations turn to members of the SOA to help mitigate ever-growing risks and lead them to the right decisions for their businesses.

Take a closer look at soa.org/impact



SOCIETY OF ACTUARIES

Educating actuaries. Impacting society.

Stories at the Heart of Teaching

By Steve Kennedy



Steve Willoughby taught mathematics for 59 years at every level from elementary school to graduate school. He is a keen and perceptive observer and a witty and talented storyteller. And, man, after 59 years does he have some stories to tell in *Textbooks, Testing, Training: How We Discourage Thinking*.

From a fourth-grade book on a page titled “Dividing By 6”:

Twelve turkeys. Six turkeys in each cage. How many cages? There was a picture on the page with the right number of cages so that exactly six turkeys could be, and were, placed into each with no leftover turkeys. The teachers’ guide directed that any student who wrote the answer without writing “ $12 \div 6 = 2$ ” was to be marked wrong. Fortunately, because of the title at the top of the page and four years of intensive schooling, no child would have an urge to read the problem. There are two numbers. One is 6. Certainly 12 must be divided by 6

and the problem is solved to the satisfaction of all concerned without a single thought passing through the head of anyone involved or of any child making the heinous error of counting the cages depicted.

Did the authors really suppose that if somebody wanted to know how many cages there were, he would count the turkeys, count how many are in each cage, and, upon discovering the unlikely fact that the same number were in each cage, would divide the first number by the second?

Steve served a term as president of the National Council of Teachers of Mathematics, and his opinions are thoughtful, cogent, and firmly held. His book, really an extended essay as it’s only about 50 pages long, addresses the problems he sees with our current textbooks, teacher preparation programs, and testing regimes.

But it is more than that. Steve’s book throbs with a deep understanding that the act of teaching is a

deeply human interaction between student and teacher. The book is also irascible, opinionated, and sometimes funny: the story of the zealous editor of a national standards document who changed half of the occurrences of “real number” to “actual number” still makes me laugh.

Like a good teacher, Steve’s stories carry you along and drive you to ask the questions he’s been asking himself for decades: Why do we do things this way? Why can’t our textbooks be better? What can we do to make things better for students?

At the center of this essay is a compassionate, and passionate, core that will resonate with every passionate, and compassionate, teacher—which I suspect means just about everyone reading this magazine. It will, at times, make you laugh; it will, at times, make you angry; and it will make you think about what we do and why.

Correction: In last month’s column, I highlighted Joel Schneider, who is featured in *101 Careers in Mathematics* and was content director for the fabulous *Square One TV*. I mentioned that Joel “is still in TV.” Several readers wrote in to inform me that Joel, sadly, passed away in 2004. You can read about his life and contributions in the January 2005 issue of *The Notices of the AMS*. I regret the error.

Steve Kennedy, senior acquisitions editor at MAA, can be contacted at kennedy@maa.org.

Order *Textbooks, Testing, Training: How We Discourage Thinking*, Stephen S. Willoughby (\$11 ebook, \$18 POD) in the MAA ebooks store: maa.org/ebooks/TTT.



Mysteries: Answers, Corrections, and New Questions

By Carol Mead



Archives Spotlight

Thank those who emailed me with corrections and suggestions to the mysteries in the June/July issue. What I learned is below, followed by more questions.



[Lancaster1984] Someone suggested that the person pictured might be Richard Swan. Can you confirm or refute this guess?

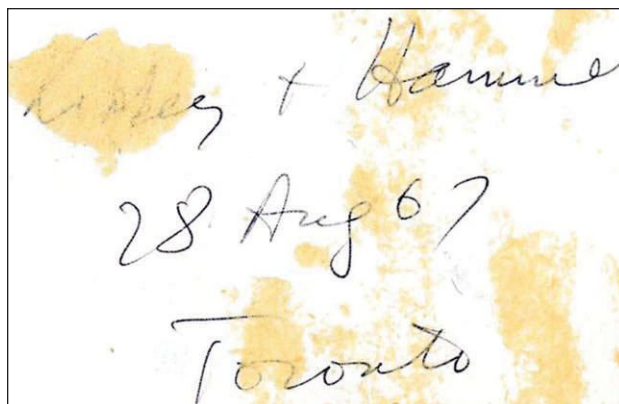


[MSRI-2015] The person in the foreground with his shoulder to the camera is most likely Donald Burkholder, whose sons, Peter and Bill, thought he closely resembled their father. Thanks to Jay Hook at Indiana University for initiating that idea.



[MSRI-3016] The gentleman in the middle of this photograph with the sweater around his waist is Phillip

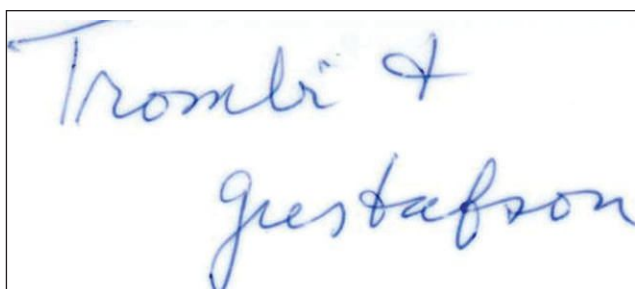
Griffiths, first suggested by Zbigniew Nitecki and confirmed by Griffiths's former graduate student, Lisa Mantini. I had misidentified him in the August/September issue as Donald Burkholder.



[5745] Halmos wrote what seems to be “Kibbey” and “Hammer” on the back of this snapshot. Is the man on the left Donald Kibbey? And, who is Hammer on the right with the cane? Halmos took the picture during the 1967 MAA-AMS summer meeting in Toronto.



[11] On the back of the photograph Halmos wrote “Topology? Berkeley Aug. 86.” Do you know anyone in the group and the occasion?



[10904] These two men are in Bloomington in 1972. The name of the person on the left seems to be “Tromli” or “Trombi” and the man on the right is Gustafson, who I believe is probably William Gustafson. Can you help me with the names?

Thank you all for your assistance! 🍷

Carol Mead is the archivist for the Archives of American Mathematics, located in the Research and Collections division of the Dolph Briscoe Center for American History on the University of Texas at Austin campus. Contact her by email (carolmead@austin.utexas.edu) or by phone (512-495-4539).

Dear MAA

Willing to Volunteer

Dear MAA,

I'm thinking that joining an MAA committee would be a good way to help me meet colleagues from other places and beef up my CV. How do I do it?

Ready and Willing

Dear Ready,

So happy you asked! The MAA has about 130 MAA committees, offering many opportunities to be involved with MAA; each committee (except the Audit Committee) belongs to one of seven councils:

- Council on Meetings and Professional Development
- Council on Members and Communities
- Council on Outreach Programs
- Council on Prizes and Awards
- Council on Programs and Students in the Mathematical Sciences
- Council on Publications and Communications
- Council on the Profession

The committees under each are listed on the MAA website, www.maa.org, at *About MAA/Governance/Councils and Committees Lists*.

The process is a little slow. In spring 2015 you can apply to fill committee terms that begin in 2016.

To suggest yourself (or someone else) for an MAA committee, you fill out an online form in early spring. In the February/March 2015 issue of *MAA FOCUS* and in the newsletter *Math Alert* we'll give you the link to the form. Names submitted are sent to chairs of councils in April. They prepare recommendations to the MAA president for appointments; emails asking members to serve are sent in early June. In the meantime, consider volunteering to help with your section or join a SIGMAA if you haven't already. MAA definitely wants to put your enthusiasm to use. 🍷

“Dear MAA” is our regular column offering advice and information. Please send us questions, large or small, regarding the MAA and life as a mathematician. “Dear MAA” will answer as honestly as possible. Address questions to the attention of DearMAA@maa.org.

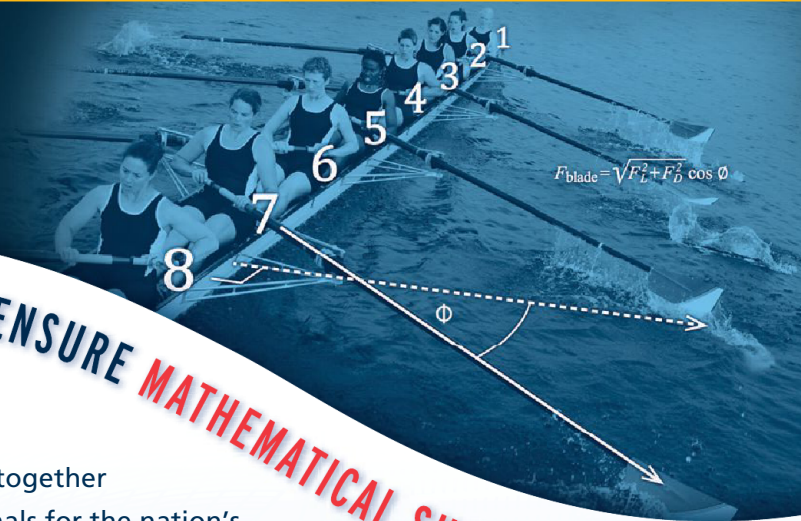


NATIONAL COUNCIL OF
TEACHERS OF MATHEMATICS

THE NATION'S PREMIER MATH EDUCATION EVENT

2015 NCTM ANNUAL MEETING & EXPOSITION

April 15-18 • Boston



EFFECTIVE TEACHING TO ENSURE MATHEMATICAL SUCCESS FOR ALL

PULLING TOGETHER

Join NCTM in Boston as we bring together thousands of education professionals for the nation's largest math education event.

Go beyond the classroom to examine the innovative ideas that can improve the quality of learning for every student.

- Gain insights into implementation and assessment of the **Common Core State Standards** for Mathematics.
- Learn about *Principles to Actions: Ensuring Mathematical Success for All*, which describes what is essential for a high-quality mathematics education.

- Collaborate with peers on concepts that diversify learning and **support student learners**.

WHO SHOULD ATTEND?

- Pre-K-12 teachers
- Math teacher educators
- New and soon-to-be-teachers
- Math coaches and specialists
- Math researchers
- School and district administrators

- Explore **more than 700 sessions** to help you grow and learn as a teacher.
- Discover fresh ways to **integrate mathematics into other disciplines**.

SAVE UP TO \$80
when you register by March 6.

Learn more at www.nctm.org/boston and follow us on



#NCTMBOSTON

Online Journal *Convergence* Celebrates 10 Years

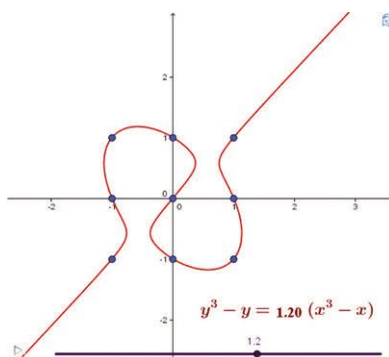
By Janet Beery

Founded in 2004 by two well-known mathematics historians and educators, Victor Katz and Frank Swetz, *Convergence* is an on-line journal on mathematics history and its use in teaching. It is also an ever-expanding collection of online resources to help you teach mathematics using its history.

Convergence is celebrating 10 years of publication by continuing to bring you interesting articles and features on the history of grades 8–16 mathematics and exciting ideas and resources for sharing this history with your students.

The images shown here have geometry in common but otherwise were selected to reflect the diversity of offerings and styles of delivery as well as the long span of history represented in *Convergence*. Visit the journal to explore and learn (maa.org/convergence).

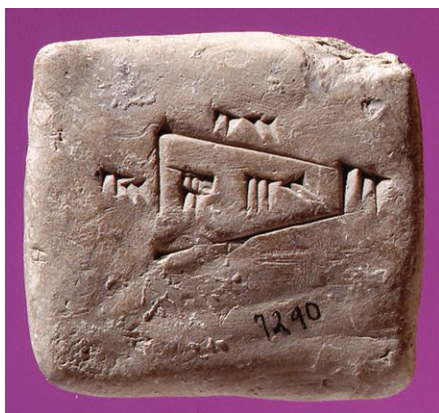
Janet Beery (University of Redlands) is editor of *Convergence*.



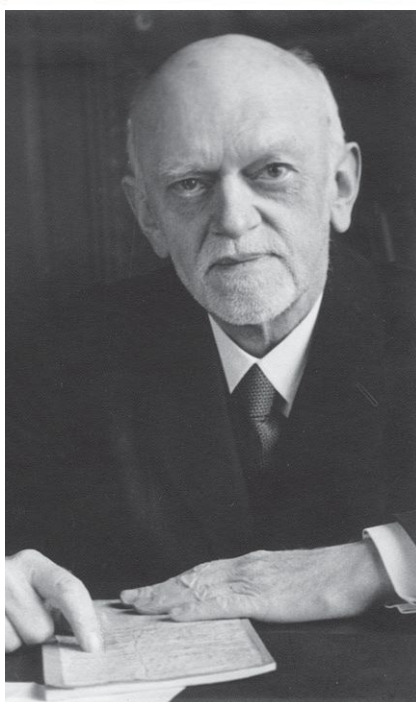
← Interact with Euler's elegant example of "When Nine Points Are Worth But Eight." (*Convergence*, February 2014) (Source: Applet created by Lee Stemkoski using GeoGebra) <http://bit.ly/1s3jDbd>



↑ Watch as students demonstrate "Maya Geometry in the Classroom." Students at Northeastern State University in Oklahoma used a knotted rope to form a right triangle. (*Convergence*, August 2013) (Source: YouTube video featuring John C. D. Diamantopoulos and his students) <http://bit.ly/1y6pzDa>



↑ View new "Mathematical Treasures" every week. Above: Trapezoidal area calculation on a Mesopotamian clay tablet from 1800–1600 BCE (*Convergence*, March 2014) (Source: Yale Babylonian Collection) <http://bit.ly/1y6otqY>



← Listen to "David Hilbert's Radio Address," recorded in 1930. Pictured is Hilbert in 1932, two years after he gave his second-most famous address with its conclusion: "We must know; we will know." (*Convergence*, June/July 2014) (Source: MacTutor Archive) <http://bit.ly/1AQj9E3>

IN A FASTER FORWARD WORLD

“Shaping the future of the Internet” could be your job description.



The Boston Globe
**TOP PLACES
TO WORK 2012**

TOP 25 COMPANIES
for Career Opportunities
glassdoor.com

NASDAQ-100

STANDARD
& POOR'S 500

Founded in the halls of MIT Akamai sits at the heart of the Internet, helping the most innovative companies like Facebook, Apple and Salesforce remove the complexities of delivering any experience, to any device, anywhere. Akamai is dedicated to problem solving through intellectual curiosity, collaboration and commitment. And we're growing quickly. If you'd like to work in a culture where hard work and innovative ideas are consistently rewarded, join us and help shape the future of the hyperconnected world.

Ready to create an exciting future? Then join us at www.akamai.com/careers

Akamai Technologies is an Affirmative Action, Equal Opportunity employer (M/F/D/V) that values the strength that diversity brings to the workplace. ©2014 Akamai Technologies, Inc. The Akamai logo is a registered trademark of Akamai Technologies, Inc. All Rights Reserved.



Dice Letter Puzzles

By Phillip Poplin



Puzzle Page

If a friend had a set of four six-sided dice with letters on each face and gave you a list of certain four-letter words that could be rolled by those four dice, could you deter-

mine which letters were on the faces of the dice? That depends, of course, on how many words are given and which words they are.

There are many solvable dice letter puzzles with 11 given words, but it is an open question as to whether a 10-word puzzle exists that yields a unique solution—even if we relax the requirement that the given words are valid in English. Here are three dice letter puzzles, starting with an 11-word puzzle for four six-sided dice and generalizing from there.

Puzzle 1

Suppose that each of four six-sided dice has a distinct letter on each side and that no two dice have any letters in common. Given that the words below can be formed by rolling these dice, determine the letters that are on each of the four dice.

AXIS CUBE FOCI GRAY GRID MATH
OVAL PLUM SKEW TWIN ZERO

Puzzle 2

There is nothing special about using four six-sided dice. We may use any number of dice and each die may have any number of sides. In this puzzle, there are four dice, one each with four, five, six, and seven sides. Each of the 22 sides has a different letter. Given that the words below can be formed by rolling these dice, determine the letters that are on each of the four dice.

BLOG BYTE DONE DUST FIBS HATS LAZY
MINE PUSH RUDE TACK TWIN ZINC

Puzzle 3

In this puzzle we consider a further generalization; here we allow letters to repeat. Suppose that each of

five six-sided dice has a distinct letter on each side. All letters A-Z appear at least once, and four letters appear twice. Given that the words below can be formed by rolling these dice, determine the letters that are on each of the five dice.

ANGLE BOUND BOXER DRAMA FOCUS
FRAME HELIX KNOTS LATEX LIMBO
MAJOR MAPLE QUEEN QUERY ROARS
SOLVE UNION WITCH ZEROS

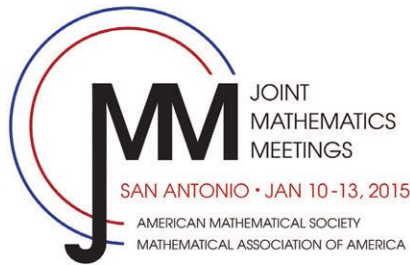
Graph Coloring

Graph coloring is a fairly common method for solving dice letter puzzles and can be done by hand in many cases. In this method, one uses the letters as vertices of an undirected graph and connects vertices when letters appear in the same word. Once the graph is created, then the graph is colored using four colors so that any two connected vertices have a different color. Once colored, the vertices of one color correspond to the letters on one die.

Another solution method involves cliques in the graph, that is, sets of vertices with the property that there is an edge between every pair of vertices. The clique method can be used to create a computer program to solve the puzzle. The graph is created as before, and then all cliques with six vertices are found. Each clique represents a set of six letters that could be on one die. A search can then be done to find a set of four cliques that have the 24 distinct vertices among them with no common vertices, thereby finding a covering set for the puzzle. For another source of these “dicey puzzles,” see <http://puzzleregistry.com/castword.html>.

Phillip Poplin is an associate professor of mathematics at Longwood University, Farmville, Virginia.

Laura Taalman is editor of the “Puzzle Page” column. To submit material to her for possible use, contact her at LauraTaalman@gmail.com.



Henry B. Gonzalez Convention Center and Grand Hyatt San Antonio • January 10-13, 2015

MAA Invited Addresses

Saturday (1/10), 2:15–3:05 p.m.,
Cockrell Theater

Diana Thomas
Montclair State University
**“Dispelling Obesity Myths through
Mathematical Modeling”**

Why do individuals lose only a modest amount of weight after performing regular exercise? Why do people plateau in a few months despite reporting high dietary compliance? Are nationwide obesity interventions responsible for leveling rates of obesity prevalence? Do liquid carbohydrates contribute more to weight gain than solid carbohydrates? There are several prevailing hypotheses formulated to answer these questions that are often vigorously debated in both the scientific and public policy arenas. Many times the formed hypotheses are sensible and seem so reasonable that they become strongly held beliefs even despite existence of experimental evidence demonstrating otherwise. These beliefs affect individual perception, health care advice, governmental health standards, and even experimental research design. Mathematical modeling brings a unique and new clarity to address these very important questions. Using several mathematical analyses I will dispel several of these long-standing and widely accepted beliefs in obesity and weight regulation research.



Sunday (1/11), 9:00–9:50 a.m.,
Cockrell Theater

Ken Ono
Emory University
**“Golden Numbers and Identities:
The Legacy of Rogers and
Ramanujan”**

The golden ratio is one of the most intriguing constants in mathematics. It has a beautiful description in terms of a continued fraction. In his first letter to G. H. Hardy, Ramanujan hinted at a theory of continued fractions, which greatly expands on this classical observation. He offered striking evaluations, of which Hardy said, “These formulas defeated me completely . . . they could only be written down by a mathematician of the highest class. They must be true because no one would have the imagination to invent them.”

Ramanujan had a secret device, two power series identities that were independently discovered previously by Leonard James Rogers. The two Rogers-Ramanujan identities are now ubiquitous in mathematics.

It turns out that these identities and Ramanujan’s theory of evaluations are hints of a much larger theory. In joint work with Michael Griffin and Ole Warnaar, the speaker has discovered a rich framework of Rogers-Ramanujan identities, one that comes with a beautiful theory of algebraic numbers. The story blends the theory of Hall-Littlewood polynomials, modular forms, and representation theory.



Monday (1/12), 9:00–9:50 a.m.,
Cockrell Theater

Christiane Rousseau
University of Montreal
**“Divergent Series and Differ-
ential Equations: Past, Present,
Future . . .”**

Divergent series have been successfully used in mathematics for centuries and have occupied an important place in mathematics until the middle of the 19th century. Then, the call for rigor banished them from most of mathematics. In the 20th century, the use of divergent series was justified rigorously in several contexts including differential equations, together with explanations as to why they are so powerful in both theoretical studies and practical applications. Yet, divergent series remain a relatively marginal subject in contemporary mathematics. In this lecture I will discuss the use of divergent series in differential equations. I will start with some history, and then show how to justify rigorously the use of divergent series. I will also explain why they are not so marginal. This will bring me to the future . . .



Monday (1/12), 4:00–4:50 p.m.,
Cockrell Theater

Catherine O’Neil,
Johnson Research Labs
**“Making the Case for Data
Journalism”**

These days, mathematical models are being deployed for use on the public



in all sorts of ways: in politics, in policing, in teacher assessment, in student learning settings, to get jobs, to get insurance, and to get parole. Many of the models have high impact and little review. It is therefore increasingly falling on journalists to understand and scrutinize them for side effects and false promises. I will explain how this young field is approaching such questions.

MAA-AMS-SIAM Gerald and Judith Porter Public Lecture

Saturday (1/10), 3:30–4:30 p.m.,
Cockrell Theater

Donald Saari

University of California, Irvine
"From Voting Paradoxes to the Search for 'Dark Matter'"



Voting paradoxes are intriguing when demonstrated, frustrating when experienced in actual elections. After offering examples of paradoxical outcomes, a mathematical reason they occur is described. The surprising fact is that this explanation applies to puzzles from other disciplines—including shedding light on the dark matter mystery from astronomy.

MAA Lecture for Students

Monday (1/12), 1:00–1:50 p.m.,
GCC 103 AB

George Hart

Stony Brook University
"Math Is Cool!"

Geometric sculptures, mathematical puzzles, insightful videos, hands-on workshop activities, and the Museum

of Mathematics in NYC are all means to demonstrate that math is a living,



creative, joyful subject—i.e., that Math is Cool! George Hart will present and discuss a variety of these works from his creative output and show you some giant mathematical artworks, 3D printed mathematical models, and original workshop projects. For examples of his work, see <http://georgehart.com>.

MAA Retiring Presidential Address

Tuesday (1/13), 10:05–10:55 a.m.,
Cockrell Theater

Robert Devaney
Boston University

"The Fractal Geometry of the Mandelbrot Set"



In this lecture we describe several folk theorems concerning the Mandelbrot set. While this set is extremely complicated from a geometric point of view, we will show that, as long as you know how to add and how to count, you can understand this geometry completely. This then will allow us to understand the chaotic behavior that occurs when a simple quadratic function is iterated. We will encounter many famous mathematical objects in the Mandelbrot set, like the Farey tree and the Fibonacci sequence. And we will find many soon-to-be-famous objects as well, like the Devaney sequence. There might even be a joke or two in the talk.

AMS-MAA Invited Addresses

Monday (1/12), 11:10–noon,
Cockrell Theater

Jordan Ellenberg, University of Wisconsin–Madison
Title to be announced

Monday (1/12), 11:10 a.m.–noon,
Cockrell Theater

Richard Tapia
Rice University
"The Remarkable Journey of the Isoperimetric Problem: From Euler to Steiner to Weierstrass"

AWM-AMS Noether Lecture

Sunday (1/11), 10:05–10:55 a.m.,
Cockrell Theater

Wen-Ching Winnie Li
Pennsylvania State University
Title to be announced

AMS Invited Addresses (alphabetically)

Ian Agol, University of California, Berkeley
Title to be announced
Tuesday (1/13), 9:00 a.m.

Henri Darmon, McGill University
"Elliptic Curves and Explicit Class Field Theory"
Sunday (1/11), 2:15 p.m.

Susan Holmes, Stanford University
"Statistically Relevant Metrics for Complex Data"
Sunday (1/11), 3:20 p.m.

Michael Hopkins, Harvard University
Title to be announced
Saturday–Monday (1/10–12),
1:00 p.m. (Colloquium Lectures)

Continued next page

AMS Invited Speeches, Con't.

Russell Lyons, Indiana University, Bloomington

Random Orderings and Unique Ergodicity of Automorphism Groups

Saturday (1/11), 10:05 a.m.

Irena Peeva, Cornell University
Matrix Factorizations and Complete Intersection Rings

Monday (1/12), 10:05 a.m.

Daniel A. Spielman, Yale University

Graphs, Vectors, and Matrices

Saturday (1/10), 8:30 p.m. (Josiah Willard Gibbs Lecture)

MAA Invited Paper Sessions

Recent Advances in Mathematical Modeling of the Environment and Infectious Diseases

Saturday (1/10), 8:00–10:55 a.m., GCC 217B

The impact of environmental variation that accurately reflects the impact of changes on an ecological or epidemiological system has always been a challenge in mathematical modeling. Heterogeneity and variability of the environment have been incorporated in models in a variety of ways, through differential and difference equations that account for spatial patterns or temporal variation or through stochastic differential equations that account for random variation. In this session, some recent advances in model formulations and analyses that study environmental effects in unique ways in either deterministic or stochastic settings will be presented. Speakers will discuss, for example, models that include the impact of the environment on disease outbreaks, link the environment to disease dynamics at multiple scales, relate population extinction to stage-structure and the environment, and

incorporate both demographic and environmental variability.

Organizer: Linda J. S. Allen, Texas Tech University

Speakers:

Edward Allen, Texas Tech University

Jim Cushing, University of Arizona

Zhilan Feng, Purdue University

Sophia Jang, Texas Tech University

Fractal Geometry and Dynamics

Saturday (1/10), 8:00–11:00 a.m. and 2:15–6:00 p.m., GCC 214D

This session brings together a number of researchers interested in the intricate relationship between fractal geometry and dynamics. It will highlight the many ways fractal geometry is present in a variety of subfields of dynamical systems, especially complex dynamics. The talks will be mostly of an expository nature and therefore be accessible to a broad cross section of the participants in the Joint Mathematics Meetings. This session accompanies the MAA Retiring Presidential Address by Robert Devaney.

Organizers: Michel L. Lapidus, University of California Riverside; and Robert G. Niemeyer, University of New Mexico

Speakers:

Robert Niemeyer, University of New Mexico Albuquerque

Nishu Lal, Occidental College

Jeff Lagarias, University of Michigan, Ann Arbor

Paul Blanchard, Boston University

Yunping Jiang, City University of New York Graduate Center, City University of New York Queens College

Dennis Sullivan, State University of New York Stonybrook

Marjorie Senechal, Smith College

Liz Fitzgibbon, Boston University

Linda Keen, City University of New York Graduate Center, City University of New York Lehman College

Yang Wang, Michigan State University

Scott Sutherland, State University of New York Stonybrook

Ricardo Pérez-Marco, Université Paris 13

Mathematical Techniques for Signature Discovery

Saturday (1/10), 2:15–6:00 p.m., GCC 217B

A signature is a distinguishing measurement, pattern, or collection of data that identifies a phenomenon of interest. Signatures are ubiquitous in the sciences, for example: Acoustic signals distinguish types of boats, biomarkers identify diseases, and fingerprints distinguish individuals. In this invited paper session, we will survey various approaches to the signature discovery process. For example, manifold learning techniques are being used to identify bone and brain abnormalities in humans to aid in the diagnostic process. Sparse data representations are used to analyze and decompose hyperspectral images. Tensor decomposition techniques are being applied to gain insight into protein function and phylogeny. And genetic algorithms are being coupled with abstract algebra to extract features from arbitrary discrete data.

Organizers: Emilie Hogan and Paul Bruillard, Pacific Northwest National Laboratory

Speakers (Tentative):

Nathaniel Beagley, Johns Hopkins University

Elizabeth Jurrus, University of Utah

Andrew Stevens, Duke University

Jennifer Webster, Pacific Northwest National Laboratory

Mark Oxley, Air Force Institute of Technology

David Bader, Georgia Tech

The Mathematics of Planet Earth

Sunday (1/11), 8:00–11:50 a.m. and 1:00–4:10 p.m., GCC 214D

This session will explore several topics related to Mathematics of Planet Earth (MPE). They are chosen from celestial mechanics, ecology, and geophysics to illustrate the wide range

of challenging mathematical problems encountered in MPE.

Organizers: Hans Kaper, Georgetown University and Mathematics and Climate Research Network; and Christiane Rousseau, University of Montreal

Speakers:

Todd Arbogast, University of Texas at Austin

Edward Belbruno, Princeton University

Pietro-Luciano Buono, University of Ontario Institute of Technology

Clint Dawson, University of Texas at Austin

Kenneth Golden, University of Utah
Richard McGehee, University of Minnesota

Alik Ismail-Zadeh, Karlsruhe and Russian Academy of Science

Mary Wheeler, University of Texas at Austin

The Mathematics of Rogers and Ramanujan

Monday (1/12), 8:00–10:55 a.m., GCC 214D

More than 100 years ago, Rogers and Ramanujan independently derived two strange power series identities. We now know that these identities are related to so much beautiful mathematics: golden ratio, partitions in number theory, representation theory, conformal field theory, and so on. This session will include lectures by world experts on the history of these identities and the beautiful theories that have been inspired by their simplicity and deeper meaning. This MAA Invited Paper Session accompanies the MAA Invited Address by Ken Ono.

Organizer: Ken Ono, Emory University

Speakers:

Bruce Berndt, University of Illinois

Amanda Folsom, Yale University
George Andrews, Penn State University

Ole Warnaar, University of Queensland

Michael Griffin, Emory University
Jim Lepowsky, Rutgers University

Making the Case for Faculty Relevance: Case Studies in Best Practices for Classroom Teaching

Monday (1/12), 8:00–10:55 a.m., GCC 217B

The MAA Committee on the Teaching of Undergraduate Mathematics (CTUM) is creating a pedagogy guide for mathematical instruction at the postsecondary level in an effort to address the “how to teach” questions encountered in the development process for the CUPM Curriculum Guide. This session is to highlight several areas that will be included in the Pedagogy Guide.

Organizer: Martha Abell, Georgia Southern University

Speakers:

Gavin LaRose, University of Michigan: *What Technology Should I Use—Oh, and How Does It Enhance Student Learning?*

Robin Lock, St. Lawrence University: *Technology-Enhanced Trends in Teaching Statistics*

Annalisa Crannell, Franklin & Marshall College: *Four-and-a-Half Useful Methods for Grading Mathematical Writing*

Carol Schumacher, Kenyon College: *What We Say/What They Hear: Culture Shock in the Classroom*

Rachel Schwell, Central Connecticut State University: *Examples and Best Practices of Moore Method and Inquiry-Based Learning in the Teaching of Proofs*

Jackie Dewar, Loyola Marymount University: *Is There an Ecology of Teaching and Learning: Should There Be?*

Mathematics and Voting Theory

Sunday (1/11), 8:00–10:55 a.m., GCC 217D

Election procedures may be viewed as functions from voters’ preferences to an ordering of the candidates and

can be used to elect a single winner or a subset of the candidates. The study of the properties and behavior of election procedures applies ideas from combinatorics, algebra, and geometry. Recent work has also focused on issues related to computational complexity and probability. The talks in this session will highlight the application of mathematics to voting theory at an accessible level. This session accompanies the MAA-AMS-SIAM Gerald and Judith Porter Public Lecture by Donald Saari.

Organizers: Michael Jones, *Mathematical Reviews*; Tommy Ratliff, Wheaton College; and Russel Caflisch, UCLA

Speakers:

John Cullinan, Bard College
Tomas McIntee, University of California, Irvine

Catherine Stenson, Juniata College
Michael Orrison, Harvey Mudd College

Nicolas Lanchier, Arizona State University

Joint Prize Session

Sunday (1/11), 4:25 p.m.

A cash bar reception will immediately follow.

The AMS, ASA, MAA, and SIAM will announce the JPBM Communications Award winner.

The AMS, MAA, and SIAM will award the Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student.

The MAA will award the Beckenbach Book Prize, Chauvenet Prize, Euler Book Prize, Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics, and the Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics.

MAA Contributed Paper Sessions with Themes

Ethnomathematics: A Tribute to Marcia Ascher

Monday (1/12), morning

Ethnomathematics, the study of mathematical aspects of the cultures of indigenous peoples, has been an active area of research for many decades. As more institutions strive to present multicultural offerings to their students, courses on or incorporating ethnomathematics are becoming more popular. This session features talks that present research in ethnomathematics or well-tested ideas for its use in teaching. The session is a tribute to Marcia Ascher (April 23, 1935–June 11, 2013), who devoted much of her career and life to the development of ethnomathematics.

Organizers: Ximena Catepillan, Millersville University; Amy Shell-Gellasch, Montgomery College; and Janet Beery, University of Redlands

Sponsor: HOM SIGMAA

Cryptography for Undergraduates

Saturday (1/10), morning

In increasing numbers, cryptography courses are being developed to serve the needs of undergraduate mathematics and computer science majors. For mathematics majors, cryptography fits into the undergraduate curriculum in much the same way that number theory does. In addition, cryptography is appearing as a topic in mathematics courses for nonmajors, as it is a hook to interest these students in mathematics. This contributed paper session solicits presentations that address topics appropriate for undergraduate cryptography courses for mathematics or computer science majors, or presentations of cryptological topics that could interest and motivate nonmathematics majors.

Organizers: Robert Lewand, Goucher College; and Chris Christensen, Northern Kentucky University

Mathematics and Sports

Saturday (1/10), afternoon

The expanding availability of play-by-play statistics and video-based spatial data, for professional and some collegiate sports, is leading to innovative kinds of research, using techniques from various areas of the mathematical sciences. By modeling the outcome distributions in certain situations, researchers can develop new metrics for player or team performance in various aspects of a sport, comparing actual results to expected values. Such work often has implications for strategic game management and personnel evaluation. Classic areas of study, such as tournament design, ranking methodology, forecasting performance, insight into rare or record events, and physics-based analysis, also remain of interest. This session includes presentations of original research and expository talks; all talks should be accessible to mathematics majors.

Organizers: R. Drew Pasteur, College of Wooster; and John David, Virginia Military Institute

Innovative and Effective Ways to Teach Linear Algebra

Sunday (1/11), morning

Linear algebra is one of the most interesting and useful areas of mathematics, because of its beautiful and multifaceted theory, as well as the enormous importance it plays in understanding and solving many real-world problems. Consequently, many valuable and creative ways to teach its rich theory and its many applications are continually being developed and refined. This session will serve as a forum in which to share and discuss new or improved teaching ideas and approaches. These innovative and effective ways to teach linear algebra include, but are not necessarily limited to: (1) hands-on, in-class demos; (2) effective use of technology, such as Matlab, Maple, Mathematica, Java Ap-

plets or Flash; (3) interesting and enlightening connections between ideas that arise in linear algebra and ideas in other mathematical branches; (4) interesting and compelling examples and problems involving particular ideas being taught; (5) comparing and contrasting visual (geometric) and more abstract (algebraic) explanations of specific ideas; (6) other novel and useful approaches or pedagogical tools.

Organizers: David Strong, Pepperdine University; Gilbert Strang, MIT; and Megan Wawro, Virginia Tech

Helping Students See beyond Calculus

Sunday (1/11), afternoon

Society needs more and better mathematics and science students. Many talented and promising students lose interest in mathematics—some never take a single mathematics course in college—because they never experience the beauty and importance of the many other areas of mathematics beyond calculus. Indeed, many high school students think of mathematics simply as calculus and the topics leading to calculus. Students would benefit enormously from more exposure to other areas of mathematics before leaving high school.

This session, a first step toward this goal, will be a forum for sharing presentations that are all of the following:

- An introduction to a specific mathematical idea or application;
- Accessible to high school calculus students;
- Certainly interesting, hopefully entertaining, possibly captivating;
- Self-contained;
- Less than 45 minutes;
- Available online (for now, posted at their authors' own websites);
- Composed of slides (e.g., PowerPoints), video or audio clips, tools for experimentation and visualization, and so on, and may include worksheets of problems for stu-

dents to think about or work on.

High school teachers (or anyone else) could download, or access online, the presentations and supporting materials to use in their classes in the weeks after the AP exam. Speakers in this session will share a condensed (10–15 minutes) version of their presentation.

Organizers: David Strong, Pepperdine University; Courtney Davis, Pepperdine; Angela Spalsbury, Youngstown State University; and James Tanton, MAA

Trends in Undergraduate Mathematical Biology Education

Monday (1/12), afternoon

Several recent reports emphasize that aspects of biological research are becoming more quantitative and that life science students, including premed students, should be introduced to a greater array of mathematical, statistical, and computational techniques and to the integration of mathematics and biological content at the undergraduate level. Mathematics majors also benefit from coursework at the intersection of mathematics and biology because there are interesting, approachable research problems, and mathematics students need to be trained to collaborate with scientists in other disciplines, especially biology.

Topics may include scholarly work addressing the issues related to the design of effective biomathematics course content, courses, and curricula; the integration of biology into mathematics courses; student recruitment efforts; the gearing of content toward premed students; undergraduate research projects; effective use of technology in biomathematics courses; preparation for graduate work in biomathematics and computational biology or for medical careers; and assessment issues.

Organizer: Timothy Comar, Benedictine University

Sponsor: BIO SIGMAA

Using Flipping Pedagogy to Engage Students in Learning Mathematics

Tuesday (1/13), morning

While the expression “flipping a course” is relatively new, this pedagogical strategy has been around for a number of years. Tenets that underlie this type of pedagogy are that basic definitions, theorems, and examples can be delivered via videos or readings prior to class and that time in class can be better spent assimilating and applying knowledge on more complex problems and activities. Recently, inverted instruction, or “flipping” pedagogy, has gained traction in university mathematics departments. Participants will describe their experiences teaching inverted mathematics courses, including information about curriculum materials, innovative instructional designs, technology, and assessment strategies to support students’ engagement and learning in flipped classrooms.

Organizers: Jean McGivney-Burrelle, Larissa Schroeder, Fei Xue, and John Williams, University of Hartford

Teaching Inquiry

Tuesday (1/13), afternoon

We need to teach our students more than the content of our courses; we need to teach them how to ask and explore questions—a skill that we call mathematical inquiry. This kind of learning is challenging for students and teachers and requires new methods; sharing these ideas can help us all improve. In this session, we will explore the ways that mathematics instructors support students’ mathematical inquiry as well as the ways we prepare students to ask and investigate mathematical questions after they leave the classroom.

This session will include scholarly presentations on (1) successful methods or assignments designed to teach students to ask and explore mathematical questions and (2) the

consequences of teaching mathematical inquiry for the students’ skills, attitudes, and beliefs.

Organizers: Brian Katz, Augustana College; and Elizabeth Thoren, University of California, Santa Barbara

Sponsor: PRIMUS: *Problems, Resources, and Issues in Undergraduate Mathematics Studies.*

The Scholarship of Teaching and Learning in Collegiate Mathematics

Saturday (1/10), morning and afternoon

In the scholarship of teaching and learning, faculty members bring disciplinary knowledge to bear on questions of teaching and learning and systematically gather evidence to support their conclusions. Work in this area includes investigations of the effectiveness of pedagogical methods, assignments, or technology, as well as probes of student understanding.

The goals of this session are to: (1) feature scholarly work focused on the teaching of postsecondary mathematics, (2) provide a venue for teaching mathematicians to make public their scholarly investigations into teaching/learning, and (3) highlight evidence-based arguments for the value of teaching innovations or in support of new insights into student learning.

Organizers: Jackie Dewar, Loyola Marymount University; Thomas Banchoff, Brown University; Curtis Bennett, Loyola Marymount University; Pam Crawford, Jacksonville University; and Edwin Herman, University of Wisconsin Stevens Point

Discovery and Insight in Mathematics

Tuesday (1/13), afternoon

One new development in the philosophy of mathematics that mathematicians should welcome is an interest in the philosophy of mathematics as actually practiced by mathematicians. This session features talks address-

ing philosophical issues concerning two related topics: how mathematics is discovered, and the role of insight in mathematical understanding and discovery. Epistemology studies how we come to know things. A distinction has been made between methods of discovery and methods of justification: that is, the way one discovers a mathematical truth—a conjecture, for example—may be quite different from how it is later justified (by a proof). What are the methods and grounds for such discoveries? What is the role insight plays in these discoveries? How do interconnections between mathematical concepts or subjects lead to discoveries?

Organizers: Dan Sloughter, Furman University; and Bonnie Gold, Monmouth University

Sponsor: POM SIGMAA

Program and Assessment Implications of Common Core Implementation

Monday (1/12), afternoon

The Common Core State Standards for Mathematics (CCSS) have been widely adopted and implemented nationally. Mathematics departments share responsibility with teacher education programs to prepare teachers who are ready to teach school mathematics so that their students can meet both the content and mathematical practices standards. Mathematics faculty also collaborates with the K-12 system to ensure a smooth transition from school to higher education, one of the primary purposes of the CCSS. This session encourages faculty members to share their experiences with the role of mathematics departments in the implementation of the CCSS mathematics standards.

Organizers: William Martin, North Dakota State University; Bonnie Gold, Monmouth University; and John Carter, Westlake High School

Sponsors: MAA Assessment Committee and MAA COMET

Activities, Demonstrations, and Projects That Enhance the Study of Undergraduate Geometry

Sunday (1/11), afternoon

Presenters in this session will share activities, demonstrations, and projects used to enhance the study of Euclidean or non-Euclidean geometry in undergraduate geometry courses. Presentations will provide information about related topics, preliminary material that must be examined with students, and objectives and expected outcomes.

Organizer: Sarah Mabrouk, Framingham State University

Research on the Teaching and Learning of Undergraduate Mathematics

Sunday (1/11), morning and afternoon

This session presents research reports on undergraduate mathematics education. The session will feature research in a number of mathematical areas including linear algebra, advanced calculus, abstract algebra, and mathematical proof. The goals of this session are to foster high-quality research in undergraduate mathematics education, to disseminate well-designed educational studies to the greater mathematics community, and to transform theoretical work into practical consequences in college mathematics. Examples of such types of research include rigorous and scientific studies about students' mathematical cognition and reasoning, teaching practice in inquiry-oriented mathematics classrooms, design of research-based curricular materials, and professional development of mathematics teachers, with intention to support and advance college students' mathematical thinking and activities. The presentations report results of completed research that builds on the existing literature in mathematics education and employs contemporary educational theories of the teaching and learning of mathematics.

The research uses well-established or innovative methodologies (e.g., design experiment, classroom teaching experiment, and clinical interview, with rigorous analytic methods) as they pertain to the study of undergraduate mathematics education.

Organizers: Karen Keene, North Carolina State University; Timothy Fukawa-Connelly, Drexel University; and Michelle Zandieh, Arizona State University

Sponsor: SIGMAA RUME

Mathematics and the Arts

Saturday (1/10), morning and afternoon

An appreciation of the connections between mathematics and the arts explores and extends those aspects of our discipline that complement number and rational thought at its center: pattern, shape, and an unmistakable sense of aesthetics. This session will report on these excursions from those working in or only occasionally visiting any of the many areas of the intersection of mathematics and the arts: artists, mathematicians, educators, those claiming hyphenated versions of these titles, and those eschewing classification altogether.

Organizer: Douglas Norton, Villanova University

Sponsor: SIGMAA ARTS

USE Math: Undergraduate Sustainability Experiences in the Mathematics Classroom

Tuesday (1/13), morning

Humanity continually faces the task of balancing human needs against the world's resources, while operating within the constraints imposed by the laws of nature. Mathematics helps us better understand these complex issues that span disciplines: from measuring energy and other resources, to understanding variability in air and water quality, to modeling climate change. Moreover, these and other real-world-driven sustainability

topics have the potential for motivating students to pursue STEM courses and fields of study more deeply. This session presents faculty who have integrated sustainability-focused activities, projects, or modules into the college mathematics curriculum, in particular in introductory mathematics classes and statistics courses. Authors are encouraged to submit classroom-ready materials for broad dissemination on the Mathematics/QR Disciplinary page on the Sustainability Improves Student Learning (SISL) website (http://serc.carleton.edu/sisl/sustain_in_math.html).

Organizers: Ben Galluzzo, Shippensburg University; and Corrine Taylor, Wellesley College
Sponsor: SIGMAA EM

Inquiry-Based Learning in First-Year and Second-Year Courses

Sunday (1/11), morning

An inquiry-based learning (IBL) approach challenges students to create mathematics by providing tasks requiring them to conjecture, experiment, explore, and solve problems. Rather than showing facts or a clear, smooth path to a solution, the instructor guides students via well-crafted problems through an adventure in mathematical discovery. There is a growing body of evidence that supports the claim that IBL techniques are effective for teaching mathematics and for fostering positive attitudes about mathematics. While there is a long tradition of using IBL in proof-based classes, it is often a challenge to bring an inquiry-based pedagogy into classes with significant content expectations, a heavy computational focus, or a large number of students. Papers in this session address the use of IBL in first- and second-year classes.

Organizers: Dana Ernst, Northern Arizona University; Angie Hodge, University of Nebraska at Omaha; and Theron Hitchman, University of Northern Iowa.



Sponsor: PRIMUS: Problems, Resources, and Issues in Undergraduate Mathematics Studies

Mathematics Experiences in Business, Industry, and Government

Sunday (1/11), afternoon

The MAA Business, Industry, and Government Special Interest Group (BIG SIGMAA) provides resources and a forum for mathematicians working in business, industry, and government (BIG) to advance the mathematics profession by making connections, building partnerships, and sharing ideas. BIG SIGMAA consists of mathematicians in BIG as well as faculty and students in academia who are working on BIG problems.

Mathematicians, including those in academia, with BIG experience will present papers or discuss projects involving the application of mathematics to BIG problems. The goal of this session is to provide a venue for mathematicians with experience in business, industry, and government to share projects and mathematical ideas in this regard. Anyone interested in learning more about BIG practitioners, projects, and issues will find this session of interest.

Organizers: Carla Martin, Department of Defense; Phil Gustafson, Mesa State University; and Michael

Monticino, University of North Texas
Sponsor: BIG SIGMAA

Collaborations between Two-Year and Four-Year Institutions That Create Pathways to a Math Major

Monday (1/12), morning

As more students start their college education at two-year colleges prior to transferring to a four-year program, it is increasingly important for two-year and four-year mathematics departments to collaborate to create student pathways to the mathematics major and for alignment of credit courses. Presenters will describe collaborative strategies and programs between two-year and four-year faculty and institutions that attract and retain community college transfers.

Organizers: Nancy Sattler, Terra State Community College; Judy Ackerman, Montgomery College Rockville Campus; and Elizabeth Teles, National Science Foundation

Sponsors: Committee on Two-Year Colleges (CTYC) and the Curriculum Renewal Across the First Two Years (CRAFTY)

Wavelets in Undergraduate Education

Monday (1/12), afternoon

Wavelets are functions that satisfy certain mathematical properties and are used to represent data or other

functions. They work extremely well in analyzing data with finite domains having different scales or resolutions. Interesting applications include digital image processing, FBI fingerprint compression, the design of medical equipment, and the detection of potholes. Wavelets have typically been studied at the graduate level, but they are making their way into the undergraduate curriculum. This session shares presentations on effectively incorporating wavelets in an innovative way at the undergraduate level.

Organizers: Caroline Haddad, SUNY Geneseo; John Merkel, Oglethorpe University; and Edward Aboufadel, Grand Valley State University

Teaching Proof Writing Techniques within a Content-Based Mathematics Course

Tuesday (1/13), morning

At many small undergraduate institutions, it is not possible to offer a dedicated introductory proofs course. Therefore, a content-based course is often used to introduce proof-writing techniques. Depending on the course chosen and the method of instruction used, student success can vary widely from course to course. In this session, we seek to gain insight from those who have successfully implemented proof-writing techniques in a content-based course.

Organizers: Kristi Meyer, Wisconsin Lutheran College; and Jessie Lenarz, St. Catherine University

Original Sources and Archives in the Classroom

Tuesday (1/13), morning

In the last few years, the number of resources in the history of mathematics available on the Internet has skyrocketed. This makes it very easy for the math educator to include original and historical sources and materials in the mathematics classroom. Talks in this session show how to use online

materials such as original sources, archives, museum pieces, correspondence, and much more to supplement and enhance mathematics courses.

Organizers: Amy Shell-Gellasch, Montgomery College; and Dominic Klyve, Central Washington University

Revitalizing Complex Analysis at the Undergraduate Level

Saturday (1/10), afternoon

Complex analysis, despite its beauty and power, seems to have lost some of the prominence it once enjoyed in undergraduate mathematics, science, and engineering. Thanks to funding from NSF, a national dialogue has begun with the intention of remedying this situation. A team of people will convene for the purpose of giving some initial recommendations, but input from the broader mathematical community is solicited.

Papers at this session will be scholarly, but collectively address a wide range of questions: What are the essential components of an undergraduate complex analysis class from mathematical and scientific standpoints? What technologies seem to be promising? What pedagogical ideas have borne fruit? In general, what innovative approaches might be suggested in teaching the subject?

Organizers: Russell Howell, Westmont College; Paul Zorn, St. Olaf College; and Alan Noell, Oklahoma State University

First-Year Calculus: Fresh Approaches for Jaded Students

Tuesday (1/13), afternoon

The majority of first-year college students signing up for calculus have had a previous encounter with the subject during high school. These new college students start out in Calculus I (or even Calculus II) having seen much of the material of the course, but with weakness or lack of (or perhaps an unwarranted) confidence in some areas. As such, this audience poses special challenges to the college instructor. This session seeks to share innovative approaches to engage this audience in first- or second-semester calculus. Such responses may be curricular, say through a reorganization or approach to the material, or structural, such as innovative approaches to placement. The session is in part inspired by and seeks to complement the MAA's NSF-sponsored project on Characteristics



of Successful Programs in College Calculus.

Organizers: Bob Sachs, George Mason University; and Caren Diefenderfer, Hollins University

Sponsor: SIGMAA TAHSM

Humor and Teaching Mathematics

Saturday (1/10), morning

Humor is a powerful teaching tool. It can be used to make a course more interesting, to introduce a topic or a concept, to emphasize a misconception, or to help recall learned material. Furthermore, it can help build relationships and classroom communities by easing stressful situations, reducing anxiety levels, enhancing communication, and making the classroom a place where students want to be. This session will showcase presentations on how humor and math can be combined and how humor can be used in the classroom to enhance learning. This session specifically emphasizes the place of humor in the mathematics classroom.

Organizers: Semra Kilic-Bahi, Colby-Sawyer College; Gizem Karaali, Pomona College; and Debra Borkovitz, Wheelock College

Incorporating Formal Symbolic Reasoning into Mathematics Courses

Sunday (1/11), morning

Techniques from symbolic logic enrich the undergraduate curriculum at all levels. Courses in quantitative reasoning or liberal arts mathematics often include units on symbolic logic or basic concepts of set theory: for example, one representative text includes a section that begins with basic truth tables and concludes with a study on the validity of syllogisms. Geometry courses use formal rules of inference; proof by contradiction drives inference in statistics courses; computer science classes depend on logic for control flow; Venn diagrams

appear in many areas. Finally, more advanced courses often include a primer on the logical foundations of proof techniques.

However, it can be challenging to develop coherent curricula that help students make direct connections between formal symbolic reasoning and the other areas of mathematics they are studying. Another challenge is that formal logic is not universally taught in secondary schools, creating a wide disparity among students' preparation.

Speakers in this session will discuss creative ways of incorporating the study of formal symbolic logic into mathematics courses, the benefits of doing so, or ways to address challenges.

Organizers: Christopher Shaw and Daniel Jordan, Columbia College Chicago

Statistics Education beyond the Introductory Statistics Course

Sunday (1/11), afternoon

The introductory noncalculus-based statistics course (Intro Stats) is one of the most commonly taught courses on university campuses, and much attention has been focused on improving student learning in this course. This session is focused on the rest of the undergraduate statistics curriculum. We invite submissions that provide details about learning activities, technologies, resources, or teaching methods that have been used to teach statistics outside the Intro Stats course. In addition to discussions related to calculus-based first courses in statistics, Stat 2, MathStat, and other courses in the statistics curriculum, presentations may relate to teaching statistics through internships, undergraduate research experiences, and capstone courses, as well as efforts to partner with other disciplines to ensure that the statistics learned in Intro Stats (and other courses) is affecting the data analyses done in these disciplines. Presentations will address

the objectives and effectiveness of the described activities.

Organizers: Randall Pruijm, Calvin College; Scott Alberts, Truman State University; and Patti Frazer Lock, St. Lawrence University

Sponsor: SIGMAA Stat Ed

The Times They Are a-Changin'—Successful Innovations in Developmental Mathematics Curricula and Pedagogy

Monday (1/12), morning

Developmental mathematics education has captured the nation's attention as critical to student success in college and life. The mathematics community is working vigorously to redress high failure rates, low student preparation for subsequent courses, and routine requirements for multiple-semester sequences for reasonably prepared students. Increasing pressures to help students better prepare for college mathematics in less time and/or with dwindling resources call for new, creative solutions. For example, there are emerging curricula tailored for different student major/career pathways; novel uses of online student-learning tools; and interesting co-programs that support student learning and persistence.

This session features speakers who have implemented successful innovative curricula, pedagogy, or student support programs for developmental mathematics. Talks will briefly summarize the key changes made, provide specific evidence of student success, and highlight information or advice that would be helpful for other departments that might implement the changes.

Organizers: Suzanne Dorée, Augsburg College; Joanne Peeples, El Paso Community College; Donald Small, U.S. Military Academy; Bruce Yoshikawa, Los Angeles Pierce College; and Chris Oehrlein, Oklahoma City Community College (*continued next page*)

Sponsors: Committee on Two-Year Colleges (CTYC) and Curriculum Renewal Across the First Two Years (CRAFTY)

Well-Designed Online Assessment: Well-Formed Questions, Discovery-Based Explorations, and Their Success in Improving Student Learning
Monday (1/12), afternoon

Online delivery of homework and other assessments in mathematics courses has become standard. Many problems have been taken from textbooks and re-created in the context of a variety of online learning systems. Unfortunately, there is often something lost in this process, reducing once open-ended questions expecting a series of clearly written steps to a single answer blank, or sometimes just a multiple-choice response.

It would be arguably more effective to develop online questions and explorations that are pedagogically well formed and that take full advantage of the online environment. These would not only more accurately assess student knowledge, but also help students to develop proper understanding and clear procedures.

Papers will describe online questions or activities that have helped students learn particular learning objectives.

Organizers: Paul Seeburger, Monroe Community College; and Matthew Leingang, New York University

Sponsor: WEB SIGMAA

Infusing Quantitative Literacy into Mathematics and Nonmathematics Courses

Tuesday (1/13), afternoon

Quantitative literacy (QL) can be described as the ability to adequately use elementary mathematical tools to interpret and manipulate quantitative data and ideas that arise in an individual's private, civic, and work life. Like reading and writing literacy, quantitative literacy is a habit of mind

that is best formed by exposure in many contexts. Many institutions have entire courses devoted to QL, while others embed QL learning objectives in traditional mathematics courses or nonmathematics courses. Presenters will describe projects, applications, modules, or entire courses that help students achieve quantitative literacy.

Organizers: Andrew Miller, Belmont University; Aaron Montgomery, Central Washington University; and Gary Franchy, Mott Community College

Sponsor: SIGMAA QL

Perspectives and Experiences on Mentoring Undergraduate Students in Research

Saturday (1/10), morning

In recent years, mathematics faculty members have become increasingly interested in mentoring undergraduate research. This paper session will provide an opportunity for faculty mentors to (1) discuss and exchange ideas on current trends and best practices in mentoring undergraduate research; and (2) share their experiences in directing undergraduate-level research activities. Talks can address any issue about mentoring undergraduate research. The presentations will be scholarly and present evidence supporting the success of the described approaches.

This session serves as a follow-up event for the Regional Faculty Workshop on REU Issues (RFWREU) held in New Jersey in May 2013. Participants from RFWREU are especially encouraged to present in this session. Papers arising from this session, along with papers from RFWREU participants, may be considered for a special issue of *PRIMUS* on mentoring undergraduate research.

Organizers: Aihua Li, Montclair State University; Thomas Hagedorn, College of New Jersey; and Jan Rychtar, University of North Carolina at Greensboro

Sponsor: *PRIMUS*

What Makes a Successful Math Circle: Organization and Problems

Sunday (1/11), morning

A mathematics circle is an enrichment activity for K-12 students or their teachers, which brings them into direct contact with mathematics professionals, fostering a passion and excitement for deep mathematics in the participants. It is usually a weekly or monthly activity, but it can also be an intensive summer experience. Many factors lead to a successful math circle for either students or teachers. Talks will address either the successful organization of a math circle or a problem or topic that was successful at your math circle.

Organizers: Philip Yasskin, Texas A&M University; Tatiana Shubin, San Jose State University; Paul Zeitz, University of San Francisco; and Katherine Morrison, University of Northern Colorado

Sponsor: SIGMAA MCST

Cartography and Mathematics: Imaging the World around Us

Monday (1/12), morning

Cartography has used and inspired different kinds of mathematics for centuries, including but not limited to questions in real analysis, complex analysis, differential geometry, and Riemannian geometry. Modern incarnations of these phenomena make use of exciting topics, too, such as imaging, mirror design, spatial statistics, and optics. Talks come from a variety of fields that involve, generalize, or are inspired by cartographic projections and our quest to visualize the world around us.

Organizers: Emek Kose and Casey Douglas, St. Mary's College of Maryland

Technology, the Next Generation: Integrating Tablets into the Mathematics Classroom

Saturday (1/10), afternoon

Presenters will describe effective and ineffective classroom integration of electronic tablets into university mathematics courses. The presentations will include specific classroom examples of efforts to harness the dramatic power of an electronic tablet. Presentations will describe mathematical objectives to have been achieved, evidence of levels of success among students, and a rationale for the decision to integrate technology into the learning experiences.

Organizers: Kevin Charlwood and Janet Sharp, Washburn University

Best Practices for Teaching the Introductory Statistics Course

Saturday (1/10), afternoon

Much attention has been focused in recent years on improving student learning in the introductory statistics course. Presenters will provide details about learning activities, technologies, resources, or teaching methods that have improved student learning in Intro Stats, especially using nonconventional data, models, and computing (e.g., big data, web scraping, etc.).

Organizers: Randall Pruiem, Calvin College; Scott Alberts, Truman State University; and Patti Frazer Lock, St. Lawrence University

Sponsor: SIGMAA Stat Ed

GENERAL CONTRIBUTED PAPER SESSIONS

Saturday, Sunday, Monday, and Tuesday (1/10–13), morning and afternoon

Organizers: Kristen Meyer, Wisconsin Lutheran College; Bem Cayco, San Jose State University; and Kimberly Presser, Shippensburg University of Pennsylvania

The MAA's General Contributed Paper Session accepts contributions in all areas of mathematics, curriculum, and pedagogy:

- Assessment
- History or Philosophy of Mathematics
- Interdisciplinary Topics in Mathematics
- Mathematics and Technology
- Mentoring
- Modeling or Applications
- Outreach
- Probability or Statistics
- Research in Algebra
- Research in Analysis
- Research in Applied Mathematics
- Research in Geometry
- Research in Graph Theory
- Research in Linear Algebra
- Research in Logic or Foundations
- Research in Number Theory
- Research in Topology
- Teaching or Learning Advanced Mathematics
- Teaching or Learning Calculus
- Teaching or Learning Developmental Mathematics
- Teaching or Learning Introductory Mathematics
- Assorted Topics



Sunset Station Depot

MAA Minicourses

Minicourse 1. Introductory Proposal Writing for Grant Applications to the NSF EHR/Division of Undergraduate Education

Part A. Friday (1/9), 9:00–11:00 a.m.

Part B. Friday (1/9), 2:00–4:00 p.m.

Presenters: John Haddock and Lee Zia, Division of Undergraduate Education, National Science Foundation

Presenters will describe the general NSF grant proposal process and consider particular details relevant to programs in the Division of Undergraduate Education. This course is geared toward those who have not submitted a proposal to NSF and are unfamiliar with the organization. If you believe you have an idea, project, or program worthy of federal support that will improve undergraduate education in mathematics, you should attend. This two-part minicourse will provide information on the specific components of a NSF proposal, demonstrate the NSF peer review process, provide access to previously funded proposals, and explicate the NSF merit review criteria by which proposals are reviewed. Participants should leave this course with a draft of a project summary.

N.B. This course is offered on Friday, January 9, the day before the Joint Mathematics Meetings officially begin.

Minicourse 2. Developing Departmental Self-Studies

Part A. Sunday (1/11), 1:00–3:00 p.m., GCC 206A

Part B. Tuesday (1/13), 1:00–3:00 p.m., GCC 206A

Presenters: Donna Beers, Simmons College; and Rick Gillman, Valparaiso University

Self-study is a critical component of departmental program review. It is retrospective, engaging department members and other interested parties (e.g., other departments and the administration) in examining all aspects of departmental programs. It is also forward looking, anticipating new areas for growth and contribution. Self-study entails discussion of issues confronting a department; as such, it is both a process of reflection and a report. The goal of this minicourse is to help faculty from mathematical science departments plan and lay the groundwork for undertaking an effective self-study of their departments. It will enable participants to determine how a self-study, an administrative mandate, can be a positive opportunity for departmental renewal.

INFORMATION &
ONLINE REGISTRATION
<http://jointmathematicsmeetings.org/jmm>

Minicourse 3. Introduction to Process-Oriented Guided-Inquiry Learning (POGIL) in Mathematics Courses

Part A. Saturday (1/10), 9:00–11:00 a.m., GCC 206A

Part B. Monday (1/12), 9:00–11:00 a.m., GCC 206A

Presenters: Catherine Beneteau, University of South Florida; Zdeňka Guadarrama, Rockhurst University; Jill E. Guerra, University of Arkansas Fort Smith; and Laurie Lenz, Marymount University

This minicourse will introduce faculty to the guided-inquiry instructional method called POGIL (Process-Oriented Guided-Inquiry Learning). Participants will use hands-on activities to learn the crucial elements in a successful guided-inquiry classroom. The workshop will provide participants with a basic introduction to facilitation techniques and an opportunity to reflect on how facilitation can enhance or interfere with student learning as well as how facilitation strategies can be critical in the development of student process skills. By the end of the minicourse, participants will be trained to begin implementing guided-inquiry activities in their own mathematics classrooms.

Minicourse 4. A Dynamical Systems Approach to the Differential Equations Course

Part A. Saturday (1/10), 4:45–6:45 p.m., GCC 207A

Part B. Monday (1/12), 3:30–5:30 p.m., GCC 207A

Presenter: Paul Blanchard, Boston University

This minicourse will give an overview of the Boston University Differential Equations Project, originally funded by the National Science Foundation. The BU project involves a complete redesign of the sophomore-level ODE course. It includes more emphasis on qualitative and geometric methods as well as the incorporation of technology and numerical methods throughout. This minicourse will be useful to college instructors wishing to restructure their ODE courses.

Although the minicourse will include technology demonstrations, the BU project is independent of any particular type of technology. Students must have some access to technology, however.

Minicourse 5. Visual Topics Using Undergraduate Complex Analysis

Part A. Saturday (1/10), 9:00–11:00 a.m., GCC 207A

Part B. Monday (1/12), 9:00–11:00 a.m., GCC 207A

Presenters: Mike Brilleslyper, U.S. Air Force Academy; and Michael Dorff, Brigham Young University

An introduction to two visual topics using complex analysis. The first topic is an overview of minimal surfaces including generating model soap films on wire frames and the mathematics needed for 3D printing of minimal sur-

face models. The second is the dynamics of the set of zeros for a family of polynomials. Using technology, we generate animations that reveal surprising patterns and generate numerous questions concerning the localization of zeros. The goal is to expose participants to these interesting areas, provide ideas and materials for incorporating these topics into various undergraduate courses, and plant the seeds for possible undergraduate research projects.

Participants must bring their own computers with a current version of Mathematica, Maple, Matlab, Sage, or some other CAS.

Minicourse 6. Public- and Private-Key Cryptography

Part A. Sunday (1/11), 1:00–3:00 p.m., GCC 206B

Part B. Tuesday (1/13), 1:00–3:00 p.m., GCC 206B

Presenters: Chris Christensen, Northern Kentucky University; and Jeff Ehme, Spelman College

The interesting mathematical aspects of public-key ciphers have sparked interest by mathematics faculty in these ciphers as applications of mathematics that can be presented in undergraduate courses. Often ignored, however, are the modern private-key ciphers, which are the workhorses of cryptography. Modern private-key ciphers are equally mathematically interesting. In this minicourse, we will explore both modern public-key and private-key ciphers and their mathematical foundations. We will also briefly explore the historical evolution of both types of ciphers. No previous experience with these topics is assumed.

Minicourse 7. Teaching Introductory Statistics (for Instructors New to Teaching Statistics)

Part A. Sunday (1/11), 9:00–11:00 a.m., GCC 207A

Part B. Tuesday (1/13), 9:00–11:00 a.m., GCC 207A

Presenters: Carolyn Cuff, Westminster College; and Leigh Lunsford, Longwood University

This minicourse is intended for instructors new to teaching statistics or those seeking to move from a lecture-based course to an interactive course. Material for the course is drawn from the big ideas of introductory statistics and the ASA-endorsed Guidelines for Assessment and Instruction in Statistics Education (GAISE) report. The course considers ways to engage students in statistical literacy and thinking, and it contrasts conceptual and procedural understanding in the first statistics course. Participants will work through many of the classic activities all statistics instructors should know. Internet sources of real data, activities, and best practices articles will be examined. Participants will find out how they can continue to learn about the best practices for the first course in statistics by becoming involved in statistics education–related conferences, newsletters, and groups.

Minicourse 8. Doing the Scholarship of Teaching and Learning in Mathematics

Part A. Sunday (1/11), 9:00–11:00 a.m., GCC 206A

Part B. Tuesday (1/13), 9:00–11:00 a.m., GCC 206A

Presenters: Jackie Dewar, Loyola Marymount University; and Pam Crawford, Jacksonville University

This course will introduce participants to the scholarship of teaching and learning (SoTL) in mathematics and help them begin projects of their own. We describe a taxonomy of SoTL questions, provide examples of SoTL projects in mathematics, and discuss methods for investigation. Participants will learn about collecting and analyzing different types of evidence, conducting literature searches, dealing with human subjects requirements, and selecting venues for presenting or publishing their work. With the presenters' guidance, participants interactively select and transform a teaching problem of their own into a question for scholarly investigation and identify several types of evidence to gather.

Minicourse 9. Teaching College Mathematics (for Instructors New to Teaching at the Collegiate Level and for Instructors Who Prepare GTAs for Their First Teaching Experience)

Part A. Saturday (1/10), 2:15–4:15 p.m., GCC 206A

Part B. Monday (1/12), 1:00–3:00 p.m., GCC 206A

Presenter: Ann Humes, Michigan Technological University

This minicourse presents a model for a comprehensive program for preparing GTAs to teach at the collegiate level. Participants will be engaged in a lesson cycle used in the semesterlong training. Participants will also learn about how to navigate the blended learning course, handle online management systems, prepare assessments, and deal with student conflicts as required at Michigan Technological University.

Minicourse 10. Humanistic Mathematics

Part A. Saturday (1/10), 2:15–4:15 p.m., GCC 206B

Part B. Monday (1/12), 1:00–3:00 p.m., GCC 206B

Presenters: Gizem Karaali, Pomona College; and Eric Marland, Appalachian State University

As a scholarly stance, humanistic mathematics describes an approach to mathematics that views it as a human endeavor and focuses on its aesthetic, cultural, historical, literary, pedagogical, philosophical, psychological, and sociological aspects. As a pedagogical framework, humanistic mathematics explores and builds on the relationship of mathematics with its nontraditional partners in the humanities, the fine arts, and social sciences, providing additional perspective for the role of mathematics in a liberal arts education. This minicourse exposes participants to both facets of humanistic mathematics.

In the first session, participants will learn about the implications of a humanistic approach to teaching and explore how it can contribute to a more sophisticated understanding of mathematics, for all students. Also included will be a discussion of common implementation issues and an overview of a spectrum of materials to use in the classroom.

In the second session, participants will engage with the scholarship of humanistic mathematics, a body of literature that eschews disciplinary jargon in favor of reaching a more diverse audience. After a thorough introduction, participants will, through guided group work, initiate their own scholarly projects. Possible venues of communication, collaboration, and dissemination of work in humanistic mathematics will be discussed.

Minicourse 11. Healthcare Applications and Projects for Introductory College Mathematics Courses

Part A. Sunday (1/11), 1:00–3:00 p.m., GCC 207A

Part B. Tuesday (1/13), 1:00–3:00 p.m., GCC 207A

Presenter: Theresa Laurent, St. Louis College of Pharmacy

Mathematics teachers continuously face the challenge of getting students to recognize the relevance of the concepts learned in class to real-life situations. This minicourse provides the background knowledge necessary to introduce healthcare applications into precalculus and introductory calculus courses. Applications and projects will include calculating blood alcohol content, determining proper dosing for drugs, analyzing results of drug trials, comparing different contraceptive methods, analyzing the dosing of Zithromax Z-Pak, and serving as a consultant in a malpractice lawsuit. Participants will leave the minicourse with problems and projects ready to use in the classroom, complete with all background information needed.

Minicourse 12. Introducing Matroids to Undergraduates

Part A. Saturday (1/10), 4:45–6:45 p.m., GCC 206A

Part B. Monday (1/12), 3:30–5:30 p.m., GCC 206A

Presenters: Jenny McNulty, University of Montana; and Gary Gordon, Lafayette College

Matroids offer a unique way to incorporate and unify several topics typically studied at the undergraduate level. Matroid theory is an ideal topic for a capstone-type course; an introduction to the subject includes connections to linear algebra (through bases, independent sets, determinants, etc.), abstract algebra (matroid representations over finite and infinite fields, field extensions), finite geometry (affine and projective planes), graph theory (the prototypical examples of matroids), and combinatorics (matchings in bipartite graphs, counting various classes of

subsets). Participants will learn how matroids demonstrate the power of generalization in mathematics: Proving one theorem for matroids automatically gives a corresponding result in graph theory, linear algebra, geometry, and matching theory.

Our goal is to share the beauty of matroids and the interconnectedness of mathematics with undergraduate teachers so they in turn can share this with their students. This workshop will be structured in the same manner of our classrooms: interactive sessions with hands-on activities using examples and questions to motivate the concepts. In addition, materials with numerous exercises will be provided for classroom use, including research projects for students.

Minicourse 13. WeBWorK: An Open-Source Alternative for Generating and Delivering Online Homework Problems

Part A. Saturday (1/10), 4:45–6:45 p.m., GCC 206B

Part B. Monday (1/12), 3:30–5:30 p.m., GCC 206B

Presenters: Paul Pearson, Hope College; Geoff Goehle, Western Carolina University; and Peter Staab, Fitchburg State University

This minicourse introduces participants to the WeBWorK online homework system. Supported by grants from NSF, WeBWorK has been adopted by well over 700 colleges, universities, and secondary schools and is a popular open-source alternative to commercial products. WeBWorK can handle problems in college algebra, calculus, linear algebra, ODEs and more, and comes with an extensive library of more than 25,000 problems across the mathematics curriculum. WeBWorK recognizes a multitude of mathematical objects and allows for elegant solution checking. This minicourse will equip participants with the knowledge and skills to use WeBWorK in a course.

Minicourse 14. Teaching Statistics Using R and RStudio

Part A. Saturday (1/10), 9:00–11:00 a.m., GCC 206B

Part B. Monday (1/12), 9:00–11:00 a.m., GCC 206B

Presenters: Randall Pruijm, Calvin College; Daniel Kaplan, Macalester College; and Nicholas Horton, Amherst College

R is a freely available language and environment for statistical computing and graphics that has become popular in academia and in many industries. But can it be used with students? This minicourse will introduce participants to teaching applied statistics courses using computing in an integrated way. The presenters have been using R to teach statistics to undergraduates at all levels for the last decade and will share their approach and some of their favorite examples. Topics will include workflow in the RStudio

environment, providing novices with a powerful but manageable set of tools, data visualization, basic statistical inference using R, and resampling. Much of this will be facilitated using the mosaic package.

The minicourse is designed to be accessible to those with little or no experience teaching with R. It will provide participants with skills, examples, and resources they can use in their own teaching.

Minicourse 15. How to Run a Successful Math Circle

Part A. Saturday (1/10), 2:15–4:15 p.m., GCC 207A

Part B. Monday (1/12), 1:00–3:00 p.m., GCC 207A

Presenters: Amanda Katharine Serenevy, Riverbend Community Math Center; Philip B. Yasskin, Texas A&M University; and Paul Zeitz, University of San Francisco

A math circle brings together K-12 students and professional mathematicians on a regular basis to explore engaging topics. This course will focus on the logistics involved in organizing and sustaining a math circle as well as the fine art of conducting lively sessions. Facilitators will discuss how to adapt a promising topic for math circle use, provide tips for keeping a circle running smoothly, and address issues such as publicity and funding. Participants will craft a math circle lesson plan and take away a variety of materials including sample topics and a list of book and web resources.

Minicourse 16. Using Games in an Introductory Statistics Course

Part A. Sunday (1/11), 9:00–11:00 a.m., GCC 206B

Part B. Tuesday (1/13), 9:00–11:00 a.m., GCC 206B

Presenters: Rod Sturdivant, Ohio State University; and Shonda Kuiper, Grinnell College

Participants experience web-based games and corresponding class activities that effectively teach statistical thinking and the process of scientific inquiry. By grappling with intriguing real-world problems, these labs encourage students to experience the role of research scientist as they conduct hypothesis tests and regression analysis. Our games are designed to (1) engage students; (2) have a low threat of failure early on with optional additional challenges; (3) create realistic, adaptable, and straightforward models representing current research in a variety of disciplines; (4) provide an intrinsic motivation for students to want to learn; and (5) provide teacher instructions for easy, successful implementation.

INFORMATION

<http://jointmathematicsmeetings.org/jmm>

MAA Panel Sessions

What Every Student Should Know about JMM

Saturday (1/10), 2:15–3:35 p.m., GCC 205

Organizer: Pamela Richardson, Westminster College

Panelists: Jennifer Bowen, College of Wooster; Frank Morgan, Williams College; and George Yates, Youngstown College

Navigating a large conference can be overwhelming, even for those who have previously attended such an event. Panelists will provide guidance for students attending the Joint Mathematics Meetings, including: How do I get the most out of the program? What sessions are especially for students? What other events should I be on the lookout for? Will I understand any of the invited addresses, or should I not bother attending them? If I am presenting a poster, where do I go to set it up? How can I get some cool, free math stuff? Students and their faculty mentors are encouraged to attend.

Sponsor: MAA Committee for Undergraduate Student Activities and Chapters

MAA-AMS Panel on Career Ladders for Full-time Non-Tenure-Track Faculty

Saturday (1/10), 3:50–5:10 p.m., GCC 214B

Organizers: Amy Cohen, Rutgers University; Judy Walker, University of Nebraska Lincoln; and David Manderscheid, Ohio State University

Panelists: David Manderscheid, Ohio State University; Sue Geller, Texas A&M University; and Ellen Kirkman, Wake Forest University

Many institutions of higher education are developing career tracks for full-time instructional staff for whom active research in mathematics is not the primary job criterion. These are not tenure-track positions. They carry a variety of titles including “professor of the practice,” “clinical professor,” “lecturer,” “teaching professor,” and “instructor,” sometimes with modifiers such as “assistant,” “associate,” or “senior.” Little formal discussion has taken place within our profession of such topics as the purposes of such positions; criteria for hiring, retention, and promotion; mentoring such colleagues; and evaluating their impact on our students and our departments. This panel consists of speakers with experience and concerns about this change in faculty structure. A moderator will lead a discussion after the presentations.

MOOCs and Me: Massive Online Materials for My Students

Saturday (1/10), 9:35–10:55 a.m., GCC 214B

Organizer: John Travis, Mississippi College

Panelists: Petra Bonfert-Taylor, Wesleyan University; Jim

Fowler, Ohio State University; Grace Lyo, Stanford University; and Tom Morley, Georgia Institute of Technology

This panel will include several creators of mathematics MOOCs to discuss the opportunities realized and challenges encountered through developing and presenting one of these large online courses. Ideas for how MOOC course materials can be used for independent study as well as incorporated into standard university classes will be presented. Significant time will be reserved for questions from the audience and among the panelists.

Each of the panelists will focus on special features of his or her course and on advantages and disadvantages related to the course environment provider. Costs—both financial and personal—will be considered and compared with those normally associated with teaching an online course. Philosophical reasons for supporting MOOCs will be addressed.

Sponsors: MAA Committee on Technologies in Mathematics Education and WebSIGMAA

Actuarial Science: What Faculty Need to Know

Monday (1/12), 5:00–7:00 p.m., GCC 214B

Organizers: Kevin Charwood, Washburn University; Robert Buck, Slippery Rock University; Patrick Brewer, Lebanon Valley College; Bettye Anne Case, Florida State University; Michelle Guan, Indiana University Northwest; and Steve Paris, Florida State University

Panelists: Michelle Guan, Indiana University Northwest; Mike Boa, Casualty Actuarial Society; Bettye Anne Case, Florida State University; Catherine Taylor, USAA P&C Casualty; and Susan Staples, Texas Christian University

The panel features a diverse group of actuaries, publishers, and actuarial educators. The pace of change in actuarial science is faster than in most academic areas, and this session aims to help faculty adjust curricula and activities to meet student needs and expectations. A member representing actuarial science from the MAA Committee on the Undergraduate Program in Mathematics (CUPM) will present the group's forthcoming recommendations. Another panel speaker will address the unique challenges of meeting the needs of international students in actuarial programs. A speaker from an actuarial firm will focus on the changing landscape of actuarial internships. These are a few of the topics for discussion.

Undergraduate Research: Viewpoints from the Student Side

Sunday (1/11), 10:35–11:55 a.m., GCC 214B

Organizers: Herbert A. Medina, Loyola Marymount University; and Angel R. Pineda, California State University, Fullerton

Panelists: TBA

The number of undergraduates engaging in mathematical

sciences research has increased dramatically in the past few years. Indicators of this growth are the size of the undergraduate poster session at the Joint Mathematics Meetings (e.g., more than 300 posters at the 2014 meeting), the number of mathematics Research Experience for Undergraduates participants (now close to 70), and the recent creation of journals devoted to mathematics undergraduate research (e.g., *Involve* at UC Berkeley). Undergraduate research is now a major factor in preparing students for graduate school and industrial careers.

The panel will ask current undergraduate and graduate students who have engaged in undergraduate research to share some of their experiences and what they view as the dos and don'ts of undergraduate research, both from the student side and their perception of the faculty mentor side. Their viewpoints should prove useful to both fellow undergraduates and current and future faculty mentors of undergraduate research.

Sponsor: MAA Subcommittee on Research by Undergraduates

Writing Competitive Grant Applications

Sunday (1/11), 1:00–2:20 p.m., GCC 205

Organizers: Semra Kilic-Bahi, Colby-Sawyer College; and Kimberly A. Roth, Juniata College

Panelists: Florence Fasanelli, MAA; Elizabeth Teles, Division of Undergraduate Education, NSF; Jennifer Slimowitz Pearl, Division of Mathematical Sciences, NSF; and Roselyn E. Williams, Florida Agricultural and Mechanical University

Panelists will discuss process and give tips for writing successful grant proposals with a focus on proposals that target underrepresented groups, especially women. Each panelist will give a 15–18 minute presentation addressing key points and the common features of competitive grant applications. The presentations will be followed by questions from the audience.

Sponsor: MAA Committee on Participation of Women in Mathematics

Mathematicians Write: Publishing Options and Outlets beyond the Standard Research Journal

Sunday (1/11), 2:35–3:55 p.m., GCC 214B

Organizer: Gizem Karaali, Pomona College

Panelists: Brian Hopkins, Saint Peter's University (*College Mathematics Journal*); Marjorie Senechal, Smith College (*The Mathematical Intelligencer*); Janet Beery, University of Redlands (*Convergence*); Jo Ellis-Monaghan, Saint Michael's College (*PRIMUS*); and Gizem Karaali, Pomona College (*Journal of Humanistic Mathematics*)

Mathematicians are trained to write research papers and are often comfortable with the norms and expectations of

a standard research journal. However, many find that they have other things to say, other ideas to explore. This leads to an unfamiliar territory. How does one get an expository piece published? Can a pedagogical innovation idea develop into a publishable article? What kinds of different audiences can I address with my writing? This panel will bring together editors of several prominent journals and magazines that populate the mathematical publishing universe and enrich its offerings to provide concrete answers to such questions. Besides these, the panelists will respond to the following questions:

1. What does it take to get published in your journal?
2. What differentiates manuscripts you publish from those you don't?
3. What else do you recommend to prospective authors? The panel will conclude with a Q&A session.

NSF Funding Opportunities for the Learning and Teaching of the Mathematical Sciences

Part I: Undergraduate/Graduate Education Programs, Workforce, and Broadening Participation (DUE/DGE/DMS, HRD)

Saturday (1/10), 8:00–9:20 a.m., GCC 205

Part II: The K-16 Continuum – Learning Science & Research and Pre- and In-Service Teachers (DUE/DRL)

Saturday (1/10), 9:35–10:55 a.m., GCC 205

Organizers: John Haddock and Lee Zia, Division of Undergraduate Education, NSF; Karen King, Division of Research on Learning, NSF; Tasha Inniss, Division of Human Resource Development, NSF; Jennifer Slimowitz Pearl, Division of Mathematical Sciences, NSF

Panelists: The organizers

A number of NSF divisions offer grant programs that support innovations in learning and teaching in the mathematical sciences. These programs will be discussed along with examples of successful projects in two sessions. Anticipated budget highlights and other new initiatives for the next fiscal year, as appropriate, will also be presented.

Sponsor: MAA Committee on Professional Development

Panel Discussion by NSF-DUE Principal Investigators

Part 1: Panel of Successful PIs Talking about Their Experiences (CCLI/TUES/IUSE)

Sunday (1/11), 8:00–8:50 a.m., GCC 205

Part 2: Panel of Successful PIs Talking about Their Experiences (DRK-12, Noyce, STEM-CP & MSP)

Sunday (1/11), 9:00–9:50 a.m., GCC 205

Part 3: General Session (Audience shares project ideas, PIs and NSF staff are available for feedback)

Sunday (1/11), 10:00–11:20 a.m., GCC 205

Organizers: John Haddock and Lee Zia, Division of Un-

dergraduate Education, National Science Foundation

Panelists: Principal investigators on successful NSF projects, TBA

Presenters will describe their experiences with the general NSF grant proposal process and share their expertise in putting together proposals for specific programs.

Sponsor: MAA Committee on Professional Development

Graduate School: Choosing One, Getting In, Staying In

Saturday (1/10), 3:50–5:10 p.m., GCC 205

Organizers: Nick Scoville, Ursinus College; and Kristine Roinestad, Georgetown College

Panelists: Bill Velez, University of Arizona; Annalisa Crannell, Franklin & Marshall College; Peter Howard, Texas A&M University; and Brian Miceli, Trinity University

You've made the decision to apply to graduate school. Now you must sift through all the available information, match schools to your academic and research interests, narrow your list to a handful of schools, and submit outstanding applications. How do you accomplish all this and hopefully increase the likelihood of getting into your first- or second-choice program? Then, once accepted, how do you complete the program and earn your degree? How do you use your time in graduate school to better prepare for your postgraduate goals? Our panelists will discuss these and other important issues for those considering graduate school, transferring to a different graduate school, or switching graduate programs.

Sponsor: Young Mathematicians' Network

On-Campus Interview Survival Guide

Sunday (1/11), 1:00–1:20 p.m., GCC 214B

Organizers: Thomas Wakefield, Youngstown State University; and Jacob A. White, Texas A&M University

Panelists: Antonia Cardwell, Millersville University of Pennsylvania; Greta Panova, UCLA; and Frank Sottile, Texas A&M University

Applying for an academic position can be a daunting task. In this session, panelists will offer their perspective on the academic job search and specifically provide advice and tips regarding the on-campus interview. The panelists represent faculty and recent Ph.D.s on the job market. Learn some tips to prepare for the next step in the job application process.

Sponsor: Young Mathematicians' Network

Benefits and Challenges of Introducing Multivariate Topics Earlier in the Calculus Sequence

Monday (1/12), 9:35–10:55 a.m., GCC 214

Organizers: Mark Gruenwald, University of Evansville;

and Ken Luther, Valparaiso University

Panelists: Dave Dwyer, University of Evansville; Stephen Davis, Davidson College; and Jim Fowler, Ohio State University

Many voices within STEM disciplines have recommended that (some) multivariate topics be introduced earlier in the calculus sequence. Thus far, attempts to restructure the calculus sequence with this goal in mind have not gained widespread adoption, though several recent initiatives show promise. The panelists will share experiences with introducing multivariate calculus topics earlier in the curriculum—in both traditional courses and in MOOCs—and the challenges of swimming against the calculus current.

A Positive Feedback Loop? Impact of Mathematics Education Research and K-12 Instructional Changes on Our Teaching of Undergraduate Mathematics

Tuesday (1/13), 8:00–9:20 a.m., GCC 205

Organizers: Ben Ford, Sonoma State University; and Klay Kruczek, Southern Connecticut State University

Panelists: Chris Rasmussen, San Diego State University; Klay Kruczek, Southern Connecticut State University; and Elise Lockwood, Oregon State University

The field of mathematics education research (K-12 and undergraduate) is developing rapidly, at the same time that K-12 mathematics instruction is experiencing major change. What do these forces imply for our teaching of undergraduate mathematics, especially for future teachers? What research findings hold across all ages; which are age specific? Will our incoming students have different mind-sets, skills, and understanding? What will be required (mathematically) of our graduates who become teachers, and how can they develop those abilities while in our classes?

Sponsor: MAA Committee on the Mathematical Education of Teachers (COMET)

MAA Session for Chairs: Program Assessment: Making It Easier and Better

Sunday (1/11), 8:00–9:20 a.m., GCC 214B

Organizers: Catherine M. Murphy, Purdue University Calumet; and Daniel Maki, Indiana University

Panelists: Barbara Loud, Regis College; William O. Martin, North Dakota State University; Deborah Pace, Stephen F. Austin State University; and Elizabeth C. Yanik, Emporia State University

The results of assessment of Student Learning Outcomes are used to inform curriculum decisions as well as provide data for departmental reviews and regional accreditation documents. The panelists will address organizational principles that may ease the transition from data to informa-

tion. In particular, the following topics—focused goals and objectives, management of data, rubrics, and the feedback loop—will be discussed. Sessions for chairs are designed to encourage attendees' interaction with panelists. Please share your successes and concerns with assessment during the session.

Recommendations for the 21st-Century Mathematical Sciences Major

Saturday (1/10), 2:15–3:35 p.m., GCC 214B

Organizers: Martha J. Siegel, Towson University; and Carol Schumacher, Kenyon College

Panelists: Rachel Levy, Harvey Mudd College; Nicholas J. Horton, Amherst College; and Elizabeth A. Burroughs, Montana State University

At these Joint Mathematics Meetings, the MAA Committee on the Undergraduate Program (CUPM) is announcing the release of the 2015 *Curriculum Guide to Majors in the Mathematical Sciences*. The Society for Industrial and Applied Mathematics (SIAM) and the American Statistical Association (ASA) have recently prepared their own recommendations for undergraduate majors in applied mathematics and statistics, respectively. The MET II report gave recommendations for the preparation of future mathematics secondary school teachers. Representatives of the MAA, SIAM, ASA, and MAA's Committee on the Mathematical Education of Teachers (COMET) will discuss the highlights of their reports and the 21st-century challenges to mathematics departments offering undergraduate degrees.

Sponsors: MAA Committee on the Undergraduate Program in Mathematics (CUPM) and the MAA Committee on the Mathematical Education of Teachers (COMET)

Mathematics and the Sciences: Necessary Dialogue

Monday (1/12), 1:00–2:20 p.m., GCC 214B

Organizers: Martha J. Siegel, Towson University; and Peter Turner, Clarkson University

Panelists: S. James Gates Jr., University of Maryland; Mark Green, University of California, Los Angeles; William Press, University of Texas at Austin; and Nancy Geller, National Institutes of Health

Recent reports and meetings (e.g., the 2012 PCAST report Engage to Excel; activities of the TPSE Math [Transforming Post-Secondary Education in Mathematics] group) have raised important questions. How creatively and effectively does the mathematics community support undergraduate scientific and STEM education? How can we attract more, and more diverse, students? How well informed are the mathematics and science communities about each other's efforts and innovations? What new (and old) mathematics do our scientific siblings want our students to know, and when should they know it? Such questions are especially

timely now, when MAA, SIAM, and the American Statistical Association have all produced reports and recommendations for undergraduate education. (MAA's 2015 Curriculum Guide, historically published about once each decade, is one example.) This panel session will include speakers who see mathematics teaching and learning from outside our community. We should hear one another's views and perspectives.

Sponsor: MAA Committee on the Undergraduate Program in Mathematics (CUPM)

Out in Mathematics: LGBTQ Mathematicians in the Workplace

Tuesday (1/13), 9:35–10:55 a.m., GCC 205

Organizers: David Crombecque, University of Southern California; and Ron Buckmire, Occidental College

Panelists: Andrew Bernoff, Harvey Mudd College; Mike Hill, University of Virginia; and Lily Khadjavi, Loyola Marymount University

Discussion and Q&A session with LGBT mathematicians on being out in the mathematics community. We will discuss questions such as: Should I be out to my Ph.D. adviser? Should I mention anything on my CV, or during a job interview, for a postdoc, for a tenure-track position? And if so, what are the ways to be out in these circumstances? And many more questions relevant to the well-being and inclusion of future successful GLBTQ mathematicians.

A Common Vision for the Undergraduate Mathematics Program in 2025

Tuesday (1/13), 1:00–2:20 p.m., GCC 205

Organizers: Karen Saxe, Macalester College; and Linda Braddy, MAA

Panelists: TBA

The MAA is partnering with other professional associations in the mathematical sciences to consider how we might modernize our programs to better prepare students for the demands of the 21st-century workplace. We aim to catalyze widespread adoption of curricula and pedagogies that are (1) geared toward developing a broad base of intellectual skills and competencies to better prepare students for the workforce and (2) simultaneously endorsed by a broad cross section of the mathematical sciences community. Funded by the NSF, this work will take stock of the curricular guides endorsed by the various associations, identify and articulate common themes, and lay a foundation for future endeavors. Panelists representing the MAA, the American Mathematical Association of Two-Year Colleges (AMATYC), the American Mathematical Society (AMS), the American Statistical Association (ASA), and the Society of Industrial and Applied Mathematics (SIAM) will update the community on the project.

Other MAA Sessions

MAA Department Liaisons Meeting

Saturday (1/10), 9:30–11:00 a.m.

MAA Section Officers Meeting

Saturday (1/10), 4:30–5:30 p.m., Lone Star Ballroom, Salons A & B, Grand Hyatt

Chair: Rick Gillman, Valparaiso University

SIGMAA Officers Meeting

Sunday (1/11), 10:30 a.m.–noon, Lone Star Ballroom, Salons A & B, Grand Hyatt

Chair: Karen A. Marrongelle, Portland State University

Presentations by MAA Teaching Award Recipients

Monday (1/12), 2:00–3:20 p.m., GCC 103 AB

Organizers: MAA Secretary Barbara Faires, Westminster College; and MAA President Robert Devaney, Boston University

Winners of the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching will give presentations on the secrets of their success.

Project NEXt Reception

Monday (1/12), 8:00 p.m.–10:00 p.m.

All Project NEXt fellows, consultants, and other friends of Project NEXt are invited. See "Social Events" for details.

MAA Business Meeting

Tuesday (1/13), 11:10–11:40 a.m., Cockrell Theater

Chair: MAA President Robert Devaney, Boston University

MAA MATHfest 2015: Musicians Wanted

As part of the MAA Centennial celebration at MathFest 2015 in Washington, D.C., the MAA is sponsoring a Math Concert on Thursday, August 6, at 8:00 p.m. We are looking for experienced musicians in the MAA community to perform at this concert—we seek singers and instrumentalists, soloists, and ensembles. (There will be a piano available.) We even hope to put together a choir for the occasion. The concert is being organized by Dave Kung (St. Mary's College of Maryland, violin), Ann Stewart (Hood College, horn), and John Bukowski (Juniata College, piano). If you would like to perform or you have any questions, please contact John Bukowski at bukowski@juniata.edu.

SPECIAL INTEREST GROUP ACTIVITIES

Mathematics and the Arts (SIGMAA ARTS)

Contributed Paper Session: Mathematics and the Arts. *Saturday (1/10), morning and afternoon*

Business, Industry, and Government (BIG SIGMAA)

Contributed Paper Session: Mathematics Experiences in Business, Industry, and Government. *Sunday (1/11), afternoon*

Guest Lecture. *Sunday (1/11), 5:30–6:20 p.m., GCC 210A*

Speaker: Kyle Myers, Division of Imaging and Applied Mathematics, Office of Science and Engineering Laboratories, Center for Devices and Radiological Health, U.S. FDA
Title: “Mathematical Challenges in the Evaluation of Medical Imaging”
Abstract: A wide variety of advanced medical imaging systems are under development by academia and industry with a broad range of performance characteristics and intended uses. New methods for supporting image interpretation using computer-aided diagnosis

algorithms are also being developed for a broad range of diseases, organs, and imaging modalities. The evaluation of imaging devices and computer-aided diagnosis algorithms presents unique mathematical challenges owing to the large data sets involved and the need to consider the role of the human reader. This talk will discuss these challenges and the role of the FDA’s Center for Devices and Radiological Health’s imaging research program in bringing new medical imaging technologies to U.S. patients.

Reception. *Sunday (1/11), 6:30–6:50 p.m., GCC 210A*

Business Meeting. *Sunday (1/11), 7:00–7:30 p.m., GCC 210A*

Mathematical and Computational Biology (BIO SIGMAA)

Reception. *Sunday (1/11), 6:00–6:20 p.m., GCC 210B*

Business Meeting. *Sunday (1/11), 6:30–6:50 p.m., GCC 210B*

Guest Lecture. *Sunday (1/11), 7:00–7:50 p.m., GCC 210B*

Speaker: Jim Cushing, University of Arizona

Title: “Can Cannibalism Save the Day? Dynamic Models for Adaptive Life History Strategies in Response to Climate Change”

Abstract: Changing environments generally induce changes in a species’s life history traits as it struggles to survive. Traits related to reproduction, survival, and so on can all be affected in various ways that involve complex trade-offs. Cannibalism functions as a natural behavioral trait in a wide variety of animals, including protozoans, invertebrates, and all major vertebrate classes. For example, the interdisciplinary team with which I collaborate has recently documented a strong correlation between cannibalism and climate change (mean sea surface temperature) in colonies of marine seabirds (the glaucous-winged gull) on Protection Island, Washington, a wildlife refuge managed by the U.S. Fish & Wildlife Service. Other traits, such as reproductive synchrony within the colony, have also shown similar correlations. Motivated by these observations, we ask: What are the long-term consequences of such changes? Are

they adaptive in the long run or simply desperate aberrations of a doomed species? I will describe some mathematical models designed to address these questions. The mathematical backdrop is that of nonlinear, discrete time dynamical systems defined by projection matrices, a fundamental bifurcation theorem, and backward bifurcations that lead to so-called strong Allee effects.

Contributed Paper Session: Trends in Undergraduate Mathematical Biology Education. *Monday (1/12), afternoon*

SIGMAA on Math Circles for Students and Teachers at JMM 2014



Environmental Mathematics (SIGMAA EM)

Contributed Paper Session: USE Math: Undergraduate Sustainability Experiences in the Mathematics Classroom. *Tuesday (1/13), morning*

History of Mathematics (HOM SIGMAA)

Contributed Paper Session: Ethnomathematics. *Monday (1/12), morning*

Math Circles for Students and Teachers (SIGMAA MCST)

Math Circles Demonstration. *Sunday (1/11), 10:00–11:30 a.m., GCC 214C*

Math Wrangle. *Sunday (1/11), 1:00–2:20 p.m., GCC 214C*

Contributed Paper Session: What Makes a Successful Math Circle: Organization and Problems. *Tuesday (1/13), morning*

Philosophy of Mathematics (POM SIGMAA)

Contributed Paper Session: Discovery and Insight in Mathematics. *Tuesday (1/13), afternoon*

Reception. *Monday (1/12), 5:30–5:50 p.m., GCC 210B*

Business Meeting. *Monday (1/12), 6:00–6:20 p.m., GCC 210B*

Guest Lecture. *Monday (1/12), 6:30–7:20 p.m., GCC 210B*

Speaker: Matt Jones, California State University, Dominguez Hills
Title: “Mathematical Authority and Inquiry-Based Learning”

Quantitative Literacy (SIGMAA QL)

Contributed Paper Session: Infusing Quantitative Literacy into Mathematics and Nonmathematics Courses. *Tuesday (1/13), afternoon*

Research in Undergraduate Mathematics Education (SIGMAA RUME)

Contributed Paper Session: Research on the Teaching and Learning

of Undergraduate Mathematics. *Sunday (1/11), morning and afternoon*

Statistics Education (SIGMAA Stat Ed)

Contributed Paper Session: Statistics Education beyond the Introductory Statistics Course. *Sunday (1/11), afternoon*

Reception. *Sunday (1/11), 5:30–5:50 p.m., GCC 211*

Business Meeting. *Sunday (1/11), 6:00–6:20 p.m., GCC 211*

Guest Lecture. *Sunday (1/11), 6:30–7:20 p.m., GCC 211*

Speaker: Hadley Wickham, RStudio and Rice University

Title: “Reactive Documents for Teaching”

Abstract: When writing a static document, you have to anticipate the needs of the reader—it’s a one-way communication. With reactive documents, a document becomes more collaborative—it’s created by both the author and the reader. With a reactive document, you can allow the reader to modify parameters, change assumptions and generally explore a space of parameters. Currently, the R community is in the middle of an exciting convergence of tools for developing websites (shiny), making reproducible documents (knitr, rmarkdown) and visualisation (ggvis) that make it very easy to create reactive documents. In this talk, I’ll show you how easy it is to use R to create compelling reactive documents for teaching.

Contributed Paper Session: Best Practices for Teaching the Introductory Statistics Course. *Saturday (1/10), afternoon*

Teaching of Advanced High School Mathematics (SIGMAA TAHSM)

Workshop: Creating a Course in Mathematical Modeling. *Tuesday (1/13), 8:00–10:00 a.m., GCC 214B*

Contributed Paper Session: First-Year Calculus: Fresh Approaches for Jaded Students. *Tuesday (1/13), afternoon*

Mathematics Instruction Using the WEB (WEB SIGMAA)

Contributed Paper Session: Well-Designed Online Assessment: Well-Formed Questions, Discovery-Based Explorations, and Their Success in Improving Student Learning. *Monday (1/12), afternoon*

Business Meeting. *Monday (1/12), 5:30–5:50 p.m., GCC 211*

Guest Lecture. *Monday (1/12), 6:00–6:50 p.m., GCC 211*

Speaker: William Stein, University of Washington

Title: “SageMathCloud—Integrated Mathematical Tools in the Cloud”

Abstract: I will give you a tour of the SageMathCloud and show you how to use Sage, R, Octave, Python, Cython, GAP, Macaulay2, Singular, and much more in your web browser; edit LaTeX documents with inverse and forward search and Sage mode; collaboratively edit IPython notebooks, Sage worksheets, and all other document types; write, compile, and run code in most programming languages; and use a command line terminal. I will also discuss the commercial aspects of this project and some technical details of how I implemented it.

Panel: MOOCs and Me: Massive Online Materials for My Students. *Saturday (1/10), 9:35–10:55 a.m., GCC 214B*

Register Today
JMM
January 10–13

MAA Sessions for Students

Speed Interviewing Marathon for Students

Sunday (1/11), 1:00–2:15 p.m.

Employers suggest that communication skills are a critical component when considering a mathematics major for a job. An important time to demonstrate good communication skills is during the job interview. This session for undergraduate students, graduate students, and early-career mathematicians will start with an overview of best practices and tips on job interviewing, then guide participants in several speed interviewing sessions of 10 minutes each, where they can practice what they have learned and hone their interviewing skills. Speed interviewing sessions will include individual feedback for participants, as well as opportunities to network with fellow interviewees.

Organizers: Jenna Carpenter, Louisiana Tech University; and Michael Dorff, Brigham Young University

Sponsors: MAA Committee on Professional Development, MAA Committee on Graduate Students, and the MAA Committee on Undergraduate Student Activities and Chapters

Grad School Fair

Monday (1/12), 8:30–10:30 a.m.

This is your chance for one-stop shopping in the graduate school market. Undergrads can meet representatives from mathematical sciences graduate programs from universities all over the country. January is a great time for juniors to learn more, and college seniors may still be able to refine their search. At last year's meeting about 300 students met with representatives from 50 graduate programs.

If your school has a graduate program and you are interested in participating, a table will be provided for your posters and printed materials for \$75 (registration for this event must be made by a person already registered for the JMM), and you are welcome to personally speak to interested students. Complimentary coffee will be served.

Sponsors: MAA and AMS

MAA Lecture for Students

Monday (1/12), 1:00–1:50 p.m.

George Hart, Stony Brook University
"Math Is Cool!"

See details at page 33.

MAA Student Poster Session

Monday (1/12), 4:30–6:00 p.m.

Organizer: Joyati Debnath, Winona State University

This session features research done by undergraduate students. First-year graduate students are eligible to present if the research was done while they were still undergraduates.

Research done by high school students can be accepted if the research was conducted under the supervision of a faculty member at a postsecondary institution.

Appropriate poster material includes, but is not limited to: a new result, a new proof of a known result, a new mathematical model, an innovative solution to a Putnam problem, or a method of solution to an applied problem. Purely expository material is not appropriate for this session.

Students should submit an abstract describing their research in 250 words or less by midnight, October 11. Notification of acceptance or rejection will be sent by November 1. See maa.org/students/undergrad/jmmposterindex.html for further details and a link to the abstract submission form.

See bit.ly/Wh08wS for "A Guide to Writing an Abstract."

See ncsu.edu/project/posters for "Creating an Effective Poster."

See maa.org/example_posters for exemplary posters from past years.

Posters will be judged during the session, and award certificates will be mailed to presenters with the highest scores. Trifold, self-standing 48" by 36" tabletop poster boards will be provided. Additional materials and equipment are the responsibility of the presenters. Participants must set up posters between 2:30 and 3:30 p.m. and must be available from 3:30 to 6:00 p.m. for judging and public viewing. Judges' results will be available at the MAA Pavilion in the Exhibit Hall the following day until the exhibits close.

Questions regarding this session should be directed to Joyati Debnath at jdebnath@winona.edu. A list of frequently asked questions and other information can be found at maa.org/posterFAQs.

Some more advanced students might be interested in these sessions listed elsewhere in this announcement:

- What Every Student Should Know about the JMM, *Saturday (1/10), 2:15 p.m.*;
- YMN/Project NEXt Poster Session, *Saturday (1/10), 2:15 p.m.*;
- "Graduate School: Choosing One, Getting In, Staying In," *Saturday (1/10), 3:50 p.m.*;
- Undergraduate Research: Viewpoints from the Student Side, *Sunday (1/11), 10:35 a.m.*

See the full descriptions in the "MAA Panels" section. You may also be interested in the AMS-MAA-SIAM Special Session on Research in Mathematics by Undergraduates and Students in Post-Baccalaureate Programs, Saturday morning, Sunday afternoon, and Tuesday all day; see the listing under AMS Special Sessions.

MAA Poster Sessions

YMN/Project NExT Poster Session

Saturday (1/10), 2:15–4:15 p.m., GCC Exhibit Hall D

Organizers: Jonathan Needleman, Le Moyne College; and Kim Roth, Juniata College

Project NExT and the Young Mathematicians' Network invite submissions of abstracts for a poster session intended to highlight the research activities, both mathematical and pedagogical, of recent or future master's/Ph.D.s in mathematics and related fields. For full details, see the JMM website (<http://jointmathematic-meetings.org/jmm>).

To apply, send a poster abstract, when and where you have or will receive your Ph.D. or master's degree, and your current college or university affiliation to one of the organizers (Kim Roth <roth@juniata.edu> or Jonathan Needleman <needlejs@lemoyne.edu>). The deadline for submissions is December 15.

Sponsors: Young Mathematicians' Network and Project NExT

Mathematical Outreach Programs

Sunday (1/11), 10:00 a.m.–noon, GCC Exhibit Hall D

Organizer: Elizabeth Yanik, Emporia State University

This poster session is designed to highlight special programs that have been developed to encourage students of any age group to maintain an interest in and commitment to succeeding in mathematics. These programs might include such activities as after school clubs, weekend activities, one-day conferences, mentoring opportunities, summer camps, and so on. This poster session encompasses a wide variety of outreach efforts for a variety of age groups. We encourage everyone involved with offering mathematical outreach activities to consider submit-

ting an abstract to the session organizer, Betsy Yanik, eyanik@emporia.edu.

Expeditions in Training, Research, and Education for Mathematics and Statistics through Quantitative Explorations of Data (EXTREEMS-QED)

Sunday (1/11), 2:00–4:00 p.m.

Organizer: Tor A. Kwembe, Jackson State University

Presenters in this new poster session will share their experiences under this new NSF program designed to promote the integration of computational and data-enabled science (CDS&E) in undergraduate mathematics and statistics curricula.

Projects Supported by the NSF Division of Undergraduate Education

Sunday (1/11), 2:00–4:00 p.m., GCC Exhibit Hall D

Organizer: Jon Scott, Montgomery College

This session will feature principal investigators (PIs) presenting progress and outcomes from various NSF-funded projects in the Division of Undergraduate Education. The poster session format will permit ample opportunity for attendees to engage in small group discussions with the PIs and to network with each other. Information about presenters and their projects will appear in the program.

MAA Student Poster Session

Monday (1/12), 4:30–6:00 p.m., GCC Exhibit Hall D, GCC

See "MAA Sessions for Students," page 54.

"Poster Plus 5" Session on Open-Source Resources in Mathematics

Tuesday (1/13), 8:00–10:55 a.m. and 1:00–5:00 p.m., GCC 213B

The availability of high-quality, open-source resources that support teaching and research in mathemat-

ics is changing opportunities and pedagogical options for mathematics educators. In this hybrid contributed paper/poster session, we invite presentations on the effective use of available open-source resources in the classroom. Each speaker will present for five minutes on his or her topic, and then the session will break into an interactive poster session in which speakers talk with attendees to provide additional details and information. Applicants should send a poster abstract to the organizer, Stan Yoshinobu (styoshin@calpoly.edu). The deadline for receiving applications is December 15.

Organizer: Stan Yoshinobu, Cal Poly San Luis Obispo

Sponsor: MAA Committee on Professional Development

MAA Workshops

Workshop 1. Creating a Course in Mathematical Modeling

Tuesday (1/13), 8:00–10:00 a.m., GCC 214B

Organizer: Dan Teague, North Carolina School of Science and Mathematics

Applied mathematics, with mathematical modeling at its core, is growing in importance in the mathematics curriculum. Modeling offers students a vision of mathematics and an opportunity to engage in mathematical creativity that is largely absent from the standard mathematics major coursework. A modeling course invites creative students into the major who currently choose other disciplines that offer more interesting challenges to their creativity and ingenuity, particularly early in their college career.

This workshop will discuss the structure of and share materials from a modeling course taught at the NC School of Science and Mathematics since 1985. Students in the course have written 11 Outstanding Winner

papers in the Mathematical Contest in Modeling (MCM and ICM), capturing two INFORMS Prize papers, two SIAM Prize papers, and an MAA prize in the process. Information on the mathematical modeling competitions available to university students (MCM, ICM) and to high school students (HiMCM, Moody's) will also be shared.

Sponsors: SIGMAA TAHSM and MAA Council on Outreach

Workshop 2. The New Mathways Project's STEM Prep Initiative: A Re-Conceptualized Pathway to Calculus

Tuesday (1/13), 1:00–2:20 p.m., GCC 214B

Organizers: Frank Savina, University of Texas at Austin; and Stuart Boersma, Central Washington University

The Charles A. Dana Center's New Mathways Project has begun the work of designing a STEM Prep Pathway serving students from developmental math to calculus. For the past year two teams of leading researchers and educators have been gleaning promising practices from the field and synthesiz-

ing them to determine the content and structure of this re-conceptualized pathway to calculus. The goal of this workshop is to share the work of the design teams in a manner that will be useful to mathematics faculty and departments. In this hands-on workshop participants will be given an overview of the guiding principles of the curriculum at the New Mathways Project, join in an interactive discussion on the challenges of preparing students for calculus, have the opportunity to look over drafts of the curriculum, and be provided an overview of the findings from the research on promising practices from the design teams.

Workshop 3. Managing Your Own Course

Saturday (1/10), 5:00–6:00 p.m., GCC 203A

Organizers: Raluca Gera, Naval Postgraduate School; Timothy Goldberg, Lenoir-Rhyne University; and Gwyneth Whieldon, Hood College

One of the many challenges facing new faculty members (and sometimes advanced teaching assistants) is managing their own courses. This event will consist of small-group discussions

based on types of courses and perhaps types of institutions, with the goal of sharing ideas and experiences about managing one's own course. This may also include discussions on creating a new course.

Sponsor: Young Mathematicians' Network

Workshop 4. Find a Research Collaborator

Sunday (1/11), 5:30–6:30 p.m., GCC 203A

Organizers: Raluca Gera, Naval Postgraduate School; Timothy Goldberg, Lenoir-Rhyne University; and Gwyneth Whieldon, Hood College

As freshly graduated Ph.D.s will start their research career at a new institution, one of the obstacles observed is finding (1) collaborators in other departments or institutions, and (2) finding topics to work on. This event will consist of small-group discussions based on research interests, with the goal of sharing ideas of how to find collaborators and topics, as well as possibly finding a collaborator during the event.

Sponsor: Young Mathematicians' Network

MAA Ancillary Workshops

MAA National Research Experiences for Undergraduates Workshop

Friday (1/9), 9:00 a.m.–4:30 p.m.

This workshop will teach participants how to write a competitive grant proposal. This workshop is a hands-on experience where participants write a summary of a proposal and rate an NSF-awarded proposal in a mock panel review. Participants will also learn many helpful hints and fatal flaws to proposal writing. This workshop is appropriate for current PIs of MAA's NREUP grants and for those who were denied funding for an MAA grant.

Organizer: Dennis Davenport, Howard University

Embedding Undergraduate Research into a Living-Learning Community

Friday (1/9), 9:00 a.m.–4:00 p.m.

The goal is to enable participants to incorporate their undergraduate research programs into a living-learning community. This is especially appropriate for courses in calculus, linear algebra, combinatorics, mathematical modeling, and introductory proof-based courses, or for early statistics courses such as exploratory data analysis, probability, or introduction to statistics. We will discuss best practices for going far beyond the curriculum in training students, for example, having a holistic program that integrates the student's (1) curriculum, (2) research, (3) residential life, and (4) professional

development experiences. We will share examples, activities, projects, syllabi, calendars, and research topics from Purdue's NSF-funded Living-Learning Community. We will discuss how to integrate computational aspects of the curriculum and research into a living-learning community, using software such as Maple, Mathematica, Matlab, Sage, and/or R or SAS. The workshop is an outreach activity of NSF grant DMS-1246818.

Advanced registration is required. Send an email to the organizer at mdw@purdue.edu to register for the workshop. Space in the workshop is limited. Participants are encouraged to bring a laptop to the workshop.

Organizer: Mark Daniel Ward, Purdue University

Social Events

All events listed are open to all registered participants. It is strongly recommended that for any event requiring a ticket, tickets should be purchased through advance registration. Only a very limited number of tickets, if any, will be available for sale on site. If you must cancel your participation in a ticketed event, you may request a 50 percent refund by returning your tickets to the Mathematics Meetings Service Bureau (MMSB) by January 6, 2015. After that date no refunds can be made. Special meals are available at banquets upon advance request, but this must be indicated on the Advanced Registration/Housing Form.

2015 AMS Dinner Celebration

Tuesday (1/13), reception 6:30 p.m.; dinner 7:30 p.m.

Enjoy an evening of celebrating the spirit of connection and collaboration that is found throughout the mathematical community. Music, raffle, dinner at food stations. Tickets are \$67 including tax and gratuity. The student ticket price is \$25.

Association of Christians in the Mathematical Sciences (ACMS) Reception and Lecture

Sunday (1/11), 5:30–7:30 p.m.

The reception will take place between 5:30 p.m. and 6:30 p.m. and will be followed by a lecture given by Anthony Tongen of James Madison University. Afterward, delegates can go to dinner in small groups.

Association of Lesbian, Gay, Bisexual, and Transgendered Mathematicians Reception

Sunday (1/11), 6:00–8:00 p.m.

This annual reception is for lesbian, gay, bisexual, and transgender mathematicians, as well as their allies. We are affiliated with the National Organization of Gay and Lesbian Scientists and Technical Professionals.

AWM Reception

Saturday (1/10), 9:30 p.m.

This reception takes place after the AMS Gibbs Lecture and has been a popular, well-attended event in the past. At 10:00 p.m. the AWM president will recognize all of the honorees of the AWM Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman, the recipient of the AWM-Joan & Joseph Birman Research Prize in Topology and Geometry, and the AWM Service Awards.

Backgammon!

Monday (1/12), 8:00–10:00 p.m.

Organizer: Arthur Benjamin, Harvey Mudd College

Learn to play backgammon from expert players. It's a fun and exciting game where players with a good mathematics background have a decisive advantage. Boards and free lessons will be provided by members of the U.S. Backgammon Federation. Stop by anytime on Monday evening.

Budapest Semesters in Mathematics Annual Alumni Reunion

Sunday (1/11), 5:30–7:00 p.m.

University of Chicago Mathematics Alumni Reception

Sunday (1/11), 6:00–7:00 p.m.

Reception for Graduate Students and First-Time Participants

Saturday (1/10), 5:30–6:30 p.m.

The AMS and MAA sponsor this social hour. Graduate students and first-timers are especially encouraged to come and meet some old-timers to pick up a few tips on how to survive the environment of a large meeting. Light refreshments will be served.

Knitting Circle

Sunday (1/11), 8:15–9:45 p.m.

Bring a project (knitting/crochet/tatting/beading/etc.) and chat with other mathematical crafters!

Project NExT Reception

Monday (1/12), 8:00–10:00 p.m.

Organizers: Julia Barnes, Western Carolina University; Alissa Crans, Loyola Marymount University; Matt DeLong, Taylor University; Dave Kung, St. Mary's College of Maryland; Anthony Tongen, James Madison University; Stan Yoshinobu, Cal Poly San Luis Obispo; Thomas Judson, Stephen F. Austin State University; and Yousuf George, Nazareth College

All Project NExT fellows, consultants, and other friends of Project NExT are invited.

MAA Two-Year College Reception

Saturday (1/10), 5:45–7:00 p.m.

Open to all meeting participants, particularly two-year faculty members. This is a great opportunity to meet old friends and make some new ones. There will be hot and cold refreshments and a cash bar.

Mathematical Reviews Reception

Monday (1/12), 6:00–7:00 p.m.

All friends of the *Mathematical Reviews* (MR) are invited to join reviewers and MR editors and staff (past and present) for a special reception in honor of the 75th anniversary of MR (1940–2015), and to acknowledge all of the efforts that go into the creation and publication of the Mathematical Reviews Database. Refreshments will be served.

Mathematical Institutes Open House

Saturday (1/10), 5:30–8:00 p.m.

Participants are warmly invited to attend this open house, which is sponsored by several of the mathematical science institutes in North America. This reception precedes the Gibbs Lecture. Find out about the latest activities and programs at each of the institutes that may be suited to your own research. We hope to see you there! msri.org/openhouse/2015.

National Association of Mathematicians Banquet

Monday (1/12), 6:00–8:40 p.m.

A cash bar reception will be held at 6:00 p.m., and dinner will be served at 6:30 p.m. Tickets are \$63 each, including tax and gratuity. The Cox-Talbot Invited Address will be given after the dinner.

NSA Women in Mathematics Society Networking Session

Sunday (1/11), 6:00–8:00 p.m.

All participants are welcome to this annual event. Please stop by the NSA booth in the exhibit hall for information and the location of the event.

Pennsylvania State University Mathematics Alumni Reception

Sunday (1/11), 5:30–7:30 p.m.

Please join us for hors d'oeuvres and beverages and mingle with math alumni, faculty, and College of Science representatives.

Student Hospitality Center

Saturday–Monday (1/10–12), 9:00 a.m.–5:00 p.m., and Tuesday (1/13), 9:00 a.m.–3:00 p.m.

Organizers: Richard and Araceli Neal, American Society for the Communication of Mathematics

Sponsor: MAA Committee for Undergraduate Student Activities.

University of Tennessee Math Alumni and Friends Reception

Sunday (1/11), 5:30–7:00 p.m.

Anyone who has ever been a part of the UT Math Department, or is considering joining our department as a new graduate student or faculty, is invited to gather for some friendly conversation.

Reception for Undergraduates

Saturday (1/10), 4:30 p.m.–5:30 p.m.

AMS Special Sessions

Some sessions are cosponsored with other organizations. These are noted within the parentheses.

Accelerated Advances in Multiobjective Optimal Control Problems and Mathematical Programming Based on Generalized Invexity Frameworks:

N. J. Huang, Sichuan University; **R. N. Mohapatra**, University of Central Florida; **Ram Verma**, Texas State University; and **Alexander Zaslavski**, Israel Institute of Technology

Advances in Coding Theory: **Felice Manganiello** and **Gretchen L. Matthews**, Clemson University; and **Judy L. Walker**, University of Nebraska

Algebraic Combinatorics and Representation Theory: **Zajj Daugherty**, Dartmouth College; and **Ben Salisbury**, Central Michigan University

Algebraic and Geometric Methods in Applied Discrete Mathematics (a Mathematics Research Communities session): **Heather Harrington**, University of Oxford; **Mohamed Omar**, Harvey Mudd College; and **Matthew Wright**, Institute for Mathematics and its Applications, University of Minnesota

Applications of Dynamical Systems to Biological Models: **Yu Jin**, University of Nebraska-Lincoln; and **Xiang-Sheng Wang**, Southeast Missouri State University

Beyond First-Order Model Theory: **John T. Baldwin**, University of Illinois at Chicago; **Xavier Caicedo**, Universidad de los Andes; **Rami Grossberg**, Carnegie Mellon University; **Jose Iovino**, University of Texas at San Antonio; and **Boris Zilber**, Oxford University (AMS-ASL)

Classification Problems in Operator Algebras: **Arnaud Brothier**, Vanderbilt

University; **Ionut Chifan**, University of Iowa; **Darren Creutz**, Vanderbilt University; **Remus Nicoara**, University of Tennessee; and **David Penneys**, University of Toronto

Cluster Algebras (a Mathematics Research Communities session): **Andrew T. Carroll**, DePaul University; **Ian T. Le**, University of Chicago; and **Greg Muller**, University of Michigan

Computing Intensive Modeling in Mathematical and Computational Biology: **Timothy D. Comar**, Benedictine University; **Olcay Akman**, Illinois State University; and **Daniel Hroznecik**, Chicago State University

Continued Fractions: **James Mc Laughlin**, West Chester University; and **Nancy J. Wyshinski**, Trinity College

Creating Coherence in K-12 Mathematics: **Brigitte Lahme**, Sonoma State University; **William McCallum** and **Cody Patterson**, University of Arizona; **Kristin Umland**, University of New Mexico; and **Ellen Whitesides**, University of Arizona

Current Trends in Classical Dynamical Systems: **Lennard Bakker** and **Skyler Simmons**, Brigham Young University

Difference Equations and Applications: **Steven Miller**, Williams College; and **Michael A. Radin**, Rochester Institute of Technology

Differential Geometry and Statistics: **Susan Holmes**, Stanford University

Enumerative Combinatorics: **Brian K. Miceli**, Trinity University; and **Jay Pantone** and **Vince Vatter**, University of Florida

Ergodic Theory and Dynamical Systems: **Mrinal Kanti Roychowdhury**, University of Texas–Pan American

Factorization Theory and Its Applications: **Nicholas Baeth**, University of Central Missouri; **Scott Chapman**, Sam Houston State University; **Jim Coykendall**, Clemson University; and **Alfred Geroldinger**, Karl Franzens University

Fixed Point Theory and Applications: **Clement Boateng Ampadu**

Fractional, Stochastic, and Hybrid Dynamic Systems with Applications: **John R. Graef**, University of Tennessee at Chattanooga; **G. S. Ladde**, University of South Florida; and **A. S. Vatsala**, University of Louisiana at Lafayette

Frames and Their Applications: **Radu Balan** and **Kasso Okoudjou**, University of Maryland; and **Rachel Ward**, University of Texas

Geometries Defined by Differential Forms: **Sergey Grigorian**, University of Texas–Pan American; **Sema Salur**, University of Rochester; and **Albert J. Todd**, University of California, Riverside

Geosystems Mathematics: **Willi Freeden**, University of Kaiserslautern; **Volker Michel**, University of Siegen; and **M. Zuhair Nashed**, University of Central Florida

Graphs, Matrices, and Related Problems: **Cheryl Grood** and **Thomas Hunter**, Swarthmore College; and **Sharon McCathern**, Azusa Pacific University

Groups, Algorithms, and Cryptography: **Bren Cavallo** and **Delaram Kahrobaei**, City University of New York Graduate Center

Heavy-Tailed Distributions and Processes: **U. Tuncay Alparslan** and **John P. Nolan**, American University

History of Mathematics: **Sloan Despeaux**, Western Carolina University; **Patti Hunter**, Westmont College; **Deborah Kent**, Drake University; and **Adrian Rice**, Randolph-Macon College (AMS-MAA)

Holomorphic Dynamics in One and Several Variables: **Tanya Firsova**, State University of New York at Stony Brook and Kansas State University; and **Thomas Sharland**, State University of New York at Stony Brook

Hopf Algebras and Tensor Categories: **Susan Montgomery**, University of Southern California; **Siu-Hung Ng**, Louisiana State University and Iowa State University; and **Sarah Witherspoon**, Texas A&M University

Inequalities and Quantitative Approximation: **Feng Dai**, University of Alberta; and **Mourad E. H. Ismail**, University of Central Florida

Inverse Problems: **Peter Muller**, Rensselaer Polytechnic Institute; and **Kaitlyn Voccola**, Colorado State University

Knot Theory: **Tim Cochran** and **Shelly Harvey**, Rice University

Limits of Discrete Structures: **Peter Diao**, **Dominique Guillot**, **Apoorva Khare**, and **Bala Rajaratnam**, Stanford University

Math Teachers Circles and the K–20 Continuum: **Brian Conrey**, American Institute of Mathematics; **Michael Nakamaye** and **Kristin Umland**, University of New Mexico; and **Diana White**, University of Colorado at Denver

Mathematics in Natural Resource Modeling: **Shandelle M. Henson**, Andrews University; and **Catherine A. Roberts**, College of the Holy Cross

Mathematics in Poland: Interbellum, World War II, and Immediate Post-War Developments: **Mohammad Javaheri** and **Emelie A. Kenney**, Siena College

Model Theory and Applications: **David Marker**, University of Illinois at Chicago; **Sergei Starchenko**, University of Notre Dame; and **Carol Wood**, Wesleyan University

Network Science (a Mathematics Research Communities session): **Bailey Fosdick**, Colorado State University; **Franklin Kenter**, Rice University; **Christine Klymko**, Lawrence Livermore National Laboratory; and **Johan Ugander**, Microsoft Research

Noncommutative Function Theory: **Paul S. Muhly**, University of Iowa; and **Gelu F. Popescu**, University of Texas at San Antonio

Operator Algebras and Their Applications: A Tribute to Richard V. Kadison: **Robert S. Doran** and **Efton Park**, Texas Christian University

Partitions, q-Series, and Modular Forms: **Atul Dixit**, Tulane University; **Tim Huber**, University of Texas–Pan American; **Amita Malik**, University of Illinois; and **Ae Ja Yee**, Pennsylvania State University

Positivity and Matrix Inequalities: **Dominique Guillot**, **Apoorva Khare**, and **Bala Rajaratnam**, Stanford University

Probability and Applications: **Rick Kenyon**, Brown University; and **Russell Lyons**, Indiana University

Progress in Multivariable Operator Theory: **Ron Douglas**, Texas A&M University; and **Constanze Liaw**, Baylor University

Quantum Information and Fusion Categories (a Mathematics Research Communities session): **Paul Bruillard**, Pacific Northwest National Laboratory; **Henry J. Tucker**, University of Southern California; and **Amanda Young**, University of California, Davis

Quantum Markov Chains, Quantum Walks, and Related Topics: **Chaobin Liu**, Bowie State University; **Takuya Machida**, University of California, Berkeley; **Salvador E. Venegas-Andraca**, Tecnológico de Monterrey, Campus Estado de México; and **Nelson Petulante**, Bowie State University

Recent Advances in Discrete and Intuitive Geometry: **Andras Bezdek**, Auburn University; **Ted Bisztriczky**, University of Calgary; and **Wlodek Kuperberg**, Auburn University

Recent Advances in the Analysis and Applications of Modern Splitting Methods: **Abdul Q. M. Khaliq**, Middle Tennessee State University; **Qin Sheng**, Baylor University; and **Bruce Wade**, University of Wisconsin–Milwaukee

Recent Developments in Algebraic Number Theory: **Wen-Ching Winnie Li**, Pennsylvania State University; **Tong Liu**, Purdue University; and **Ling Long**, Iowa State University and Louisiana State University (AMS-AWM)

Research in Mathematics by Undergraduates and Students in Post-Baccalaureate Programs: **Darren A. Narayan**, Rochester Institute of Technology; **Tamas Forgacs**, California State University, Fresno; and **Jobby Jacob**, **Carl V. Lutzer**, and **Tamas Wiandt**, Rochester Institute of Technology (AMS-MAA-SIAM)

Ricci Curvature for Homogeneous Spaces and Related Topics: **Megan Kerr**, Wellesley College; and **Tracy Payne**, Idaho State University

Selmer Groups: **Mirela Ciperiani**, University of Texas; and **Henri Darmon**, McGill University

Set-Valued Optimization and Variational Problems with Applications: **Akhtar A. Khan**, Rochester Institute of Technology; **Mau Nam Nguyen**, Portland State University; **Miguel**

Sama, Universidad Nacional de Educacion a Distancia, Madrid; and **Christiane Tammer**, Martin Luther University of Halle-Wittenberg

Studies in Interconnections among Parameters in Graph Theory, Combinatorics, and Discrete Geometry: **Cong X. Kang** and **Eunjeong Yi**, Texas A&M University at Galveston

Successes and Challenges in Teaching Mathematics: **Ellina Grigorieva**, Texas Woman's University; and **Natali Hritonenko**, Prairie View A&M University

Szygies: **Giulio Caviglia**, Purdue University; **Jason McCullough**, Rider University; and **Irena Peeva**, Cornell University

The Scottish Book: **Krystyna Kuperberg**, Auburn University; **R. Daniel Mauldin**, University of North Texas; and **Jan Mycielski**, University of Colorado

Theory and Application of Reaction Diffusion Models: **Jerome Goddard II**, Auburn University Montgomery; and **Ratnasingham Shivaji**, University of North Carolina Greensboro

Topological Measures of Complexity: Inverse Limits, Entropy, and Structure of Attractors: **Loribeth M. Alvin**, University of Denver; **Jan P. Boronski**, National Supercomputing Centre IT4Innovations, Ostrava; **James Keesling**, University of Florida; **Olga Lukina**, University of Illinois at Chicago; and **P. Oprocha**, AGH University of Science and Technology, Krakow

What's New in Group Theory? **Arturo Magidin**, University of Louisiana at Lafayette; and **Elizabeth Wilcox**, Oswego State University

St. Leo: Full-Time, Tenure-Track Mathematics Position

Saint Leo University is one of the largest and most innovative Catholic universities in the United States. A leading provider of higher education to the military and a leader in online higher education, Saint Leo enrolls more than 15,000 students at the traditional University Campus (main campus), through the Center for Online Learning and at 19 regional centers in seven states.

The Department of Mathematics and Science is seeking qualified candidates for a full-time, tenure track, faculty position to teach Mathematics at our main campus in Saint Leo, Florida. At least two years teaching experience is preferred. Ability to teach statistics is a plus. Requirements of the incumbent include, but are not limited to teaching eight classes per year, advising students, and performing service to the University and the department.

Questions should be addressed to Dr. Siamack Bondari (Siamack.bondari@saintleo.edu), Chair, Department of Mathematics and Sciences.

This position is pending final budgetary approval for the 2014–2015 academic year. Review of applications will begin immediately and continue until the position is filled.

Please submit application online (<http://www.saintleo.edu/employment.aspx>).

Saint Leo University is an equal opportunity employer. Catholics, women and minorities are encouraged to apply.

Other Events

Mathematical Art Exhibition

The exhibition will be located inside the Joint Mathematics Exhibits and open during the same exhibit hours.

Organizers: Robert Fathauer, Tessellations Company; Nathaniel A. Friedman, ISAMA and SUNY Albany; Anne Burns, Long Island University C. W. Post Campus; Reza Sarhangi, Towson University; and Nathan Selikoff, Digital Awakening Studios

A popular feature at the Joint Mathematics Meetings, this exhibition provides a break in your day. On display are works in various media by artists who are inspired by mathematics and by mathematicians who use visual art to express their findings. Topology, fractals, polyhedra, and tiling are some of the ideas at play here. Don't miss this unique opportunity for a different perspective on mathematics.

Poetry Reading

Sunday (1/11), 5:30–7:00 p.m., GCC 205

All mathematical poets and those interested in mathematical poetry are invited. Share your poetry or simply enjoy the company of like-minded poetic-math people! The reading is sponsored by the *Journal of Humanistic Mathematics* (<http://scholarship.claremont.edu/jhm>) and will be hosted by Gizem Karaali and Larry Lesser. Though we do not discourage last-minute decisions to participate, we invite and encourage poets to submit poetry (≤ 3 poems, ≤ 5 minutes) and a bio in advance—and, as a result, be listed on our printed program. Inquiries and submissions (by December 1) should be made to Gizem Karaali (gizem.karaali@pomona.edu).

Mathematically Bent Theater

Featuring Colin Adams and the Mobiusbandaid Players

Monday (1/12), 6:00–7:00 p.m., GCC 103 AB

Why is it that math and humor are considered synonymous? Why do students laugh maniacally when they see their score on the calculus final? How did the Bernoulli brothers bring down the house in their first comedy appearance? Who came up with the word “functor”? Who dented the bumper of my car at the Joint Meetings in Baltimore? These are just a few of the questions we will not answer in this theatrical presentation of several short mathematically inclined humorous pieces.

Summer Program for Women in Mathematics (SPWM) Reunion

Sunday (1/11), 1:00–3:00 p.m.

Organizer: Murli M. Gupta, George Washington University

Effective Self-Promotion to Advance Your Career in Mathematics

Sunday (1/11), 1:00–2:30 p.m.

Organizers: Christine Guenther, Pacific University; Patricia Hale, California State Polytechnic University, Pomona; and Tanya Leise, Amherst College

Panelists: Pam Cook, University of Delaware; Deborah Lockhardt, National Science Foundation; Dana Randall, Georgia Institute of Technology; and Sara Y. Del Valle, Los Alamos National Labs

This session will focus on how women (and men) pursuing mathematical careers can and should “lean in,” while recognizing that cultural norms can pose obstacles. Self-promotion includes pursuing opportunities for giving talks and getting nominated for prizes, and persisting past initial failures by resubmitting revised grants and papers. How to choose a mentor and how to be a good mentor will also be covered. The panelists' advice will be beneficial to both men and women.

Sponsor: Joint Committee on Women in the Mathematical Sciences

Pure and Applied Talks by Women Math Warriors Presented by EDGE (Enhancing Diversity in Graduate Education)

Tuesday (1/13), 1:00–5:50 p.m.

Organizers: Amy Buchmann, University of Notre Dame; and Candice Price, U.S. Military Academy, West Point

This session will be composed of research talks in a variety of different subdisciplines given by women involved with the EDGE program. For more information on the EDGE program see edgeforwomen.org.

Registration Information

The importance of registering for the meeting cannot be overemphasized. Advanced registration fees are considerably lower than on-site registration fees. When a participant pays the registration fee, he or she is helping to support a wide range of activities associated with planning, organizing, and execution of the meetings.

All participants who wish to attend sessions are expected to register and should be prepared to show their badges if so requested. Badges are required to enter the JMM Exhibits, the Employment Center, or to obtain discounts at the AMS and MAA Book Sales and to cash a check with the Joint Meetings cashier.

All JMM registrations are processed by the MMSB. Participants who register by November 18, 2014, may receive their badges, programs, and tickets (where applicable) in advance by U.S. mail approximately three weeks before the meetings. Those who do not want their materials mailed should check the appropriate box on the Registration and Housing Form. Materials cannot be mailed to Canada, Mexico, or other countries outside of the United States. Participants from these countries must pick up their materials at the Joint Meeting Registration Desk, on the first floor of the Henry B. Gonzales Convention Center. Please note that a \$5 replacement fee will be charged for programs and badges that were mailed but not brought to the meeting.

Online Registration: The form to register for the meeting and to reserve a hotel room online is located at www.jointmathematicsm meetings.org/meetreg?meetnum=2168.

VISA, MasterCard, Discover, and American Express are the only methods of payment accepted for online registrations, and charges to credit cards will be made in U.S. funds. All registration acknowledgments will be

sent by email to all email addresses provided.

Paper Form Registration: The form to register for the meeting and to reserve a hotel room by paper is located at www.jointmathematicsm meetings.org/meetings/national/jmm2015/jmm15_regform.pdf.

Forms must be mailed or faxed to MMSB, P.O. Box 6887, Providence, RI 02940 or 401-455-4004. For security reasons, credit card numbers sent by email or fax cannot be accepted. If a participant is registering by paper form and would like to pay for the registration or guarantee a hotel reservation by credit card, he or she should indicate this on the form and someone from the MMSB will call that person.

Participant Lists and Mailing Lists: To opt out of any mailing lists or participant lists that are generated for the meeting, check the appropriate box on the Registration and Housing Form.

Cancellation Policy: Participants who cancel their registration for the meetings, minicourses, or short course by January 6, 2015, can receive a 50 percent refund of fees paid. Participants who cancel their banquet tickets by January 5, 2015, can get a 50 percent refund of monies paid. No refunds will be issued after these deadlines.

Registration Fees

See registration form, page 65, and http://www.jointmathematicsm meetings.org/meetings/national/jmm2015/2168_regfees.

Registration Category Definitions

Full-Time Students: Anyone working toward a degree or diploma.

Graduate Student Member: Any graduate student who is a member of the AMS or MAA. Students should check with their department administrator to check their membership status.

Emeritus: Any member of the AMS for 20 years or more and who retired

because of age or long-term disability from his or her latest position and anyone who has been a member of the MAA for 25 years and who is 70+ years of age is eligible for this category.

Librarian: Any librarian who is not a professional mathematician is eligible for this category.

Unemployed: Any person who is currently unemployed, actively seeking employment and not a student. Not intended to include any person who has voluntarily resigned or retired from his or her latest position.

Developing Country Participant: Any person employed in developing countries where salary levels are radically not commensurate with those in the United States.

Temporarily Employed: Any employed person who will become unemployed by June 1, 2015, and who is actively seeking employment.

Nonmathematician Guest: A family member or friend who is not a mathematician and who is accompanied by a participant in the meetings. Guests receive a badge and can accompany a mathematician to a session or talk and the exhibit area.

Registration Deadlines

There are three separate registration deadlines, each with its own benefits:

EARLY meetings registration (free room drawing) is November 3;

ORDINARY meeting registration (badge materials mailed) is November 18;

FINAL meeting registration (advanced registration, short course, minicourses, and banquets) is December 23.

Early Registration: Participants who register by the early deadline of November 3 will be included in a random drawing to select winners of complimentary hotel room nights during the meeting. Rooms with multiple occupants will be included in the drawing. The location of these rooms will be based on the number of complimen-

tary room nights earned in the various hotels. Therefore, a free room will not necessarily be in winner's first-choice hotel. All winners will be notified by phone and email prior to December 23, so register early!

Ordinary Registration: Participants who register after November 3 and by the ordinary deadline of November 18 are encouraged to reserve a hotel room to ensure that they receive their preferred hotel of choice. However, those who register by this date are not eligible for the room drawing. They may also elect to receive their badges and programs by mail before the meeting.

Final Registration: Participants who register after November 18 and by the final deadline of December 23 must pick up their badges, programs, and any tickets for social events at the meeting.

Unfortunately it is sometimes not possible to provide final participants with housing, so everyone is strongly urged to make hotel reservations by November 18.

The final deadline of December 23 is firm. Any forms received after that date will be returned with full refunds.

Registration materials can be picked up at the Meetings Registration Desk on the first floor of the Henry B. Gonzalez Convention Center.

Miscellaneous Information

Audiovisual Equipment: For a list of standard equipment in all session rooms and for more details, see the JMM website, <http://jointmathematicsm meetings.org/jmm>.

Child Care: The AMS and the MAA will provide reimbursement grants of \$250 per family to help with the cost of child care for a number of registered participants at JMM2015. The funds may be used for child care that frees a parent to participate more fully in JMM.

Information and deadlines are at

jointmathematicsm meetings.org.

Email Services: Limited email access for all Joint Meetings participants will be available in an email center located near the JMM Registration Desk, East Lobby, on the first level in the Henry B. Gonzales Convention Center. The hours of operation will be published in the program. Complimentary Internet access will be available in the networking center in Bridge Hall, first level of the convention center.

Information Distribution: Tables are set up in the exhibit area for dissemination of general information of possible interest to the members and for the dissemination of information of a mathematical nature not promoting a product or program for sale. Information must be approved by the director of meetings prior to being placed on these tables.

If a person or group wishes to display information of a mathematical nature promoting a product or program for sale, they may do so in the exhibit area at the Joint Books, Journals, and Promotional Materials exhibit for a fee of \$50 (posters are slightly higher) per item. Please contact the exhibits manager, MMSB, P.O. Box 6887, Providence, RI 02940, or by email at cpd@ams.org for further details.

The administration of these tables is in the hands of the AMS-MAA Joint Meetings Committee, as are all arrangements for Joint Mathematics Meetings.

Local Information: For information about the city, see visitsanantonio.com.

Photograph and Video Policy: The videotaping of any AMS or joint sponsored events, talks, and sessions is strictly forbidden without the explicit written permission of the AMS director of meetings and conferences. The policy for videotaping of any MAA events, talks, and sessions is posted at [maa.org/about-maa/policies-and-procedures/recording-or-](http://maa.org/about-maa/policies-and-procedures/recording-or)

broadcasting-of-maa-events.

Photographs and videos of meeting interactions will be taken by professional photographers hired by the Joint Mathematics Meetings or by AMS and MAA staff. These photographs and videos may occasionally be used for publicity purposes.

By participating in the Joint Mathematics Meetings, attendees acknowledge that their photograph or a video that includes them may be published in material produced by the Joint Meetings, AMS or MAA. AMS and MAA are not responsible for unauthorized photographs or other images not taken by professional photographers hired by the Joint Mathematics Meetings or AMS and MAA staff.

Telephone Messages: It will be possible to leave a message for any registered participant at the meetings registration desk from January 10 through 13 during the hours that the desk is open. These messages will be posted on the Mathematics Meetings Message Board in the networking center; however, staff at the desk will try to locate a participant in the event of a bona fide emergency. The telephone number will be published in the program and daily newsletter.

Travel/Transportation

Detailed information about travel and transportation is online at <http://jointmathematicsm meetings.org/jmm>.

San Antonio is on Central Standard Time. The principal airport is the San Antonio International Airport (SAT), sanantonio.gov/SAT/, nine miles north of downtown San Antonio.

Airline: The official airline for this meeting is Delta. Participants are encouraged to book their flights for the meeting, if possible, with Delta and receive special pricing (in most cases a 5 percent discount) from U.S. and Canadian locations. The discount is not valid with other discounts, certificates, coupons, or promotional offers.

To make a reservation, go to delta.com, and click on the box that says “Book a Trip.” At the bottom of the drop-down menu, click on “More Search Options” (includes Flexible Airport and Meeting Event Code). On the reservation screen, please enter the Meeting Event Code **NMJYY**. It will be to the right of “Number of Passengers.”

Reservations can also be made by calling Delta Meeting Network reservations at 800-328-1111 and citing the meeting event code. A direct ticketing charge will apply for booking by phone.

Ground Transportation: Options are located curbside in front of Terminal A and B baggage claim areas. Uniformed transportation agents (wearing red shirts) can provide assistance. A terminal map is located at sanantonio.gov/SAT/IntheAirport/TerminalMaps.aspx.

Airport Shuttle: GO Airport Shuttle, www.citytoursinc.com, 210-281-9900, is San Antonio International’s authorized airport shuttle service. Shuttles depart every 15 minutes from 7:00 a.m. to 1:30 a.m. daily to the downtown hotels. The fare is \$19 per person one way, or \$34 for a round trip. There is currently a fuel surcharge

of \$1.25 each way. Tickets may be purchased in the baggage claim area. You may also book a shuttle online at <https://citytoursinc.com/reservations>.

Car Rental: All major car rental services are available at the San Antonio International Airport. If the rental counters are closed, passengers can use the courtesy phones provided in the baggage claim area to request shuttle transport to the car rental company of their choice.

Hertz is the official car rental company for the meeting. A brochure with the information on this meeting is located at <http://jointmathematicsmeetings.org/meetings/national/jmm2015/Hertz-info-SanAntonio.pdf>.

To access the JMM special meeting rates at www.hertz.com, please click the box that says “Enter a discount or promo code” and enter **04N30005** as the convention number (CV#).

Reservations can also be made by calling Hertz directly at 800-654-2240 (U.S. and Canada) or 405-749-4434.

Information about rates is online at <http://jointmathematicsmeetings.org/jmm>.

Driving Directions from the Airport to the Convention Center: Take Highway 281 South toward downtown San

Antonio. Take the Commerce Street exit, 141A, toward downtown. Keep right to take the ramp toward Downtown/The Alamo. Merge onto East Commerce Street. Turn left onto Losoya Street. Turn left onto East Market Street. The Convention Center is on your right.

Taxi: Fares to downtown San Antonio start at \$29.

Public Transportation: VIA Metropolitan Transport (viainfo.net), 210-362-2020 or

866-362-2020, is San Antonio’s public transportation agency.

The trip from the airport to the Convention Center takes approximately 50 minutes.

The 5-McCullough runs from 5:30 a.m. to 9:40 p.m. every day, approximately every 30 minutes until 7:30 p.m. The last two buses are 60 minutes apart.

Prices and schedules are subject to change. The fare is currently \$1.20 per ride; \$2.50 for Express. A VIA day pass is \$4 and can be obtained at the San Antonio Visitor Center at 317 Alamo Plaza.

For detailed instructions on taking public transportation from the airport to downtown, visit the JMM website.

Please call VIA directly and ask to speak to an agent, or check the route finder at viainfo.net if you would like directions to other locations.

Two VIA Streetcar routes, Red (301) and Blue (305), serve many of the popular destinations in downtown San Antonio. The streetcars circulate every 10 minutes, seven days a week. Hours of operation are 7:00 a.m. to 10:30 p.m., Monday through Friday, and 9:00 a.m. to 10:30 p.m. on weekends. Information and a map of the routes can be found at viainfo.net.

Note that the VIA 7-Sightseer Special bus travels to the San Antonio Children’s Museum, the San Antonio Museum of Art, Brackenridge Park, the San Antonio Zoo, Witte Museum, and the Botanical Garden. See viainfo.net/BusService/Schedules.aspx.

Parking: The city of San Antonio has a parking page at <http://downtownsanantonio.org/park/parkingoverview>, which has an interactive map and a pdf map of parking locations. The Henry B. Gonzalez Convention Center lists the four parking garages as being the closest available. Prices are subject to change. See the JMM website for the list: <http://jointmathematicsmeetings.org/jmm>.

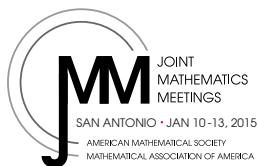
MAA Special Session at JMM 2015 Teaching Calculus with a Tablet

Steve Kennedy, Senior Book Acquisitions Editor, MAA
Gwyneth Whieldon, Hood College

Integrating technology into the classroom is a hot topic, but best practices in the use of tablets and other devices for math education are still in development. In this workshop, participants will have a chance to demo the MAA electronic textbook *Calculus: Modeling and Application* and see how a book designed specifically for a tablet can be integrated into their classrooms. We will introduce several apps to supplement an electronic textbook (and more generally, for use in a technology-based calculus course) and suggest ways to introduce students to a very different style of math course.

Check the JMM program book for more information.

2015 Joint Mathematics Meetings Advance Registration/Housing Form



Name _____
(please write name as you would like it to appear on your badge)

Mailing Address _____

Telephone _____ Fax: _____

In case of emergency (for you) at the meeting, call: Day # _____ Evening #: _____

Email Address _____ Additional email address for receipt _____

Acknowledgment of this registration and any hotel reservations will be sent to the email address(s) given here. **Check this box to receive a copy in U.S. Mail:**

Affiliation for badge _____ (company/university) Nonmathematician guest badge name: _____ (Note fee of US\$15)

I DO NOT want my program and badge to be mailed to me on 12/12/14. (Materials will be mailed to the address listed above unless you check this box.)

Registration Fees

Membership please all that apply. First row is eligible to register as a JMM member.

AMS MAA ASL CMS SIAM
 AWM NAM YMN AMATYC

Joint Meetings	by Dec 23	at mtg	Subtotal
<input type="checkbox"/> Member AMS, MAA, ASL, CMS, SIAM	US\$ 252	US\$ 331	
<input type="checkbox"/> Nonmember	US\$ 400	US\$ 510	
<input type="checkbox"/> Graduate Student (Mem. of AMS or MAA)	US\$ 56	US\$ 66	
<input type="checkbox"/> Graduate Student (Nonmember)	US\$ 90	US\$ 100	
<input type="checkbox"/> Undergraduate Student	US\$ 56	US\$ 66	
<input type="checkbox"/> High School Student	US\$ 5	US\$ 11	
<input type="checkbox"/> Unemployed	US\$ 56	US\$ 66	
<input type="checkbox"/> Temporarily Employed	US\$ 205	US\$ 235	
<input type="checkbox"/> Developing Countries Special Rate	US\$ 56	US\$ 66	
<input type="checkbox"/> Emeritus Member of AMS or MAA	US\$ 56	US\$ 66	
<input type="checkbox"/> High School Teacher	US\$ 56	US\$ 66	
<input type="checkbox"/> Librarian	US\$ 56	US\$ 66	
<input type="checkbox"/> Press	US\$ 0	US\$ 0	
<input type="checkbox"/> Exhibitor (Commercial)	US\$ 0	US\$ 0	
<input type="checkbox"/> Artist Exhibitor (work in JMM Art Exhibit)	US\$ 0	US\$ 0	
<input type="checkbox"/> Nonmathematician Guest of registered mathematician	US\$ 16	US\$ 16	

\$ _____

AMS Short Course: *Finite Frame Theory: A Complete Introduction to Overcompleteness (1/8-1/9)*

<input type="checkbox"/> Member of AMS	US\$ 108	US\$ 142
<input type="checkbox"/> Nonmember	US\$ 160	US\$ 190
<input type="checkbox"/> Student, Unemployed, Emeritus	US\$ 56	US\$ 77

\$ _____

MAA Minicourses (see listing in text)

I would like to attend: One Minicourse Two Minicourses

Please enroll me in MAA Minicourse(s) # _____ and # _____

Price: US\$ 85 for each minicourse.

(For more than 2 minicourses, call or email the MMSB.) \$ _____

Graduate School Fair

Graduate Program Table US\$ 75 US\$ 75
(includes table, posterboard & electricity) \$ _____

Receptions & Banquets

Graduate Student/First Time Attendee Reception? (1/10) (no charge)

NAM Banquet (1/12) US\$63 # _____ Chicken # _____ Vegan
_____ Kosher

(Additional fees may apply for Kosher meals.)

AMS Dinner (1/13) Regular Price # _____ US\$ 67
Student Price) # _____ US\$ 25
\$ _____

Total for Registrations and Events \$ _____

Registration for the Joint Meetings is not required for the short course but it is required for the minicourses and the Employment Center. To register for the Employment Center, go to www.ams.org/profession/employment-services/employment-center.

Payment

Registration & Event Total (total from column on left) \$ _____

Hotel Deposit (only if paying by check) \$ _____

Total Amount To Be Paid \$ _____

Method of Payment

Check. Make checks payable to the AMS. Checks drawn on foreign banks must be in equivalent foreign currency at current exchange rates. For all check payments, please keep a copy of this form for your records.

Credit Card. All major credit cards accepted. For your security, we do not accept credit card numbers by postal mail, email or fax. If the MMSB receives your registration form by fax or postal mail, it will contact you at the phone number provided on this form. For questions, contact the MMSB at mmsb@ams.org.

Signature: _____

Purchase Order # _____ (please enclose copy)

Other Information

Mathematical Reviews field of interest # _____

I am a mathematics department chair.

For planning purposes for the MAA Two-year College Reception, please check if you are a faculty member at a two-year college.

Please do not include my name and postal address on any promotional mailing lists. (The JMM does not share email addresses.)

Please do not include my name on any list of JMM participants other than the scientific program if I am, in fact, making a presentation that is part of the meeting.

Please this box if you have a disability requiring special services.



Deadlines

Eligible for the complimentary room drawing:

Nov. 3, 2014

Receiving badges/programs in the mail:

Nov. 18, 2014

Housing reservations, changes/cancellations

through the JMM website:

Dec. 17, 2014

Advance registration for the Joint Meetings, short course, minicourses, and tickets:

Dec. 23, 2014

50% refund on banquets, cancel by

Jan. 5, 2015*

50% refund on advance registration, minicourses,

and short course, cancel by

Jan. 6, 2015*

***no refunds issued after this date**

Mailing Address/Contact:

Mathematics Meetings Service Bureau (MMSB)

P. O. Box 6887

Providence, RI 02940-6887 Fax: 401-455-4004; **Email:** mmsb@ams.org

Telephone: 401-455-4144 or 1-800-321-4267 x4144 or x4137

2015 Joint Mathematics Meetings Hotel Reservations – San Antonio, TX

(Please see the hotel page in the announcement or on the web for detailed information on each hotel.) To ensure accurate assignments, please rank hotels in order of preference by writing 1, 2, 3, etc. in the column on the left and by circling the requested bed configuration. If your requested hotel and room type is no longer available, you will be assigned a room at the next available comparable rate. Please call the MMSB for details on suite configurations, sizes, availability, etc. All reservations, including suite reservations, must be made through the MMSB to receive the JMM rates. Reservations made directly with the hotels before **December 19, 2014** may be changed to a higher rate. All rates are subject to a 16.75% sales/occupancy tax. **Guarantee requirements: First night deposit by check (add to payment on reverse of form) or a credit card guarantee.**

Deposit enclosed (see front of form)

Hold with my credit card. For your security, we do not accept credit card numbers by postal mail, email or fax. If the MMSB receives your registration form by postal mail or fax, we will contact you at the phone number provided on the reverse of this form.

Date and Time of Arrival _____ Date and Time of Departure _____ Number of adult guests in room _____

Name of Other Adult Room Occupant _____ Arrival Date _____ Departure Date _____

Name of Other Adult Room Occupant _____ Arrival Date _____ Departure Date _____

Housing Requests: (example: rollaway cot, crib, nonsmoking room, low floor) _____

I have disabilities as defined by the ADA that require a sleeping room that is accessible to the physically challenged. My needs are: _____

I am a member of a hotel frequent-travel club and would like to receive appropriate credit. The hotel chain and card number are: _____

I am not reserving a room. I am sharing with _____, who is making the reservation.

Order of choice	Hotel	Single (1 adult) Rate	Double Rate (2 adults - 1 bed)	Double Rate (2 adults - 2 beds)	Triple (3 adults) Rate	Quad (4 adults) Rate	Rollaway Cot Fee (add to special requests)
	Grand Hyatt San Antonio (hqtrs)	US\$ 189	US\$ 209	US\$ 209	US\$ 229	US\$ 249	No charge, king rooms only
	Student Rate	US\$ 159	US\$ 159	US\$ 159	US\$ 179	US\$ 199	No charge, king rooms only
	San Antonio Marriott Rivercenter	US\$ 185	US\$ 185	US\$ 185	US\$ 205	US\$ 225	US\$ 15 one-time fee, king rooms only
	Student Rate	US\$ 175	US\$ 175	US\$ 175	US\$ 195	US\$ 215	US\$ 15 one-time fee, king rooms only
	San Antonio Marriott Riverwalk	US\$ 185	US\$ 185	US\$ 185	US\$ 205	US\$ 225	US\$ 15 one-time fee, king rooms only
	Student Rate	US\$ 175	US\$ 175	US\$ 175	US\$ 195	US\$ 215	US\$ 15 one-time fee, king rooms only
	Hilton Palacio del Rio	US\$ 179	US\$ 179	US\$ 179	US\$ 199	US\$ 219	air mattresses at US\$ 25 one-time fee instead of rollaways, king rooms only
	Student Rate	US\$ 159	US\$ 159	US\$ 159	US\$ 179	US\$ 199	air mattresses at US\$ 25 one-time fee instead of rollaways, king rooms only
	Hyatt Regency San Antonio	US\$ 159	US\$ 159	US\$ 159	US\$ 184	US\$ 209	US\$ 25 per day, king rooms only
	Student Rate	US\$ 135	US\$ 135	US\$ 135	US\$ 155	US\$ 175	US\$ 25 per day, king rooms only
	Hotel Contessa	US\$ 140	US\$ 140	US\$ 140	US\$ 190	US\$ 215	no rollaways, all rooms have sleeper sofas
	Student Rate	US\$ 130	US\$ 130	US\$ 130	US\$ 155	US\$ 180	no rollaways, all rooms have sleeper sofas
	LaQuinta Inn & Suites	US\$ 135	US\$ 135	US\$ 135	US\$ 135	US\$ 135	no rollaways on property
	Student Rate	US\$ 125	US\$ 125	US\$ 125	US\$ 125	US\$ 125	no rollaways on property
	The Westin Riverwalk San Antonio	US\$ 135	US\$ 135	US\$ 135	US\$ 175	US\$ 195	No charge, king rooms only
	The Crockett	US\$ 130	US\$ 130	US\$ 130	US\$ 140	US\$ 150	US\$ 25 per day, king rooms only
	Student Rate	US\$ 120	US\$ 120	US\$ 120	US\$ 130	US\$ 140	US\$ 25 per day, king rooms only
	Springhill Suites by Marriott	US\$ 94	US\$ 94	US\$ 94	US\$ 94	US\$ 94	no rollaways on property; all suites include a sofa-sleeper
	Student Rate	US\$ 84	US\$ 84	US\$ 84	US\$ 84	US\$ 84	no rollaways on property; all suites include a sofa-sleeper
	Fairfield Inn & Suites by Marriott	US\$ 94	US\$ 94	US\$ 94	US\$ 94	US\$ 94	no rollaways on property
	Student Rate	US\$ 84	US\$ 84	US\$ 84	US\$ 84	US\$ 84	no rollaways on property
	Red Roof Plus San Antonio Downtown	US\$ 83	US\$ 83	US\$ 83	US\$ 88	US\$ 93	no rollaways on property
	Student Rate	US\$ 73	US\$ 73	US\$ 73	US\$ 78	US\$ 83	no rollaways on property

People interested in suites should contact the MMSB directly by email at mmsb@ams.org or by calling 800-321-4267, ext. 4137 or 4144 (401-455-4137 or 401-455-4144).

How to Obtain Hotel Accommodations – 2015 Joint Mathematics Meetings

Importance of Staying in an Official Joint Mathematics Meetings Hotel

The importance of reserving a hotel room at one of the official Joint Mathematics Meetings (JMM) hotels cannot be stressed enough. The AMS and the MAA make every effort to keep participants expenses at the meeting, registration fees, and hotel rooms for the meeting as low as possible. They work hard to negotiate the best hotel rates and to make the best use of your registration dollars to keep the meetings affordable. The AMS and MAA encourage all participants to register for the meeting. When anyone pays the registration fee and reserves a room with an official JMM hotel, he or she is helping to support not only the JMM in 2015, but also future meetings.

General

Participants are encouraged to register for the JMM in order to reserve hotel rooms at the contracted JMM rates. If a participant needs to reserve a hotel room before they are registered for the JMM, he or she must contact the MMSB at mmsb@ams.org or 1-800-321-4267 ext. 4137 or ext. 4144 for further instructions.

Special rates have been negotiated exclusively for this meeting at the following hotels: Grand Hyatt San Antonio (headquarters), San Antonio Marriott Rivercenter, San Antonio Marriott Riverwalk, Hilton Palacio del Rio, Hyatt Regency San Antonio, LaQuinta Inn and Suites, Westin Riverwalk, Hotel Contessa, Crockett Hotel, SpringHill Suites by Marriott San Antonio Downtown/Alamo Plaza, Fairfield Inn & Suites by Marriott San Antonio Downtown/Alamo Plaza, and Red Roof Plus San Antonio Downtown. (See details on these hotels below.)

To receive the JMM rates, reservations for these hotels must be made through the Mathematics Meetings Service Bureau (MMSB). The hotels will not be able to accept reservations directly until after **December 19, 2014** and at that time, rooms and rates will be based on availability. Any rooms reserved directly with the hotels before **December 19, 2014** are subject to rates higher than the JMM rates.

A link to the 2015 JMM housing site will be included at the end of the online registration form. It will also

be included in the email confirmation that will be sent for registration for the meeting. If anyone needs to have the link emailed to him or her, please send the request to mmsb@ams.org. If anyone cannot reserve a room online, please complete the housing section of the Registration and Housing Form and send it by email to the MMSB at mmsb@ams.org or to them by fax at 401-455-4004 before **December 17**. Sorry, reservations cannot be accepted over the phone.

All reservations must be guaranteed by either a credit card or check deposit in an amount equivalent to the first night's stay. Only a credit card guarantee can be accepted for any reservation made online. If a paper form is used to reserve a room, a credit card or a check maybe given for the guarantee. For security reasons, credit card numbers will not be accepted by postal mail, email, or fax. If anyone who is reserving a room by paper form wants to guarantee his or her room by credit card, he or she should call the MMSB at 1-800-321-4267, ext. 4137 or 4144. Note that the paper version of the registration form is located at the end of this announcement.

ADA Accessibility

We strive to take the appropriate steps required to ensure that no individual with a disability is excluded, denied services, segregated, or otherwise treated differently. If special assistance, auxiliary aids, or other reasonable accommodations to fully participate in this meeting is required, it should be indicated in the appropriate section on the Registration and Housing Form or emailed to the MMSB at mmsb@ams.org. Requests for ADA-accessible rooms should also be clearly indicated when making hotel reservations. All requests for special accommodations under the Americans with Disabilities Act of 1990 (ADA) must be made allowing enough time for evaluation and appropriate action by the AMS and MAA. Any information obtained about any disability will remain confidential.

Cancellation Policies

The Hyatt Regency San Antonio, LaQuinta Inn Suites, Crockett Hotel, SpringHill Suites, and Fairfield Inn & Suites have a 24-hour cancellation policy prior to check-in.

The Grand Hyatt, Marriott Rivercenter, Marriott Riverwalk, Westin Riverwalk, and Hotel Contessa have a 48-hour cancellation policy prior to check-in.

The Hilton Palacio del Rio and Red Roof Plus have a 72-hour cancellation policy prior to check-in.

Check-in/Check-out

Check-in at the Hilton Palacio del Rio, Hyatt Regency, LaQuinta Inn & Suites, Westin Riverwalk, Crockett, and Red Roof Inn is 3:00 p.m.

Check-in at the Grand Hyatt, Marriott Rivercenter, Marriott Riverwalk, Hotel Contessa, SpringHill Suites, and Fairfield Inn & Suites is 4:00 p.m.

Check-out at the Grand Hyatt, Hotel Contessa, and Red Roof Plus is 11:00 a.m. Check-out at all of the other hotels is noon.

Complimentary Room Drawing

Participants who register and reserve a hotel room by **November 3, 2014**, will be included in a lottery for complimentary hotel room nights during the meeting. Rooms with multiple occupants will be included. The winners will be notified by phone and/or email prior to **December 23, 2014**.

Confirmations

An immediate and real-time email confirmation number will be provided for each hotel reservation made online. This confirmation number will provide participants with direct access to edit reservations up to **December 17, 2014**. After this date, a second email confirmation for the hotel reservation will be sent from the hotel, with the exception of the Hotel Contessa, which will send a second confirmation only if contacted directly. Those who did not receive a confirmation number from their hotels or who have any questions about the reservation process should contact the MMSB at mmsb@ams.org or 1-800-321-4267, ext. 4137 or 4144.

Deadlines

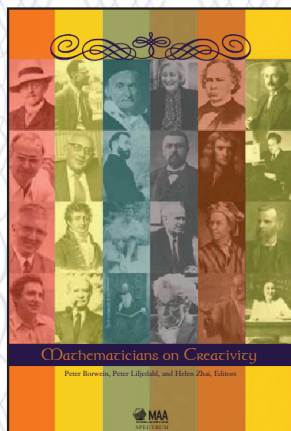
Complimentary Room Drawing: **November 3**
Badge/Program Mailed: **November 18**
Reservations, Changes, and Cancellations through the MMSB: **December 17**

The Mathematical Association of America
1529 Eighteenth Street, NW
Washington, DC 20036

Periodicals Postage Paid at
Washington, DC, and
additional mailing offices

FOCOCT14

New Book



Mathematicians on Creativity

Peter Borwein, Peter Liljedahl, and Helen Zhai, Editors
Spectrum

This book aims to shine a light on some of the issues of mathematical creativity. It is neither a philosophical treatise nor the presentation of experimental results, but a compilation of reflections from top-caliber working mathematicians. In their own words, they discuss the art and practice of their work. This approach highlights creative components of the field, illustrates the dramatic variation by individual, and hopes to express the vibrancy of creative minds at work. *Mathematicians on Creativity* is meant for a general audience and is probably best read by browsing.

Catalog Code: MCT
List Price: \$30.00
MAA Member: \$24.00

Print ISBN: 978-0-88385-574-4
216 pp., Paperbound, 2014

To order, call 800-331-1622 or
visit maa-store.hostedbywebstore.com.

Don't forget to use the code **BMEMB4R4**
to receive your MAA member discount.

