

MUDD MATH



VOLUME 8 + ISSUE 1 = 2014

**HARVEY
MUDD
COLLEGE**



Letter From the Chair

It has been said that the only thing that is constant is change...

The photo above shows the outdoor classroom just outside the math department's new home in the R. Michael Shanahan Center for Teaching and Learning. The Shan (as our students affectionately call our new home) houses modern, flexible and inviting teaching spaces and is constructed with an eye on sustainability, with classrooms and offices lit by natural light and outdoor learning and social spaces (complete with whiteboards and a rooftop cactus garden) designed to leverage the mild Southern California climate. We have offices on the second and third floors; our second-floor lounge is the Hilbert Space, and the third-floor foyer has been named in honor of Bob Borrelli.

The department continues to flourish. This spring, Jon Jacobsen was promoted to full professor, and Talithia Williams and Dagan Karp were each promoted to associate professor with tenure. Francis Su was elected last year to be the next president of the Mathematical Association of America, which followed quickly on the heels of his 2013 Deborah and Franklin Tepper Haimo Award for Distinguished Teaching of Mathematics. The MAA also recently recognized Rachel Levy, who received the 2013 Henry L. Alder Award for Distinguished Teaching by a Beginning Faculty Member. The Colombian Mathematical Society awarded Alfonso Castro its 2013 National Mathematics Prize, the first time this award has ever been given to a non-Colombian resident. We also welcomed our newest faculty member, Mohamed Omar, who in addition to being an expert in combinatorics and optimization, is devilishly good at board games and writes high school math competitions in his spare time.

Sadly, we said goodbye to Bob Borrelli, who died last September. Bob's legacy is enormous; in many ways he was the engineer who built the Harvey Mudd mathematics department. I will miss his sage wisdom and his boisterous laugh. In the third-floor lounge named for Bob, we hosted a party on his birthday attended by faculty, alumni and friends. There was good wine, sweet Italian desserts and many memories of our dear, departed friend.

And speaking of change, after five years as chair of the department I will be stepping down, passing the baton to Lisette de Pillis. It has been a good five years for the College, the department and me.

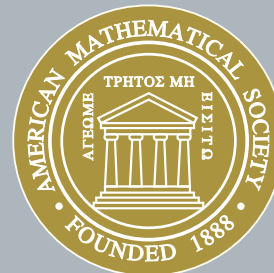
As always, we love visitors and hearing alumni news! Come see our new digs, and tell us what you've been up to.



Andrew J. Bernoff
Chair, Department of
Mathematics 2009–2014,
Kenneth and Diana Jonsson
Professor of Mathematics

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In 2006, the HMC Department of Mathematics received the very first Award for Exemplary Program by the American Mathematical Society.

MuddMath is published by the Harvey Mudd College Department of Mathematics, 301 Platt Boulevard, Claremont, CA 91711.
math.hmc.edu

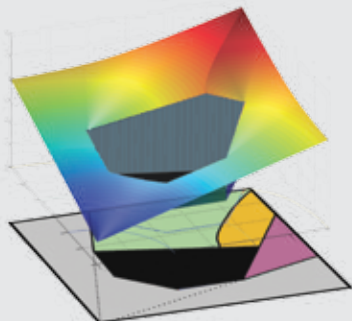
Darryl Yong '96, editor. Produced in cooperation with the Office of Communications and Marketing. Inquiries, suggestions, comments and updates are welcome and can be emailed to muddmath@math.hmc.edu.

Harvey Mudd College is a co-educational liberal arts college of engineering, science and mathematics that also places strong emphasis on humanities and the social sciences. The College's aim is to graduate engineers, scientists and mathematicians sensitive to the impact of their work on society.

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About the Cover

PHOTO BY KAEW TINYANONT '15



During the 2013–2014 academic year, Tum Chaturapruek '14, Professor Weiqing Gu and Professor Zachary Dodds used algebro-geometric and machine learning approaches to help a quadrotor fly autonomously without colliding into obstacles. The surface in the three-dimensional plot shows the shortest Euclidean distance of a continuous, collision-free path from one of the corners to any point in a two-dimensional space, which is represented in

the projected diagram. In the case depicted in this diagram, there is a pentagonal obstacle, shown in black. The projected diagram can be used to reduce the query time of the shortest distance and a path from a single source to any point in the space. In three dimensions, this problem is NP-hard. Chaturapruek continued the research this summer with the support of a Giovanni Borrelli Fellowship and the guidance of Professor Mohamed Omar.





Bob Borrelli in 1993

In Memoriam: Bob Borrelli

On September 11, 2013, the Harvey Mudd College community lost Bob Borrelli, a dear colleague and friend.

Bob was instrumental in the development of the Harvey Mudd mathematics program. He joined the faculty in 1964 and retired in 2000 after 35 years of service, during which time he served multiple terms as department chair and as director of the Mathematics Clinic Program (occasionally doing both jobs simultaneously). Bob played a pivotal role in the hiring of the second generation of HMC mathematicians, including Art Benjamin, Lisette de Pillis and Michael Moody.

Three of Bob's true loves in life were his vivacious wife, Ursula, a good bottle of wine and differential equations. Ursula was a force of nature and the perfect foil for Bob's ebullient personality. Bob's knowledge of wine was encyclopedic, and those of us who were fortunate enough to share a bottle with Bob knew we were in for a treat—and also a short lecture on the origin and the vintage of the bottle. Bob's passion for differential equations was shared by his longtime colleague and collaborator Courtney Coleman (and many, many others, including Darryl Yong, Lisette de Pillis, Mike Moody and Ami

Radunskaya). With Courtney he authored a textbook and built ODE Architect, a piece of visualization software used by a generation of HMC students. Those of us who were privileged to be at his 80th birthday celebration got to see not only his love for Ursula, wine and ODEs but also to see how many lives Bob has touched and changed for the better.

Bob's legacy in the department includes two awards he endowed (the Giovanni Borrelli Fellowship and the Giovanni Borrelli Prize) and the *Interface Journal*, which promotes undergraduate interdisciplinary research and has been reinvented as the online *Interface Compendium*. More broadly, he co-founded the Claremont Center for the Mathematical Sciences and infused the magic of the Clinic Program into a summer program at UCLA, the Research in Industry Program for Students. But his true legacy is the generations of mathematicians at Harvey Mudd and beyond that he inspired to do great things.

More information about Bob and his many accomplishments is available on his remembrance page on the College's website. hmc.edu/remembering-bob-borrelli



• New Home for Math Department

We've moved!

During 2013, the Department of Mathematics moved into its new home in the R. Michael Shanahan Center for Teaching and Learning. The structure occupies the former site of Thomas-Garrett Hall.

Incorporating state-of-the-art design with best practices in sustainability, the Shanahan Center features a living roof, water-efficient plumbing and landscaping and innovative bubble decking—a building method that uses significantly less concrete by replacing it with hollow plastic balls. Certified Gold under the Leadership in Energy and Environmental Design (LEED) rating system, it was awarded a City of Claremont 2013 Excellence in Design Award in the category of “Sustainable Development.”

With offices on the second floor—right next door to President Klawe’s office—and more on the third, the Department of Mathematics is well represented in the new space. Nearly all classes now take place in the building’s modern, spacious and naturally lit classrooms, and the third floor offers an environment like no other found at Mudd, with a gorgeous outdoor learning space, verdant rooftop garden and the sleek, glass-walled SkyCube classroom.

We are proud and honored to call the new building home and to be part of the College’s sustainable approach to development, helping to ensure ample resources for future generations.



Omar Welcomed to Faculty

Mohamed Omar joined the Department of Mathematics as an assistant professor in 2013. He earned his bachelor’s and master’s degrees in pure mathematics, combinatorics and optimization from the University of Waterloo in 2006 and 2007, respectively, and his PhD in mathematics from the University of California, Davis, in 2011. He comes to Harvey Mudd from a postdoctoral fellowship as a Harry Bateman Instructor in the mathematics department at the California Institute of Technology. His research interests include algebraic methods in graph theory and combinatorial optimization.

Since joining the department, Omar has hit the ground running. In his first two semesters, he has taught Abstract Algebra (Math 171) twice, Discrete Mathematics (Math 55) twice and Operations Research (Math 187) and has co-led the Putnam Seminar. He worked with several students on research this summer and will teach Algebraic Geometry (Math 176) in fall 2014.

• Scholars Promoted

This past spring, the Harvey Mudd Board of Trustees approved the promotions of several mathematics faculty members.

Talithia Williams was promoted to associate professor with tenure. Williams' passion for integrating the educational process with real-world statistical applications drives her research, which emphasizes the spatial and temporal structure of data with environmental applications. Her professional research appointments include the Jet Propulsion Laboratory, the National Security Agency and NASA. Williams is also involved in several diversity and outreach programs in STEM, including the Association of Women in Mathematics, Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) and the Sacred SISTAHs. Williams was hired in 2008.

Dagan Karp was also promoted to associate professor with tenure. Karp's research focuses on algebraic geometry, quantum geometry and Gromov-Witten theory—the latter of which intersects enumerative geometry, mathematical string theory and the modern theory of moduli. Karp is also active in STEM diversity causes, including SACNAS and as a member of the diversity committee of the Mathematical Sciences Research Institute (MSRI). Karp also helped organize the 2011 HMC Mathematical Conference, which focused on broadening participation in the mathematical sciences. He began teaching at the College in 2008.

Jon Jacobsen was promoted to full professor. Jacobsen's research interests include differential and integral equations and their applications, particularly in mathematical ecology. He is also deeply involved in Pathways, a mathematics community outreach program featuring faculty members eager to share their love of mathematics with elementary, junior high and high school students. Hired in 2002, Jacobsen is also the associate dean for academic affairs.

Michael Orrison was promoted to full professor July 1, 2013. Orrison's research interests include harmonic analysis on finite groups and algebraic voting theory, particularly in finding, exploring and describing applications of the representation theory of finite groups. He's a North American co-director of the Aquinum Institute of Technology and volunteers for Pathways.



Talithia Williams



Dagan Karp



Jon Jacobsen



Michael Orrison



CCMS workshop participants

• Mudd Hosts Renowned Math Events

WAGS

Harvey Mudd College became the first-ever undergraduate institution to host the prestigious Western Algebraic Geometry Symposium (WAGS), Feb. 16–17, 2013. Supported by a National Science Foundation grant and participating institutions, WAGS is held twice a year and draws participants—including students and experts in the field of algebraic geometry—from throughout the western United States.

This year's speakers included Federico Ardila of San Francisco State University, who investigates mathematical objects by understanding their underlying combinatorial structure; Noah Giansiracusa of the University of California, Berkeley, whose research focuses on moduli spaces, birational geometry and geometric invariant theory; Xinyi Yuan, also of UC Berkeley, who studies Arakelov geometry, Shimura varieties and automorphic forms; and Zhiwei Yun of Stanford University, whose research focuses on geometric representation theory.

"WAGS is the premier venue in the western United States to learn about cutting-edge research in algebraic geometry," said Professor Dagan Karp, the event coordinator. "Algebraic geometry is one of the oldest and most active branches of mathematics. Its current research includes applications to robot motion and image recognition. Relations with other subjects include string theory and theoretical physics."

CCMS

More recently, on April 19, 2014, the College hosted the Differential Equations and Nonlinear Analysis Workshop at the Claremont Center for the Mathematical Sciences (CCMS). The workshop was sponsored and organized by CCMS, Harvey Mudd College and Pomona College.

Harvey Mudd Professor of Mathematics Alfonso Castro and Pomona College Professor of Mathematics Adolfo Rumbos served as the event organizers.

Additional information on the workshop may be found at ccms.claremont.edu/Nonlinear-Analysis-Workshop.

The workshop featured a broad panel of experts:

- Ratnasingham Shivaji, University of North Carolina at Greensboro. Topic: an existence result for a p, q Laplacian infinite semipositone system
- John W. Neuberger, University of North Texas. Topic: how to distinguish global from local existence using Lie generators
- Gabriel Lopez Garza, Universidad Autónoma Metropolitana, Mexico. Topic: Mikusinski's operational calculus with algebraic foundations and applications to Bessel functions
- Guillermo Reyes, University of California at Irvine. Topic: equipartition of operator-weighted energies in damped wave equations
- Leandro Recova, Claremont Graduate University. Topic: multiple solutions to asymmetric semilinear elliptic problems via Morse Theory
- Peter Bates, Michigan State University. Topic: spectral convergence and Turing instability in systems with long-range diffusion
- John M. Neuberger, Northern Arizona University. Topic: differential operators in Matlab
- Gabriel Bengochea, Universidad Autónoma de la Ciudad de Mexico. Topic: exploring operational solutions of fractional differential equations
- David G. Costa, University of Nevada. Topic: compactness properties of critical Sobolev embeddings and applications
- Alfonso Castro, Harvey Mudd College. Topic: the existence of singular solutions for a semilinear elliptic boundary value problem

• Postdoctoral Program Prepares Future Professors

The Harvey Mudd Mathematics Postdoctoral Teaching and Research Postdoctoral Fellowship prepares recent PhDs for tenure-track jobs at liberal arts colleges similar to Harvey Mudd. The program has a multifaceted mentoring component, with research, teaching and professional development mentoring from many members of the department. We have had five terrific postdocs since the department was awarded an NSF grant in 2009.

Our first four postdocs are now in tenure-track positions: Ursula Whitcher joined the faculty at the University of Wisconsin, Eau Claire in fall 2011; Matt Davis joined the faculty at Muskingum College in fall 2012; Erin Byrne '00 began at Olin College in spring 2013; and Jackie Dresch joined the faculty at Amherst College in fall 2013.

Our most recent postdoc, Amanda Ruiz, came to us last fall from Binghamton University and conducted research with Francis Su. Her research focuses on matroids with cool applications to things like “parking functions” (which really relate to car parking!). She taught Probability and Statistics and the calculus refresher course in the fall and a module of the Discrete Mathematics course this past spring.

Ruiz appreciates the mentoring from the department as well as the all-campus junior faculty lunches. “I really enjoy the Office of Institutional Diversity workshops on topics related to the importance of diversity,” says Ruiz. “Open discussions about things I care about make me feel connected to the campus and a part of the community.” Amanda mentored two HMC research students this past summer. She begins a tenure-track position at the University of San Diego in September.

In fall 2014, we will welcome our next two postdoctoral fellows. Nora Youngs received her PhD from the University of Nebraska, Lincoln, and studies neuroscience from the viewpoint of algebraic geometry. Rob Thompson received his PhD from the University of Minnesota and studies differential geometry and symmetry with applications to dynamical systems; he mentored two HMC students in research this past summer.



“Open discussions about things I care about make me feel connected to the campus and a part of the community.”

—AMANDA RUIZ



Ravi Vakili



Jennifer Quinn



Anette (Peko) Hosoi

• Visiting Lecturers Inspire Through Art, Innovative Design

Drawing Numbers

Award-winning Stanford Professor of Mathematics and Robert K. Packard University Fellow Ravi Vakili looked deeper into “The Mathematics of Doodling” at the fifth installment of the Michael E. Moody Lecture on April 19, 2013. Exploring the patterns of his own doodles, Vakili offered sophisticated mathematical analysis of this time-honored artistic diversion, identifying natural building blocks, expanding upon them and uncovering fundamental notions about geometry, topology and physics.

Math to DIE For

Combinatorics expert Jennifer Quinn wowed audiences during the sixth Moody series lecture on Oct. 11, 2013, titled “Mathematics to DIE For: The Battle Between Counting and Matching.” Quinn’s engaging lecture was one part performance art and three parts combinatorics, as she let the audience judge a combinatorial competition by weighing the pros and cons of positive versus alternating sums. The talk explored Fibonacci numbers and other beautiful combinatorial quantities. Quinn is a professor of mathematics at the University of Washington, Tacoma. She received MAA’s 2007 Haimo Award for Distinguished College or University Teaching and the MAA’s 2006 Beckenbach Book award for *Proofs That Really Count: The Art of Combinatorial Proof*, co-authored with Arthur Benjamin, professor of mathematics.

The Math Behind Biologically Inspired Design

The first Moody Lecture held in the R. Michael Shanahan Center for Teaching and Learning featured MIT Professor of Mechanical Engineering Anette (Peko) Hosoi. The talk, titled “From Razor Clams to Robots: The Mathematics Behind

Biologically Inspired Design,” focused on the evolution of natural systems to perform tasks—climbing, sensing, swimming—as perfectly as possible within the limits set by the laws of physics.

Observing these systems, Hosoi explained, can help us to guide engineering design and gain insights into the form and function of biological systems. Hosoi described how an analysis of the physical principles exploited by creatures like snails and clams leads to the development of novel robotic diggers and crawlers. The lecture also explored the role of mathematics in the design, control and assessment of unconventional robotic systems.

The Moody Lecture Series was established by the Harvey Mudd College Department of Mathematics in honor of Professor Michael Moody, who served as department chair from 1996 to 2002. Under Moody’s leadership, the department revised its curriculum, rejuvenated the senior-thesis program and tripled the number of math majors. Moody was also a guiding force that led to the department’s receipt of the American Mathematical Society’s inaugural award for Exemplary Program or Achievement in a Mathematics Department in 2006. Moody passed away in January 2010, and later that year was posthumously named an Honorary Alumnus of Harvey Mudd College.

Gifts made to the College in support of the Moody Lecture Series help Harvey Mudd continue to attract the outstanding caliber of lecturers that Moody had drawn to the department. Contributed funds also support other activities in Moody’s name that enhance the department in ways that would make him proud. To make a gift, or to get more information, visit math.hmc.edu/moodylectures/support.

• Harvey Mudd Hosts Sacred Sistahs Conference

Excellence and diversity go hand in hand. At Harvey Mudd, this is demonstrated by the College's continued efforts to increase the diversity of its community and through engagement activities that expand access to STEM careers for underrepresented populations and generate passion for science at an early age.

On April 26, the Office of Community Engagement and Department of Mathematics teamed with Sacred Sistahs Inc. to organize the fourth annual Sacred Sistahs Math, Science and Technology Conference, an enriching experience for minority girls ages 12 to 18. Hosted by Professor Talithia Williams, the free, public event showcased a diverse selection of female speakers in the STEM fields who shared life experiences that inspired their development, work and dreams.

The conference included a special parent session, a mixture of expert science talks, a professional panel and an opportunity for attending students to share their own science fair projects.

In addition to host/organizer Williams, speakers included Tara Gomez, FDA Regulatory Affairs, the Clorox Company; Melissa Aczon '93, senior scientist, Arete Associates; Ariel Sweet, vice president of strategic communications and public advocacy, the Aliah Sweet Fragile Hearts Foundation; Nicki Mitchell, counselor, Claremont High School; and Professor Rachel Levy. Professional panelists included an engineer, a graduate student and a pediatrician, among others.

Support for the conference was provided by the Department of Mathematics, the Mathematical Association of America, and Transcendence Children and Family Services of Pomona. Since 2004, Sacred Sistahs has provided mentorship to young women in the Inland Empire to inspire and promote self-esteem, self-concept and affirmation.



• Supporting Teachers, Enabling Great Teaching

Since 2007, Harvey Mudd College has been involved in Math for America Los Angeles (MfA LA), a nonprofit organization dedicated to supporting secondary-school math teachers in the Los Angeles area and raising student achievement. This effort, a collaboration between the University of Southern California, Claremont Graduate School and Harvey Mudd, is a concrete example of how the College is making a difference in the community, increasing its visibility and becoming better established as a leader in education and community engagement.

In 2007, President Klawe assembled a small team—including Darryl Yong '96 and CGU Professor David Drew—to help start Math for America in Los Angeles with seed funding from the parent organization Math for America (headquartered in New York City). Today, MfA LA works with 93 teachers in the greater Los Angeles area through its two initiatives: a Teaching Fellowship Program and a Master Teaching Fellowship Program.

The Teaching Fellowship Program is designed to encourage talented individuals to become teachers and to give them everything they need to start a successful career as a middle or high school math teacher. The fellowship comes with an annual stipend of up to \$20,000 (on top of teachers' school salaries), comprehensive professional development, coaching and support to travel to conferences. The Master Teacher Fellowship Program is designed to help experienced teachers develop leadership by giving them the resources and training to make substantive improvements at their schools. It comes with a \$10,000 annual stipend, professional development, conference travel support and funds to buy out one class so that teachers have more time to plan and collaborate with each other.

Funding for MfA LA has come from private foundations and two National Science Foundation grants through the Robert Noyce Teacher Scholarship Program, both of which were written by Yong. Along with Pam Mason, executive director of MfA LA, Yong helps to design the professional development program for all of the beginning and experienced teachers in

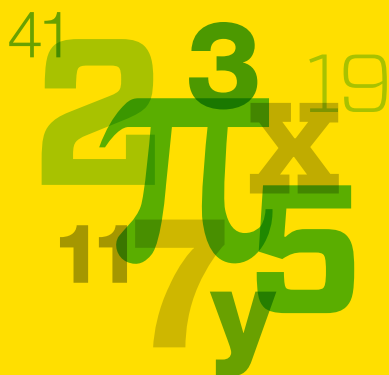


STEVE COHN

MfA LA. These professional development meetings take place on the first Saturday of each month and usually involve at least a few hours of teachers doing mathematics to deepen their own understanding and appreciation of the subject. Yong's involvement with MfA LA was the reason he chose to teach at Helen Bernstein High School during a sabbatical leave in 2009–2010 alongside three other MfA LA fellows. He also visits master teachers at their schools regularly to provide assistance and support.

Several Claremont Colleges alumni are current MfA LA Fellows: Craig Weidert '07, Donavion Huskey '09, Karli Orr SCR '10, Diana Ortiz PIT '13 and Thalia Rodriguez POM '14. (See Craig's update in Alumni News on page 23.)

MfA LA continues to grow and increase its impact on schools in Los Angeles. Its eventual goal is to have fellows teaching at every high school in the Los Angeles Unified School District and to bring about sustainable school reform, one math department at a time.



AfterMath Conference

Undecided students and mathematics majors explored mathematics careers and graduate study opportunities at the AfterMath Conference on Feb. 9, 2013, on campus. The event drew more than 100 students from throughout Southern California and featured expert lectures, hands-on workshops and panels with graduate students and industry professionals. Panelists included representatives from Aerospace Corporation, Math for America, Mercer, University of California at Irvine, UCLA and Harvey Mudd. The event also included a graduate school fair.

AfterMath is supported by the National Science Foundation, the National Alliance for Doctoral Studies in the Mathematical Sciences and the Harvey Mudd Department of Mathematics.



Francis Su won the 2013 Deborah and Franklin Pepper Haimo Award for Distinguished Teaching of Mathematics. Given by the Mathematical Association of America, the award honors college or university professors who have been widely recognized as extraordinarily suc-

cessful and whose teaching has had influence beyond their own institutions. It is the MAA's highest teaching honor. The MAA previously recognized Su with the James R.C. Leitzel Lecturer award (2006), the Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member (2004) and the Merten M. Hasse Prize for outstanding mathematical exposition (2001).

Not long after presenting Su with the Haimo Award, the MAA elected him as its 56th president—one of the youngest ever.

A recent article in the *New York Times*, “To Divide the Rent, Start with a Triangle,” featured Su’s research considering the problem of how roommates with differing preferences should divide the rent in a house with rooms of varying sizes and features. Although this work was done 15 years ago, *New York Times* reporter Albert Sun found Su’s research when he faced this situation with his roommates and decided to write an article about it. In an interactive online version, *The New York Times* also provided an updated version of a portion of the Fair Division Calculator, first developed by Elisha Peterson ’00 and Patrick Vinograd ’02. You can find the article at nyti.ms/1nA20wa and the rent division calculator at nyti.ms/1h859w0



In March 2014, Rachel Levy was named one of 40 Women in Tech by NPR and got to tweet for a day about life as a math professor. She also got to appear with her daughter on NPR’s radio show “Tell Me More” with Michel Martin to talk about encouraging young people to explore

STEM subjects.

Last summer, Levy was awarded a 2013 Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member. She received the prize at the Mathematical Association of America’s MathFest in Wisconsin, where she gave a talk about her blog, *Grandma Got STEM* (ggstem.wordpress.com). Levy is the fourth Harvey Mudd College faculty member to receive the Alder award since its inception in 2003, and Harvey Mudd is the only college to appear more than once on the Alder Award list.

Levy has been experimenting with flipped classroom instruction along with professors Yong, Lape (engineering) and Haushalter (chemistry and biology). With support from the College and the NSF, Yong and Levy are flipping sections of Math 45 and incorporating more modeling activities into

the curriculum. Their work was recently featured in *Slate*. Levy has also been involved in efforts to bring more mathematical modeling into elementary schools as part of the Society for Industrial and Applied Mathematics education committee.



Art Benjamin spent 2012–2013 on sabbatical at Oxford University. In summer 2013, he had another DVD course produced by The Great Courses titled “The Mathematics of Games and Puzzles: From Cards to Sudoku.” He also spoke at TEDGlobal in Edinburgh, Scotland, on “The Magic of Fibonacci Numbers.” The talk went online at TED.com in November 2013 and has been viewed nearly two million times. Art shared his mental math prowess on the *Queen Latifah Show*, which aired June 23. He is shown with Rachel Levy, Queen Latifah and his wife, Deena Benjamin.



The Colombian Mathematical Society awarded Alfonso Castro its 2013 National Mathematics Prize on July 17, 2013, during the 19th Colombian Mathematics Congress in Barranquilla, Colombia, in recognition of his contributions to the development of mathematics in Colom-

bia. Before Castro could be awarded his native land’s most prestigious math prize, the Colombian Mathematical Society had to change a rule that required award recipients to live and work in Colombia. Nearly 500 people petitioned for rule changes that would allow his nomination, citing his involvement with the Colombian mathematical community. Castro co-authored 14 of his published papers with Colombian mathematicians, advised six Colombian doctoral students and organized four national Colombian mathematical meetings.

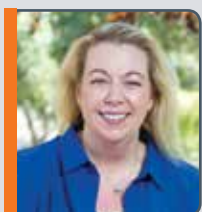


Andrew Bernoff and research collaborator Chad Topaz of Macalester College were awarded the 2014 SIAM Best Paper Prize for their paper titled “A Primer of Swarm Equilibria.” An enhanced version of the paper was republished in December’s *SIAM Review*. Bernoff was also appointed

to the 2013 NSF Committee of Visitors for the Division of Mathematical Sciences.

This June, he was awarded a Simons Foundation Collaboration Grant for Mathematicians for his research titled “Discrete & Continuous Models of Non-local Chemical and Biological Systems.” The Collaboration Grant supports the “mathematical marketplace” by substantially increasing collaborative contacts among mathematicians working in the United States.

On a personal note, he and his husband, Thomas Trautmann, spent a week in Cuba enjoying the vibrant culture and decaying architecture of Havana.



Lisette de Pillis spent a productive sabbatical year keeping up with her research, but also took advantage of the break from teaching to spend more time playing keyboards, singing for her church worship team and swing dancing as often as her schedule allowed. Her math-related fun

activities during sabbatical included working as project leader for an IMA (Institute for Mathematics and Its Applications) research collaboration workshop, in which she co-led a group of mathematicians in the development of models of blood clot formation and treatment. De Pillis was flown to Santa Rosa, California, to present her team’s blood-clot modeling work to researchers at Medtronic, who have expressed an interest in the group’s early results.

She was invited to give the distinguished keynote lecture on her research in cancer modeling at the second annual Pasadena City College Pi Day celebration, with over 300 students partici-

pating. She also gave the keynote talk at the Mathematical Biosciences Institute’s National Capstone Conference for Undergraduate Research, where she spoke on cancer immunology modeling as part of the STEM speaker series at the University of Hawaii, Hilo, Pharmacy School. In addition, de Pillis spoke on an AWM JMM Panel on increasing the retention of women faculty in mathematics.

De Pillis has continued her collaborative research work with the James S. McDonnell Foundation-sponsored Brain Tumor Ecology Collaborative and is making progress toward completing her book in tumor immunology modeling for the AMS. She continued to serve on the AMS Short Course Subcommittee and began her service as chair of that committee during her sabbatical. Unwilling to neglect the MAA, however, she has been working on co-editing a special edition of the *American Mathematical Monthly* dedicated to mathematical biology. The special issue of the *Monthly* should appear late in 2014.

After the start of the 2014–2015 school year, de Pillis is looking forward to giving invited talks at Mathematical Biosciences Institute at Ohio State University in a “Cancer and the Immune System” workshop, another invited talk at the American Institute of Mathematics workshop on Math Modeling of Tumor Immune Dynamics, a workshop on PDEs in Cancer Modeling at Banff, and giving the keynote research address at the SCALA (Scientific Computing Around Louisiana) conference in New Orleans. De Pillis is co-organizing this year’s BEER and WINE conference (BEER = Biomathematics and Ecology Education and Research, WINE = Working in Numerical Ecology), which will be hosted at Harvey Mudd Oct. 10–12.

Beginning summer 2014, De Pillis stepped down from the directorship of the Harvey Mudd College Global Clinic Program to take on the role of mathematics department chair.

Putnam Competition Tradition of Excellence

Harvey Mudd College continues to perform well in the annual William Lowell Putnam Mathematical Competition, seen by many as the world's most prestigious university-level mathematics competition. The median score of competitors is usually 0 or 1 out of a total of 120 points.

In 2012, 42 HMC students took the the difficult six-hour exam. Many scored well in both the team and individual categories. Across the U.S. and Canada, 4,277 students competed. Mudders Sorathan (Tum) Chaturaprupek '14, Kevin O'Neill '13 and Peter Fedak '13 placed 11th out of 578 teams. In the individual category, out of 4,277 students, Chaturaprupek scored 14th nationally and was recognized in the N1 category, which is the second-highest level of distinction possible in the competition (just under Putnam Fellow). He received a \$1,000 cash prize. Tongjia Shi '16 scored 32.5th nationally and was recognized in the Honorable Mention category. In 2012, the following students also made the Putnam Top 500 list: Andrew Carter '13, Michael Earnest '13, Emil Guliyev '13, Henry Huang '15, O'Neill, Joel Ornstein '14, John Phillipot '16 and Jeremy Usatine '14.

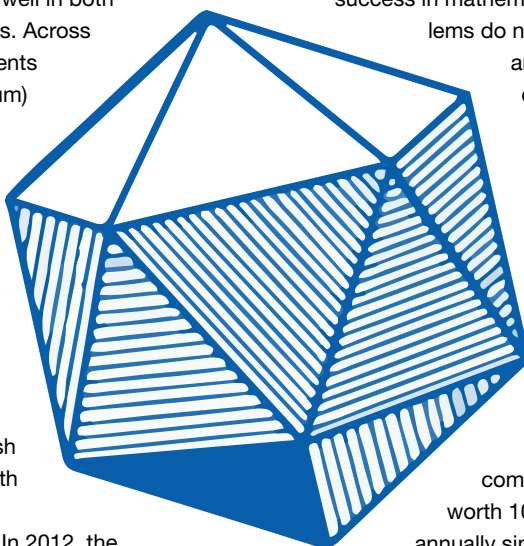
In 2013, 50 HMC students took the exam. Chaturaprupek, Reyna Hulett '16, Joshua Petrack '16,

Spencer (Spike) Harris '14, Shi, Benjamin Lowenstein '16 and Phillipot all made it to the Putnam 500 list.

"The Putnam Competition requires a unique blend of cleverness and problem-solving skills," said Professor Francis Su, who often coaches the Putnam Seminar. "But Putnam success is not required for success in mathematics, since research prob-

lems do not always have neat and tidy answers like Putnam problems do. Persistence is often much more important at research success. In the math department, we hope that all students experience the joy of discovery, and math competitions are just one way that our students continue to impress us with their love for mathematics."

The six-hour exam, composed of 12 problems, each worth 10 points, has been offered annually since 1938 to college students in the United States and Canada and is administered by the Mathematical Association of America. HMC students first participated in the Putnam competition on Dec. 2, 1961. The 1991 HMC team earned third place and the 2003 team earned fifth place.





• Mudd Teams Meritorious at MCM/ICM

The Mathematical Contest in Modeling (MCM) and Interdisciplinary Contest in Modeling (ICM), held each February, are traditions at Harvey Mudd College. The competitions give each team of three students 96 consecutive hours to develop a mathematical model to solve a real-world problem and to write a formal paper describing their work. This year, two teams received “Meritorious” honors based on the accuracy, clarity and creativity of their work, while two others were deemed “Successful Participant.”

The MCM and ICM take place concurrently and focus on mathematical modeling in continuous, discrete or interdisciplinary mathematics. This year’s contests included 8,000 teams (high school and undergraduate students) from around the globe.

The MCM challenges students to address a typically open-ended problem, which can range in subject from social science to business to public policy. This year’s MCM problems concerned the Keep-Right-Except-to-Pass driving rule (Problem A) and metrics to predict collegiate sports coaching legends (Problem B).

Three of the four participating Harvey Mudd teams tackled Problem A for the MCM, which asked teams to analyze a common traffic rule in countries where driving on the right-hand side is the norm, suggest a more effective solution and determine how the solution might be implemented in countries where driving on the left is the norm. A sophomore team consisting of Cheng Wai Koo, Matt Wilber and Arthur Chang earned a result of “Meritorious” for its work, as did the team of Joel Ornstein ’14, Sarah Scheffler ’15 and Ben Lowenstein ’16.

Meritorious honors, received by only the top 15 percent of teams, recognize “modeling, problem solving and communication that are exemplary for the scope of the contest.”

A third team consisting of Lucy Gao ’16, Bo Li ’16 and Yantao Wu ’15 received the result of Successful Participant for Problem A.

Harvey Mudd’s only ICM team this year was Mimee Xu ’15, Martin Loncaric ’15 and Tum Chaturapruek ’14, who were deemed Successful Participants. This year’s ICM problem concerned network models of influence in an academic co-author network, based on the collaborative works of mathematician Paul Erdős.

Four Mudd student teams also made an impressive showing at the MCM/ICM in 2013. Three teams tackled Problem A, which asked participants to model the shape of the optimal brownie pan. One team opted for Problem B, which asked students to project water needs in the year 2025. A team consisting of Milo Toor ’13, Nash Witkin ’13 and Braden Neufeld ’13 and another consisting of Martin Loncaric and Mimee Xu both earned Honorable Mentions for their solutions to Problem A. Sean Campbell ’14, Shreyas Kumar ’14 and Andrew Yandow ’14 were deemed Successful Participants for their work on Problem A, as were Katarina Hoeger ’13, John Wentworth ’13 and Eric Autry ’13 for their work on Problem B.

The MCM and ICM are organized by the Consortium for Mathematics and Its Applications (COMAP), a nonprofit organization whose mission is to improve mathematics education for students of all ages and create learning environments where mathematics is used to investigate and model real-world issues.

MOOCs Can Empower Teachers



Elly Schofield '13

While at Mudd, Elly Schofield '13 worked with Nate Pinsky '13 and Professor Michael Orrison to prepare and deliver math lessons to third-graders. She also addressed challenges in math education as one of four student speakers at the fall 2012 TEDxClaremont Colleges. Schofield now works at Mudd as its first MOOC (massive open online course) program coordinator. During the 2013–2014 academic year, she worked with a Computer Science

Clinic team to develop two MOOCs at Harvey Mudd featuring middle school computer science content and calculus-based high school physics content.

The world of MOOCs is rapidly becoming a crowded field, with big players like Khan Academy, EdX and Coursera. HMC's two MOOCs are a bit different. Instead of guiding students through self-directed learning like many MOOCs, the goal is to provide middle and high school teachers with resources that are as easy as possible to bring to their classrooms: videos, explanations of activities, lesson plans and exercises to check

comprehension. The idea is to empower teachers to teach these rarely offered courses, not to replace them via technology.

The first project, a computer science MOOC, draws its curriculum from MyCS: Middle Years Computer Science, a National Science Foundation-funded program aimed at students from underrepresented groups. Computer science professors Zach Dodds and Mike Erlinger worked with Harvey Mudd student teams to build upon successful K–12 computing courseware and create a compelling curriculum. The MyCS MOOC teaches programming basics using SCRATCH, a visual programming language developed by MIT and the Lifelong Kindergarten Project. It also addresses broad questions such as, What is a computer?, How do computers interpret data?, and Why do we use algorithms? The second MOOC under development is a physics course for high school and college students titled How Stuff Moves, with lectures from Harvey Mudd's Newtonian Mechanics class at its core. Both MOOCs will be available in fall 2014.

During the 2013–2014 academic year, Schofield also co-authored papers for the SIGCSE '14 proceedings, *Journal of Computing Science in Colleges* and EDUCAUSE. She remained at HMC for one more year to work with Cecily Hunt '14 to develop a teacher-adapted MOOC for high school and college instructors based on CS5.



Samuel Gutekunst '14



Andrew Patrick Turner '14

Goldwater Scholarship Program Recognizes Gutekunst and Turner

Samuel Gutekunst '14 (mathematics) received the most prestigious national award for undergraduate researchers in science, mathematics and engineering for the 2013–2014 academic year.

He and Sheena Patel '14 (physics) were awarded Goldwater Scholarships for 2013–2014. Andrew Patrick Turner '14, a mathematics and physics major, received an honorable mention.

For the 2014–2015 academic year, three students received honorable mentions: Rowan Zellers '16 (mathematics and computer science), Shannon Wetzler '16 (biology and chemistry) and Kaitlyn Dwelle '15 (chemistry).

All college sophomores and juniors are eligible to compete for the scholarships, which provide a maximum of \$7,500 each year for one or two years to cover tuition, fees, books and room and board. Each year, Harvey Mudd College nominates up to four students for the Goldwater Scholarship Program.

• National Science Foundation Funds Graduate Research in Mathematics



Jeremy Usatine '14

Seniors Sam Gutekunst and Jeremy Usatine were recipients of 2014 National Science Foundation Graduate Research Fellowships, which recognize outstanding students pursuing advanced degrees in the STEM disciplines. Gutekunst will pursue operations research or combinatorics, and Usatine will enter Yale's PhD program in mathematics. Fellow senior Matthew McDermott received an honorable mention.

Also in 2014, the following mathematics alumni received fellowships for their ongoing graduate research: Brendan Folie '11, John Peebles '13, Brian Stock '09 and Melissa Strait '09. In addition, four received honorable mentions: Olivia Beckwith '13, Anne Clark '13, Alice Paul '12 and Alexandra Schofield '13.

During 2013, fellowships were awarded to alumni Louis Ryan '12, Tselil Schramm '12 and Jenny Iglesias '12. Honorable mentions went to alumni Brian Stock '09 and Alice Paul '12.

The fellowship supports graduate students pursuing research-based master's and doctoral degrees at accredited U.S. institutions. Recipients are awarded three years of research support, including an annual \$32,000 stipend, \$12,000 cost-of-education allowance, research opportunities abroad and access to the XSEDE Supercomputer. For meritorious applicants who do not receive fellowship awards, the NSF awards honorable mention, considered a significant academic achievement.

Departmental Awards and Recognition

2014

The Chavin Prize for Best Mathematics Paper:
Jaron Patrick Kent-Dobias

The Giovanni Borrelli Mathematics Fellowship Award: Sorathan Chaturapruek
Honorable Mention: Jeremy Usatine
The Giovanni Borrelli Prize: Andrew Patrick Turner

The Greever Clinic Prize: Yongqian Li, Amanda Llewellyn, Patrick Thomas Meehan (PARC Clinic team)

RIF Hutchings Prize for Outstanding Performance in the Putnam Competition: Sorathan Chaturapruek, Spencer Harris

SIAM Student Chapter Certificate of Recognition: Marina Ghigliano Johnson

Stavros Busenberg Prize in Applied Mathematics:
Shreyas Kumar

Henry A. Krieger Prize in Decision Sciences:
Emily Fischer, Samuel C. Gutekunst

Departmental Honors: Thomas Bradley Ashmore, Jacob Tracy Bades-Storch, Sorathan Chaturapruek, Emily Fischer, Samuel C. Gutekunst, Spencer Harris, Gregory Allan Kronmiller, Amanda Llewellyn, Matthew Brian Andrew McDermott, Patrick Thomas Meehan, Joel Ornstein, Andrew Patrick Turner, Jeremy Usatine

2013

The Chavin Prize for Best Mathematics Paper: Taylor McAdam, Elizabeth Amy Sarapata

The Giovanni Borrelli Mathematics Fellowship Award:
Kevin William O'Neill
Honorable Mention: Olivia Beckwith, Taylor McAdam

The Giovanni Borrelli Prize: Kevin William O'Neill

The Greever Clinic Prize: Eric Arthur Autry, Corinne S. McElwain, Stephanie Mariko Porter, Elizabeth A. Schofield

RIF Hutchings Prize for Outstanding Performance in the Putnam Competition: Peter Zachary Fedak

SIAM Student Chapter Certificate of Recognition:
Connor Ahlbach

Stavros Busenberg Prize in Applied Mathematics:
Matthew Hin

Alvin White Prize: Elizabeth A. Schofield, Nathan J. Pinsky

Departmental Honors: Connor Ahlbach, Olivia Beckwith, Michael Earnest, Julius H. Elinson, Peter Zachary Fedak, Matthew Hin, Taylor McAdam, Kevin William O'Neill, John Lee Thompson Peebles Jr., Nathan J. Pinsky, Matthew Scott Prince, John S. Wentworth

Senior Theses

2014

Allison F. Arnold-Roksandich: **There and Back Again: Elliptic Curves, Modular Forms, and L-Functions**

Advisor: Christopher Towse, associate professor of mathematics, Scripps College

Sorathan Chaturapruk: **A Mathematical Framework for Unmanned Aerial Vehicle Obstacle Avoidance**

Advisors: Weiqing Gu; Zachary Dodds

Emily M. Fischer: **Infinitely Many Rotationally Symmetric Solutions to the Semilinear Laplace-Beltrami Equations on the Unit Sphere**

Advisor: Alfonso Castro

Samuel C. Gutekunst: **Characterizing Forced Communication in Networks**

Advisor: Susan Martonosi

Shreyas Kumar: **Simulations of Surfactant Driven Thin-Film Flow**

Advisors: Rachel Levy; Darryl Yong '96

David Alan Lingenbrink Jr.: **A New Subgroup for the Finite Affine Group**

Advisor: Michael Orrison

Matthew McDermott: **Fast Algorithms for Analyzing Partially Ranked Data**

Advisor: Michael Orrison

Peter Megson: **Experiments on Surfactants and Thin Fluid Films**

Advisors: Rachel Levy, Jon Jacobsen

Alexa Serrato: **Reed's Conjecture and Cycle-Power Graphs**

Advisor: Nicholas Pippenger

Tongjia Shi: **Cycle Lengths of θ -biased Random Permutations**

Advisor: Nicholas Pippenger

Carling Sugarman: **Using Topology to Explore Mathematics Education Reform**

Advisor: Jon Jacobsen

Jeremy B. Usatine: **Arithmetical Graphs, Riemann-Roch Structure for Lattices, and the Frobenius Number Problem**

Advisors: Dagan Karp; Melody Chan, National Science Foundation postdoctoral fellow and lecturer, Harvard University

Jaron P. Kent-Dobias: **Planar Dipole Driven Pattern Formation**

Advisor: Andrew Bernoff

2013

Connor Thomas Ahlbach: **A Discrete Approach to the Poincaré-Miranda Theorem**

Advisor: Francis Su

Olivia D. Beckwith: **On Toric Symmetry of $P^1 \times P^2$**

Advisor: Dagan Karp

Rosalie J. Carlson: **Voter Compatibility in Interval Societies**

Advisor: Francis Su

Michael J. Earnest: **Extortion and Evolution in the Iterated Prisoner's Dilemma**

Advisor: Nicholas Pippenger

Peter Z. Fedak: **Quadrotor Obstacle Avoidance**

Advisor: Weiqing Gu

J. Zachary Gaslowitz: **Chip Firing Games and Riemann-Roch Properties for Directed Graphs**

Advisor: Dagan Karp

Taylor J. McAdam: **Analysis of Time-Dependent Integrodifference Population Models**

Advisor: Jon Jacobsen

Kevin O'Neill: **Lines in Tropical Quadrics**

Advisor: Dagan Karp

John Peebles: **Hypergraph Capacity With Applications to Matrix Multiplication**

Advisor: Nicholas Pippenger

Nathan Pinsky: **Mathematical Knowledge for Teaching and Visualizing Differential Geometry**

Advisor: Weiqing Gu

Elizabeth A. Sarapata: **A Comparison and Catalog of Intrinsic Tumor Growth Models**

Advisor: Lisette de Pillis

Ryan Takahashi: **Structured Matrices and the Algebra of Displacement Operators**

Advisor: Michael Orrison

Clinic Projects

2014

Mathematics

Palo Alto Research Center (PARC): **Intelligent Workflow Diagnostics**

Team: Andrew Gibiansky, Yongqian Li, Amanda Llewellyn (project manager), Patrick Meehan, Jacob Morris-Knower

Advisor: Weiqing Gu

Computer Science/Mathematics

Lawrence Berkeley National Laboratory: **Cluster-Based Graph Algorithms for Biological Ontologies**

Team: Ki Wan Gkoo, Spencer Harris, Marina Johnson (PM), Ileane O'Leary, Kyle Roskamp

Advisor: Andrew J. Bernoff

NationBuilder: **Predictive Behavior Modeling for Community Organizing**

Team: Michael Culhane, Joey Klonowski (PM), Greg Kronmiller, Mitul Verma

Advisors: Susan Martonosi, Mohamed Omar

Walt Disney Animation Studios: **Analysis and Visualization of Tool Usage in Animated Film Production**

Team: Travis Athougies, Ben Corr (PM), Michael Fox, David Scott

Advisor: Talithia Williams

Intel Corporation: **Data Visualization for Software Developers**

Team: Jason Wang (PM, spring), Miranda Parker (PM, fall), Rohitashwa Bagaria, Sneha Viswanathan

Advisor: Daniel Zimmerman (computer science)

2013

E. & J. Gallo Winery: **Livingston Cooperage Problem**

Team: Eric Autry, Corinne McElwain, Stephanie Porter, Elizabeth Schofield (PM)

Advisor: Susan Martonosi

InstaMed Communications LLC: **Estimating Health Care Prices Using Historical Data**

Team: Peter Loftus (PM, fall), Matt Hin (PM, spring), Leverett Morgan, Lisbeth Santana

Advisor: Talithia Williams

Jane Street Capital: **Analyzing the Effects of Market Legislation on Market Behavior**

Team: Devin Bowers (PM), Matt Johnson, Jeehyun Kim, Matt Toal

Advisor: Weiqing Gu

Shell Exploration and Production: **Optimizing Drilling Rate With Machine Learning**

Team: Kyle Chakos, Sam Gray, Xanda Schofield (PM), John Wentworth

Advisor: Rachel Levy

Southern California Gas Company: **Manual Meter Reading Cost Minimization**

Team: Ben Gross, Katarina Hoeger (PM), Kevin Varela O'Hara, Tim Yee

Advisor: Lisette de Pillis

● In the Footsteps of Paul Erdős

Study abroad inspires student

Preparing graduates to work in the global science and engineering industries is a priority, so as part of its Strategic Vision, Harvey Mudd College has been expanding opportunities for students and faculty to study and work abroad. During 2013-2014, 41 students participated in study abroad programs in 12 countries.

There are some especially attractive options for mathematics majors because of the department's longstanding interactions with programs in places such as Budapest, Hungary; England; and Australia. Approximately three mathematics students per year travel and study abroad.

Tum Chaturapruek '14, an international student from Thailand (so he's actually studying abroad in Claremont!), traveled to Budapest, Hungary, during his junior spring semester. He took classes from both the Aquincum Institute of Technology program and the Budapest Semesters in Mathematics program. All told, he took 10 classes, including Computer Graphics, Hungarian Music in the Central European Context, Old World and New World Political Philosophy, Combinatorial Optimization, and Structures and Dynamics of Complex Networks.

The latter two courses tied for his favorites, he says. "Combinatorial Optimization class was very fun and engaging. The professor's lectures were crystal clear, and his problems were challenging. In Structures, I liked all the theoretical, practical and application sessions. It made me interested in learning more about network science."

He says his most enriching class was IT Entrepreneurship. "It was a fun experience learning from Gábor Bojár, the AIT founder and the founder of Graphisoft, the most successful global software company from Central Europe," says Chaturapruek. "We got to visit many amazing companies such as Graphisoft, Prezi, ColorFront and others, and for each place we went, we got to chat with the CEO of the company. Talking to CEOs was simply amazing and inspiring."

Chaturapruek's first trip to Europe, this study abroad opportunity allowed him to learn about a new culture and study its language, travel to different countries, try Hungarian wine and row for the first time (his team won third place).

"My undergraduate plan was quite ambitious: double major in mathematics and computer science, study abroad, research and internship experiences, and working as an academic excellence facilitator, writing center consultant and an HMC tour guide. I managed to fit all of these into my undergraduate education, with careful planning," says Chaturapruek. "Prof. Ran and Prof. Orrison gave me info about the AIT program and convinced me that studying abroad would be a really worthwhile experience. In the end, I think this semester was really worth it."

Chaturapruek now attends graduate school at Stanford and is studying computer science.



Chaturapruek and his Hungarian roommate, Chris, along the Danube River.



Chaturapruek was amazed by Gaudí's Sagrada Família and how it incorporated mathematics.

• Mathematics Alumni Earn 2014 Outstanding Alumni Awards

Two mathematics alumni received Outstanding Alumni Awards during Alumni Weekend 2014 for remarkable contributions to their fields.



Henry E. Brady '69

Henry Brady is dean of the Goldman School of Public Policy and Class of 1941 Monroe Deutsch Professor of Political Science and Public Policy at UC Berkeley. After graduating from Harvey Mudd with degrees in mathematics and physics, he went on to get a PhD in economics and political science from MIT in 1980. Among his books are *Letting the People Decide: Dynamics of a Canadian Election* (1992), which won the Harold Innis Award for the best social science book published in Canada, and *Rethinking Social Inquiry* (2004), which won the Sartori Award for best book on qualitative methods. His most recent book is *The Unheavenly Chorus: Unequal Political Voice and the Broken Promise of American Democracy* (2012). He is past president of the American Political Science Association and is a Fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, and the Political Methodology Society. He received the Career Achievement Award of the Political Methodology Society in 2012.



Joseph B. Costello '74

Joseph Costello graduated from Harvey Mudd with a bachelor's degree in mathematics, then earned master's degrees in physics from both Yale and UC Berkeley. Costello founded Electronic Speech Systems and then joined Solomon Design Automation, where he became president and grew the company and its subsidiaries from \$10 million to more than \$1 billion. He was CEO of think3, a product lifecycle management software and consulting company, and then moved on to become CEO of Orb Networks. Costello was a Harvey Mudd trustee from 2003 to 2005 and was the College's 2001 commencement speaker.

Other 2014 Outstanding Alumni Award recipients were Jonathan L. Gay '89, Kenneth J. Livak '74, Tyrel M. McQueen '04, Russell L. Merris '64 and George B. Zimmerman '69.

SIAM Publication Features Recent Alumnae

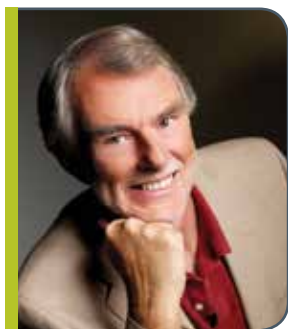
Harvey Mudd College alumnae Lindsay Hall '12 and Andrea Levy '11 were featured in the spring 2013 edition of *Careers in Applied Mathematics*, published by the Society for Industrial and Applied Mathematics (SIAM). The SIAM publication profiled 18 professionals who represent the diverse careers available to mathematicians.

"If you broaden your perspective on what you can do with your interests and passions, you might find yourself in a career that you never imagined—but end up loving," said Hall, a software engineer at Google Inc., who works on the Google Docs team.

Levy, a research analyst for the public policy research firm Acumen LLC, shared how her work employs creative problem-solving skills that remind her of the logic puzzles she enjoyed as a child. "The applications of math are broad enough that you should be able to find an overlap between math and another one of your interests," she said.

CLASS NOTES

Bob Beck '63: “After 21 years as chair of the Department of Computing Sciences at Villanova University, I stepped away from the position last fall. I have been chair since the department was created by splitting away from mathematics. I have received the Outstanding Undergraduate Research Mentoring award from the National Center for Women and Information Technology (NCWIT). The formal presentation was made on May 20 at the NCWIT Summit in Newport Beach.”



Gary Smith '67 (Fletcher Jones Professor of Economics at Pomona College) published a new book this July titled *Standard Deviations: Flawed Assumptions, Tortured Data, and Other Ways to Lie With Statistics*. Ronald Coase cynically observed that, “If you torture the data long enough, it will confess.”

This book is an exploration of

dozens of examples of tortuous assertions that, with even a moment's reflection, don't pass the smell test. Sometimes, the unscrupulous deliberately try to mislead us. Other times, the well-intentioned are blissfully unaware of the mischief they are committing. The book will help protect us from errors—both external and self-inflicted.



Jack Cuzick '70: “I climbed an 18,000-foot mountain in Peru in August. Last year, I went to Madagascar for a 21-day expedition that involved lots of lemurs and chameleons, a six-day float down the inaccessible Manambolo River (except by small boat) and exploration of the Tsingy, which is an eroded coral reef and one of the most spectacular places on the planet. On the

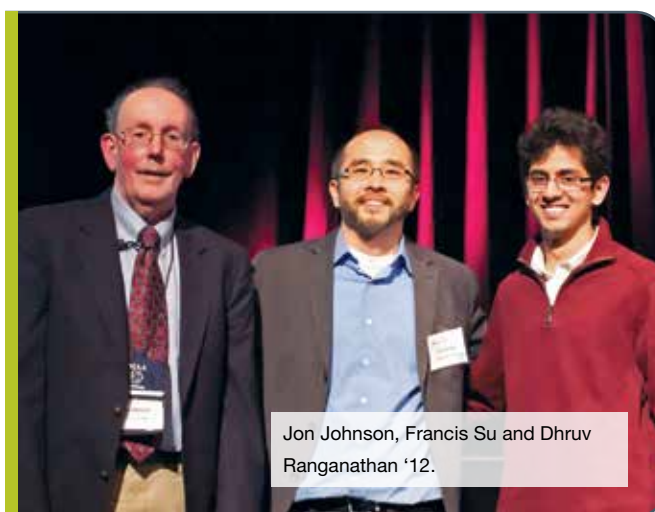
work front, our paper on breast cancer prevention with anastrozole (3) has attracted huge attention. Rather less spectacular is my paper on the use of frailty models in high-dimensional tables (<http://dx.doi.org/10.1016/j.jmva.2013.07.012>), which has some interesting but fairly elementary mathematics in it.”

Bill Hager '70: “This spring, SIAM Gators at the University of Florida (advised by Hager) hosted a student-run conference focusing on mathematical biology and modeling, mathematical algorithms in imaging and numerical optimization and its applications. <http://siam.math.ufl.edu/conference/>

Steve Itelson '70, now retired, split his career between being an actuary and teaching. At Harvey Mudd, he taught in Project Open Future and the Program of Special Directed Studies, and tutored the son of assassinated Civil Rights activist Medgar Evers. He taught high school for a few years, then started the actuarial work. In 1991, he started a consulting firm and began teaching math at City College of San Francisco (CCSF), where he taught 60 percent of full time for 20 years. (“When I left HMC my goal was to save the world by teaching math to the poor. Alas, the world has not been saved.”)

“As a retirement actuary, I have planned the retirement of my wife and me, and we are the FDR analogy of the three-cornered stool: employer-provided pensions, personal savings and Social Security. We will travel more, play with the grandson (now age 6) and pursue other interests. I expect to tutor math at CCSF, and we will visit some alumni in our travels.

“I have made thousands of ‘predictions’ of the future as an actuary, and I have actually been ‘right’ a few times! For example, assumptions I used predicted 47.1 terminations from employment (not retirements or deaths) and there actually were 47. But they were not aligned by age, service or representation unit to what actually occurred. As a consulting actuary, it has been important to communicate complex work to public boards that often include non-mathematical members. I have been successful at this aspect of the HMC education.”

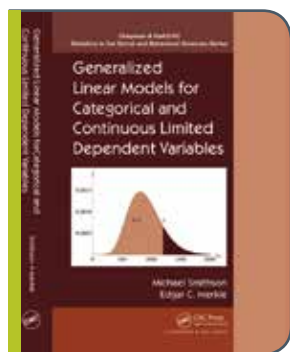


Jon Johnson, Francis Su and Dhruv Ranganathan '12.

Jon L. Johnson '70: “In March 2013, Elmhurst College was awarded a National Science Foundation STEM Talent Expansion Program grant. I am the PI for the project. In August 2012, 14 Pi Mu Epsilon awards were given for student presentations at MathFest (the annual summer meeting of Pi Mu Epsilon and the Mathematical Association of America) in Madison, Wisconsin. All three of my students were award winners! In January 2013, I was awarded the Mathematical Association of America's Certificate for Meritorious Service at the Joint Mathematics Meetings in San Diego for the work that I have been doing in the Illinois Section of the MAA.”



▲ Floyd Spencer '72, Dick Jones '72, Jerry Tunnell '72, Rick Greer '72 and Don Rodriguez '72 reunited in Boston in October 2013 for the wedding of Floyd's daughter, Melissa. Pictured left is Floyd, Jerry, Raj Basu (Floyd's son-in-law); upper right is Rick and Don, lower right is Dick and wife Joan.



Michael Smithson '72 is a professor in the Research School of Psychology at the Australian National University. His research areas are judgment and decision making under uncertainty and statistical methods. With Dr. Edgar Merkle (University of Missouri), he published a book last year with Chapman & Hall titled *Generalized Linear Models for Categorical and Contin-*

uous Limited Dependent Variables, which can be found at <http://www.crcpress.com/product/isbn/9781466551732>. Michael is currently putting together a MOOC (massive open online course) titled Ignorance, due to launch in 2015.

John Lavrakas '74 serves as an expert consultant to the U.S. Department of Transportation on the Global Positioning System, supporting operations and modernization for civil applications of GPS. He also leads a newly formed company, Fish Trax Marketplace, a service that tells consumers who caught their fish and where. This startup has been proven in the Gulf of Mexico and is expanding to other parts of the U.S. and Asia. The Fish Trax system was developed in cooperation with scientists and fishermen in his new home of Newport, Oregon.

Mark Chang '75: "It has been a year now since I resigned from IMS Consulting Group. I am now semi-retired, doing occasional contracting work with Strategic Decisions Group. In my 26 years of consulting, I have done many interesting projects across different industries. The last project was in Mumbai, for the Organisation of Pharmaceutical Producers of India, in collaboration with the Ministry of Health. We did some numbers

sleuthing (i.e. triangulation, systems thinking and plain old 'follow the money') to surface and link key challenges to health care access and affordability in India. To download the report, visit <http://goo.gl/14jLOM>.

Alec Kercheval '80: "I graduated my 11th and 12th PhD students in December 2013 at FSU, where I am professor and director of financial mathematics. We have an active M.S. and PhD program in financial mathematics (www.math.fsu.edu/finmath). HMC students are welcome to apply! This year I was awarded a five-year Simons Foundation Collaboration Grant for Mathematicians, so maybe I will get to California a bit more often! I would love to be able to visit HMC again in 2015 for our 35th reunion, since the 30th was so much fun."

Dana Hobson '85 has joined a bitcoin startup called Bitnet (www.bitnet.io), a merchant payment processor that enables merchants to sell goods and services online to consumers who want to pay in bitcoin. "We pay the merchant in his local currency (what bitcoiners call 'fiat' currency: USD, EUR, GBP, etc.). I'm the person designing the process to deal with the 24/7 risk of receiving bitcoin and while paying fiat to merchants, leveraging my experience in Visa's FX group as well as my finance experience more broadly. There is a bit of math in all this. There are the basic stochastic calculus notions to understand and model how volatility in bitcoin can be dealt with. Beyond that there are network and discrete math problems associated with the history of bitcoin transactions and the so-called blockchain. If any Mudders are interested in that stuff, I have the math background and professional expertise in the bitcoin protocol world to offer advice. An outstanding reference for this world is <http://www.michaelnielsen.org/ddi/how-the-bitcoin-protocol-actually-works/>"

Ray Bouvier '86: "My wife and I started Vancouver Segway Tours in April 2013. We had a very successful first year and have just started our second season of providing fun historical tours of Vancouver, Washington, via Segway. We operate out of the Fort Vancouver National Park. It is quite a change from working as an actuary, but I am loving it."

Susan Parker '86: "Frank Byrum '86, Trish Priest '87 (engineering) and I are attempting to join the Seven Continents Club by completing a marathon on all seven continents. We have completed four: Europe (Athens Classic Marathon 2010), Africa (Cape Town Marathon 2011), Asia (Osaka Marathon 2013) and North America (San Diego for Trish and Frank and Honolulu for me). We are going for our fifth one in November with the Auckland Marathon (Oceania). That will leave South America (undetermined location) and Antarctica (icemarathon.com in 2015 or 2016). As a side note, with our trip to Asia last October, I have now been to all Disneylands in the world: Disneyland (both parks), Walt Disney World (all parks), Euro-

Disney/Disneyland Paris (missing Walt Disney Studios Park), Tokyo Disneyland (all parks) and Hong Kong Disneyland. I will have to go back to Asia sometime after the opening of Shanghai Disneyland in 2015.

“Anna Kim ’86 (engineering), her boyfriend Steve Nunamaker and I will be trekking the Inca Trail to Machu Picchu in September. They have been before, but this will be my first time.”

Dave Somers ’87 is now chair of the Department of Psychological and Brain Sciences at Boston University and is getting up to speed on graph theoretical approaches to analyzing brain networks.

Kyle Roesler ’89 is working for Lockheed Martin in Sunnyvale, California, as a systems engineer. He has been with the company for 17 years since he separated from the Air Force. He’s written four novels, two of which (*Fate*, available from Amazon, and *Saba*, available from Amazon and for all e-readers) are self-published using the pen name Mary Jane. “I haven’t been back to Mudd for years and miss the place terribly; Foster’s Run, anyone?”

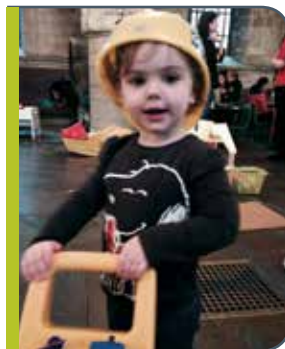
Eric Huggins ’91 was recently promoted to Professor of Management at Fort Lewis College in Durango, Colorado.

Greg Levin ’92: “I’ve been in Santa Cruz for the last eight years, working on a second PhD (this time in computer science). I finished up last August, and after a year of travel and fun, will begin work at Google in June on the Chrome OS team.”



▲ **Ben Weiss ’94**: “I recently released an iPhone/iPad app called Frax that performs real-time fractal rendering and visualization with animated coloring, lighting and zoom. For Mudders who download the app, feel free to write me at support@fract.al for a free upgrade to the Pro feature set! Above is an example of the type of image the app can create.”

Andrew Ross ’96 organized the 16th annual Michigan Undergraduate Math Conference this March. One highlight was an invited talk from a psychology professor about “stereotype threat,” which Andrew says can explain a large part of racial and gender math test score gaps.



Eric Harley ’04: “We had a kid in April 2012—Catherine. I took time to stay at home with her, which paid off because she loves to count and is well on her way to becoming a discrete mathematician. This January, I started a new job at The MITRE Corporation as a researcher developing applications of high-performance computing for cybersecurity.”



Josh Padgett ’04: Some recent news from the Josh Padgett family: “Meagan and I now have two children, Luke (3.5 years) and Cal (7 months). Here’s a picture of the little ruffians.”



▲ **Dave Gaebler ’04**: “I finished my math PhD in May 2013 at the University of Iowa and am now an associate professor of mathematics at Hillsdale College. Our family size is both prime and Fibonacci again, with me, Leslie, Timothy (age 4.5), Iain (2.5), and Joanna (1).”

Gaebler is pictured with fellow math professors Cameron W. McLeman ’02, Andrew Ross ’96 and Francis Su at the Michigan MAA section meeting, May 2-3.



▲ **Ruben Arenas '05**, right, is entering his seventh year in the math department at East Los Angeles College (ELAC). During the last few years he has been taking on roles outside of the department, including as part of ELAC's first-year experience, where he oversees interactions between faculty and the program as well as advising on curriculum matters. The program served 500 students during its pilot year and is expected to serve 1,200 students per year when it reaches maturity. He recently developed an online quiz system to help ELAC students prepare for the high-stakes math and English assessment tests. These assessment tests can only be taken once per year, and misplacement in a lower math course will often result in noncompletion of the student's educational goal.

Ruben continues to enjoy travel. In January, he traveled to the Caribbean island of Curacao for a much needed vacation with Mjumbe Poe '05, Hanhan Li '05 (both shown above) and Hanhan's now-husband, Nickolas Nahm. Last summer, he also traveled with his parents and Mjumbe to Japan, Korea and Taiwan, where they all ate huge amounts of ramen.

In the 2016–2017 academic year, Ruben plans to take a sabbatical. He is hoping to come up with an extensive world travel plan, or use the time to take more linguistics or Korean language coursework.

Jeff Brenion '05 completed a master's degree in library and information science in December 2013.

Zaji Daugherty '05 will end her three-year appointment as a John Wesley Young Research Instructor at Dartmouth College this August and head to the University of Melbourne for three months, followed by a tenure-track assistant professorship in the math department at the City College of New York starting in January.



Jeff Hellrung '05: "I spent my birthday last October on a plane to Shanghai traveling to a friend's wedding, and followed that up with a week in Japan. In November, I traveled to Oahu for the wedding of Justin

Kauwale '06 and spent lots of time with some Mudd alums. I dropped by Alumni Weekend 2014 for a day, saw a few familiar faces and met some new ones. I don't know if anyone would be interested in this, but as far as my work at Google is concerned, my team finally launched our product externally. It's called "Brand Interest" (<http://www.thinkwithgoogle.com/products/brand-interest-gdn.html>) and measures changes in aggregate search behavior due to ads."

Jeffrey Jauregui '05 received his PhD in mathematics from Duke University in 2010. During graduate school, he met Ellen Gasparovic, who earned her PhD in mathematics from UNC Chapel Hill. They were married in 2011. After completing a postdoc at the University of Pennsylvania, Jeffrey has been an assistant professor of mathematics at Union College in Schenectady, New York, since 2013. His research is on geometric aspects of Einstein's theory of general relativity. He is also involved with the Albany Area Math Circle, which helps high school students develop their mathematical interests.

Carl Yerger '05 will be taking a sabbatical from his position at Davidson College to be at Carnegie Mellon University as a Eugene P. Shelly Visiting Assistant Professor during the 2014–2015 academic year. This position is designed to foster collaborations in both teaching and research.

Joe Majkut '06 defended his thesis on Aug. 1 in the program in Atmospheric and Oceanic Sciences at Princeton. Next year, he will serve as a Congressional Science Fellow: <http://www.americangeosciences.org/news/princeton-doctoral-candidate-selected-william-l-fisher-congressional-geoscience-fellow>. "I owe it all to Mudd and hope to do you all proud. See you in 2016!"

Gregor Passolt '06: "I got my master's in Quantitative Ecology and Resource Management from the University of Washington in 2012. Though my master's thesis was very focused on classic ecology (juvenile salmon survival), I also became a fellow and trainee in the people-focused Center for Studies in Demography and Ecology. In November 2012, I started work as a data scientist at Partners for Our Children, a research group based at the UW School of Social Work that does systems research and analysis aimed at improving public policy and social work practice. My main focus at POC is our data portal, which makes Washington child welfare data accessible and understandable to the public. I'm also working on some research projects looking at educational outcomes of kids in foster care and analyzing court involvement on the duration of foster care, as well as general measurement development for monitoring this system. This quarter, I've also been teaching for the UW's Certificate Program in R (statistical programming language), which has been a lot of work but very rewarding. Non-professionally, I got married on Aug. 9!"

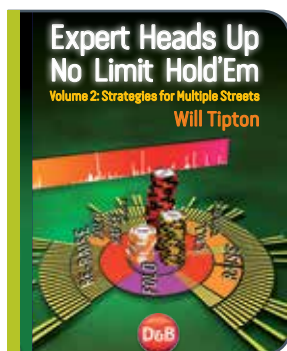


Nate Chenette '07: "First, a new family member (our first child), Sylvia Adele Chenette, was born Dec. 12, 2013. She's happy, healthy and growing fast! I will be leaving my visiting assistant professor position at Clemson and, in the fall, starting a visiting assistant professor position at Rose-Hulman Institute of Technology in Terre Haute, Indiana. My wife, Heather (Schalliol)

Chenette '07 (engineering), is starting a tenure-track position with the Rose-Hulman chemical engineering department. We are doing our best to solve the two-body problem!"

Andrea Heald '07 got her PhD in mathematics from the University of Virginia last June (dissertation title: "Bounded Generation of Two Families of S-Arithmetic Groups"), taught a class at Seattle University last fall, had a child in December and is a part-time lecturer at the University of Washington.

Craig Weidert '07: "I'm finishing up my third year teaching at Ramón C. Cortines High School. Next year I'm going to be teaching at University High School in West Los Angeles. I'm very excited about that. I was featured in the following magazine article, so that was kind of fun: https://rossier.usc.edu/files/2014/02/rossier_futures_mag_spring_2014.pdf. I continue to hang out around L.A. with lots of Mudders, so that's also fun."



Will Tipton '08: "In the past couple months I finished up my doctorate (Materials Science at Cornell), my second book came out (*Expert Heads Up No Limit Hold'em Volume 2*), and I moved back to California to begin as a software engineer at Google. I also bought a car!"



▲ **George Tucker '08** (center) successfully defended his PhD in mathematics at MIT ("Statistical Methods to Infer Biological Interactions"). He did a short summer postdoc at Harvard School of Public Health to finish up a project he's been working on this year. In August, he started at Amazon in Cambridge, Massachusetts, as a research scientist.

Nadia Abuelezam '09 received her doctor of science in epidemiology from Harvard School of Public Health (HSPH) last May. For her dissertation, Abuelezam helped devise a mathematical simulation model called the CEPAC Dynamic Model (CDM), designed to project how long it will take to eliminate HIV in South Africa. *HSPH News* recently featured a profile on Abuelezam and her continuing research: <http://www.hsph.harvard.edu/news/features/hiv-by-the-numbers/>.

Bo Chen '10: "In January 2014, I left UCSD's math department with a master's degree and started work as a software engineer in machine learning at the Palo Alto startup Infer (www.infer.com). Prior to this, I did a stint as a trader on Wall Street with Jane Street Capital, alongside several other Mudders (Andy Neidermaier '04, Aaron Pribadi '12 and Dan Houck '15)."

Kaylin Spitz '10 works at Google as a software engineer and had a fellow Mudder as an intern last summer. Since leaving Mudd, she has discovered the wonders of rock climbing, the horrors of apartment hunting and the ins and outs of New York's subway system.

Simeon Koh '12 will attend Rosalind Franklin University of Medicine and Science in Chicago this fall. "I've been tutoring high school students in math, and I've learned that teaching is HARD. I now truly appreciate all the work that my professors put in during my four years at HMC, and I just marvel at how incredibly good they are at doing such a difficult thing. Although I no longer have math homework assigned to me, I find math problems all around me. I recently had a very nerdy moment when I solved a problem in a cell phone game I've been addicted to. I just used simple probabilities, algebra and infinite series. This of course wasn't a super high-level math problem, but I think it demonstrates that the way I look at my

everyday activities is so very different than an average person's perspective, and this is all thanks to the math education I got at Mudd. I don't know how interesting this would be for readers of *MuddMath*, but you can easily check out this problem on my blog: hobbitsadventure.wordpress.com/2014/05/07/math-is-useful-cell-phone-game-wind-runner/."



▲ **Stephanie Levins '12:** "Since graduating, I have worked as an avian field technician in Ecuador, Peru, Texas and Florida (where I am currently studying Florida Scrub-Jays). I love this line of work because I am able to travel the world while working with some incredible people and animals. I have straddled the equator, explored the Galapagos Islands, climbed trees in the Amazon (rainforest, not tech company), stood in awe of Machu Picchu, seen a jaguar attack a pair of capybaras, held several dozen species of birds, been to a rodeo and become a proud aunt. Now I am looking for work in wildlife conservation on the west coast so I can be closer to friends and family (being on the same continent is a start!)."

Julius Elinson '13: "I have had an exciting year. I spent a month in Budapest studying at AIT before starting work as a software engineer at a small travel startup called Room 77. Earlier this year, the company was partially acquired by Google and I now work for them at their Mountain View headquarters. It's been fun to go from working at a tiny startup to one of the largest software companies in the world; both have been great experiences."

Ben Gross '13 is in the M.A./PhD program in applied mathematics at UC Santa Barbara. He worked on a research project this summer in numerical analysis and fluid dynamics.

Katarina Hoeger '13 finished the first year of a two-year master's program at the College of William and Mary. She is pursuing a masters of computer science with a specialization in computational operations research. This summer, she interned with Intel in its supply chain group. In her free time, she goes dancing.



Liz Sarapata '13 got engaged to **Peter Fedak '13** [nice ring, Peter] on Feb. 7, 2014 at a Mudd-themed puzzle hunt called Wally's Solvers.

Xanda Schofield '13: "I've been working at Yelp for the past year on the Search team, but am actually about to switch to starting my PhD with the Cornell CS department in natural language processing and machine learning applied to the digital humanities."

Nathan Pinsky '13 received a Leonore Annenberg Teaching Fellowship and a Knowles Science Teaching Foundation (KSTF) Fellowship in 2013. The Leonore Annenberg Teaching Fellowship, often referred to as the equivalent of a national Rhodes Scholarship for teaching, is one of three fellowships launched by the Woodrow Wilson National Fellowship Foundation to address fundamental challenges to improving the teacher workforce. KSTF provides beginning high school science and mathematics teachers with five-year fellowships designed to help them become master teachers and leaders. Nate graduated from the Stanford Teacher Education Program this past June and will take a job teaching math in San Francisco Unified School District.



Senior Trip to Magic Castle 2014

Back Row:

Alex Wright, Michael Saffron, Travis Athougies,
Bo Lee, Christian Mason, David Lingenbrink,
Jack Ma, Ben Corr, Vyas Savanur, Tommy
Ashmore, Frank Liu, Mitul Verma, Andrew Turner

Middle:

Marina Johnson, Matt McDermott, Sam
Gutekunst, Natasha Parikh, Ari Janoff, Miranda
Parker, Michelle Vick, Anastasia Patterson,
Sophie Parks, Jeremy Usatine, Jacob
Bandes-Storch, Tiffany Lim, Sean Velazquez,
Stephanie Fawaz

Front:

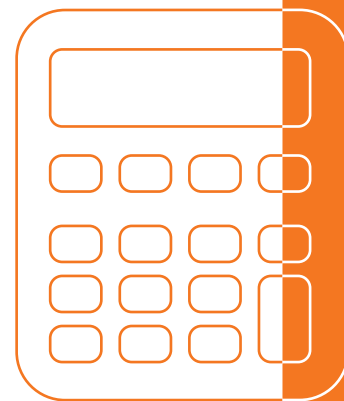
Sidra Hussain, Allison Arnold-Rocksandich,
Gabi Heller, Ileana O'Leary, Art Benjamin, Joel
Ornstein, Tessa Adair, Audrey Musselman-
Brown, Abby Gregory, Emily Fischer

PUZZLE BREAK

Math Mudd Puzzle

A certain pocket calculator can add, subtract and take reciprocals of numbers. However, the times (multiplication) button is defective, so that it cannot multiply. Given two whole numbers, we could perform a multiplication by simply adding one of them to itself an appropriate number of times; however, this is a tedious task. How else is it possible to find the product of two given numbers by using only the three available operations?

answer: math.hmc.edu/muddmath



Michael Orrison leads class in the outdoor classroom in the R. Michael Shanahan Center for Teaching and Learning, where the Department of Mathematics now resides.

