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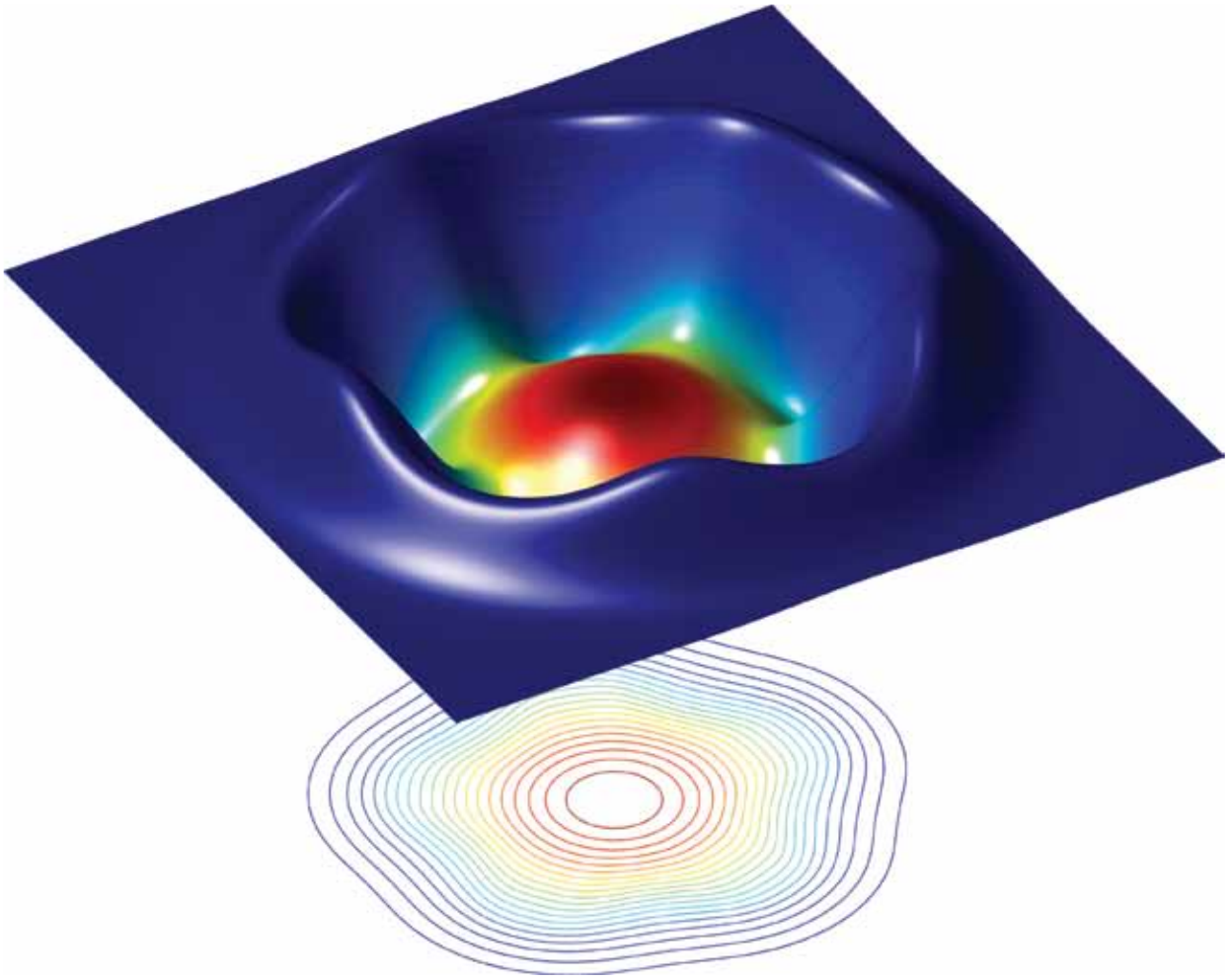
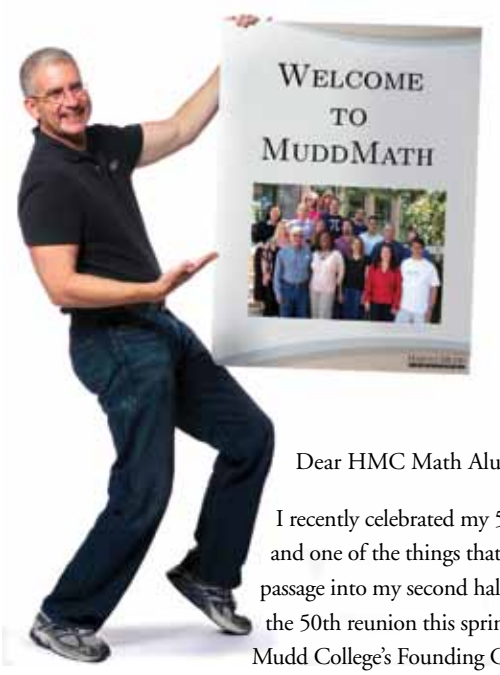


HARVEY MUDD
COLLEGE

letter from the **chair**



FIFTY YEARS YOUNG AND STILL HAVING FUN

Dear HMC Math Alums,

I recently celebrated my 50th birthday, and one of the things that eased my passage into my second half-century was the 50th reunion this spring of Harvey Mudd College's Founding Class. This sprightly group convinced me that, like the College and the Mathematics Department, I am 50 years young and still full of surprises.

Our students, alumni and faculty are a busy group, and I am constantly amazed by their activities and accomplishments. One of our seniors, Palmer Mebane '12 recently won the U.S. Puzzle Championship with a perfect score. Alumnus Greg Rae '00, won a Tony Award for co-producing a Broadway play, "The Normal Heart." Another alum, Robert Bell '72, co-led the team that won the $1 million Netflix Prize for improving the recommendation software that predicts the movies Netflix customers would like. And one of our faculty, Art Benjamin, was interviewed on Comedy Central's "The Colbert Report." A diverse group indeed.

Mathematics is thriving at HMC. We have more than 100 students majoring in one of our three majors (Mathematics, Mathematics and Computer Science, or Mathematical and Computational Biology). A little over half our students are going on to graduate school, mostly in mathematics but also in fields as diverse as operations research and veterinary sciences. Many of our students are getting jobs in areas such as mathematical finance, software engineering and solar energy. Some of our alumni have joined the Peace Corp and others are teaching in secondary school.

Our faculty has grown to 14 energetic and committed individuals. Our two most recent hires are Dagan Karp, an algebraic geometer who comes to us via UC Berkeley, and Talithia Williams, a statistician from Rice, both of whom have a passion for community outreach. Susan Martonosi was just tenured and promoted to associate professor and is doing an amazing job as Clinic director. Jon Jacobsen is in his second year as associate dean of academic affairs at the College and Darryl Yong '96 is just beginning as the associate dean for diversity. Lisette de Pillis continues to direct the Global Clinic Program. Rachel Levy was appointed the Iris and Howard Critchell Assistant Professor of Mathematics in recognition of excellence in teaching and student mentoring. The department was also awarded an $800,000 NSF grant to support two teaching and research postdoctoral fellows; our most recent hire through this program was Erin Byrne '00.

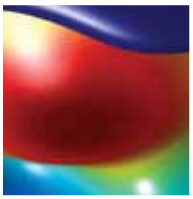
Sadly, since the last edition of *MuddMath* we are also marking the passing of three former faculty members. We commemorated the passing of Alvin White by creating the Alvin White Prize that recognizes students who contribute to the humanistic side of mathematics, a passion of his. Mel Henriksen passed away at the age of 82 after publishing more than 100 papers, including a paper co-authored with Paul Erdös; the department honored Mel with a research conference, which drew an international attendance of Mel's friends colleagues and former students. The passing of former department chair Michael Moody, who hired many of our present faculty, profoundly saddened the department. We have established the Moody Lecture Series in his honor. I want to personally thank the many alumni, my colleagues at HMC, Mike's family and the many friends of the department who gave generously to support the founding of this series. Our former faculty member Lesley Ward gave a beautiful inaugural Moody Lecture and started the series off in a style I think Mike would have approved.

Before I sign off, I want to encourage you to come visit us. The Mathematics Department is still primarily ensconced in Olin, but we are in the process of building an experiential learning space on the third floor of Sprague Center (the former Sprague Library). From there, you have a prime view of the site that will become the new teaching and learning center, which is currently under construction. There is always something amazing going on here; *MuddMath* will help catch you up on some of the things we have been up to.

Andrew Bernoff
Chair, Department of Mathematics
Kenneth and Diana Jonsson Professor of Mathematics

CONTENTS

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



about the cover

The cover depicts a numerical simulation modeling the evolution of a thin liquid film of uniform height, initially surfactant-coated in a five-petal flower shape, over a short time. Surfactant lowers the surface tension, causing fluid to be pulled outward toward regions of higher tension. Red marks where the surfactant concentration is the highest and the darkest blue where there is none. The model is a coupled system of nonlinear fourth-order, hyperbolic-parabolic PDEs solved by a code written by Jonathan Claridge (University of Washington) in collaboration with HMC's Prof. Rachel Levy and Jeffrey Wong '11. The image was created by students in Levy's 2011 Summer Research Group: Eric Autry '13, Cameron Conti '13 and Greg Kronmiller '14.

Muddmath is published by the Harvey Mudd College Department of Mathematics, 301 Platt Boulevard, Claremont, CA 91711, www.math.hmc.edu. Jon Jacobsen and Darryl Yong, co-editors. Produced in cooperation with the Office of Communications. Inquiries, suggestions, comments and, of course, updates are welcome and can be e-mailed to muddmath@math.hmc.edu

Harvey Mudd College is a coeducational 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.

department news

DEPARTMENT HONORS TRAILBLAZER MICHAEL MOODY WITH LECTURE SERIES

The Harvey Mudd College Mathematics Department has established a lecture series in honor of Michael Moody. We are enthusiastic about recognizing Mike for his achievements and contributions to the College and our department.

Under his leadership as chair from 1996–2002, the mathematics department revised its curriculum, rejuvenated the senior-thesis program, and tripled the number of majors. Mike was a guiding force that led to our department being awarded the American Mathematical Society's inaugural award for an Exemplary Program or Achievement in a Mathematics Department in 2006.

Michael Moody (shown above, center) sought to inspire students and communicate the joy, mystery and applicability of mathematics.

He also founded an evening lecture series that brought speakers to the College who illuminated the joy, wonder and applicability of mathematics and that attracted hundreds of students. We would like to continue this tradition by establishing this lecture series in his honor.

Mike was thrilled and humbled to hear about our plans for this lecture series before he died in January 2010. Our department—and many students, faculty, staff and friends within its community—have benefited from his extraordinary legacy.

Professor Lesley Ward of the University of South Australia presented the inaugural lecture in the Moody Lecture Series May 2, 2010, on "The Linear Algebra of Internet Search Algorithms."

Ward is a recipient of the MAA's Alder Award for Distinguished Teaching, and has held a Prize Teaching Fellowship at Yale, a Postdoctoral Fellowship at the Mathematical Sciences Research Institute (MSRI), and an Evans Instructorship at Rice. Her research is in complex analysis, harmonic analysis, and industrial applications of mathematics. She was a proud member of the HMC Mathematics Department for nine years before moving to the University of South Australia in 2006.

She addressed the question, How do web-search algorithms work? Early algorithms just counted the number of times a query word appeared in a given webpage. More recent algorithms rely on "link analysis," which aims to mine the collective wisdom encoded in the network of links: people make judgements about how useful a given page is for a given topic, and they express these judgments through the hyperlinks they choose to put on their own pages. Ward showed how linear algebra forms the common underpinning of three link-analysis algorithms for web search: PageRank, HITS and SALSA. She also discussed a modification of HITS that originated from a Mathematics Clinic at Harvey Mudd College, and is joint work with several people, including HMC undergraduates.

Professor Jonathan Rogness of the University of Minnesota presented the second lecture in the Moody Lecture Series Nov. 19, 2010, on "When Mathematics Meets YouTube."

What happens when 1.7 million people encounter high-level mathematics on YouTube? "Möbius Transformations Revealed" is a short film that illustrates the beauty of Möbius Transformations and shows how moving to a higher dimension makes them easier to understand. After winning an award from the National Science Foundation and *Science* magazine, the video went viral, with unexpected and entertaining results. Rogness' talk described the behind-the-scenes making of the movie, explored the mathematics it illustrates, and showed the reactions of YouTube users who discovered the visual allure of mathematics.

An assistant professor of mathematics at the University of Minnesota, Rogness, a topologist by training, has become well-known for his mathematical visualizations for use inside and outside of the classroom. He is director of the university's Mathematics Center for Educational Programs (MathCEP), which runs one of the nation's premier accelerated mathematics programs for middle- and high-school students.

2011 Michael Moody Lecturer

Bob Devaney of Boston University, was the third Michael E. Moody lecturer, Friday, Sept. 30. He described some of the beautiful images that arise from the "Chaos Game." He showed how the simple steps of this game produce—when iterated millions of times—the intricate images known as fractals and described applications of this technique used in data compression as well as in Hollywood. He also challenged the audience to "Beat the Professor" at the chaos game.

Supporting the Michael Moody Lecture Series Fund

Gifts can be made to the College to support the Moody Lecture Series. Contributed funds help HMC support the outstanding caliber of lecturers that Michael helped attract to the department and allows the support of other activities in Michael's name that would enhance the department in ways that would make him proud.

To make a gift, or for more information see www.hmc.edu/invest/prof-moody.shtml.

Michael Moody, former professor of mathematics and chair of the Department of Mathematics at HMC was a cherished friend, mentor, and inspiration to the Department of Mathematics. Moody came to the college in 1994 as a visiting professor of mathematics from Washington State University, where he was an associate professor of mathematics. In 1996, he became HMC's first Diana and Kenneth Jonsson Professor and, that same year, was named chair of the Department of Mathematics.

Moody received his B.A. degree from the University of California at San Diego in 1975, with a double major in mathematics and chemical physics, and a double minor in history and philosophy. Pursuing an interest in biological systems at the University of Chicago, he finished an applied mathematics thesis in population genetics in 1979. Following graduate school, he spent two years as a USPHS post-doctoral fellow in the Department of Genetics at the University of Wisconsin at Madison. In 1981, he joined the faculty at Washington State University, with a joint appointment between the Department of Pure and Applied Mathematics and the Department of Genetics and Cell Biology. He received a Fulbright Fellowship for research at the Institute for Mathematics at the University of Vienna from 1990–1991. He worked at HMC from 1994 to 2001, then helped establish the programs and curriculum at Olin College, which opened in fall 2002. At the time of his death on January 21, 2010, Moody was vice president for academic affairs and founding dean of faculty at Olin College in Massachusetts.

Moody's research in biomathematics focused on genetic models for evolving populations. His developmental work in teaching concentrated on designing and implementing curricular models and technological tools to improve mathematics education for engineers and scientists. He was co-designer and developer of the award-winning multimedia ODE Architect software program for teaching and solving ordinary differential equations. He also published two books for integrating technology into the calculus curriculum through laboratory experiments and gave numerous talks and workshops at national meetings on these topics. Much of his work was supported by grants from the National Science Foundation.

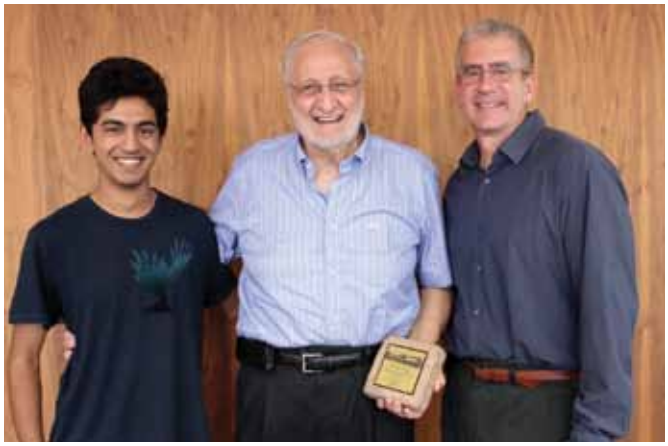
department news

NEW FELLOWSHIP CREATED BY BORRELLI

Dhruv Ranganathan '12 of Chennai, India, was awarded the inaugural Giovanni Borrelli Fellowship, which recognizes an HMC mathematics major who has demonstrated the ability to complete high-quality research either independently or in tandem with a faculty advisor. The fellowship includes a stipend that will support summer research and travel, related to the research.

Ranganathan is working with mathematics Professor Dagan Karp and Paul Riggins '12 on techniques to study basic properties of toric varieties, with applications to Gromov-Witten Theory and Donaldson-Thomas Theory. This work impacts high-energy physics, algebraic geometry, algebraic topology and combinatorics. Ranganathan has described his results in a co-authored article entitled "Toric Symmetry of CP^3" and has lectured about his results in the Algebra, Number Theory and Combinatorics Seminar of The Claremont Colleges and at the 2011 Joint Mathematics Meetings in New Orleans. A poster of this work was presented at the Fall 2010 Western Algebraic Geometry Seminar at the University of Arizona and was selected for inclusion at the WAGS Fall 2011 poster session at Colorado State University.

Ranganathan's current interests include algebraic geometry and representation theory. He plans to continue studying these and other subjects in graduate school, with the goal of joining the professoriate.



Fellowship recipient Dhruv Ranganathan '12 with Emeritus Professor Bob Borrelli and Mathematics Department Chair and Professor Andrew Bernoff.

Honoring Emeritus Professor Robert Borrelli

The Giovanni Borrelli Fellowship was established through the generosity of Emeritus Professor Robert ("Bob") Borrelli, who joined HMC as a mathematics professor in 1964. In his over 30 years of service to the College, he has served as department chair and was pivotal in the development of the Clinic program. "Bob Borrelli was instrumental in helping to build the amazing Mathematics Department we have here today," said fellow mathematics professor Andy Bernoff. "His creation of the Giovanni Borrelli Fellowship will support the next generation of mathematicians. He continues to be an inspiration for the Mathematics Department."

HUMANISTIC TENDENCIES HONORED WITH ALVIN WHITE PRIZE

The Alvin White Prize is an annual award presented to a student or students who have contributed greatly to the humanistic side of the HMC mathematics community and beyond. The award recognizes efforts to make mathematics more accessible and enjoyable, contributions to the mathematical experiences at the College, mathematical education outreach, and/or the use of mathematics in the service and betterment of humanity. These values embody the spirit of Alvin White's vision of a kinder, gentler and more humanistic approach to the practice and teaching of mathematics.

The inaugural Alvin White prize was awarded jointly to Natalie Durgin '09 and Sarah Fletcher '09.

Natalie Durgin's infectious enthusiasm for all things mathematical reminded many of us about the joys of math on an almost daily basis. As president of the Math Club she organized many events, including a celebration of Pi Day and the first Harvey Mudd Integration Bee. She is presently a mathematics graduate student at Rice University.

Sarah Fletcher showed leadership both as a head grader and through countless unofficial hours of tutoring in the dormitories. She is a passionate supporter of the Budapest Semester in Mathematics and Mathcamp. She is presently a mathematics graduate student at Georgia Tech studying algorithms, combinatorics and optimization.

Emeritus Professor Alvin White joined the faculty at Harvey Mudd College in 1962 and was on the faculty for over 35 years. He passed away June 2, 2009. White played a pivotal role in developing the Humanistic Mathematics Network and founded and edited the associated *Humanistic Mathematics Network Journal.* His own humanistic pursuits included tutoring inmates at the Chino Men's Prison and reading and recording textbooks for the blind. In many ways he was ahead of his time, his work foreshadowing a growing emphasis on service learning and outreach in the HMC Mathematics Department. White served for many years as project director for the Interdisciplinary Holistic Teaching/Learning Program at The Claremont Colleges, which advocated a synthesis of science and humanities and an awareness of the interdependence of intuitive and analytical thought processes. In 1971, he was called upon to take part in the State of California's Blue Ribbon Commission on Writing Standards.

Before coming to HMC, White was a member of the Math Research Center at the University of Wisconsin. He earned his A.B. in liberal arts at Columbia University, his M.A. in mathematics at UCLA and his Ph.D. in mathematics at Stanford University.

Professor of Mathematics Emeritus Robert Borrelli said of his colleague, "Al was the sweetest, kindest person who was very interested in helping students. He will be missed."

Descriptions of all departmental awards and past recipients can be found at www.math.hmc.edu/program/awards/

MATH CORE CHANGES AIM FOR LIFELONG APPRECIATION OF MATHEMATICS

As you may have heard, HMC recently introduced several changes to the Core Curriculum taken by every Mudder. The revised Core supports the College's Strategic Vision by increasing flexibility for students, making room for electives, and introducing a new College-wide writing course and "choice" labs. As a result, the Core has a somewhat smaller footprint, but is still the most extensive of any college or university. Yet, students now have room for more unconstrained electives and can take electives in their first year. For example, students can now take a foreign language in each semester of their first year.

The mathematics core has been revamped to support these changes. A general student at HMC now takes three semesters of mathematics in the Core, while engineers take three and a half semesters, and CS/physics students take four semesters.

The table shows a typical sequence of mathematics courses that HMC students take in their first two years under the revised Core Curriculum. Courses marked with (#) are half-courses. The core math courses (six half-courses, three semesters) are marked with (*). The other courses, as indicated, are also available for various majors.

In the revised model, probability and statistics is taken in the first semester so it can better support lab courses that follow in the core. Math 15 is an optional course for students who feel they need more help in calculus, and the new core allows space for students who need that extra help to get it. There is a similar course in Chemistry.

Math 30 and 35 are the courses students are most likely to place out of, and if so, they can use that semester long slot to take an elective or immediately jump into Math 55 or the sophomore core 60/65, if they are able to place out of Math 40 and 45. The linear algebra and differential equations material in Math 70/80 is now aimed directly at math majors, rather than the general student at HMC. For example, we can prove the Existence & Uniqueness Theorem for systems, rather than just stating it. These courses are also popular with engineering majors who want to strengthen their rigorous foundation in linear algebra and the analysis of differential equations. Math 110 (cross-listed as Engineering 72) is an exciting new course, co-taught by mathematics and engineering faculty, that is designed to give engineering majors experience integrating all of the tools that they learn in the Core and some new tools too (like the Laplace transform, optimization techniques and experience with Matlab and Mathematica).

The new mathematics core maintains the same high standards as the old math core, and retains topics important to all majors. We are tweaking the model as we try it out, but initial reviews of the new curriculum have been very positive. We continually strive to give all our students the best mathematical experience for lifelong appreciation of mathematics.

MATH CLASSES TYPICALLY TAKEN DURING FIRST TWO YEARS

FIRST SEMESTER	THIRD SEMESTER
Math 15: Application and Art of Calculus This is an optional 1-unit "side-car" course, to be taken with Math 30, for students who would like to strengthen their basic calculus skills Math 30: Calculus# Reviews calculus with emphasis on understanding concepts and rigor. Short introduction to multivariable calculus. Math 35: Probability and Statistics#	Math 60: Multivariable Calculus# Math 65: Linear Algebra and Differential Equations II#
SECOND SEMESTER	**FOURTH SEMESTER**
Math 40: Introduction to Linear Algebra# Math 45: Introduction to Differential Equations# **Math 55: Discrete Mathematics** (required for math and CS majors)	**Math 70: Intermediate Linear Algebra#** (required for math majors) **Math 80: Intermediate Differential Equations#** (required for math majors) **Eng 72/Math 110: Applied Mathematics for Engineering#** (required for engineering majors) **Math 115: Fourier Series and Boundary Value Problems** (required for physics majors) **Math 131: Real Analysis** (required for math majors)

core math courses; # half courses
Complete course descriptions can be found at www.math.hmc.edu/program/courses/descriptions/

department news

Ursula Whitcher

Matt Davis

Erin Byrne '00

OPTIMIZING THE POSTDOCTORAL EXPERIENCE

An $800,000, five-year grant to the Harvey Mudd College Department of Mathematics from the National Science Foundation (NSF) is underwriting a new Department of Mathematics program, "Optimizing the Mathematics Postdoctoral Experience: A Teaching and Research Postdoctoral Fellowship."

The new postdoctoral fellowships will focus on the synergistic activities of teaching and research as well as connections between the two. Over the five years of this grant, awarded in 2009, the program will support five postdoctoral fellows and 10 undergraduate summer research associates. Each fellow will spend two years at HMC and develop their research under the guidance of a research mentor. They will also teach an average of one course per semester in tandem with a teaching mentor, supervise a summer research student, advise a capstone research experience such as a senior thesis or one of HMC's industrial research-based Clinics, and participate in outreach activities and other vital departmental functions. The ultimate goal of these fellowships is to help improve the teaching and learning of undergraduate mathematics outside HMC by helping recent Ph.D.s develop their teaching and research skills and gain experience that will help them find positions at other four-year, undergraduate-focused institutions. Professors Andrew Bernoff, Jon Jacobsen and Rachel Levy are principal investigators on the grant.

"Harvey Mudd College is a recognized leader in the teaching of undergraduate mathematics and mentoring of undergraduate research," said Bernoff. "This grant allows us to train recent Ph.D.s to excel as faculty members at undergraduate institutions."

So far, the department has had the pleasure of welcoming three accomplished mathematicians.

Ursula Whitcher was the first postdoctoral fellow supported by this grant. She received her doctorate in mathematics from the University of Washington under the direction of Charles Doran. Whitcher's work centers on K3 surfaces and toric geometry with applications to Mirror Symmetry and number theory. While at HMC, she supervised the senior thesis work of Dmitri Skjorshammer, and also led the research of two different groups of undergraduate students. With these students and her research supervisor, Dagan Karp, Whitcher added insight into the geometry and Mirror Symmetry of K3 surfaces, and also studied the toric symmetry of CP^3 with applications to Gromov-Witten and Donaldson-Thomas theory. Whitcher is now an assistant professor of mathematics at the University of Wisconsin-Eau Claire.

Matt Davis joined the department in 2010, having completed his graduate work at the University of Wisconsin-Madison under the guidance of Arun Ram. While at Mudd, he's been working with Michael Orrison on applications of representation theory to fields as diverse as voting theory and automated object tracking. He writes: "This past summer, while working on projects with Jack Newhouse '12 and Palmer Mebane '12, I learned more than I knew there was to know about the Catalan numbers."

Erin Byrne, the third postdoctoral fellow supported by this grant, received her B.S. in engineering in 2000 at Mudd and went on to work at the Aerospace Corporation after graduation. While at Aerospace, she did space architecture and vehicle concept design for spacecraft and interplanetary missions, most notably the Mars Exploration Rover and the second and third generation GPS. Eventually the academic world lured her back and she completed her M.S. and Ph.D. in applied math from the University of Colorado at Boulder. There, she developed a love for modeling, PDEs and fluid dynamics, eventually combining these interests and applying them to the field of mathematical biology. Under the supervision of David Bortz, she studied the biomechanics of bacterial aggregates in the bloodstream. She is looking forward to working alongside the mathematics department and with our incredibly gifted HMC students.

SPRAGUE THIRD: DEPARTMENT'S NEW EXPERIENTIAL LEARNING SPACE

The dissection of the square carpet mosaic.

The Shell Oil Clinic Team enjoins the new Clinic space on Sprague Third. Note the floor to ceiling whiteboards and the windows!

While many alumni will have (perhaps fond) memories of windowless subterranean Clinic rooms, the Mathematics Department is moving up in the world. Literally.

For many years the third floor of Sprague Library housed the Claremont Library's Mathematics Book Collection. In the summer of 2009 the building ceased to be part of The Claremont Colleges Libraries and the space reverted back to HMC. Through the generosity of the College, the Mathematics Department is in the process of developing an experiential learning center on the third floor of Sprague, affectionately known as Sprague Third or just "S3" for short.

As one enters the space, one is greeted by a carpet mosaic representing the dissection of a square into smaller rectangles, firmly announcing that the space is home to mathematical recreations. There are three dedicated Clinic rooms (with windows!), two conference rooms, a seminar space and a lounge/kitchen area. Translucent walls lend a light, airy and welcoming feel to the space. Floor to ceiling whiteboards ensure that there is lots of room for proving theorems or working homework problems.

In perhaps the ultimately irony, the HMC Mathematics Department will move its library collection back into Sprague Third. This collection is notable in its breadth and size due to the generous donations of some of our emeriti faculty. The space had its inauguration on Aug. 31, 2011 when it hosted the Math Department's Welcome Back Dessert Reception.

We hope that the reinvigorated Sprague Third will once again become a center of mathematical activity at HMC.

community partnerships

LONG BEACH EIGHTH-GRADERS STUDY MATH AT HMC

Eighth-grade boys from north Long Beach experienced a new kind of summer school this past July designed to shift their math skills into high gear.

The Claremont-Long Beach Math Collaborative is a free, four-week, residential summer math program at Harvey Mudd College that brings motivated African American male eighth graders to The Claremont Colleges to live, learn and take part in inspiring math explorations led by college faculty, graduate students and undergraduate math majors.

Intended to provide a model for locally focused partnerships nationwide, the Claremont-Long Beach Math Collaborative is a partnership between Claremont Graduate University, HMC and the Long Beach Unified School District. The program connects the best math minds with the students who need them the most. Led by world-class faculty and students from HMC and teachers from CGU's School of Educational Studies, daily sessions explored math concepts with an emphasis on relevance rather than on rote learning.

Participating students make concluding presentations on the program's final day, Aug 3, in front of parents, mentors, Claremont Colleges faculty and guests.

The 20 program participants, selected from four north Long Beach middle schools, entered Jordan High School this fall. They will have the opportunity to return to HMC each summer during their high school years to further their math studies.

"You are going to be math stars. You are all going to be taking calculus by your senior year and getting A's and A-pluses," said President Maria Klawe at the program's July 5 opening ceremony. "We are going to be working with you to make this dream happen."

The math program was conceived by Rev. Leon Wood, CGU director of the McNair Scholar Program, who approached Klawe and CGU President Deborah Freund with his idea and received immediate support. Wood's vision materialized with support from teachers and mentors from The Claremont Colleges, the Claremont University Consortium, the Long Beach Unified School District, and financial contributions from Long Beach philanthropist Roberta Jenkins, Honda and Wells Fargo.

HMC mathematics professors Darryl Yong, Talithia Williams and Dagan Karp helped develop the program's math curriculum to capture students' interest with relevant, everyday applications of math principles. Students from the Claremont Colleges teach classes, serve as program resident advisors and engage the students in co-curricular activities.

The program is intended to promote social justice by providing educational opportunities, thus creating a new generation of leaders in math and the sciences.

TEACHING AND LEARNING: A FORMULA FOR SUCCESS

Nate Pinsky '13 and Elly Schofield '13 taught math to 23 third graders from Chaparral Elementary School in Claremont, Calif., for several weeks, culminating in a trip to the Harvey Mudd College campus this past May.

"I think exploring what it's like to be a teacher in a classroom is really valuable," says Schofield. "It is really amazing to see the look on kids' faces when they get a concept. It is very rewarding."

Pinsky and Schofield decided to design an independent study project around the need to improve mathematics literacy of elementary school students. With the help of advisor and Mathematics Professor Michael Orrison, Pinsky and Schofield teamed up to develop five interactive lessons of educationally enriching (and fun!) activities to get third graders excited about learning math.

During their first year at HMC, both students became interested in math education while working at Homework Hotline, a call-in tutoring service that helps elementary and middle school students with math and science homework.

The Chaparral third graders toured the HMC campus led by Pinsky, Schofield and other HMC students and were able to participate in a hands-on experiment in the chemistry lab. They also visited the rocket and computer science labs. Pinsky and Schofield look forward to expanding their project with elementary school students.

Juniors Elly Schofield and Nate Pinsky introduce local third graders to the wonder of math and the fun of the HMC campus.

EVENT HELPS GIRLS ENVISION STEM CAREERS

More than 140 middle- and high-school aged girls attended the first Sacred SISTAHS math and science conference held March 26 at Harvey Mudd College.

Although open to all girls, the event focused on empowering young African American girls by introducing them to successful academic and professional role models.

"My desire is that they will begin to imagine themselves in our positions in the future," said keynote speaker Talithia Williams, assistant professor of mathematics at HMC.

Williams never envisioned herself earning a doctorate degree, because she had never "seen anyone who looked like me" who had an advanced degree in science or mathematics. After attending Spelman College (a historically black college for women), however, she was exposed to a wealth of successful African-American role models.

"There were five of them in the Mathematics Department alone," Williams said. "It was during those years that I began to imagine myself attaining a Ph.D."

Conference organizers hope to inspire young African American girls to pursue careers in science, technology and mathematics and to become leaders in their fields, Williams said.

The conference, "Envisioning a World of New Possibilities," included workshops and panel discussions led by women in diverse academic and professional fields. Workshop facilitators included HMC mathematics Professor Rachel Levy, Technology Arts Composer Stacey Daniels, and Nurse Manager Michelle Atkins-Young, who serves as director of children's services at Pomona Valley Hospital Medical Center.

Sacred SISTAHS (Sisters in Solidarity Teaching and Healing our Spirits), the Harvey Mudd College Mathematics Department, and Transcendence Children & Family Services of Pomona sponsored the event.

"My desire is that they will begin to imagine themselves in our positions in the future."

—Talithia Williams

Talithia Williams

Sacred SISTAHS conference participants

Conference organizers sought to inspire young African-American girls to pursue careers in science, technology and mathematics.

HMC conference news

MATHEMATICIANS SEEK TO BROADEN PARTICIPATION IN FIELD

The Harvey Mudd College Department of Mathematics hosted the 12th Annual HMC Mathematics Conference on February 4–5, 2011. The two-day event brought together students, faculty, industry leaders and the public to discuss how to broaden participation in the mathematical sciences.

Conference participants discussed how to increase participation in the mathematical sciences.

"Broadening Participation in the Mathematical Sciences" included an opening public lecture by mathematics alumnus Robert Bell '72, a co-winner of the 2009 Netflix Prize. Bell's talk was followed by lectures and a panel discussion.

Robert Bell '72

"People often find themselves being told to wait: do not focus on broadening participation in mathematics until you are more senior, more recognized or more advanced," said conference co-organizer Talithia Williams, assistant professor of mathematics. "We chose to discuss how to navigate these waters and provide answers to the question: How can one work toward broadening participation in mathematics at all levels of one's career?"

The conference was organized by Williams and mathematics professors Dagan Karp and Ursula Whitcher.

CONFERENCE HONORS HENRIKSEN

An honored guest at a mathematics conference in Iran? A curling enthusiast? A lover of dogs and small children? While many of us thought we knew Mel Henriksen, HMC professor of mathematics emeritus, this softer side of Mel was revealed when his long and productive career was commemorated by the Claremont Mathematics community, an assortment of prominent mathematicians, and members of Mel's family at a one-day conference on March 27, 2010.

Mel passed away on Oct. 14, 2009 at the age of 82 and spent a significant portion of his life at Harvey Mudd College where he served as a professor of mathematics from 1969 to 1997. After Mel retired, he remained an active member of the mathematics community in Claremont and beyond. Henriksen was well known in the mathematics community for his work on the study of rings of continuous functions, which involves the interplay of algebra and topology.

Jezmynne Dene, former Claremont Science Librarian compiled a set of Mel memorabilia, including copies of Mel's papers (he authored over a hundred publications) and the single variable calculus text that he wrote. Mel's published papers spanned over half a century, starting in the early 1950s and continuing through 2009.

The opening speaker, W. Wistar Comfort (Wesleyan University), recounted some of Mel's groundbreaking work in topology. Prof. Comfort fondly noted that after a hiatus of communication of months or years, Mel was notorious for sending e-mails that consisted solely of mathematical questions, Mel's way of saying hello.

Through the wizardry of Judy Grabiner, Flora Sanborn Pitzer Professor of Mathematics at Pitzer College, Mel made an appearance and recounted his days as a mathematician. Judy, as a historian of mathematics interviewed Mel in 2006 to create an oral history for the Archives of American Mathematics. Hearing Mel recount anecdotes from his long career brought back his passion for mathematics, his sense of humor, and his strong commitment and admiration of his collaborators and friends.

Three former students fondly recalled Mel's mentoring and guidance; Suzanne Larson (Loyola Marymount-Los Angeles, CGU '84) recounted tales of Mel including advice on how to pass a graduate oral exam, Frank Smith (Kent State University) gave examples of Mel's encyclopedic memory for papers and results, and Ted Chinburg (University of Pennsylvania, HMC '75) likened Mel's dexterity and inventiveness with mathematics to the virtuosity of a blues piano player.

The conference was organized by Sandy Grabiner (Pomona), Asuman Aksoy (CMC), and Andrew Bernoff (HMC) and was made possible by the generosity of the HMC Mathematics Department and the HMC Administration. Pomona College's Barbara Beechler Colloquium Fund supported Garth Dales' travel.

Read more about the conference at www.hmc.edu/newsandevents/melvin-henriksen-memorial.html

department faces

Arthur T. Benjamin
Professor of Mathematics
Ph.D., The Johns Hopkins University
Combinatorics, game theory, operations research

Andrew J. Bernoff
Chair (2009–);
Kenneth and Diana Jonsson Professor of Mathematics
Ph.D., Cambridge University
Applied dynamical systems, fluid mechanics, self-similarity and scaling

Erin C. Byrne '00
Teaching and Research Postdoctoral Fellow
Ph.D., Applied Mathematics and Statistics, University of Colorado–Boulder
Mathematical biology, flocculation dynamics, modeling, fluid dynamics

Alfonso Castro
Professor of Mathematics
Ph.D., University of Cincinnati
Partial differential equations, variational methods, inverse-function theorems, water waves (solitons)

Matt Davis
Teaching and Research Postdoctoral Fellow
Ph.D., University of Wisconsin–Madison
Combinatorial representation theory

Lisette G. de Pillis
Norman F. Sprague, Jr., Professor of Life Sciences; Professor of Mathematics; Global Clinic Director
Ph.D., University of California, Los Angeles
Computational fluid dynamics, numerical linear algebra, mathematical biology

Weiqing Gu
Professor of Mathematics
Ph.D., University of Pennsylvania
Differential geometry, Grassmann manifolds

Jon Jacobsen
Associate Professor of Mathematics;
Associate Dean of Academic Affairs
Ph.D., University of Utah
Partial differential equations, nonlinear analysis

Dagan Karp
Assistant Professor of Mathematics
Ph.D., University of British Columbia
Algebraic geometry

Rachel Levy
Iris and Howard Critchell Assistant Professor of Mathematics
Ph.D., North Carolina State University
Thin films with surfactant, hydrodynamics of whale flukeprints, cooperative strategies for aquatic robotics

Susan Martonosi
Associate Professor of Mathematics;
Director, Mathematics Clinic
Ph.D., Massachusetts Institute of Technology
Operations research, applied probability, aviation security

Michael E. Orrison
Associate Professor of Mathematics
Ph.D., Dartmouth College
Harmonic analysis on finite groups, algebraic voting theory

Nicholas J. Pippenger
Professor of Mathematics
Ph.D., Massachusetts Institute of Technology
Discrete mathematics, probability, and applications to communications and computation

Francis Edward Su
Avery Professor of Mathematics
Ph.D., Harvard University
Geometric and topological combinatorics, game theory, mathematical economics

Talithia Williams
Assistant Professor of Mathematics;
Associate Director, Mathematics Clinic
Ph.D., Rice University
Spatial–temporal modeling of rainfall data

Darryl Yong '96
Associate Chair; Associate Professor of Mathematics;
Associate Dean for Diversity
Ph.D., University of Washington, Seattle
Mathematics education, applied mathematics, perturbation theory, partial differential equations

Jocelyn Olds-McSpadden
Academic Administrative Aide

DruAnn Thomas
Clinic Coordinator
(Computer Science, Global, and Mathematics Clinics)

Claire Connelly
Systems Administrator

faculty news

NEW MATH COLLEAGUES

Dagan Karp

The Department of Mathematics gained two faculty members in 2008.

Dagan Karp graduated from Tulane University in 1999 with a double major in mathematics and physics, earned his Ph.D. from the University of British Columbia, Vancouver, in 2005, and was a postdoctoral fellow and visiting assistant professor at the University of California, Berkeley, prior to coming to Mudd. His research is centered in algebraic geometry and Gromov-Witten theory. The latter is an exciting subject that intersects enumerative geometry, mathematical string theory and the modern theory of moduli. He is also deeply committed to working for civil rights both within and through mathematics. In 2009, Karp received a grant from the National Science Foundation to organize a symposium for students and other scientists to pursue research in quantum geometry and topology at the National Meeting of the Society for Advancement of Chicano and Native Americans in Science (SACNAS) in Dallas, Texas, October 15–18, 2009. In 2010, Karp joined the National Mathematics Task Force at SACNAS, and received a grant from the National Security Agency to enhance the mathematics component of SACNAS. Karp will organize a symposium on Interdisciplinary Algebra at the National Meeting of SACNAS in San Jose, California in October, 2011.

Talithia Williams

Talithia Williams studied mathematics and physics at Spelman College, earned a master's degree at Howard University, and a Ph.D. in statistics at Rice University. She has worked for the Jet Propulsion Laboratory, NASA Johnson Space Center, and the National Security Agency. Williams works on developing dynamic statistical models that emphasize the spatial and temporal structure of data and that have environmental or biological applications. Williams recently organized the first Sacred SISTAHS math and science conference (see page 11) and was an invited speaker at the Spring 2011 Southern California-Nevada Section of the Mathematical Association of America, where she delivered a talk entitled "Lies, Damn Lies, and Statistics: The Misapplication of Statistics in American Life."

NSF SUPPORTS SU'S MATHEMATICAL ECONOMICS STUDIES

Francis Su, professor of mathematics, was awarded a National Science Foundation grant that continues his work using methods of combinatorics, topology and geometry to study problems in mathematical economics and the social sciences. The three-year, $205,668 grant will fund his Research in Undergraduate Institutions (RUI) proposal in the Division of Mathematical Sciences, entitled "Triangulations, Set Intersections, Fair Division, and Voting."

Francis Su

Su's prior work introduced methods from combinatorial topology and discrete geometry to the study of fair division questions and voting problems. The current project supports the development of the mathematics behinds these tools and the solution of several combinatorial questions that have been motivated by his prior work, including: 1) the study of triangulations of cubes and simplotopes; 2) the further development of combinatorial fixed point theorems and constructive solutions; and, 3) the development of set intersection theorems and associated applications in social choice theory and fair division. The project also supports participating undergraduates.

The Mathematical Association of America honored Su's work with 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). In addition to his teaching and research activities, Su is the creator of the popular, award-winning Math Fun Facts website. He currently serves as first vice-president of the Mathematical Association of America.

BENJAMIN SHARES HIS MATH MAGIC

Arthur Benjamin

Arthur Benjamin, HMC's resident "mathemagician" and dedicated professor of mathematics, was a special guest on Comedy Central's "The Colbert Report" on Jan. 27, 2010 where he dazzled host Stephen Colbert and nearly one million viewers with his mental math skills. Benjamin was able to perform a few of his famous high-speed mental calculations and other math stunts on the mock-news show hosted by Stephen Colbert. He was the first mathematician ever to be interviewed on the program.

Benjamin's other recent appearances include The Voice Tribune, "The Mathematician," July 29 (Louisville, KY); NBC News Education Nation, "5 Questions for Mathemagician Arthur Benjamin," July 27; CNN Politics online, quoted in "American Sauce: Debt Ceiling Limbo," May 23; Canadian Broadcasting Corporation radio, May 13.

He has created three DVD courses for The Great Courses series, The Joy of Mathematics (2007), Discrete Mathematics (2009), and The Secrets of Mental Math (2011). His next course, expected in 2013, will be on The Mathematics of Games and Puzzles. In 2009, he edited (with Ezra Brown) the book, *Biscuits of Number Theory,* published by the Mathematical Association of America. He also serves as secretary of the Fibonacci Association.

JON JACOBSEN IS ASSOCIATE DEAN FOR ACADEMIC AFFAIRS

Jon Jacobsen

Jon Jacobsen has been appointed to a three-year term as Associate Dean for Academic Affairs, succeeding Mary Cardenas, La Fetra Associate Professor of Environmental Engineering. He is responsible for monitoring academic workload and progress, especially for the College Core, coordinating the First-Year Advising Program; reviewing and approving student overloads and incompletes; overseeing the Off-Campus Major, Program of Transfer Studies and Individual Program of Studies and chairing the Academic Affairs Committee.

"I am confident he will be an enthusiastic advocate for students and will help ensure their success throughout their time at the college. He clearly connects well with students in many venues and is already recognized for his leadership among the faculty," said Bob Cave, vice president and dean of faculty.

Jacobsen spent his 2008–09 sabbatical as a visiting scholar on the Faculty of Science at the University of Alberta in Edmonton, Alberta, Canada, working with Mark Lewis, Senior Canada Research Chair in Mathematical Biology. Jon and Mark collaborated on two projects related to population persistence in steams, where the steady advective flow and temporally varying flow regimes provide for some intriguing mathematical questions for the analysis of associated spatiotemporal models. Jon was a plenary speaker for the seventh annual Canadian Young Researchers Conference and presented at the AMS Western Sectional Meeting in Las Vegas. Jacobsen is also working on a modern calculus text with Randy McCarthy (UIUC) which they hope to release in January 2014.

LEVY NAMED CRITCHELL ASSISTANT PROFESSOR

Rachel Levy

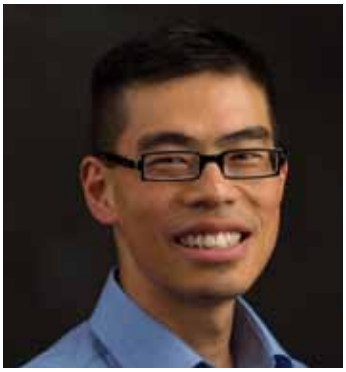
Rachel Levy, assistant professor of mathematics, has been selected as the HMC Critchell Assistant Professor for 2011–2013. The Critchell Professorship is awarded to a junior professor who has exhibited an unusual talent for mentoring and counseling students in all aspects of their lives.

Levy serves as chair of the Teaching and Learning Committee and advisor for the Math Club and the SIAM (Society for Industrial and Applied Mathematics) student chapter. She is also the former associate director of the Mathematics Clinic. Levy works extensively with students on research projects such as developing algorithms for the coordination and control of aquatic robots and modeling whale footprints, the slick swirls observed on the ocean's surface near whale activity.

Her effort has enabled students to work with professional scientists, collaborate with other esteemed colleges—such as Claremont Graduate University and UCLA—and co-author research articles, which have appeared in publications such as the Journal of Engineering Mathematics. Levy has also been instrumental in obtaining funds from the Office of Naval Research, which supported student summer research and a Clinic project.

Levy is working on several projects in fluid mechanics and has established a fluids lab at HMC. One project focuses on the motion of thin liquid films and surfactants, which is supported by the NSF and Research Corporation. As of this summer, nine HMC Math, Math/CS and Physics majors have worked on this problem with collaborators in Math and Physics at North Carolina State University and Duke University. A second problem concerns the origin of whale flukeprints, which are surface patterns on the ocean created by cetacean swimming. This work was recently published in the special issue on biological structures of the *International Journal of Non-linear Mechanics.* A third problem has become a math/engineering Clinic, with funding from the Office of Naval Research and Claremont Graduate University. The teams are working on mathematical algorithms and engineering for networks of cooperative aquatic sensors. Levy serves on the Society for Industrial and Applied Mathematics Education Committee.

faculty news



Darryl Yong '96

YONG APPOINTED ASSOCIATE DEAN OF DIVERSITY

Darryl Yong '96, associate professor of mathematics and associate math chair, has been appointed associate dean of diversity. Yong, who succeeds Ran Libeskind-Hadas, will work with the Office of Institutional Diversity (OID) to further the College's progress in creating a campus environment that is equally supportive of all its members.

"When we think about diversity, it's important to go beyond just considerations of representation," said Yong. "We must also think about how to make the campus a more inclusive place where everyone feels they have access to opportunities to succeed and achieve their goals."

Yong will develop and enhance diversity efforts in faculty recruitment, campus culture and student support. Goals for his three-year appointment include increasing retention rates for all students and supporting faculty recruitment to ensure we attract the widest pool of candidates possible. The associate dean of diversity position was created in 2009 to designate a faculty representative to complement the parallel position held by the director of OID.

Yong spent his sabbatical during the 2009–10 academic year teaching high school in Los Angeles, and kept a blog during that time (http://profteacher.wordpress.com). In short, he reports, it was an extremely difficult, but eye-opening experience. Though it took some adjusting to get back to Mudd, he is absolutely thrilled to be back. He is also starting a small business related to food (what else?).

Susan Martonosi

SUSAN MARTONOSI PROMOTED

Susan Martonosi was recently promoted to associate professor with tenure. Martonosi is an expert in applying operations research and applied probability to address homeland security issues. She also serves as Mathematics Clinic Director and advisor for the international MCM/ICM annual competition. In January 2009, Martonosi traveled to Kenya, Africa with a team of students to help construct a solar still to purify a school's water system and teach a course on solar distillation to teenage Kenyan students.

Michael Orrison

MICHAEL ORRISON CO-DIRECTS STUDY ABROAD PROGRAM

Michael Orrison recently became a North American co-director (with Ran Libeskind-Hadas) for a new study abroad program for computer science and software engineering majors. The program is based at the Aquincum Institute of Technology, located in Budapest, Hungary. Orrison was a plenary speaker at the 2011 CombinaTexas conference, and the keynote speaker at the 2011 UCLA Math Festival. He continues to enjoy being a part of the HMC Math department's outreach program, Pathways, through which he is able to speak to hundreds of students each year, from kindergarten to high school, about big ideas in mathematics.

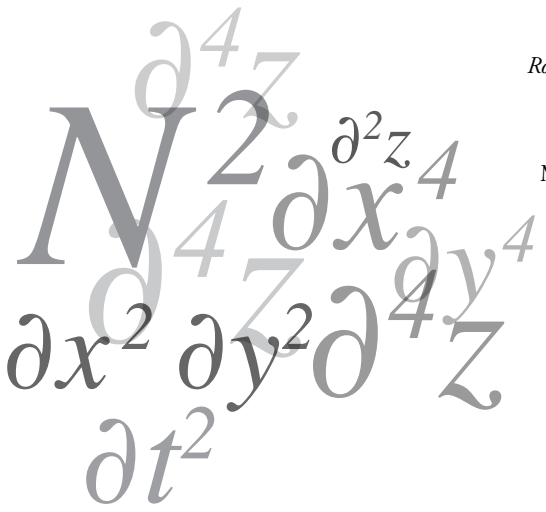
Hank Krieger

KRIEGER ATTENDS 50TH REUNION

Hank Krieger, emeritus professor, recently attended the 50th reunion of a class that he taught at the Navy Nuclear Power School. He taught mathematics there while in the Navy between his undergraduate and graduate training. At the reunion, which was held at the Naval Submarine Base New London, Krieger gave a lecture on statistical probability and was named an honorary member of the Class 60–3 of the Navy Nuclear Power School.

Boundary Conditions

by Ursula Whitcher



Royal Academy of Science, Paris, 1823

This is her moment of triumph:
a seat at the center, a node.
Mademoiselle Germain sits silent,
head upright, chaperoned.
Academy members rise
or dip; the speaker drones.

Steel plate hums to the bow
like silk stretched tight.
Who grasps the edge controls—
she claims—the waves inside.
She makes her hands unfold.
Her lips taste dry.

Sophie Germain was awarded the Royal Academy of Science's prix extraordinaire for research in elasticity, in absentia, in 1816. Her friend Joseph Fourier extended a formal invitation to the Academy's meetings in 1823, after his November 1822 election as Permanent Secretary.

The College Mathematics Journal, Volume 42, Number 1, January 2011 , pp. 56–56(1)

Suzanne Frantz

FRANTZ AWARDED BINDER PRIZE

Hers was the friendly face that greeted you in the HMC Department of Mathematics. She was also the designated "go-to" person, the one you could rely on to get the job done well.

During her first year on campus, she helped launch the first HMC math conference, which continued annually for many years. Her positive attitude and work ethic have earned her respect and renown.

These are but a few reasons why math department coordinator Suzanne Frantz, who retired in June, was awarded the 2011 Mary G. Binder Prize. Awarded each year to a member of HMC's support staff, the prize recognizes someone who has combined a record of exceptional service with a helpful and friendly attitude toward students, staff and faculty.

"I feel very honored to have won this special prize and truly blessed to work for such appreciative people as those in the math department," said Frantz, who was described as "gentle, clear and friendly" by one of the faculty members who nominated her and as one who serves "not only the math department but the broader community."

Frantz's award includes a $500 check, a commemorative certificate and the addition of her name on the Mary G. Binder Prize plaque in the foyer of Galileo Hall.

The Mary G. Binder Prize was established in 1997 with a gift from Professor Emeritus Sam Tanenbaum and his wife, Carol, in honor of Carol's mother, Mary G. Binder, and in expression of their gratitude to HMC's support staff.

student research

2010–11 SENIOR THESES

Every HMC mathematics major must complete a capstone project to graduate, and students choose to complete either a senior thesis or a Clinic project. During the 2010–11 academic year, 15 students wrote theses on topics ranging from mathematics education to martingale couplings. We are in the process of archiving senior theses in the Claremont Colleges Digital Library. Please contact the senior thesis coordinator, Nick Pippenger (nick_pippenger@hmc.edu), if you have questions about the electronic publication of your senior thesis.

Kate Burgers
Finding the Beat in Music: Using Adaptive Oscillators
Advisor: Jon Jacobsen

Georgi Dinolov
Swarm Control Through Symmetry and Distribution Characterization
Advisor: Rachel Levy

Ann Johnston
Markov Bases for Noncommutative Harmonic Analysis of Partially Ranked Data
Advisor: Michael Orrison

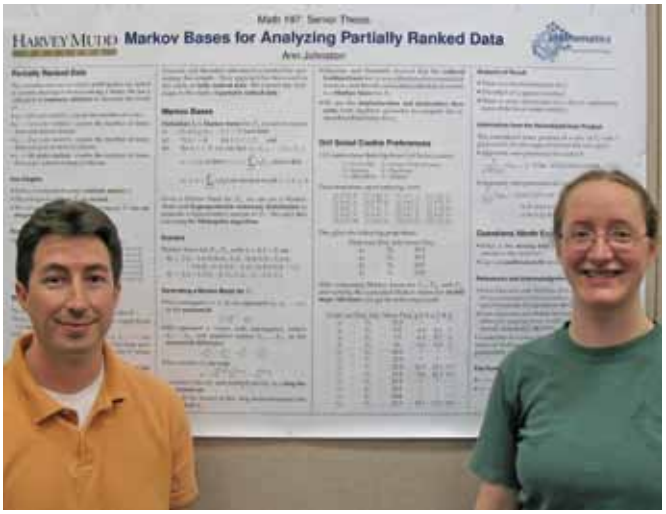
Max Kutler
Group Actions and Divisors on Tropical Curves
Advisor: Dagan Karp

Sarah Loeb
Extending List Colorings of Planar Graphs
Advisor: Kimberly Kindred

Kyle Luh
Martingale Couplings and Bounds on Tails of Probability Distributions
Advisor: Nicholas Pippenger

Chandler May
Verification of Solutions to the Sensor Location Problem
Advisor: Susan Martonosi

Allison Park
Comparing the Cognitive Demand of Traditional and Reform Algebra 1 Textbooks
Advisor: Darryl Yong



Prof. Michael Orrison and Ann Johnston '11

Austin Quan
Noise, Delays and Resonance in a Neural Network
Advisor: John Milton (Scripps)

Elizabeth Reiland
Combinatorial Interpretations of Fibonomial Identities
Advisor: Arthur Benjamin

Andrew Ronan
Analytic and Numerical Studies of a Simple Model of Attractive-Repulsive Swarms
Advisor: Andrew Bernoff

Donald Lee Wiyninger III
Continued Fractions: A New Form
Advisor: Nicholas Pippenger

Jeffrey Wong
Simulations of Surfactant Spreading
Advisor: Rachel Levy

2010–11 MATHEMATICS CLINIC

The Math Clinic Program continues to thrive and provide our students ample opportunities to synthesize and apply what they have learned in the classroom and to develop important professional skills. Additionally, we expect our sponsors to be thrilled with the results! Many of our projects come to us through alumni connections. If your organization has a problem that might benefit from mathematical analysis, please contact the Mathematics Clinic Director, Prof. Susan Martonosi (martonosi@hmc.edu), for more information about sponsoring a Clinic.

Mathematics Clinic

Space Systems/Loral
Application of Robust Control to Spacecraft Attitude Stability

Liaisons: Saghir Munir, Sophia Huynh '05, Xen Price, Gerrit van Ommering
Advisor: Rachel Levy
Students: Jake Bouricius (project manager), Maxwell Lee, Andrea Levy, Margaret Rogers

Geosynchronous communications satellites must be precisely pointed to ensure proper payload delivery. The team was tasked to explore modern control theory including multiple-input/multiple-output techniques to improve the fidelity of the feedback control system for spacecraft attitude. The control system is designed to minimize the system's response to actuator and sensor noise. The team will provide simulation data and performance indicators as experimental and theoretical justification.

CGU/Mathematics Clinic

Los Alamos National Laboratory
Optimizing Smart Power Grids

Liaisons: Russell Bent, Ph.D., Jason Johnson, Ph.D.
Advisor: Allon Percus (CGU)
Students: Robert Carrington (project manager, fall), Amelia Musselman (project manager, spring), Mark Wilson (CGU)

The development of a power system based on renewable resources requires an appropriately designed power grid. This has become increasingly important as the transfer from non-renewable to renewable energy sources has become wide-spread. Our project focuses on optimizing the power grid design by minimizing the combined costs of transmission line placement and power loss. We are developing a hybrid approach for the optimization problem, combining the discrete method of genetic algorithms with a continuous Newton's method.

LANL Clinic team member Rob Carrington '11 describes the project to his parents.

CGU/Engineering/Mathematics Clinic

DYNAR Collaboration, CGU
Cooperative Autonomous Aquatic Vehicles: Mathematics and Robotics

Liaisons: Rachel Levy (HMC), Allon Percus (CGU)
Advisor: Susan Martonosi
Students: Jennifer Flenner (CGU-fall), Matthew Keeter, Dan Moore, Ryan Muller (project manager), Eric Nieters

The Dynamic Networks for Aquatic Robots (DYNAR) research group is developing algorithms for autonomous submaries to cooperatively search an aquatic region. The Clinic team has implemented multiple randomized search algorithms for three-dimensional bounded environments and tested them in simulation. In an aquatic testbed, the team has improved computer-to-submarine communication and created software for tracking the motion of submarines. The search algorithms have been implemented in the testbed to compare data from the physical environment with theoretical results from the simulations.

Computer Science/Mathematics Clinic

Consortium of Ordinary Differential Equations Educators ODEToolkit

Liaisons: Darryl Yong '96, Robert Borrelli
Advisors: Talithia Williams, Christopher Stone
Students: Beky Kotcon, Samantha Mesuro (project manager), Daniel Rozenfeld, Anak Yodpinyanee

The Consortium of Ordinary Differential Equations Educators (CODEE), an organization dedicated to improving the teaching and learning of ordinary differential equations, created an educational, differential equation solving software called ODEToolkit to pursue its goals. During this year, we have implemented an additional numerical solver capable of handling stiff differential equations, made necessary changes to the software's architecture, fixed bugs in the software, and conducted user testing regarding bugs and the usability of the software.

student news

PALMER MEBANE '12 ACHIEVES PERFECT SCORE TO BECOME U.S. PUZZLE CHAMP

Palmer Mebane '12

Palmer Mebane '12 achieved the second-ever perfect score to win the 2011 U.S. Puzzle Championship and to earn the honor of representing the U.S. at the World Puzzle Championships in Hungary in November.

Participants representing 33 countries besides the United States submitted answer forms. Thomas Snyder was second, falling short in his effort to win a sixth consecutive title, solving 20 of 22 puzzles and scoring 349 out of 395 points. William Blatt (309) was third, followed closely by Dan Katz (305), Wei-Hwa Huang (297) and Roger Barkan (290).

Last October, Mebane, Snyder (two-time world Sudoku champion), and veteran competitors Barkan and Huang, won the 19th World Puzzle Championship held in Paprotnia, Poland. The U.S. team is 12-6-1 (gold, silver, bronze) in the 19 editions of the World Puzzle Championships. Mebane, then the rookie on the U.S. team, placed 19th—out of 105 competitors—in the individual round, a record-setting score for a first-timer.

"That Palmer performed so well during his first time at a world championship is a testament to his passion and talent for problem solving," said President Maria Klawe, who noted that Mebane was HMC's top finisher in the 2009 Putnam Mathematical Competition and the recipient of a sophomore mathematics prize. "He's a very talented mathematician."

Try your hand at a puzzle created by Mebane on page 23.

STUDENTS SHINE IN PUTNAM COMPETITION

In a test so challenging that this year's median score was two out of a possible 120 points, landing on the Top 200 list—with a score of 50+—is nothing short of a stellar performance.

And the 39 Harvey Mudd College students who faced more than 4,000 competitors to nab their place in the 2010 William Lowell Putnam Mathematical Competition shined like stars. Seven seized spots in the Top 200 List for the individual category: Palmer Mebane '12, Craig Burkhart '12, Jackson Newhouse '12, Jacob Scott '11, Kevin O'Neill '13, Tum Chaturapruek '14 and Lee Wiyninger '11.

The accomplishment is especially honorable considering only five other, much larger schools—Harvard, MIT, Caltech, Stanford and Waterloo—had more than seven students in the Top 200, said math professor and Putnam Seminar Coach Francis Su.

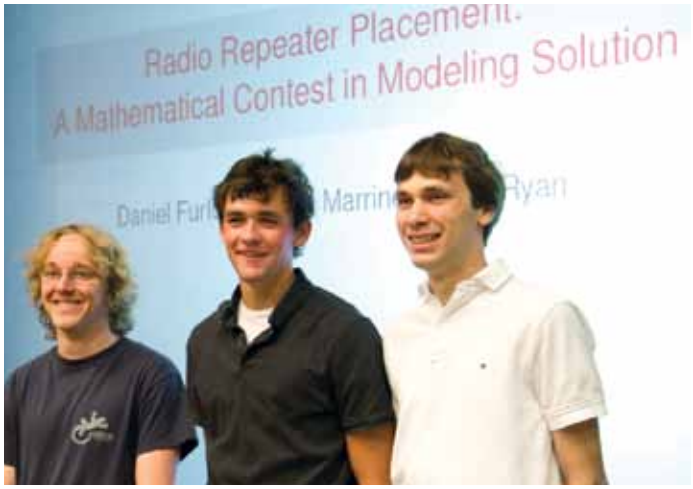
Seven more students made the Top 500 List: Emil Guliyev '13, Jennifer Iglesias '12, Andrew Carter '13, Louis Ryan '12, Ryan Muller '11, Aaron Pribadi '12, and Peter Fedak '13. Additionally, Mebane, Iglesias and Fedak also placed 21st in the competition's team category.

"We are very proud of all our students who represented us in this competition," Su said. "It reflects how much our students appreciate the beauty and joy of doing mathematics."

Established in 1938, the contest is named after William Lowell Putnam, a Harvard graduate who valued academic competitions. The annual competition, held the first Saturday in December, is open to college students in the United States and Canada. Participants are given a six-hour exam, composed of 12 problems, each worth 10 points.

HMC students first participated in the Putnam competition on Dec. 2, 1961 and, in 1991, the HMC team garnered third place.

HMC TEAM RANKS OUTSTANDING IN MCM-ICM STUDENT COMPETITION



Dylan Marriner, Daniel Furlong and Louis Ryan earned an Outstanding for their MCM/ICM teamwork.

Harvey Mudd College Dylan Marriner '12, Daniel Furlong '12 and Louis Ryan '12 earned top honors in the 2011 International Mathematical Contest in Modeling and Interdisciplinary Contest in Modeling (MCM/ICM).

Their team received an "Outstanding" rank, which was given to only eight teams out of 2,775 entries worldwide, for their resolution in reducing the number of radio repeaters needed to serve a geographical area.

Tasked with determining the minimum number of repeaters for radio users in a 40-mile radius, the team used a clustering algorithm to group points in dense population areas and placed repeaters at the centers of each region. Their approach significantly increased the transmission capability of their network.

HMC's seven teams participated in the competition in February, and when the results were announced, all seven had garnered high marks. In addition to the Outstanding team, one team earned a Meritorious designation (top 15 percent), three earned an Honorable Mention (top 45%) and two were designated as Successful Participants.

"This is an incredible showing for HMC and a testament to the strength of our core curriculum and academic program," said Susan Martonosi, MCM/ICM advisor.

The MCM/ICM is analogous to an applied Putnam exam, but in the form of a grueling 96-hour competition. Teams of up to three students are given 96 hours to solve their problem and submit their solution in the form of a research paper, which is judged not only on its scientific and mathematical accuracy, but also on clarity, insight and creativity.

This year's problems concerned
(A) Maximizing "vertical air" achievable on a snowboarding half-pipe,
(B) Minimizing the number of cell phone repeaters needed to serve a geographical area,
(C) Modeling the social, environmental, health and economic impacts of Electric Vehicles.

MATH MODEL GARNERS PRIZE AT INTUIT'S IDEAJAM

In seeking to build a recruiting pipeline within The Claremont Colleges, Intuit initiated a kick-off event March 25, 2011: a cross-functional, 5-C "dream team" for the first ever "IdeaJam" at the undergraduate colleges. Three Mudders participated on the multi-college teams, and one Mudder was a member of one of the Top 3 teams.

Matt McDermott '14 and David Lingenbrink '14, and Logan Kroloff '13 and three students from Claremont McKenna College were among the eight teams presented with the challenge to help Intuit determine how to increase use of its GoPayment credit card processing software.

McDermott and Lingenbrink created a detailed mathematical model that impressed the judges. They were rewarded with a fourth-place finish and $50 Amazon.com gift certificate.

alumni news

MATH ALUMNI APPOINTED TO HMC BOARD

The HMC Board of Trustees recently approved the appointments of **James Bean** '77 and **Greg Rae '00**.

Bean is senior vice president and provost at the University of Oregon and former Harry B. Miller professor and dean of the Lundquist College of Business at Oregon. He spent 24 years at the University of Michigan, including appointments as the Ford Motor Company co-director of the Tauber Manufacturing Institute, associate dean for graduate education and international programs in the College of Engineering and associate dean for academic affairs. Bean was the president of the Institute for Operations Research and the Management Sciences (INFORMS), a charter fellow of the institute and a recent winner of the George E. Kimball medal. Bean received a B.S. in mathematics from Harvey Mudd College and a master's and Ph.D. from Stanford University in operations research.

Rae returns to the board after serving from 2006 to 2009 as a young alumni trustee. After graduating from HMC with a degree in computer science and mathematics, Rae went on to co-found and become chief technology officer of Shiny Boxes. He worked as a software engineer at Google for six years then founded 22 by 7 Labs, an Internet technology company, in 2006. He serves on the board of several non-profits, including Living Liberally and The Tank Space.

DEWAR NAMED OUTSTANDING ALUMNUS

Strategic planner **James Dewar '66** received an HMC Outstanding Alumni Award for his far-reaching contributions. Dewar is the Frederick

James Dewar '66 is presented the HMC Outstanding Alumnus Award by Fred Pickel '74.

S. Pardee Professor of Long-Term Policy Analysis at the Pardee RAND Graduate School. He founded the RAND Frederick S. Pardee Center for Longer Range Global Policy and the Future Human Condition.

Dewar and his co-authors won the Military Operations Research Society's highest award, the Rist Prize, for their paper on "Non-Monotonicity, Chaos and Combat Models." He has done strategic planning at the RAND Corporation for military and other governmental organizations, colleges and universities, Fortune 100 companies and a wide range of other clients. He also led the development and application of Assumption-Based Planning (ABP), a tool for reducing avoidable surprises, and is author of a book on the topic.

Dewar has spoken and published widely on strategic planning, planning methodologies, the long-range future and planning under uncertainty. Dewar's B.S. degree is in mathematics. He has a master's and Ph.D. in mathematics from the University of Southern California.

MORE ALUMNI NEWS

Mathematician and award-winning musician and HMC young alumna trustee **Jennifer Lindsay '02** was featured on CBS-2 News Oct. 5, 2010. The segment highlighted Jennifer's path from oxygen deprivation at birth to becoming a cryptologic engineer with two advanced degrees and an exciting music career on the side.

Sarah Fletcher '09 and **Benjamin Preskill '09** were awarded National Science Foundation Graduate Research Fellowships. Fletcher will study combinatorics at the Georgia Institute of Technology and Preskill plans to study applications of mathematics at the University of California, Berkeley.

Erin Bodine '03 completed her Ph.D. at the University of Tennessee, Knoxville and is now in a tenure-track position at Rhodes College.

Carl Yerger '05 completed his Ph.D. at the Georgia Institute of Technology and is now in a tenure-track position at Davidson College.

Jeff Jauregui '05 completed his Ph.D. at Duke University and is currently a postdoc at the University of Pennsylvania.

Dan Walton '07 is currently pursing his Ph.D. in the Department of Atmospheric and Oceanic Sciences at UCLA. He writes: "My current research is on the topic of regional climate modeling of California and the neighboring ocean. Our work is new and interesting because we are using a coupled model that allows for direct feedback between the ocean and atmosphere. Right now I'm in the process of validating this model by comparing the output data to observed measurements off the California coast. Once the validation is complete we can move on to more high level tasks where we use the model to help us understand the complex interactions between atmosphere and ocean. For instance, we will investigate how topographic land features like coastal mountain ranges can affect the wind patterns, which affect the ocean circulation. Ultimately, once we get a good understanding of how these systems work, we can do a forecast into the future, to see how these systems will vary in response to global climate change. Anyway, I find the research to be really cool and my background in math comes in handy every day. It makes me happy that I went to Mudd where in addition to learning math, I learned physics, chemistry and programming, all of which I use all of the time here."

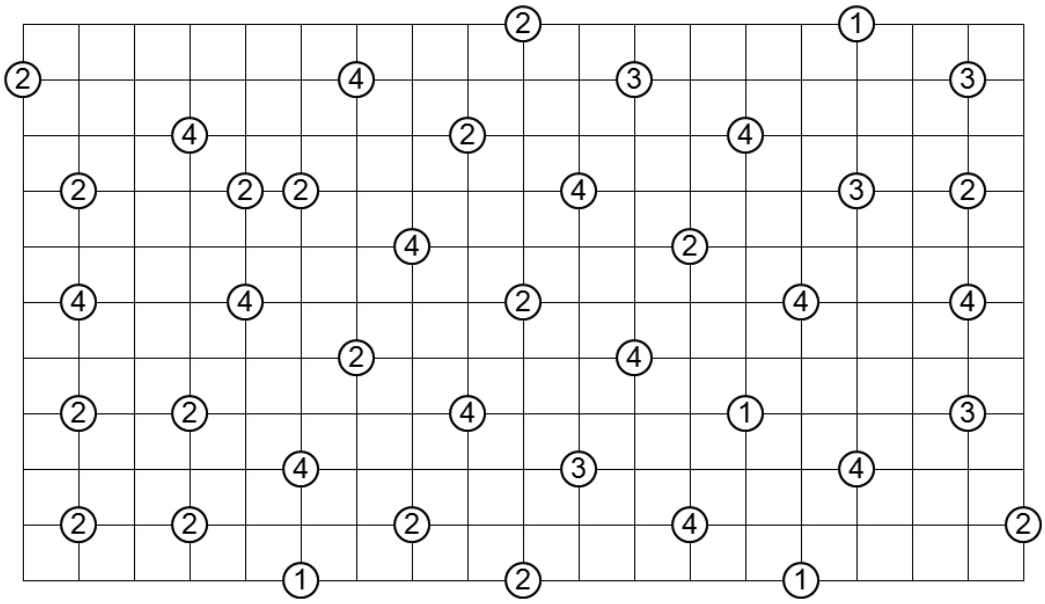
More news to share? Please send email to muddmath@math.hmc.edu.

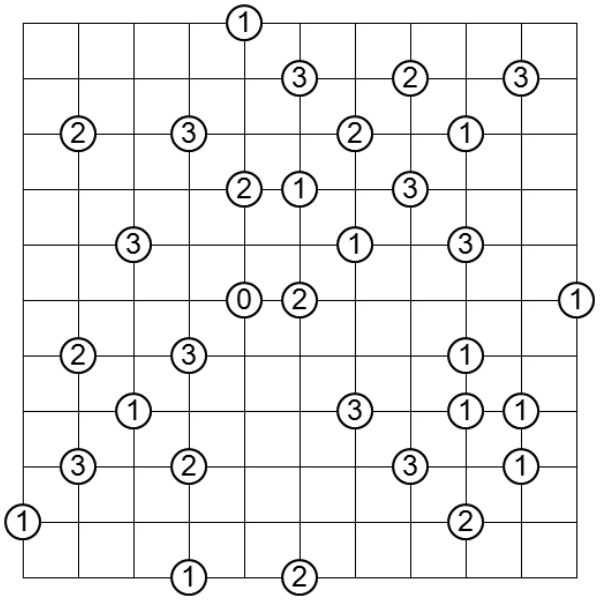
puzzle break

PALMER'S PUZZLERS

Instructions: The object is to shade in some of the squares in this grid so that the circled numbers, which are at the corners of grid cells, correctly indicate how many of the grid cells that it touches are shaded. The unshaded cells in the finished grid must form a single contiguous region. There is no restriction on unclued squares; they may be shaded or unshaded. The solution is unique.

Many thanks to the 2011 U.S. puzzle champion Palmer Mebane '12, who designed these two puzzles. Find more on his puzzle blog http://mellowmelon.wordpress.com/.





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A happy gathering of HMC alumni, current students and faculty at Palace Cafe on Jan. 18, 2011 in conjunction with the Joint Mathematics Meeting in New Orleans. Hope to see you at the meeting in Boston during January 2012!