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Humboldt State University

MINI-FOCUS

THE NEWSLETTER OF THE GOLDEN SECTION OF THE MAA

Michelle Manes Wins Section Teaching Award

Michelle Manes, of the University of Hawai'i at Mānoa, won the 2015 MAA Golden Section Award for Distinguished College or University Teaching of Mathematics. The award was presented at the 2015 Golden Section Meeting at Foothill College, California, on February 28, 2015. (Michelle Manes's complete award citation can be found online at http://sections.maa.org/golden/Teach.html)

Michelle Manes earned her doctorate from Brown University in 2007, and has been a faculty member at the University of Hawaii since then. An active researcher in the intersection of dynamical systems and number theory, Michelle's teaching style is informed by her grounding in mathematics education research and her conviction that all students are capable of learning math. One student writes: "*What made her stand out amongst the other professors were her passion and enthusiasm for what she taught and her relatability to her students.*" In research, she works in the intersection of dynamical systems and number theory. She has been a mentor for both undergraduate and graduate women in mathematics. For example, in 2011 she organized a conference at Banff University for women number theorists. One of Michelle's most important contribution at the UH at Mānoa Mathematics Department has been to the "Math for Elementary Teachers" two-course sequence. The materials that she developed with her colleagues in the College of Education are now the basis for new distance learning courses that will allow students from other Hawai'ian islands to complete their College of Education prerequisites online, as well as to train teachers on other Pacific islands, including Guam and American Samoa. Locally, she is the founder and leader of the Math Teacher's Circle of Hawaii (MaTCH), and in addition, Dr. Manes distinguishes herself with numerous community outreach efforts. For example, she served as a consultant to the Honolulu Museum of Art for a special exhibit in 2013 about mathematics and art, called *Finding x*. Another exhibit is planned for 2015, and Michelle has already been contacted to be a consultant for the reprise.

The Golden Section congratulates Michelle Manes, an incredibly effective and inspiring teacher!

Remembering Peter Stanek

Peter Stanek passed away unexpectedly on October 18, 2014. He was born in Chicago, Illinois, on December 3, 1937. After attending Saint Ignatius High School (but never graduating) he was admitted to the University of Chicago, where he earned a master's and a doctorate in mathematics (that's right no BS) in the summer of 1960 at the age of 22.

He met his wife Jean B. Chan while both were students of mathematics at the University of Chicago, and they got married in 1960. Pete enjoyed a successful career in teaching and working in systems analysis and tele-communications, earning several awards, including a patent. Among other hobbies, he had a lifelong love of flying and participating in ham radio competitions.

Peter was passionate about serving his community. He was a member of the American Mathematical Society and the Mathematical Association of America (MAA). He was elected to serve as a national governor for the MAA, representing business, industry, and government (BIG). He served as chair of the MAA's BIG committee which advises the Board of Governors on BIG issues and he was a founding member of the BIG SIGMAA.

Greg Coxson, current vice chair for membership of the BIG SIGMAA had this to say on Peter's behalf: "*Peter Stanek was a solid supporter of BIG SIGMAA. You could often find him in the room for the contributed paper sessions. He and I shared a common background in defense electronics. I always appreciated that at my first JMM, when I was feeling quite out of place, he invited me to join him for coffee. After that, I always hoped to bump into him at JMM. He had a wonderful smile and a gentle, wry delivery when he spoke*."

Locally, he was the Marin Chinese Cultural Association Treasurer, and he was a long-time board member of the Asian Scholarship Fund. In addition, he participated in and supported the Asian American Alliance of Marin, since its founding over 20 years ago.

After his retirement, Peter began a more focused study of the Mandarin language and studied the history of the Pacific War. He became an unshakable force in seeking redress for millions of victims and survivors of the massive and barbaric crimes against humanity by the Imperial forces of Japan in the Asia Pacific War during 1931-1945.

Peter is survived by his beloved wife, son, daughter-in-love, daughter, sisters-in-law, brothers-in-laws, aunt, nieces, nephews, cousins, and numerous dear friends.

Peter, a former Community Education instructor teaching "Pacific War History" at the College of Marin, was inducted posthumously to the inaugural Asian American Alliance Marin Hall of Fame on November 14, 2014. He also received a proclamation for his quest for justice from the San Francisco Board of Supervisors.

A scholarship, in memory of Peter Stanek, is being established in the Asian Scholarship Fund of the Marin Community Foundation.

Peter Stanek (1937-2014)

News from the Section

Compiled by Walden Freedman

Editor's Note: News is included from institutions who replied before the deadline. To avoid being left out next year, please watch for the call for news each fall season, or contact a section officer.

American River College

There are three new hires: Brett Sanchez, J. Matthew Register, and Cristina Domokos, along with two retirements: Sandra McKaig, and Patricia Peterson. New publications include "*A Stroll through Calculus*" by Anthony Barcellos (published by Cognella), and "*Beginning and Intermediate Algebra*" by Benjamin Etgen (via MyOpenMath). In other news, Roger Davidson of Yuba College has been appointed as American River College's new math dean.

Humboldt State University

Professors Martin Flashman and Diane Johnson have started the gradual retirement process known as FERP (Faculty Early Retirement Program). They teach at a 50% load for at most five years.

A number of students and faculty participated in the Forty-Fourth Annual State of Jefferson Mathematics Congress, October 2-4, 2015 at Whiskeytown Lake, CA. Several students from Sonoma State University and one from San Francisco State University also attended. Next meeting takes place September 30-October 2, 2016.

Dr. Peter Goetz has a new publication, *Some non-Koszul algebras from rational homotopy theory*, joint work with Dr. Andrew Conner of St. Mary's College, published in May 2015 in Bull. London Math. Soc.

Ohlone College

Bob Bradshaw reports that there are two new full-time hires in Fall 2015, Drew Wise and Nabeel Atique. Retirements: Tania Munding in December 2014.

With support from the non-profit group Growth Sector[1], Professor Jeff O'Connell (Math) and Professor Rose-Margaret Itua (Engineering) have created the program Ohlone Math Gateway[2] that is designed to accelerate the progress of students through the math prerequisites for STEM majors.

Prof. Oylum Akkus-Ispir and Prof. Gul Yayli presented the paper "*The Dilemma of Integrating Innovative Pedagogies into College Mathematics Classrooms*" at the Eighth International Conference on e-Learning and Innovative Pedagogies on Nov. 2 and 3 at UC Santa Cruz.

Ohlone College has been recognized by BestColleges.com as Number 7 on the list of California's Best Two-Year Colleges for 2015! According to Best Colleges, their higher education experts reviewed nearly 250 two-year schools in the state, taking into account key performance indicators such as retention, graduation, and loan default rates. One of the metrics on the Student Success Scorecard[3] is improvement in remedial math; that is, the percentage of students whose first math class was basic skills who eventually completed a college level math course. There are 25 colleges that are grouped together as peers, and Ohlone had the highest performance rate of all 25. Our 46.1% rate of basic skills math students completing a college level math course with a grade of C or higher was the only rate above 40%, with a peer average of 28.1% and a statewide average of 31.0%. What's more, both our African American and Hispanic students had the highest rate among our peers and both far exceeded the statewide rates.

[1] http://growthsector.org/

[2] http://www.ohlone.edu/org/collegeadvancement/articles/20142015/20150519mathgateway.html

[3] http://scorecard.cccco.edu/scorecard.aspx

Teaching Awards:
Call for Nominations

2017 MAA Golden Section Distinguished College or University Teacher of Mathematics Award (General)

&

2017 MAA Golden Section Distinguished College or University New Teacher of Mathematics Award

The MAA has two awards for distinguished college or university teaching of mathematics: the Deborah and Franklin Tepper Haimo Award (instituted in 1991) and, for beginning college or university teachers of mathematics, the Henry L. Alder Award (instituted in 2003). The recipient of the Golden Section Teaching Award (General) is nominated by the Section for the MAA Haimo Award. The recipient of the Golden Section New Teaching Award is nominated by the Section for the MAA Alder Award if the recipient holds a Ph.D.

The Golden Section has a two-step nomination process that consists of (i) the initial nomination, and (ii) the full nomination. The initial nomination is very simple, and requires the filling out of a one-page form together with a one-page summary that supports the nomination. After screening the initial nominations, the Teaching Awards Committee will invite the nominators of clearly competitive nominations to submit full nominations.

Members of the Golden Section are encouraged to nominate their exceptional colleagues for the two Golden Section Distinguished Teaching Awards (New Teacher and General). The formal Call for Nominations and the Nomination Form files are available at

http://sections.maa.org/golden/Teach.html.

These files describe the award and eligibility requirements. The initial nomination deadline is

April 30, 2016.

Please direct questions to John Thoo, Teaching Awards Committee Interim Chairman, at the Department of Mathematics and Statistics, Yuba College, 2088 N Beale Rd, Marysville, CA 95901-7605, jthoo@yccd.edu.

Interested in serving in a leadership role?
(Chair cycle, Book Sales, Teaching Award Committee, etc.)

Interested in hosting the section meeting?

Please contact one of the officers listed on the cover for more information.

⇒⇒⇒ **We want you!** ⇐⇐⇐⇐

Previous Teaching Award Winners

An asterisk precedes names of those who went on to win a national Haimo Award.

1992 **G. D. Chakerian**, UC Davis
1993 ***Paul R. Halmos**, Santa Clara University
1994 **Jane Day**, San José State University
1995 ***Edward M. Landesman**, UC Santa Cruz
1996 **G. Thomas Sallee**, UC Davis
1997 **Jean J. Pedersen**, Santa Clara University
1998 **Donald C. Pfaff**, University of Nevada, Reno
1999 ***Leonard F. Klosinski**, Santa Clara University
2000 ***Evelyn Silvia**, UC Davis
2001 **Wade Ellis, Jr.**, West Valley College
2002 ***Paul Zeitz**, University of San Francisco
2003 **Peter Tannenbaum**, Fresno State
2004 ***Gerald L. Alexanderson**, Santa Clara Univ.
2005 **Russell Merris**, Cal State East Bay
2006 **Tatiana Shubin**, San José State University
2007 **William Fisher**, Chico State University
2008 **John B. Thoo**, Yuba College
2009 ***Allan J. Rossman**, Cal Poly San Luis Obispo
2010 **Dennis Smolarski**, Santa Clara University
2011 **Joseph Conrad**, Solano Community College
2012 ***Matthias Beck**, San Francisco State University
2013 **Steven Blasberg**, West Valley College
2014 **Duane Kouba**, UC Davis

A Message from the Governor

by Shirley Yap

Greetings MAA members! 2015 was truly an eventful year, and not just for the national organization. I hope many of you were able to enjoy some of the MAA centennial celebrations, either on the national or local level. This year, we also rolled out a new departmental membership, which will give an unlimited number of math students MAA memberships for a fixed price.

This year, the Golden Section had, for the first time in many years, two sectional meetings, our regular one in the spring and in the fall, a joint sectional meeting with the Southern California/Southern Nevada Section. We are busy preparing an interesting and fun Golden Section meeting February 27th at UC Davis. For the first time in the history of our section, we will be hosting a mathematical art exhibit. We would love to receive submissions from anyone who creates art involving anything mathematical. To find out more about this exhibit, please go to the MAA Golden Section webpage.

The Board of Governors continues to analyze and debate our roles and responsibilities and I will keep you up to date on any changes that may occur in the organizational structure of the MAA. Finally, I'd like to remind everyone that every year, the national organization gives a variety of teaching, research, writing, and service awards and that any of you are welcome to nominate candidates. The national organization also has a plethora of committees that might interest you. You can find more information about awards and committees at MAA.org.

I hope to see many of you at the Joint Math Meetings in Seattle this January and at UC Davis in February.

Report on the Section Meeting at Foothill College, February 28, 2015

by Ed Keppelmann (photos by Jonathan E. Shapiro, except where noted)

In what was probably one of the most inspiring welcomes the section has seen in a very long time (if ever), Foothill-De Anza Community College District Chancellor Linda Thor told us how important our work is as the cornerstone of the STEM fields. She described the powerful changes that Ion Georgiou's work with students and STEM literacy would continue to make at Foothill, despite his untimely passing.

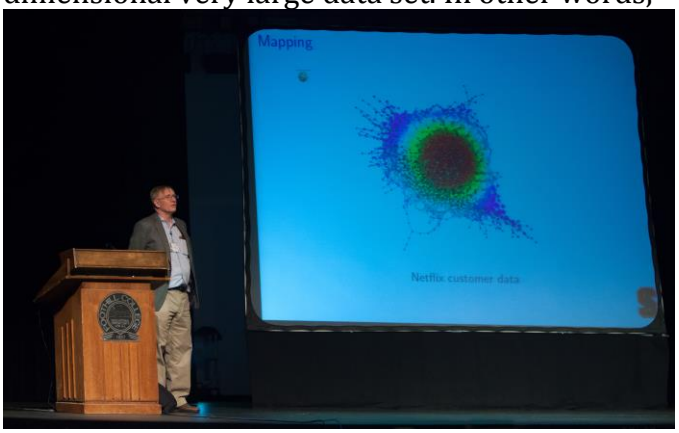
The first talk was pure fun as **Michael McGinnis** told us the story of his wonderful 3-dimensional **Perplexus** puzzles. Right after the meeting I was quick to order a full set of these remarkable puzzles – The Original, the Warp, The Rookie, the Epic, and The Twist (and there is now a new Star Wars Death Star Perplexus). If you haven't tried these puzzles they are nothing like the labyrinth of old – but beware: they can be incredibly addicting – I almost forgot to go and teach my classes when I first gave them a try! There are tracks which have tracks underneath, tubes, elevators, spirals, staircases and platforms of all

The Perplexus Warp
photo courtesy of www.vat19.com

sorts. Michael told of his marketing exploits – initially TOYS R US didn't know how to stack them on their shelves and at one point marketing experts sensed a need to make them battery

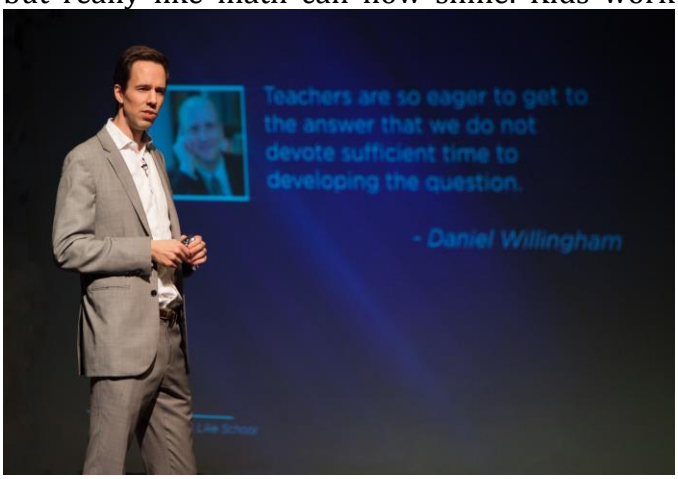
operated so a somewhat irrelevant timer was put into one model. When this version was reproduced in China without the battery, the shape of the battery compartment stayed on as a permanent feature of the puzzle – sort of like a human's appendix that no longer serves any purpose! He even has a $30,000, 36 inch diameter version for the true collector.

Gunnar Carlson of Stanford told us about the shape of data. This is a remarkable notion that in the age of high speed computation can give us enormous insight into very large data sets. To understand the basic idea, imagine a very high-dimensional very large data set. In other words,



there are many points to the data and each point is described by a large number of parameters. For example, you could describe a certain genome sequence for each of a large set of animals or perhaps the many features of a particular patient's cancer symptoms along with their treatment would encompass another type of point. You could take an NBA player's point totals in a game-by-game recounting of the regular season. Then, depending on the application, we need to define a metric so that we have a quantitative way to determine the distance between two data points. So maybe in the case of the NBA player we don't care when a particular score was made, but rather we would store the scores in increasing order, and then work component-wise to measure distance. Once this is done we can then define, for each $d > 0$, the graph which is created when the data points (vertices) are either combined when their distance is less than d or connected when their distance is between d and $2d$. We then look at those topological features of this graph which persist when d increases over large intervals. Of course initially the graph has no edges when d is tiny and ultimately when d is big there is only one vertex. The key is what occurs in between and how long a particular feature lasts. Instead of using distance you could look at other features of the data where thresholds vary with a parameter. One example presented dealt with variations in breast cancer. In fact, the shape of the data showed that even within a portion of the data representing very seriously ill patients there was a pocket of high survivors. Realizing how close bad patients are to such features suggested methods of treatment.

The luncheon talk was presented by **Dan Meyer** (also of Stanford but in math education) who has become quite famous with his problem-based videos. These wonderful three-act stories present a scenario visually and then ask questions that cause all sorts of creative problem solving behaviors in children. Kids who were previously held back by weaker reading skills but really like math can now shine. Kids work

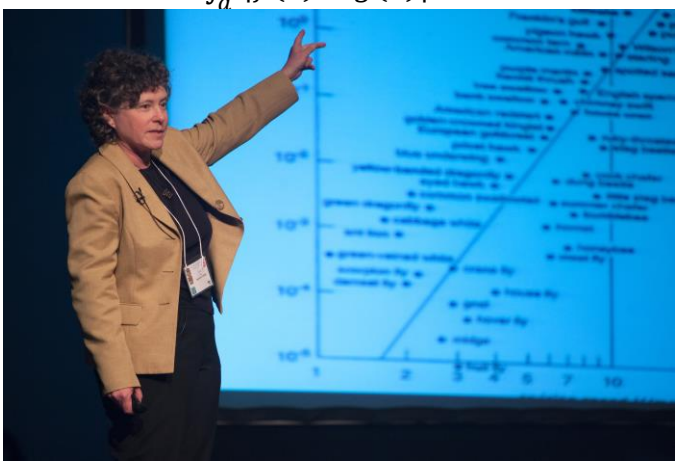


together so they don't have to know everything - they just have to contribute to the process. Dan's problems lead kids to define, argue, listen to others and of course learn. It's a philosophy that should give all of us pause to consider. Check out Dan's You Tube video "Math Class Needs a Makeover" and a list of his 3-act tasks at

http://www.watsonmath.com/2012/04/24/spreadsheet-of-dan-meyers-tasks-in-three-acts/

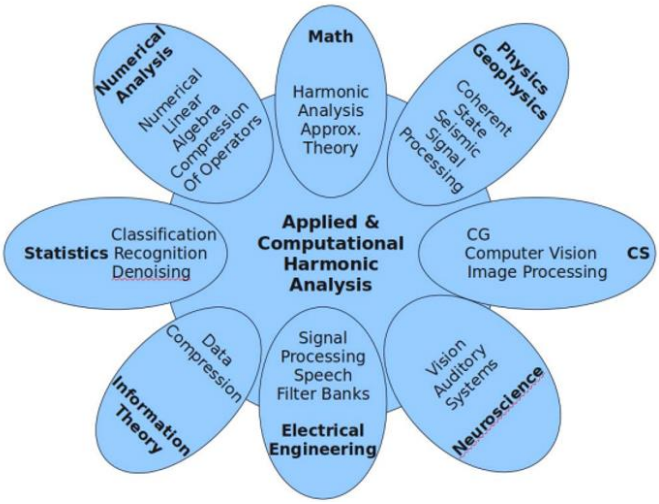
Karen Saxe of Macalaster College and the MAA's 2nd Vice President talked about Function Approximations. The talk outlined the rich theory behind various approximation techniques and their history. Did you know that one of the first applications of the least squares algorithm was to settle a controversy between Newton and Cassini as to whether the earth is oblate or prolate (i.e., flattened so that the poles are closer than they should be on a sphere or farther apart than they should be?). Newton won with his oblate argument using data collected on the variation of arc length with latitude. What's the difference between least squares and interpolation? In least squares calculations your measure of closeness is about a relationship only at certain data points whereas you could look for approximations that minimize distance to every point with distance measured as

$$\int_a^b |f(x) - g(x)|dx.$$

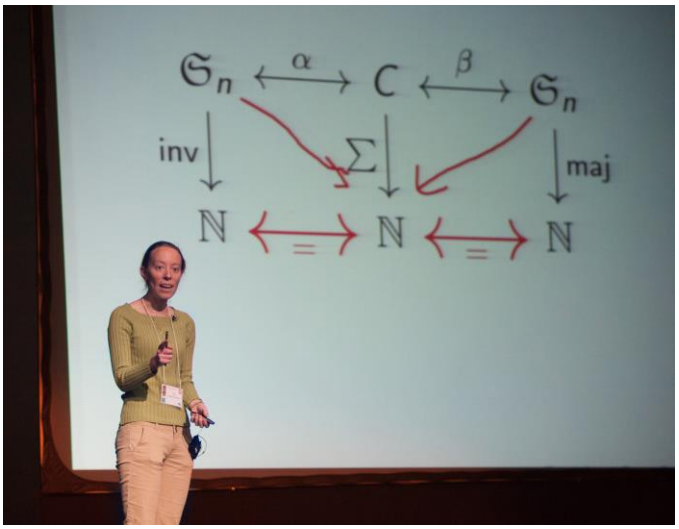


Ordinary interpolation may not do a very good job at this away from the interpolated points. The Taylor approximation at a given point for a function is an extreme form of Hermite interpolation where we find a polynomial that matches values and derivatives at various points. You can do this by applying the Gram-Schmidt process to the span of $\{1, x, x^2, x^3, \dots\}$. This gives you an orthogonal basis for the function space of all possible candidates to be approximated and then you can use a finite subspace that suits the accuracy you need. If you are approximating periodic functions then use a basis of sines and cosines which can remain bounded unlike polynomials which will eventually go off to $\pm\infty$.

The vast interplay of approximation theory with many applied and pure areas of mathematics is profoundly illustrated using the following diagram from Naoki Saito:



Angela Hicks of Stanford closed the main lineup of speakers with a deep discussion of the permutations which leave invariant Dyck paths, parking functions and sandpile models. Each of these configurations has its own very interesting combinatorics. A **Dyck path** is a string of X's and Y's such that no initial string has more Y's than X's. A **parking function** of length n is a list of size n consisting of the positive integers (possibly with repeats) from 1 to n. The ith coordinate represents the preferred parking location of car i. Cars cannot back up and they encounter the spots in increasing order with Car 1 going first, Car 2 next, etc. If a car finds its desired spot open, it will park there. Otherwise it will seek the next open space. Parking functions are those lists in which everyone finds a spot. For example, with n=3 (3,2,1) works nicely but (2,2,3) does not. A sandpile model on a graph involves randomly placing pebbles one at a time on the vertices of the graph. When the number of pebbles at a given vertex equals the number of its neighbors then it shares a pebble with each – i.e. the sand pile has reached a critical height somewhere and it collapses. These collapsings can cause chain reactions and consequently an



ordered set or sequence of toppling vertices. What permutations preserve these sequences in some suitably defined way?

The day ended with the following four **Ignite Talks**. These are precisely timed five-minute lectures in which 20 power point slides advance whether the speaker is ready or not!

Karen Saxe reminded us of the upcoming 100th anniversary celebration of the MAA and all the great things the MAA does from grants and the AMC to publications galore. She bragged about the Math Olympiad team's second place finish in 2014 – little did we know then that we would soon have some winners!

Tatiana Shubin probably had the hardest fast paced talk of all as she told us about a series of unsolved problems. Is it possible to color all the points on a circle either red or blue so that no three points of the same color form an isosceles triangle? The answer turns out to be NO but what if you allow r colors? The numbers $W(r,k)$ come from van der Waerden's theorem which says that given positive integers r and k there is an N so that if you color $\{1, 2, \dots, N\}$ with r colors then there will be an arithmetic sequence of length k of one color. $W(r,k)$ is the minimum such N. A small set of van der Waerden numbers have been computed (e.g. $W(2,6) = 1132$) but all we know in general is that $W(r,k) \le 2^{2^{r^{2^{2^{k+9}}}}}$. In her five-minute talk she presented no less than 11 unsolved problems! That's an average of one problem every 27.27 or so seconds! That has to be the world's hardest exam! How much time do we get, Tatiana?

Ed Keppelmann, with many thanks to the great section histories of Leonard Klosinski, tried to do the history of the section justice in a mere five minutes. The first secretary of the section Harold Bacon was heard to say:

"A professor of things mathematical
Decided to take a sabbatical
He intended to roam
While his wife stayed at home
But to this she demurred most emphatical!"

Some great talks of the past included (in 1942) "*The theory of budgets based on Parabolic Engel curves*" and in 1993 Paul Halmos asking "*Is research necessary after lunch*?" The five greatest remarks in section teaching citations went from #5 about Steve Blasberg: "*He literally leaves his half-eaten lunch in the staff break room in order to help a student.*", to #3 about a student evaluation of Leonard Klosinski : "*The most memorable course I took was Advanced Calculus during the start of my sophomore year. This was a difficult and challenging course with exams that must have been inspired by the Putnam*." The #1 quote has to be about Paul Halmos' philosophy of life: "*The major part of every meaningful life is the solution of problems*."

Frank Farris told us a good bit about his new book on creating symmetry – see the article on the SLO meeting in this issue of the mini-focus for more details.

The following seven posters were presented at the meeting:

Wenjia Bai, Jake Hasse, and John Spalluzzi of Saint Mary's College of California performed a study of crime types versus personal characteristics for inmates in Marin County. They found some distinct patterns.

Sofia Burille also of St Mary's looked at the tree cover number and the positive semidefinite zero forcing number of a graph. These numbers can be calculated by working on certain subgraphs and combining the results.

Drew Gallatin and Ryan Smith of Cal Poly used time series analysis and other techniques to compare differing conceptual climate models of the Mid-Pleistocene Transition. Currently two models are very different but their physics match what is known so some deeper analysis is needed.

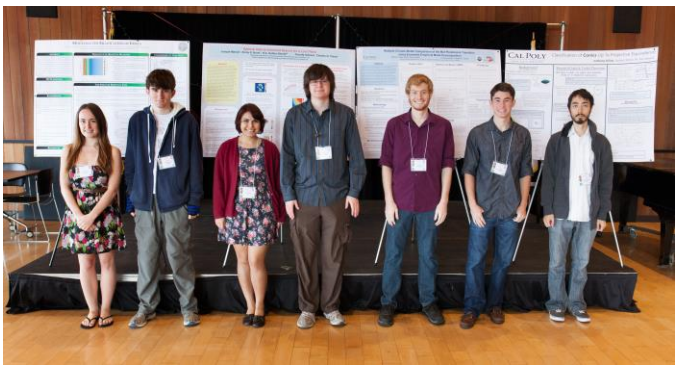
Antonio Silveti-Falls of CSU Chico basically asked the following: Even when a statistical distribution is not normal, large enough sample sizes will have sample means which are normally distributed. How do the confidence intervals produced by such methods compare to using Bayesian credible intervals?

Anthony Kling and Zachary Straus of Cal Poly studied how to define and consider conics over non-algebraically closed fields. The main effort was to work over $\mathbb{Q}$ but this is examined using *p*-adic number fields.

Maureen N. Smith, Anthony Bardessono, and Donna L. Martin of Cal Poly looked at a model to eradicate the Ebola virus. They studied the effects of vaccines and cures strategically employed in time and space.

Joseph L. Marsili, Emily S. Nunn, and N. A. Sutton-Smolin of Cal Poly created a model to search for plane wreckage in the open ocean. In particular, they looked at how models of ocean current can change a projected probability distribution for the wreckage (based on an aerial search) as time passes.

The Foothill Meeting attendance was 156 and included 59 students.



Seven students from Cal Poly and their posters

Report on the Joint Golden/So Cal Meeting at Cal Poly, Nov. 14, 2015

by Ed Keppelmann (photos by Jonathan E. Shapiro)

On Saturday November 14, 2015 the Golden Section of Northern California, Northern Nevada and Hawaii teamed up with the section of Southern California Southern Nevada for a Joint meeting at California Polytechnic in San Luis Obispo. The meeting had just 111 attendees with only 39 of these from the Golden Section. Thanks to our colleagues in the south, the organization of the meeting was impeccable and the three main talks exceptionally good:

Pat McKeague of XYZ textbooks gave a very intriguing lecture on the spiritual side of mathematics. The talk was a very enjoyable trip through a variety of connections (some known but others quite remarkable) between the ideas of Pythagoras, Fibonacci, Pascal, Mandelbrot and others. (e.g., did you know that the Fibonacci numbers occur in Pascal's Triangle as certain diagonal sums?) The really fun part was a variety of great quotes, such as

"*What's the best part of being a mathematician? I'm not a religious man, but it's almost like being*

in touch with God when you're thinking about mathematics. God is keeping secrets from us, and it's fun to try to learn some of the secrets."
Paul R. Halmos (1916-2006)

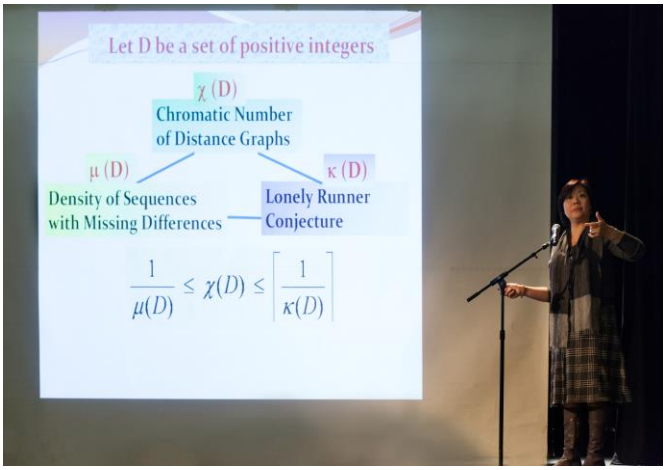
"*An equation for me has no meaning, unless it represents a thought of God.*"
S. Ramanujan (1887-1920)

There were also a variety of other gems such as the following: Turing invented the Turing test where humans try to tell through interrogation if a being is human or merely a computer. Pat pointed out that the modern CAPTCHA system (and other similar schemes) is the reverse, where a computer tries to determine whether you are human or a computer.

Daphne Liu of CSU Los Angeles (a former SoCal teaching awardee) gave us a remarkable tour of graph theory and chromatic numbers in her talk about forbidden sets, graph colorings and the lonely runner conjecture. Take a set D of positive integers and a maximal infinite set S of positive integers with the property that if $x, y \in S$ then $|x - y| \notin D$. Let $\mu(D)$ denote the density of S within the positive integers. (This notion is in fact well defined). A distance graph on D is a graph whose vertex set is $\mathbb{Z}$ and is such that there is an edge between integers a and b iff $|a - b| \in D$. The chromatic number $\chi(D)$ is the minimum # of colors needed to color the integers of this graph in such a way that no two adjacent integers have the same color. It is known for example that if D is the set of all primes, then $\chi(D) = 4$. When D is finite we can define

$$\kappa(D) = \sup\{||tD||: t \text{ is real}\}$$

where for any real number x we define $||x||$ to be the minimum distance from x to the nearest integer. (e.g. $||1.2||=0.2$ and $||1.9||=0.1$). This is related to the notion of a lonely runner: For some positive integer $k = |D|$ imagine that there are k runners on a circular track of length 1 all



moving at different constant speeds. The Lonely Runner Conjecture is that each of the runners will at some time be lonely – i.e., they will be greater than $1/k$ units away from all the other runners. This has been proved for some small values of k.

One of the big points of Dr. Liu's lecture (besides how she herself was inspired to research mathematics and how she passes this on to her many students) is that

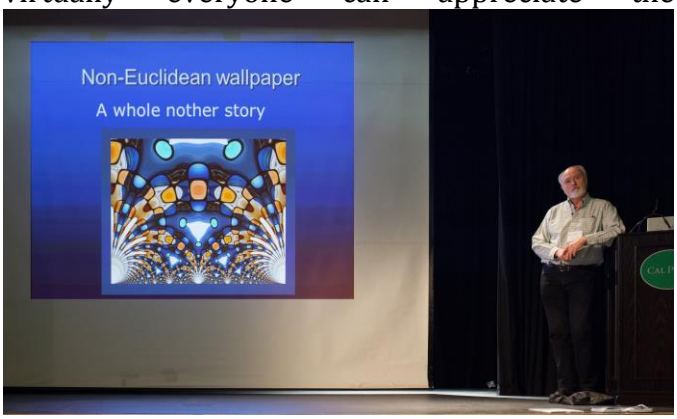
$$\frac{1}{\mu(D)} \leq \chi(D) \leq \frac{1}{\kappa(D)}$$

Thinking of the previous talk one cannot discount the remarkable connections (maybe even spiritual?) drawn together by this statement.

Frank Farris of Santa Clara University brought us into his artistic world of symmetry through his wonderful new book *Creating Symmetry: The Artful Mathematics of Wallpaper Patterns*, from Princeton University Press[4]. Frank hopes that the methods introduced here which employ "wallpaper waves and photographs" and use analysis, rather than the traditional discrete methods that typically characterize symmetry, will ignite a new generation of artists and visually creative minds. The current text (light reading for the research mathematician yet enjoyable even for a former student of calculus and a great education for those in between) is a recipe manual for these amazing images. Frank

[4] http://press.princeton.edu/titles/10435.html

demonstrated applying them to everything from famous photos to some personal images of his. His next project is a "wallpaper look book" so virtually everyone can appreciate the



beauty these algorithms create. Frank promises that the book provides great connections between all sorts of undergraduate math courses that faculty might teach. There was also some work using non-Euclidean Geometry and Escher-type ideas. The book includes discussion of Frank's own artistic tastes and inspirations which make this work go far beyond any ordinary textbook.

The following contributed talks were given by students of the Golden section: (P denotes the presenter)

Caleb J.-L. Miller (P), Tuyen Q. Pham, and Skyler R. Young of Cal Poly presented work on how data can be assimilated into ocean current models. In particular, how do the singular value decompositions of the predicted variables tell you where the data should come from for optimal accuracy of the model?

Sean Gasiorek of UC Santa Cruz extended the classical Tait-Kneser theorem for osculating circles of a strictly monotonic planar curve (these are nested and disjoint) to various settings involving non-differentiable foliations with smooth leaves.

Xiaoyan Chong, Sha Li (P), Minglu Ma, and Yue Wang of San José State University presented their efforts from a business data analysis contest (hosted by Kaggle) in which a database of 146,000 customers is considered for various forms of outreach like targeted emails. The data had many features of the customers but also contained many missing fields. Their result was a response rate of 79.6% which is extremely close to the Kaggle based optimal rate of 80.4%.

Dan Li (P), Wilson Florero-Salinas (P) and Carson Sprock of San José State University used principal component analysis (PCA) and a kernel support vector machine to classify and digitally recognize various handwritten digits. The PCA method defines a certain vector subspace of possible writings and their method basically projects the samples to one of the subspaces created for each digit. Their method improves on the speed and accuracy of current techniques.

Jonathan Lindgren (P), Zach Zhang (P), and Chad Eckman of Cal Poly and **David J. Sacco** of Oklahoma State University showed how to use geometric harmonics to reconstruct images which have been damaged up to 70%. The method is iterative and can do its job in about 30 minutes on a desktop computer.

Heidi Keas and Robert Lee of Cal Poly looked at a notion of left and right n-inverses for linear operators on finite dimensional vector spaces. They study spectral compatibility for these notions, when a one-sided inverse is a two sided inverse and how one-sided inverse is a two sided inverse and how the result can be written as an ordinary inverse plus the sum of two nilpotent matrices.

THE MATHEMATICAL ASSOCIATION OF AMERICA – GOLDEN SECTION
Saturday, February 27th, 2016, at UC Davis
All talks will be held in Giedt Hall 1001
Lunch is buffet style at TERCERO dining (short walk from Giedt Hall)

Registration 8:00—11:00 am	**Refreshments** 8:30—10:30 am	**MAA Book Sale** 8:30 am—4:00 pm
Giedt Hall	Giedt Hall entrance	Giedt Hall entrance

8:45–9:00 **Opening Welcome**
Giedt Hall 1001
Presider: **TBD**

9:00–9:50 **Persi Diaconis**, Stanford University
Carries, Group Theory, and Additive Combinatorics
Presider: **TBD**

9:50–10:05 Golden Section Business Meeting and Governor's Report
Giedt Hall entrance

10:10–11:05 **Rekha Thomas**, University of Washington
Graph Densities, Extremal Combinatorics and Optimization
Presider: **Tom Freeman**

11:10–12:00 **Janko Gravner**, UC Davis
Randomness and order in random order
Presider: **Shirley Yap**

12:00–1:00 **Lunch** (at Tercero Dining Commons, short walk from Giedt Hall, see map)
Buffet style, many options available including vegan and gluten-free; soft drink, coffee, tea and dessert are included. Cost: $15 in advance. You must have a ticket to have lunch, tickets to be purchased in advance while registering.

1:00–2:30 **Student Poster Session and Mathematical Art exhibition**
Giedt Hall, rooms 1002-1003
Organized and curated by Shirley Yap, CSU East Bay
Refreshments available in lobby

2:40–3:30 **Erica Flapan**, Pomona College (Pólya Lecturer)
Intrinsic properties of graphs in R^3
Presider: **Joseph Conrad**, Solano Community College

3:40–3:55 **Teaching Awards Ceremony**
Giedt Hall entrance
Presider: **John Thoo**, Yuba College, Teaching Award Committee Chair

4:00–4:50 **Bernd Sturmfels**, UC Berkeley
Eigenvectors of Tensors
Presider: **Chris Goff**

PROGRAM ABSTRACTS

PERSI DIACONIS, Stanford University, *Carries, Group Theory, and Additive Combinatorics*

Abstract: When we add numbers in the usual way, "carries" occur (for two digits chosen at random, the chance of a carry is 45%). We can do better, by a factor of two, by using signed digits but no choice of digits does any better. This last result is a theorem in additive combinatorics. The same kind of questions can be asked for any group (as I will explain, carries are co-cycles). With Shao and Soundararajan, we proved the following: Let H be a normal subgroup of a finite group G. Let X be co-set representatives for H in G. Let $C(X)=\#\{x,y \text{ in } X \text{ with } xy \text{ outside } X\}/|X|^2$ (so $C(X)$ is, at most, 1). We show that if $C(X)$ is greater than 7/9, the extension splits (there is a choice of co-set representatives with no carries).

REKHA THOMAS, University of Washington, *Graph Densities, Extremal Combinatorics and Optimization*

Abstract: One of the cornerstones of extremal combinatorics is the 1907 result of Mantel that a triangle-free graph on n vertices cannot have more than half the maximum possible number of edges as n goes to infinity. The more detailed version of this question asks what the edge density will limit to, given a specific triangle density. The full answer to this question eluded mathematicians for almost 100 years until it was settled by Razborov around 2007 using a framework called flag algebras. This tool has led to several other powerful results in extremal combinatorics. I will present a new take on this approach using symmetry exploiting methods in optimization. Along the way one encounters algebra, combinatorics, probability, representation theory, and optimization, making for a wild ride across several mathematical landscapes. Joint work with Annie Raymond and Mohit Singh.

JANKO GRAVNER, UC Davis, *Randomness and order in random order*

Abstract: The talk will be an elaboration on the principle that a mixture of randomness and order makes life interesting. A common lie heard from mathematicians is a variation of: "The talk will be understandable by general audience." I will take that statement as a challenge, presenting ideas such as self-organization and metastability with no formal statements at all, in fact with no mathematical symbols.

ERICA FLAPAN, Pomona College, *Intrinsic properties of graphs in* R^3

Abstract: Knot theory is the study of embeddings of simple closed curves in R^3. A natural extension of knot theory is the study of embeddings of graphs in R^3. However, in contrast with knots, the structure of a graph can be complex, and this can affect all of its embeddings. If every embedding of a graph has a particular property, then we say that property is *intrinsic* to the graph. For example, a graph is said to be *intrinsically knotted* if every embedding of the graph in R^3 contains a knot. In this talk, I will discuss intrinsic knotting and other intrinsic properties of graphs.

BERND STURMFELS, UC Berkeley, *Eigenvectors of Tensors*

Abstract: Eigenvectors of square matrices are central to linear algebra. Eigenvectors of tensors are a natural generalization. The spectral theory of tensors was pioneered by Lim and Qi a decade ago, and it has found numerous applications. We discuss the use of orthogonal tensor decompositions in data analysis, and we present work with Abo and Seigal aimed at characterizing which configurations of vectors arise as the eigenvectors of some tensor. This lecture also serves as an invitation to applied algebraic geometry.

How to Register

All participants should first **register online** at http://sections.maa.org/golden/. After registering online, you can pay by credit card (11% surcharge), or by sending a check (arriving no later than February 19, 2016 and made payable to the MAA) to

MAA 2016 Meeting & Luncheon
Department of Mathematics and Statistics MS084
University of Nevada Reno
Reno, NV 89557

If you experience any problems, contact Ed Keppelmann at keppelma@unr.edu or 775-722-0658.

General Retired Student (all levels) or unemployed Speaker, poster presenter, student worker	$20 $10 $5 Free (register online with pay by mail option)
Luncheon	$15 (in advance)
Suggested donation to support student members	$10

Note: there are no other convenient dining options on the UC Davis campus on Saturdays within walking distance. Please consider sending an extra $10 to support student members.

Mathematical Art exhibition

For the first time in the history of the Golden Section, we will be hosting a mathematical art exhibition. The art exhibit will take place during the break between the morning and afternoon sessions (1:00 to 2:30 pm). During that time, the artists will be present to discuss their works with viewers. If you know anyone who produces art with a strong mathematical theme or content, please encourage them to submit their piece for consideration in the exhibit. Artists are expected to register for and attend the conference. Artists are also responsible for their pieces throughout the conference. Artist participants may store their pieces in a locked room until the exhibition begins. **Submissions**: Please email at most two photos (< 10 MB each) of each piece you'd like to submit, along with a brief description (< 100 words) of the piece, to shirley.yap@csueastbay.edu. Deadline for submission: January 20, 2016.

Conference Location and Parking Information

The conference will be held at **Giedt Hall, Rooms 1001-1003**. Parking is free in the Pavilion Parking Structure at the corner of Hutchison Drive and Dairy Road (see map). No permit is required on the weekend.

Directions

See http://visit.ucdavis.edu/tourreg/directions.cfm for full directions and see below for a campus map or visit http://campusmap.ucdavis.edu/.


Parking
Events/Lectures
Lunch
UCDAVIS
CAMPUS MAP
Legend
Campus Buildings
Student Housing
Faculty/Staff Housing
Under Construction
Service Vehicle Gate
Restricted Parking
Visitor Parking
Information
Unitrans Terminals
Arboretum Gardens
ATHLETICS
CONFERENCE AND EVENT FACILITIES
EATERIES
GALLERIES
GARDENS/ OUTDOOR SPACES
PERFORMANCE HALLS

Call for Student Posters

Who, When and Where
All undergraduate and graduate mathematics students, Saturday, February 27, 2016 at UC Davis.

What
Presentations of research, new approaches to old problems, solutions to problems from mathematics journals, results of class projects or mathematical modeling contests, historical investigations in pure and applied mathematics, mathematical topics outside the standard curriculum, or mathematical investigations arising from internship experiences.

Why
The meeting provides a great opportunity to learn about interesting and entertaining areas of mathematics, as well as to network with other students and professors. Student presenters receive **complimentary registration and Saturday luncheon**, plus a **free one-year membership to the MAA** or (for those who are already MAA members) a **free book**.

Details
If you wish to participate or have any questions (e.g., whether your idea is appropriate for presentation or what size font to use on your poster), contact Professor Kristen Beck (see contact info below). Participants must have an email address, possibly through a faculty mentor, where they can be contacted. Email your name and an abstract (2-5 sentences, LaTeX typesetting is acceptable), including poster title, name of institution, and name of faculty advisor, to Professor Beck, no later than **Friday, February 12, 2016**. All student posters should be typed, illustrated, and displayed on a board 3 feet tall by 4 feet wide. Posters will be on display throughout the meeting, including during the scheduled poster session from 1 to 2:30 pm. For more information about the 2016 Golden Section Meeting at UC Davis, visit http://sections.maa.org/golden/MeetingMAA-UCD.html.

Contact
Kristen Beck, Department of Mathematics, Saint Mary's College of California, Moraga CA 94575
(925) 631-6298 (Office), kab24@stmarys-ca.edu.

In alphabetical order by last name, Trevor Chan, Jason Goss, Shengqiao Luo, Melody Molander, Hannah Polterock, and Brendon Verissmo of UC Davis at the Poster Session at the Foothill College Meeting, February, 2015.