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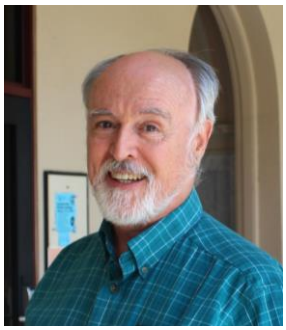
MINI-FOCUS

THE NEWSLETTER OF THE GOLDEN SECTION OF THE MAA

Frank Farris Wins Section Teaching Award

Frank Farris, of Santa Clara University, won the 2018 MAA Golden Section's Distinguished College or University Teaching of Mathematics Award. The award was presented at the 2018 Golden Section Meeting at CSU East Bay, California, on February 24, 2018. (Frank Farris's complete award citation can be found online at http://sections.maa.org/golden/Teach.html)



After he majored in mathematics at Pomona College and earned his Ph. D. from M.I.T., he held a three-year postdoctoral position at Brown University. Since 1984, he has held a permanent faculty position at Santa Clara University, where he has had a stellar career. A full professor, he is currently the chair of the Department of Mathematics and Computer Science.

Previously, Professor Farris won Santa Clara University's David Logothetti Teaching Award, and the MAA's Trevor Evans Award for his article "The Edge of the Universe" in the September 2001 issue of Math Horizons. Dr. Farris is a true Renaissance man.

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Elizabeth Gross Wins Section Award for New Teachers

Elizabeth Gross, of the University of Hawai'i at Mānoa, won the 2018 MAA Golden Section's Distinguished College or University New Teacher of Mathematics Award. The award was presented at the 2018 Golden Section Meeting at CSU East Bay, on February 24, 2018. (For Elizabeth Gross's complete award citation go to http://sections.maa.org/golden/Teach.html).

Elizabeth's early career is distinguished by its intensity and the speed with which she has made her mark. This is evident in both her research and her use of problem solving and research collaboration to spur students' interest in mathematics, develop their reasoning skills, and lead some of them to undertake mathematical research themselves. Elizabeth completed her undergraduate study at CSU, Chico. At San Francisco State, she began doing research in modeling social networks and earned a master's degree in 2010. There she began study of the new field of algebraic statistics and parlayed that into a full research program at the University of Illinois at Chicago, where she earned a doctorate degree in

continued on the next page

Farris: Teaching Award

(*Continued from the previous page*)

With distinction and aplomb, he sings, plays the piano, designs clothes, creates artwork, and explains mathematics to other mathematicians and the general public. Professor Farris became involved in the MAA through the influence of Professor Jerry Alexanderson. Dr. Farris served as the editor of Mathematics Magazine in 2001-2005 and again in 2009.

Professor Farris has numerous publications in mathematics, including his book "Creating Symmetry: The Artful Mathematics of Wallpaper Patterns" which was published in 2015 by Princeton University Press and received an Honorable Mention for a 2016 PROSE Award. A reviewer, Professor Sarah Hart of Birkbeck, University of London, wrote, "*This book is about symmetry and wallpaper patterns, but its approach is completely different … This book is written by someone whose love for mathematics suffuses every page*." Another reviewer, E. J. Barbeau, University of Toronto, wrote, "*A significant feature … is the aesthetic appeal of numerous strikingly beautiful illustrations, the result of experimentation by the author on the color-assigning photographs and functions…*"

Professor Farris has given talks widely. For example, his talk "Seeing Mathematics" at Carleton College was well received by the general public, and his talk "More Examples Like the Figure-Eight Sphere in R^4" was given at the conference in honor of the 65th Birthday of Tom Banchoff of Brown University. Further, Professor Farris helps coordinate Bay Area Mathematical Adventures, which is a series of talks intended for high school students interested in mathematics, sponsored jointly by Santa Clara and San Jose State University.

The Golden Section congratulates Frank Farris, an extraordinarily effective and inspiring teacher.

Gross: New Teachers Award

(*Continued from the previous page*)

2013. After a year's postdoctoral study, she obtained a tenure-track position at San Jose State (SJSU) in 2014. She transferred this year to an assistant professorship at the University of Hawai'i at Mānoa.

At SJSU, Elizabeth's classes featured extensive student participation. For example, in an advanced algebra class, she would alternate between lecturing and helping groups of students construct proofs on the board. A colleague noted that she turned her class into a "true conversation"; a student called her the "best professor I've seen at getting voluntary participation from a class." Beyond the classroom, Elizabeth has encouraged student participation in research by organizing her department's colloquium, fostering student participation in the annual Bay Area research meeting, and helping organize a week-long summer community, national in scope, of such researchers in early stages of their careers. Collaboration is her strong point: since 2012, she has coauthored at least 15 published research papers. An inspiring model for young women entering our field, she has recently published an article in the *Journal of Humanistic Mathematics* on academic life as a mother and mathematician.

The Golden Section congratulates Elizabeth Gross, an extraordinarily effective and inspiring new researcher and teacher.

Elizabeth Gross and Matthias Beck

Teaching Awards: Call for Nominations

2019 MAA Golden Section Distinguished College or University Teacher of Mathematics Award (General)
&
2019 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

Tuesday, April 30, 2019

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, Teaching Award Cmte, etc.)

Interested in hosting the section meeting?

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

⇒⇒⇒ We want you! ⇐⇐⇐⇐

Previous General 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
2015 **Michelle Manes**, Univ. of Hawai'i at Mānoa
2016 **Serkan Hoşten**, San Francisco State University
2017 **Jesús De Loera**, UC Davis
2018 **Frank Farris**, Santa Clara University

Previous New Teaching Award Winners

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

2016 **Martha Shott**, Sonoma State University
2018 **Elizabeth Gross**, University of Hawai'i at Mānoa

News from the Section

Compiled by Walden Freedman, Mini-Focus Editor

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

California State University, East Bay

Fifty-year member and 2005 Section Distinguished Teaching Award winner Russ Merris is spearheading a crowdfunding drive to endow a Cal State East Bay scholarship in the name of Ken Rebman. Ken, who died in 2002 after a courageously optimistic struggle with prostate cancer, was a former Section Vice-Chair (1975), Chair (1976), Program Chair (1977), Newsletter Editor (1976-77) and Governor (1978-81) – in which capacity he organized a sale of MAA books for the 1979 Section meeting, an initiative that has since become a Golden Section tradition. In addition to serving as Section representative on the Board of Governors of the national MAA, Ken was on the editorial board member of the Dolciani Book Series (1978-84), of MAA Focus (1981-83), an assistant editor of the College Math Journal (1987-88), an associate editor of the American Mathematical Monthly (1981-83), a member both of CUPM (1976-80) and its Basic Library List Subcommittee, of the Committee on Mathematics for Liberal Arts (1977-79), the Membership Committee (1979-82), and the Committee on Sections (1981-83). And, he was Public Relations Director for the 1981 Joint Mathematics Meeting!

Look for more details on the Golden Section webpage about how to donate to this scholarship. For more information please contact CSU East Bay's University Advancement officer Richard Watters at richard.watters@csueastbay.edu. Russ Merris russ.merris@csueastbay.edu would appreciate being cc'd on such correspondence.

California State University, Fresno

New hires: Earvin Balderama and Mario Banuelos, who work in the areas of statistics and applied math, respectively.

Marat Markin has two new books published: *Elementary Functional Analysis* (De Gruyter) and *Integration for Calculus, Analysis, and Differential Equations: Techniques, Examples, and Exercises* (World Scientific).

Fresno State will host the AMS Spring Western Sectional Meeting on May 2-3, 2020 and they anticipate offering a wide range of Special Sessions.

Dr. Rajee Amarasinghe received a Faculty Innovation and Leadership Award from the CSU Chancellor's Office, August 2018.

Fresno State has a new NSF grant-funded program: M^2S^2 (Mentoring Math Scholars for Success) that provides scholarships to talented low-income students who major in mathematics.

Humboldt State University

The Department of Mathematics is searching for a new tenure-line faculty, starting in Fall 2019. We are looking for someone who can strengthen our teaching in lower division courses and who can offer interdisciplinary connections between Mathematics and other departments at HSU. For more details, please see the vacancy announcement: https://hraps.humboldt.edu/sites/default/files/vacancy_announcements/1920-13_mathematics_vacancy_final.pdf

Professor Bori Mazzag was elected to be the 2019-2020 Program Chair of BIO SIGMAA, the special interest group of the MAA focused on curriculum development, faculty development and undergraduate research opportunities in mathematical biology. For more on BIO SIGMAA, please see: https://qubeshub.org/community/groups/biosigmaa

Students and faculty participated in the Forty-Seventh Annual State of Jefferson Mathematics Congress, October 12-14, 2018 at Lake Siskiyou, CA (not the usual Whiskeytown location due to fires). Students and/or faculty from Chico State, Oregon Institute of Technology, Sonoma State, Sacramento State, Southern Oregon University, and others also attended. The next State of Jefferson Math Congress takes place at Lake Siskiyou, CA, October 4-6, 2019. For details, see https://sites.google.com/view/sojmc/

HSU's biannual Kieval Lecture featured Dr. Gigliola Staffilani of MIT with "How the Study of Complex Wave Phenomena Inspires Beautiful Mathematics" (May 2018) and Dr. Alon Amit of Origami Logic with "Probability Paradoxes" (October 2018).

Dr. Peter Goetz (with coauthor Andrew Connor of Saint Mary's College) published "*The Koszul property for graded twisted tensor products*" in the Journal of Algebra, 513, (2018), p. 50-90.

Santa Clara University

Santa Clara University welcomed three new faculty members in 2018: Shiva Houshmand Yazdi (Assistant Professor, Data Security), PJ Jedlovec (Lecturer, Mathematics), and Luvreet Sangha (Lecturer, Mathematics).

Norm Paris was promoted to Lecturer in Mathematics.

Tenure track searches are underway for one mathematician and one computer scientist.

Thomas F. Banchoff of Brown University served as our inaugural Halmos Visiting Professor, teaching Survey of Geometry, giving several additional lectures, and engaging in research with SCU student Oras Phongpanangam.

Frank Farris's book, "Creating Symmetry," was awarded the Alpha Sigma Nu Book Award in mathematics and computer science from the Association of Jesuit Colleges and Universities.

Gerald L. "Jerry" Alexanderson retired after a record-breaking sixty years of service to SCU, including 35 years as Chair. Alexanderson will be honored with an annual Alexanderson Lecture, an engaging public lecture meant to carry on Alexanderson's passion for communicating mathematics. (Anyone wishing to donate to our Alexanderson Lecture Fund should contact Frank Farris at ffarris@scu.edu.)

SCU and AIM are working together on a single event to honor the winners of their Alexanderson Prize on the occasion of the Lecture. The first lecture/prize session was held December 12, 2018 with Persi Diaconis speaking on "Universality and the Taming of Randomness."

Frank Farris now serves as Chair of the Department of Mathematics and Computer Science, which continues its period of unprecedented growth. We now have almost 400 students majoring in mathematics and computer science, with the balance heavily skewed toward computer science.

University of Nevada, Reno

Dr. Tin-Yau Tam began his appointment as the Department Chair and Seneca C. & Mary B. Weeks Chair in Mathematics in the Department of Mathematics and Statistics at the University of Nevada, Reno (UNR) on July 1, 2018. Dr. Tam joined UNR from Auburn University (AU) where he held tenure as a full professor. Dr. Tam served as Chair of the Department of Mathematics and Statistics at Auburn University from 2012 to 2018. He was honored as Lloyd and Sandra Nix Endowed Professor (2012-15) at AU. His areas of specialization are Matrix Theory and their Applications, Multilinear Algebra, and Lie Theory. He serves on the editorial boards of Linear and Multilinear Algebra, Electronic Linear Algebra, and Special Matrices. To date, Tam has authored or coauthored more than one hundred research peer-reviewed papers and a research monograph. He has delivered more than 200 talks, organized several conferences, and been the advisor of eight PhD students.

University of the Pacific

The Mathematics Department at University of the Pacific welcomes two new faculty members who started in 2018. Professor of Practice Syed Hossain is the first director of UOP's new Actuarial Science Program. He brings a wealth of experience not only working in higher education, most recently from the University of Nebraska - Kearney, and consulting for insurance companies, but also teaching internationally in Canada, Romania, and Bangladesh. Assistant Professor Kevin Lamb joins us after earning his PhD from UC Davis last spring. His research areas include geometric topology and topological applications to biology as well as to dynamical systems.

MAA Congress Report

by Ed Keppelmann, Congressional Representative

The MAA Congress met on Wednesday, August 1, 2018 in Denver, Colorado. This is only the third meeting of the MAA Congress and so we are still figuring out what we can and should be doing. However, we are making progress, as a working subgroup is establishing expectations for members of congress. Among the most basic (this list is a work in progress) are the following:

- Read MAA FOCUS magazine regularly.
- Attend national meetings and network.
- Attend annual meetings of congress (now only at MathFest as the MAA cannot afford a meeting at JMM (see below for more on this)).
- Join a Congressional Learning Community (CLIC).

I have joined the CLIC on Communications. We feel that many aspects of MAA communication can be improved – this includes everything from how the MAA Board of Directors (BOD) talks to congress and congress relays this to members in their sections, to how the many committees communicate with one another. I feel it is important that every MAA body should spend some of its time thinking about how other MAA bodies could inform their work. We have participated in several ZOOM (online meetings) with members of congress and BOD. The MAA has a license for ZOOM and members at many levels could use this. Our CLIC is also doing some undercover work to try out the MAA's "contact me" buttons on the main webpage to see if these buttons work well when making press inquiries or asking questions about the AMC. We will soon be piloting a new product from Higher Logic to communicate better.

By an agreement formed in 1998 the AMS and MAA have shared the management of the annual January national joint meeting (JMM). After MathFest, we received a message from President Deanna Haunsperger on September 12, 2018 announcing that beginning in 2022, the MAA will no longer be involved and this will become the job of the AMS alone. Many in the congress felt that we should have been consulted regarding this and that we have many questions about exactly what this all means. During numerous online discussions it was explained that the MAA simply cannot afford financially to continue this arrangement and that this was not a decision taken lightly. In fact, other solutions have been discussed and pursued at length for several years now and this really is the only viable choice. Some of our many questions involve deciding just what current MAA activities will be supported by the AMS (such as the SIGMAA on Math Circles and the Math Wrangles and Circle Demos we love doing at these meetings). The MAA has stated that they have been able to do slightly more than break even at Math Fest and this JMM arrangement will now free some resources for the association to provide more support for sections. They want to know what we would like. One idea being currently floated is to have an additional lectureship series like the POLYA but for BIG (Business, Industry, and Government) speakers. Your ideas and thoughts are always welcome!

Report on the Section Officers Meeting at MathFest, Denver, Colorado

by Walden Freedman, Mini-Focus Editor

This was my first MathFest, and my first time attending the Section Officer's Meeting, from which I offer the following highlights. One of the main themes of the Officer's Meeting was BIG (Business, Industry, and Government), in particular, getting BIG speakers at meetings, and how otherwise to increase participation by BIG in our sections. One reason for the strong interest in BIG is that it helps students get a better understanding of what one can do with a degree in mathematics. Some of the speakers discussed their connections with the MAA and BIG. In addition to Dr. Deanna Haunsperger (MAA President), Dr. Michael Dorff (President-Elect) and Dr. Rachel Levy (new Deputy Executive Director) spoke. Many faculty have experience in

such jobs that can be valuable to share with students. We went around the room to see whether participants had spent some time in a BIG job or career prior to academics. There was mention of maintaining a collection of appropriate clothing that students could borrow for interviews. There was some discussion about possibly having some job-oriented session at section meetings. Below are some of the main discussion items/topics:

MAA Career Resource Center: https://mathcareers.maa.org/

New Book: "*Big Jobs Guide: Business, Industry, and Government Careers for Mathematical Scientists, Statisticians, and Operations Researchers*", by Rachel Levy, Richard Laugesen, Fadil Santosa 2018 / ISBN: 978-1-611975-28-4 / List Price $25.00. Note that this book is distinct from and complementary to "101 Jobs …" http://bookstore.siam.org/ot158/

MAA's BIG SIGMAA: http://sigmaa.maa.org/big/BIG_SIGMAA_Home.html

PIC Math (Preparation for Industrial Careers in Mathematical Sciences): With PIC Math, a company gives a student group a problem, and working with a contact from the company, students would write up a solution, and possibly give a presentation (at MathFest maybe). The experience could be helpful for students in interviewing. Mention was made of the MAA's website for PIC Math (Note that Rachel Levy and Michael Dorff are two of the four directors) https://www.maa.org/programs-and-communities/professional-development/pic-math

WIDS (Women in Data Science) Conference at Stanford. Next one is March 4, 2019. See https://www.widsconference.org/ for more information and a "highlight" video of the 2018 conference.

Report on the Section Meeting at CSU East Bay, February 24, 2018

by Ed Keppelmann, photos by Jonathan E. Shapiro

While attendance was bit down this year at 151 (from 175 at Santa Clara in 2017) and students were down to 58 from 72, we all had a wonderful time.

After a warm welcome to campus in one of the university's new multi-purpose rooms, we began the day with a presentation by the American Mathematical Monthly's new editor **Susan J. Colley**. In 1848, Jakob Steiner claimed that the number of smooth conics which are tangent to five arbitrary conics in standard position is $6^5 = 7776$. However, it was later discovered that the correct number is only 3264. Susan's work with long-time coauthor Gary Kennedy and others involves extending this result in a huge number of wonderful ways.

This can be done in the plane by talking about order k-contact between curves (meaning they intersect and their first k Taylor series terms agree) or by looking at intersections of all sorts of surfaces in higher dimensions. The organization of so-called *curvilinear data* (and keeping the required conditions on this data compact) has applications to solving systems of differential equations.

Jesús De Loera then began a delightful tale discussing certain optimal solutions to a system of inequalities. This comes from his expertise in the field of combinatorial optimization. For enthusiasts of linear algebra, the notion of a cone is a wonderfully intriguing construction. Like a

vector space, a cone is closed under scalar multiplication and linear combinations except that all scalars must be non-negative. So, for

example, in dimension 1 you can get {0}, $\mathbb{R}$, or a half line. A richer example is the cone of all non-negative 3 × 3 magic squares. These are 3 × 3 arrays of non-negative real numbers where all column, row, and diagonal sums are equal. Of course when you form a linear combination of these, this common sum will change but all the sums will remain equal. The following four (sum equaling 3) magic squares are essential:

$$\begin{bmatrix} 0 & 2 & 1 \\ 2 & 1 & 0 \\ 1 & 0 & 2 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 & 2 \\ 2 & 1 & 0 \\ 0 & 2 & 1 \end{bmatrix} \quad \begin{bmatrix} 2 & 0 & 1 \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{bmatrix} \quad \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 2 \\ 2 & 0 & 1 \end{bmatrix}$$

What Carathéodory's Theorem essentially says about this situation is that, analogous to a vector space, the cone of such magic squares has dimension 3. So, you ask, why do we need the four magic squares above (presumably as some kind of generators) if the space only has dimension 3? This is because the notion of dimension is a little different. Namely, if one takes any non-negative 3 × 3 magic square, then one can find a cone generated by three of those matrices which will contain it. In other words, you can't capture all the matrices in a cone of dimension 3 but you can get any one of them in such a cone. Before telling us about all the applications of such a wonderful theorem to problems of combinatorial optimization, Jesús challenged us to find the generators for the non-negative $n \times n$ magic squares.

We next had dessert (even though we hadn't had lunch yet!) when MAA President **Deanna Haunsperger** treated us to a delightful story of halving your cake and other much harder problems of fair division. The number of players can be arbitrary and the quantity to be divided can be continuous (e.g., in mathematical terms a unit interval or unit disc) and homogenous or not. Alternatively, the quantity to be divided can be a finite set of indivisible items of various types like cars, computers or an apartment. fair division lets the players each assign their own concept of value to the items or regions within a continuous entity. In some schemes, cash might grease the exchanges. Inductive methods can often be used on known algorithms when the number of players increases.

As one example of a division algorithm, consider the following scheme to divide a cake among *n* players. We start by picking a cutter who will attempt to divide the cake into what they view as *n* equal parts. These might not actually all be the same physical size if the cake is not homogenous: say it contains lots of cherries in one part or some disliked peanut butter in another part. However, the divider views them as all equal, and so is indifferent as to which piece they receive. The remaining players then decide which piece or pieces they believe to be their fair share. If any player chooses a piece that no one else wants, then they can have it and they are done. If any piece is in contention, then it must be given to the divider and they are sent on their way. The

remaining pieces are them recombined (god what a mess!) and the procedure is repeated with at least one and hopefully several fewer players. When only two players remain, the most basic method – "you cut I choose" – finishes the job. Of course, if you don't want to mangle the cake in the process of dividing it (say with just $n-1$ cuts) then there are other schemes!

After lunch and a marvelous time viewing posters and art projects (see the discussion of the posters below), we embarked with **Serkan Hoşten** on a wonderful tour through the applications of algebraic geometry. Serkan is SIAM's program director for the activity group in algebraic geometry and one of the many areas he works in is the field of algebraic statistics. Algebraic statistics can for example help you design an experiment. For example, suppose that you are studying a treatment protocol that has several different parameters, say in pressure, time, or maybe choice of chemical and quantity of that chemical. It might be too expensive or time consuming to try all the possibilities, so you need a scheme to pick the most important ones. There are lots and lots of other applications of algebraic geometry. For example, we can engineer system control protocols for complex industrial processes by finding optimal solutions to certain systems of polynomial equations or inequalities.

Numerical algebraic geometry comes up in the manipulation of robots. A graphical model is the notion of a tree-like structure that specifies certain specific dependencies among a collection of random variables. Algebraic geometry can help you sort this all out to find the probabilities of various key events. This has applications to biological systems and the effects and treatments for various gene-based diseases.

The day ended with a delightful hour of **Paul Zeitz** sharing his philosophy of problem solving and telling us about problems galore. The point of this talk was to urge us to understand *why* things are true and not just *how* they are true.

Rather than reflect on the examples in his presentation, I will share one of my own collaborations with Paul that I think makes his point quite nicely. When working on a problem set with Paul for a MathFest demonstration Wrangle, I proposed the following problem:

An urn contains the numbers 1, 2, . . . , 2018. Four numbers are drawn without replacement from the urn and we shall call these numbers a, b, c, d.

What is the probability that the system of equations

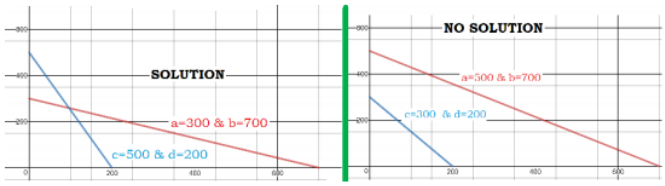
$$ax + by = ab$$
$$cx + dy = cd$$

has a solution strictly inside the first quadrant?

Paul told me he liked the problem but not my solution. My solution tried to make an exercise out of this problem with lots of inequalities and ugly manipulations! All he said to me was "I think there is a correspondence there." I had the *how* but Paul wanted me to see the *why* – in other words, to see the big picture that makes it all so beautiful. What's more, he wanted me to find my own way to this beautiful view.

SPOILER ALERT – WE WILL NOW DISCUSS THE SOLUTION.

The use of 2018 is not important and the without replacement condition just assures that all the numbers are different. The first equation is the line through $(0, a)$ and $(b, 0)$ and the second is the line through $(0, c)$ and $(d, 0)$. The existence of a solution depends precisely on the relative ordering of these four numbers.



By simply swapping the roles of a and c we will turn a no solution situation into a solution situation or vice versa. In a flash, I thought of pick-up sticks that I could simply uncouple from one another! The correspondence is clear, and the probability is exactly ½.

While the quantity (five) of poster presenters was down this year, there was still lots of quality:

Rosa Garza from CSU Monterey Bay (with Andrew Pfalz and faculty sponsor Dr. Edgar Berdahl of Louisiana State University) presented "Machine Learning for the Inverse Control of FM Synthesis". Their research explores using a Long Short Term Memory (LSTM) RNN (recurrent neural network) model to learn what control signals were inputted to an FM synthesizer. With an FM inverse synthesizer, an LSTM RNN can receive audio and output the control signals used in the FM synthesizer.

Khiem Pham with faculty advisor Guangliang Chen of San Jose State University presented "Bipartite Approximate Spectral Clustering". As a data analysis technique, spectral clustering is powerful in data mining. It seeks to divide data points into similar groups so that points in different groups are not similar. Unfortunately, the power of the technique is frustrated by its order n^3 complexity. So Khiem and Guangliang are looking at a technique called Bipartite Approximate Spectral Clustering which breaks the problem into appropriate smaller parts along with a bipartite graph. Complexity is significantly reduced and in some in some important cases, accuracy of this iterative method is even improved.

Tim Wetzel (with Valerie Bada and Adam Driedger and faculty advisor Paul F. Choboter of Cal Poly San Luis Obispo) did a comparative study between the Fast Fourier Transform and the Discrete Wavelet transform. They established that FFT is more accurate on linked acoustic data like rock and roll music and DWT more accurate on non-related acoustic data like seismic signals. But FFT denoised both signals faster than DWT, all in keeping with their hypotheses.

Jamie Haddock (currently a post-doc at UCLA), and faculty sponsor Jesús De Loera of UC Davis, presented "The Minimum Euclidean-Norm Point on a Convex Polytope: Wolfe's Combinatorial Method is Exponential". The complexity of Wolfe's Method for the minimum Euclidean-norm point problem over a convex polytope has remained unknown since 1974. This research provides the first example that Wolfe's method takes exponential time. Another contributor to this work was L. Rademacher.

Rajiv Nelakanti , Alex Tholen and Nitya Mani (Euler Circle) and faculty sponsor Simon Rubinstein-Salzedo, analyzed the game of Candy Nim. This game has the usual goal of taking the last piece (of candy), but the secondary goal of taking as many pieces of candy as possible. Variations involve playing with several piles and restricting players to work on only one pile at a time. They found an important collection of settings in the three-pile game where the optimal winning strategy for taking the last piece forces one to lose in getting the most candy. As my sweet tooth begins to nag me – it makes me wonder … if you can't get the most candy – is winning really worth it?

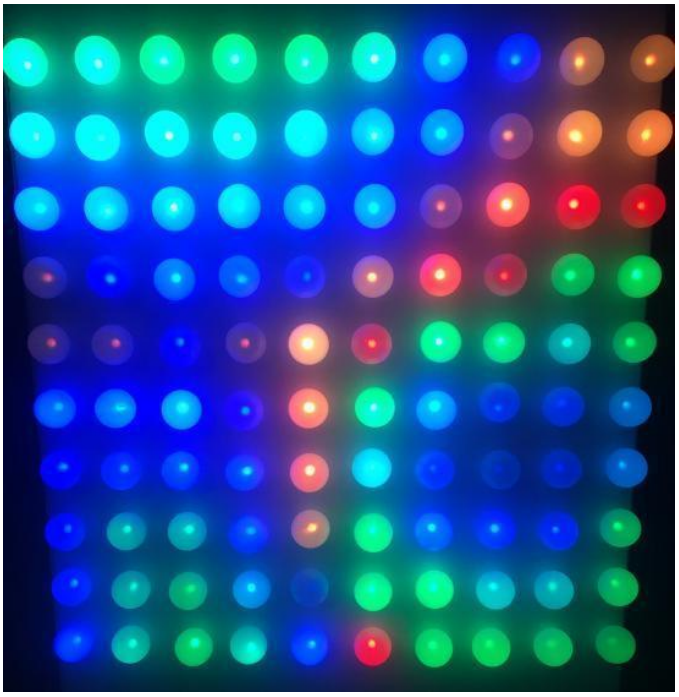
For more info on the posters, go to http://sections.maa.org/golden/documents/POSTERS2018.pdf

Mathematical Art Exhibition

by Vince Matsko with art work photos by the artists

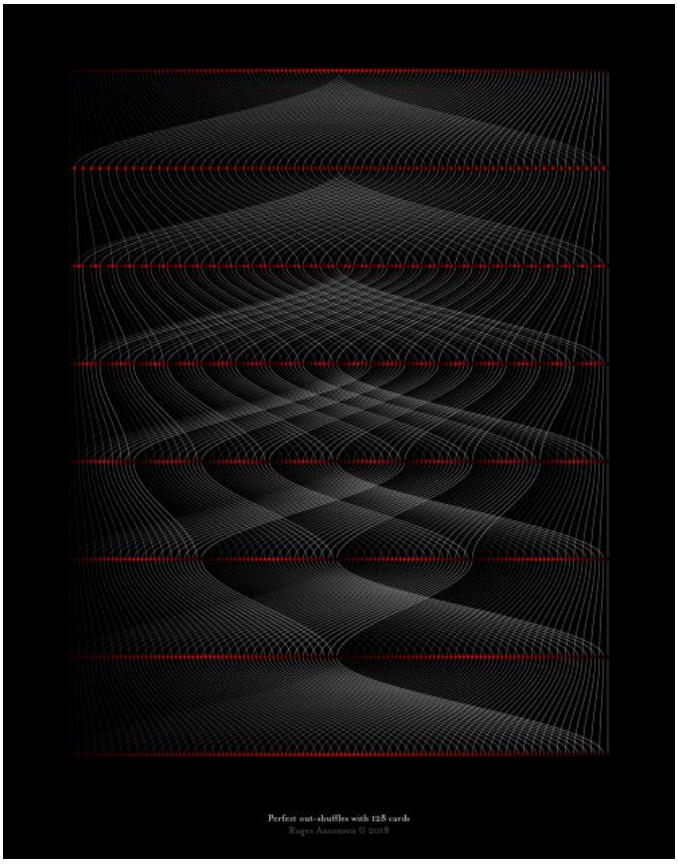
The 2018 Meeting of the Golden Section marked the third year that the meeting included an exhibition of mathematical art. In addition to myself, Vince Matsko, 14 artists participated in the exhibition: Roger Antonsen, Dan Bach, Linda Beverly, Wayne Daniel, Frank A. Farris, Paul Gonzalez-Becerra, Jason Herschel, David Honda, Navneet Kaur, Nick Mendler, Stacy Speyer, Sandra Torres, Phil Webster, and Shirley Yap, who was also the local organizer of the meeting. This time, I thought I'd let two of the artists (in no particular order) speak for themselves and tell us about their works. Visit https://cre8math.com/2018/02/27/art-exhibition-golden-section-2018/ and see page 17 of this newsletter for more!

Jason Herschel (jherschel@gmail.com)
Title: Perlin Bubbles



Undulating organic light show with minimal code generated by a 16 MHz processor calculating color and brightness values through a Perlin noise algorithm. Blobs appear to grow, shrink, and drift relaxingly over the LED grid. 100 ping pong balls covering 100 individually addressable LEDs on poster board with Arduino Nano v.3 controller and battery pack.

Roger Antonsen
(http://rantonse.no/ and rantonse@ifi.uio.no)
Title: Perfect cut-shuffles with 128 cards



This is a visualization of seven repeated perfect out-shuffles of a deck with 128 cards. The horizontal lines represent the particular orders of the cards throughout the shuffling, and the vertical curves represent the path each card takes from start to finish. The curves are colored from black to white in order to show the mechanics of the shuffling. The dots are colored from black to red to black in order to show that each perfect out-shuffle preserves the so-called "stay-stack principle". Notice that the order of cards returns to the original order after seven shuffles.

Are you interested in showcasing some of your mathematical art at the 2019 Golden Section Meeting at AIM? Send a note to Stacy Speyer at cubesandthings@gmail.com for more information about how to submit your work for inclusion in the Art Exhibition, or see page 17 of this Mini-Focus newsletter!

THE MATHEMATICAL ASSOCIATION OF AMERICA – GOLDEN SECTION
Saturday, February 23, 2019, at American Institute of Mathematics (AIM)

All talks, library and lunch downstairs in headquarters of Fry's Electronics, follow the signs
Poster Session and Mathematical Art Exhibition upstairs in AIM's facility, follow the signs
Registration 8:00—11:00 am Refreshments 8:30—10:30 am

8:45–9:00	**Opening Welcome**	Presider: **Jung-Ha An**

9:00–9:50	**Jordan Schettler**, San Jose State University	Presider: **Ken Suzuki**

Orbit Counting Theorems and a Guitar with Curved Frets

Abstract: The owner of Sweetwood Guitar Company asked a mathematician (that would be me) to help locate the placement of fret positions on a special guitar. He was designing a guitar with "curved frets" which corresponded to an irregular tuning system, meaning that notes were not equally spaced so the frets could not be parallel line segments. The design was a modified version of a tuning for harpsichord conjecturally used by J.S. Bach. In this talk, we will discuss: (1) tuning systems from a mathematical perspective, (2) why certain tuning systems are better than others for a given purpose, and (3) how one can use linear algebra and the theory of group actions [in particular, counting and studying orbits] to derive optimal irregular tunings for any given style of music. This work is joint with Mitchell Chavarria and was partially supported by the NSF through the PUMP program award DMS-1247679.

9:50–10:05	**Section Business Meeting and Congressional Report**	Presider: **Ed Keppelmann**

10:10–11:05	**Elizabeth Gross**, University of Hawai'i at Mānoa	Presider: **TBD**

Algebraic Systems Biology

Abstract: Chemical reaction networks are directed graphs used to model complex biological systems such as metabolic and cell signaling networks. Under the assumption of mass action kinetics, these networks give rise to polynomial dynamical systems, which when analyzed at steady-state, result in polynomial ideals with significant combinatorial structure. Using a couple of common biological network motifs as examples, we will discuss some of the combinatorial and algebraic techniques available for parameter estimation and model selection for this family of models.

11:10–12:00	**Marion Campisi**, San Jose State University	Presider: **TBD**

Analysis of partisan gerrymandering tools in advance of the US 2020 census

Abstract: Over the last decade, mapmakers have precisely gerrymandered political districts for the benefit of their party. In response, political scientists and mathematicians have more extensively investigated tools to quantify and understand the mathematical structure of redistricting problems. Two primary tools for determining whether a particular redistricting plan is fair are partisan-gerrymandering metrics and stochastic sampling algorithms. In this work, we explore the Declination, a new metric intended to detect partisan gerrymandering. We consider instances in which each district has equal

turnout, the maximum turnout to minimum turnout is bounded, and turnout is unrestricted. For each of these cases, we show exactly which vote-share, seat-share pairs (V,S) have an election outcome with Declination equal to 0. Within our analyses, we show that Declination cannot detect all forms of packing and cracking, and we compare the Declination to the Efficiency Gap. We show that these two metrics can behave quite differently, and give explicit examples where that occurs.

12:00–1:00	**Lunch**

Cost: $20 in advance. You must have a ticket to have lunch, tickets to be purchased in advance while registering.

1:00–2:00	**Student Poster Session/Mathematical Art Exhibition**

Upstairs at AIM
Organized by: Kristen Beck/Stacy Speyer, Nicholas Mendler

2:10–3:00	**Jemma Lorenat**, Pitzer College	Presider: **Jim Smith**

Demands upon your imagination: developing mental images in nineteenth-century pure geometry

Abstract: The classic story of nineteenth-century geometry tells of intuitive, illustrated figures gradually abandoned in favor of rigorous axioms and general coordinate equations. However, for some pure geometers, the use of figures was separate from, or even in opposition to, developing spatial intuition. This tension can be seen in Jakob Steiner who claimed that three-dimensional geometry could only be "properly understood if they are intuited purely, without any sensory media, through the inner power of representation [Vorstellungskraft]." This judgment is even more apparent in Karl Christian von Staudt's *Geometrie der Lage* (1847), where there are no figures at all. Drawing on published lectures and expository writing, this talk will examine competing methods for developing *Vorstellungskraft*. Further, I will consider why creating mental images was so important and how this practice supplements our understanding of visualization in mathematics.

3:10–3:25	**Teaching Awards Ceremony**	Presider: **John Thoo**

3:30–4:20	**James Sellers**, Penn State University	Presider: **Ken Ross**

Revisiting What Euler and the Bernoullis Knew About Convergent Infinite Series

Abstract: All too often in first-year calculus classes, conversations about infinite series stop with discussions about convergence or divergence. Such interactions are, unfortunately, not often illuminating or intriguing. Interestingly enough, Jacob and Johann Bernoulli and Leonhard Euler (and their contemporaries in the early 18th century) knew quite a bit about how to find the *exact* values of numerous families of convergent infinite series. In this talk, I will show two sets of *exact* results in this vein. The talk will be accessible to anyone interested in mathematics.

AIM: American Institute of Mathematics

The American Institute of Mathematics (AIM) advances the frontiers of mathematical knowledge by fostering collaborations among diverse groups of researchers. AIM has been supported as one of six NSF mathematics institutes since 2002, and hosts short, mathematically focused programs that complement the semester- and year-long programs of other NSF institutes. AIM was founded in 1994 and is currently located in San Jose, CA.

AIM's primary scientific programs are week-long focused workshops and small research groups called Structured Quartet Research Ensembles (SQuaREs). Approximately 750 mathematicians per year visit AIM for either a workshop or a SQuaRE.

Workshops

Since 2002, AIM has hosted more than 250 week-long focused workshops in all areas of the mathematical sciences. 20 workshops take place each year, each with 30 participants. Examples include "Topology of the biomolecular world" (big data sets), "Arithmetic golden gates" (quantum computing), and "Optimization strategies for transportation" (a collaboration with the Valley Transportation Authority). Three distinctive features of these week-long workshops are their focused topics, small size (25 to 30 researchers), and structured afternoon work time, including time for research in small groups. To find out about AIM's upcoming workshops, please visit http://www.aimath.org/workshops/upcoming.

SQuaREs

The SQuaREs (Structured Quartet Research Ensembles) program, introduced in 2007, supports collaborations of four to six researchers who meet multiple times for week-long intervals to make progress on an ambitious research agenda. The program encourages the development of new and lasting collaborations, particularly between junior and senior researchers, that produce exceptional mathematics. AIM hosts 50 SQuaREs per year.

To further support the goals of the scientific programs, AIM has developed a set of web-based tools that enhance collaboration before, during, and after participants' time at AIM. These tools also contribute more broadly to mathematics research through helping disseminate progress to a larger community of interest and have long-term potential for wider use by the mathematics community.

Special Projects

Throughout its history, AIM has also supported a variety of Special Projects, including Research Experiences for Undergraduate Faculty (REUF), a program for undergraduate faculty who want to mentor undergraduate students in research; and the Math Teachers' Circle (MTC) Network, a national outreach program connecting K-12 mathematics teachers with research mathematicians. These projects contribute to the broader impacts of AIM's work as an institute and provide opportunities to form partnerships both within and beyond the mathematics community.

Visit AIM at https://aimath.org/ to find out more!

AIM's Rare Book Library

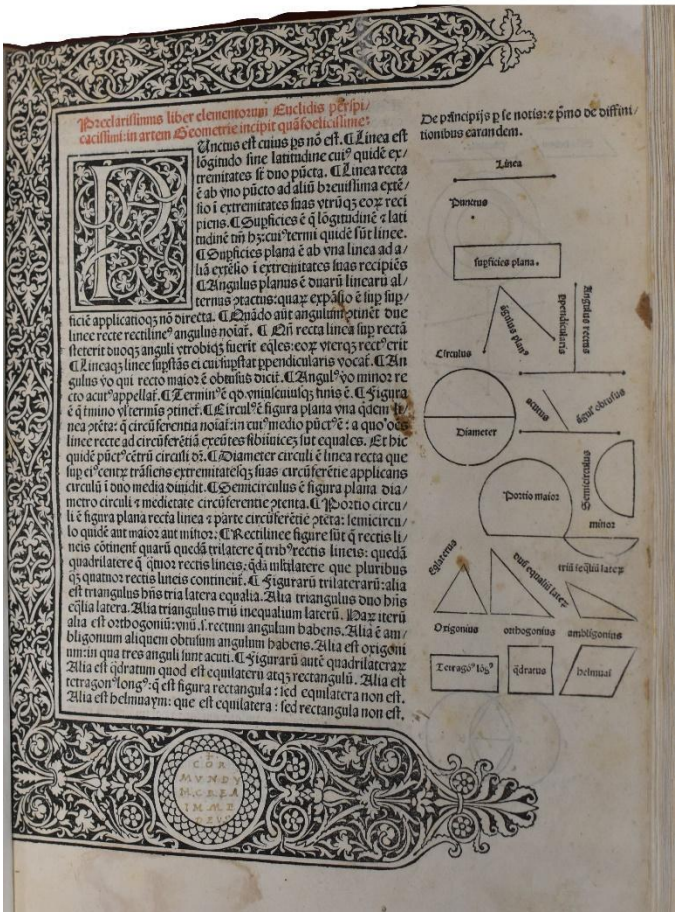
by Walden Freedman, Mini-Focus Editor

In April, I had the pleasure of touring AIM's rare book library. I highly recommend the experience. This is a collection with both breadth and depth. According to the library's director, Ellen Heffelfinger, the collection has over 5000 items dating from the 15th to the 20th centuries (many of the 20th century items are offprints). Inspired by his Santa Clara University professor and mentor, Gerald L. Alexanderson, John Fry began collecting nearly 30 years ago, with the purchases of the first edition of Newton's Principia (1687) and the first edition (editio princeps as it is called) of Euclid (1482), both shown below.

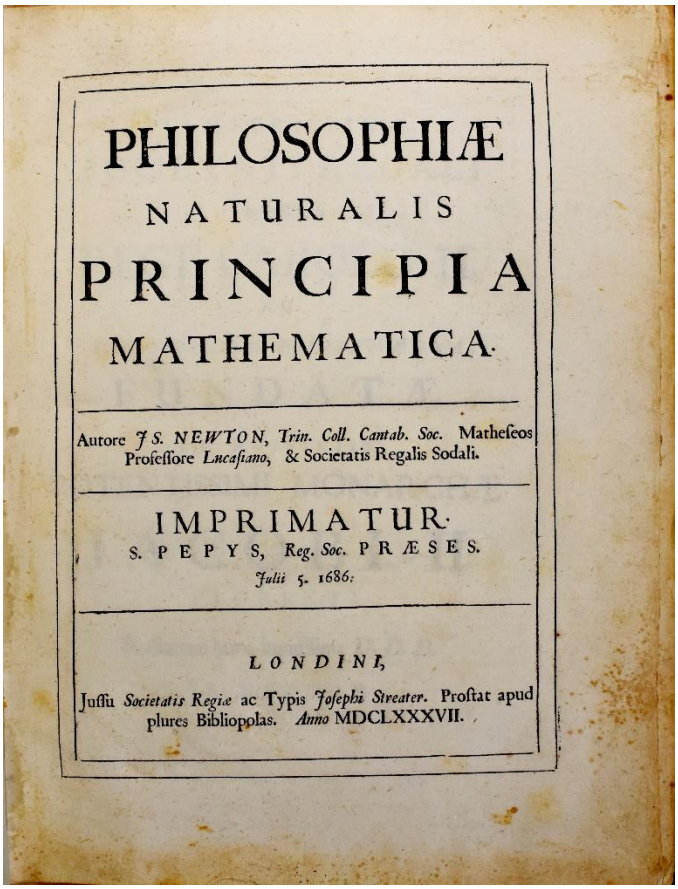
With frequent consultation with Dr. Alexanderson, especially on major purchases, the library focuses on acquiring works of real importance in various fields of mathematics. These are not just the landmark volumes in say, number theory, geometry, etc., but secondary and

collateral pieces as well — for instance, the library has many first editions of Newton, apart from the Principia. Past issues of AIMatters, AIM's annual newsletter (https://aimath.org/aimnews/newsletter/) have mouthwatering pictures of some of the noteworthy items in their collection. For example, dissertations of Ramanujan (1915) and Bernoulli (1694), items from the personal library of Carl Friedrich Gauss, including his logarithmic tables, Dirichlet's exceedingly rare first paper (1825), and a first edition of Napier's work on the invention/discovery of logarithms (1614).

Don't miss the opportunity to see some of these gems in person! A limited number of tours (20 people each) will be offered at the Golden Section meeting. Sign up for a tour when you register online for the meeting!



First edition (editio princeps) of Euclid (1482)



First edition of Newton's Principia (1687)

Directions to the Meeting at AIM (American Institute of Mathematics)

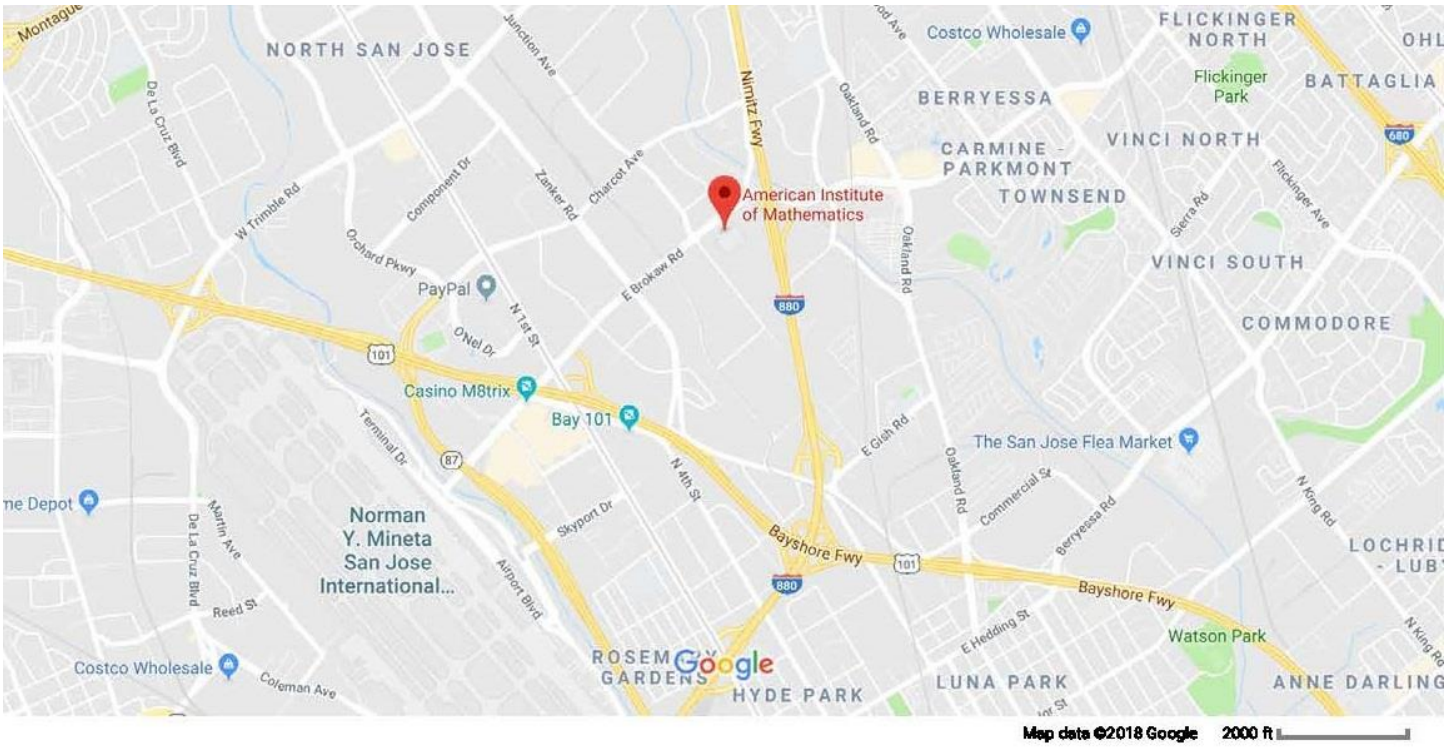
AIM is located on the second floor at the headquarters of Fry's Electronics, 600 E. Brokaw Road, San Jose, CA 95512, in the heart of Silicon Valley. Parking is free, and participants can park anywhere in the Fry's Electronics parking lot.

From US-101: Take the Brokaw Road and First Street exit. Southbound drivers turn left, and northbound drivers turn right onto E. Brokaw Road. Go 0.9 mile. The Fry's building will be on the right. Come in the main entrance facing Brokaw Road.

From I-880: Take the Brokaw Road exit. Southbound drivers turn right, and northbound drivers turn left onto E. Brokaw Road. Go 0.2 mile. The Fry's building will be on the left. Make a U-turn at the traffic light. Come in the main entrance facing Brokaw Road.

See the map on the next page and for more information see https://aimath.org/visitors/directions/

Registration, **refreshments**, **lunch**, and the **talks** will be downstairs at the headquarters of Fry's Electronics. The **poster session** and **mathematical art exhibition** will be upstairs at AIM. AIM's **library** is located downstairs at the headquarters of Fry's Electronics.



How to Register

All participants should first register online on the Golden Section webpage (links at top of webpage) at

http://sections.maa.org/golden/MAAAIM2019.htm

Indicate whether you want to have a tour of AIM's rare book library/collection. After registration, you can complete the registration by payment with a credit card (with an 14.25% surcharge) or by regular mail. For the mail option, send a check (arriving no later than Friday, February 15, 2019 and made payable to the MAA) to

MAA 2019 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.

Regular	$20
Retired/Unemployed	$10
Student (all levels)	$5
Speaker, poster/art presenter, student volunteer	Free (register online with pay by mail option)
Luncheon	$20 (in advance)
Suggested donation to support student members	$10

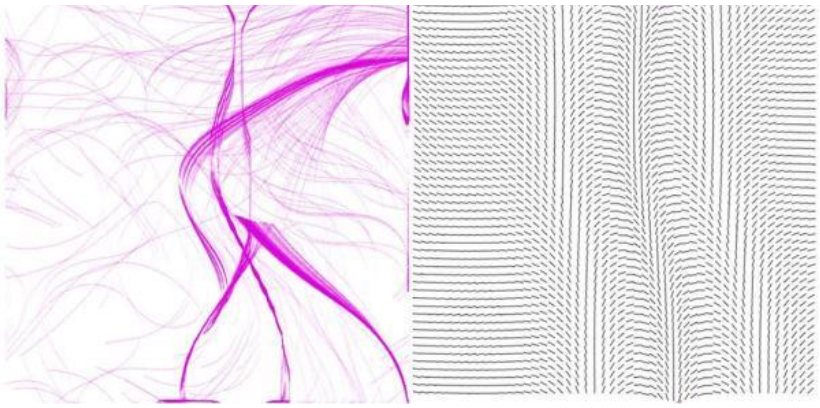
Please consider sending an extra $10 donation to support student members.

Call for Mathematical Art Exhibits

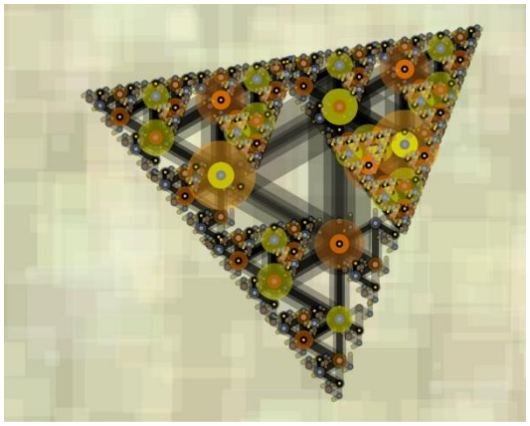
The Golden Section will again host a mathematical art exhibition. The exhibition will take place **upstairs at AIM** during the break between the morning and afternoon sessions (1:00 to 2:00 pm). During that time, the artists will be present to discuss their works with viewers. If you know anyone who produces art with a strong mathematical theme or content, please encourage them to submit their piece for consideration in the exhibition. Artists are expected to register for and attend the meeting. Artists are also responsible for their pieces throughout the meeting. Artist participants will be able to set up their work in a locked conference room, to prepare it for viewing during the exhibition. **Submissions**: Please email at most two photos (< 10 MB each) of each piece you would like to submit, along with a brief description (< 100 words) of the piece to Stacy Speyer at cubesandthings@gmail.com.

Deadline: Monday, January 28, 2019

Images below by J. Shapiro and the artists from the Mathematical Art Exhibition at the CSU East Bay Meeting, February 2018



Artist: **Paul Gonzalez-Becerra**
http://www.pgonzbecer.com/
Programming is my art. I might not be a good "designer", but I am a good developer where I am able to take a structured approach on art. I specialize in computer graphics, thus my understanding of the mathematics behind geometry, 3D models, and 2D sprites are better than my ability to free-form draw them.



Artist: **Vince Matsko** http://www.vincematsko.com/
This piece is based on fractal binary trees. The usual way of creating a binary tree is to move forward, then branch to the left and right some fixed angle as well as shrink, and repeat recursively. Recent work involves specifying the branching by arbitrary affine transformations. In this piece, the affine transformations were chosen so that as the tree grows, nodes are repeatedly visited. The nodes are covered by disks which become smaller with each iteration, accounting for the overlapping circles. The research needed to produce these images was undertaken jointly with Nick Mendler.

Shirley Yap of CSU East Bay

Frank A. Farris of Santa Clara University

Call for Student Posters

Who, When and Where

All undergraduate and graduate math students, Saturday, February 23, 2019, at the annual meeting of the MAA Golden Section at the American Institute of Mathematics, San Jose, CA.

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* (two-five sentences, LaTeX typesetting is acceptable), including *poster title*, name of *institution*, and name of *faculty advisor*, to Professor Beck at kab24@stmarys-ca.edu.

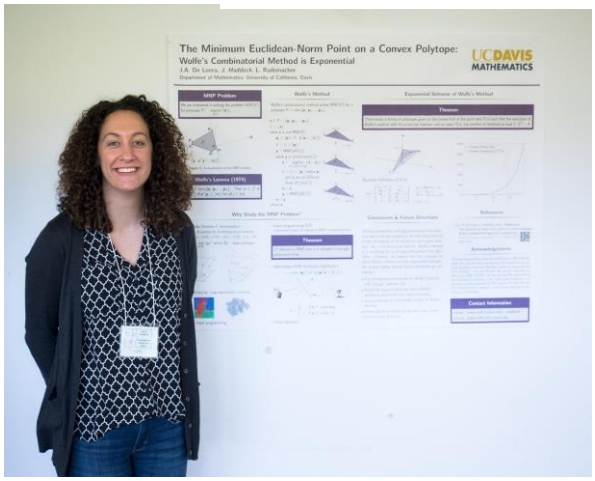
Deadline: Friday, February 15, 2019

All student posters should be typed, illustrated, and displayed on a poster board that is three feet tall by four feet wide. Posters will be on display throughout the meeting, including during the scheduled poster session from 1:00 to 2:00 pm. For more information about the 2019 Golden Section Meeting at AIM, visit http://sections.maa.org/golden/MAAAIM2019.htm.

Contact

Professor Kristen Beck, Department of Mathematics & Computer Science, Saint Mary's College of California, Moraga CA 94575 Office Phone: (925) 631-6298 E-mail: kab24@stmarys-ca.edu.

Poster Session at the CSU East Bay Meeting, February 2018



Jamie Haddock, UC Davis (current UCLA post-doc)

Tim Wetzel, Cal Poly San Luis Obispo