MathFest 2013

Prizes and Awards

Hartford, Connecticut
11:30am
August 2, 2013

Program for the MAA Prize Session

Opening and Closing Remarks

Bob Devaney, President
Mathematical Association of America

Carl B. Allendoerfer Awards

The Carl B. Allendoerfer Awards, established in 1976, are made to authors of articles of expository excellence published in *Mathematics Magazine*. The Awards are named for Carl B. Allendoerfer, a distinguished mathematician at the University of Washington and President of the Mathematical Association of America, 1959-60.

Khristo N. Boyadzhiev

"Close Encounters with the Stirling Numbers of the Second Kind", *Mathematics Magazine,* Volume 85, Number 4, October 2012, pages 252-266.

The Scottish mathematician James Stirling, in his 1730 book *Methodus Differentialis*, explored Newton series, which are expansions of functions in terms of difference polynomials. The coefficients of these polynomials, computed using finite differences, are the Stirling numbers of the second kind. Curiously, they arise in many other ways, ranging from scalar products of vectors of integer powers with vectors of binomial coefficients to polynomials that can be used to compute the derivatives of $\tan x$ and $\sec x$. This well-written exploration of Stirling numbers visits the work of Stirling, Newton, Grünert, Euler and Jacob Bernoulli. Boyadzhiev's fascinating historical survey centers on the representation of Stirling numbers of the second kind by a binomial transform formula. This might suggest a combinatorial approach to the study, but the article is novel in its analytical approach that mixes combinatorics and analysis. Grounded in Stirling's early work on Newton series, this analytical approach illustrates the value of considering alternatives to Taylor's series when expressing a function as a polynomial series. The story of Stirling numbers continues with the exponential polynomials of Johann Grünert and geometric polynomials in the works of Euler. Boyadzhiev shows the relation of Stirling numbers of the second kind to the Bernoulli numbers and Euler polynomials. The article closes with a brief look at Stirling numbers of the first kind, a nice touch that deftly brings the proceedings to a close. Boyadzhiev's lively exposition engages the reader and leaves one eager to learn more.

Response from Khristo N. Boyadzhiev

The Allendoerfer Award is an exciting milestone in my life. I am truly honored to be recognized by the Mathematical Association of America. With its mission and especially with its publishing operation the MAA unites and educates a vast mathematical community. *The Mathematics Magazine*, the *College Mathematics Journal*, the *Monthly*, and *Math Horizons* have become my good friends. Students and professors all over the world read them, discuss them, send materials, and work on the problem sections. What a treasure these journals are!

For my review on the Stirling numbers, I was inspired by the magic interplay between analysis and combinatorics. I was also inspired by the works of Henry W. Gould, Professor Emeritus at West Virginia University, who has a special taste for beautiful combinatorial identities. I am obliged to the editor Walter Stromquist for his friendly and competent help in bringing the manuscript to its final form. Thank you all!

Biographical Note

Khristo Boyadzhiev is a Professor of Mathematics at Ohio Northern University. He was born and educated in Sofia, Bulgaria. Khristo enrolled at Sofia University, "St. Kliment Ohridski", with the intention to study physics, but the calculus lectures of Yaroslav Tagamlitski changed his mind. Later Tagamlitski became his PhD advisor.

At the beginning of his career Khristo was interested mostly in Banach algebras and operator theory. Later in life he developed a steady interest in classical analysis.

He is married and has two daughters. In his spare time Khristo enjoys blogging, taking long walks around the beautiful ONU campus, and listening to classical music.

Adrian Rice and Ezra Brown

“Why Ellipses Are Not Elliptic Curves”, *Mathematics Magazine*, Volume 85, Number 3, June 2012, pages 163-176.

While ellipses and elliptic curves are two topics most mathematicians know something about, few of us have considered how they relate to each other. It is clear that the equations of ellipses and elliptic curves are different, but why then are their names so similar? This excellent exposition explores where the related names came from despite the core differences in these two famous mathematical objects.

The authors begin with a brief history of ellipses, starting in Ancient Greece. We then quickly arrive at elliptic integrals, which first arose from the desire to compute the arc length of a section of an ellipse. This historical tour ends with Jacobi and Eisenstein working with the doubly periodic properties of elliptic functions, the inverses of elliptic integrals. This engaging article returns to the Greeks, with the focus on elliptic curves this time, then progresses to Fermat, goes on to Newton, and finally returns to Eisenstein to connect elliptic curves to elliptic functions. It is here that the two subjects come together; they are both connected, in their own way, to elliptic functions. The authors then give us the final twist: having parameterized elliptic curves using elliptic functions and ellipses using trigonometric functions, they show us that the parameterization of an ellipse in complex space is topologically a sphere, whereas the parameterization of an elliptic curve in complex space is topologically a torus.

Rice and Brown’s well-written article weaves the story of these two diverse mathematical objects, giving key historical and mathematical references along the way. Their engaging tour of mathematical history illustrates both how these two objects are related and why, mathematically, they are fundamentally different.

Response from Ezra Brown and Adrian Rice

We are thrilled, honored, and deeply grateful to the Allendoerfer Committee for this award. This paper united our respective interests in elliptic curves (Bud) and elliptic functions (Adrian) with our joint interest in the history of mathematics, and it was great fun to write. In addition to the Committee, we wish to express our sincere thanks to Walter Stromquist for all his editorial support at the helm of *Mathematics Magazine*, and to our respective departments for their encouragement and interest in our work. Finally, we want to thank the MAA for three significant reasons: Firstly, meetings of the MAA's Maryland-DC-Virginia section fostered our initial collaboration. Secondly, it was an MAA journal that published the fruits of this partnership. And thirdly, it was a committee of the MAA that saw fit to honor our work in this way. In short, none of this would have been possible without the MAA. So thank you, MAA, once again!

Biographical Notes

Ezra (Bud) Brown grew up in New Orleans, has degrees from Rice and Louisiana State University, and has been at Virginia Tech since 1969, where he is currently Alumni Distinguished Professor of Mathematics. His research interests include number theory and combinatorics, and elliptic curves have fascinated him for a long time. He particularly enjoys discovering connections between apparently unrelated areas of mathematics and working with students who are engaged in research. He has been a frequent contributor to the MAA journals, and he recently served a term as the MD/DC/VA Section Governor. In his spare time, Bud enjoys singing (from opera to rock and roll), playing jazz piano, and solving word puzzles. Under the direction of his wife Jo, he has become a fairly tolerable gardener, and the two of them enjoy kayaking. He occasionally bakes biscuits for his students, and he once won a karaoke contest.

Adrian Rice received a B.Sc. in mathematics from University College London in 1992 and a Ph.D. in the history of mathematics from Middlesex University in 1997 for a dissertation on Augustus De Morgan. He is currently a Professor of Mathematics at Randolph-Macon College in Ashland, Virginia. His research focuses on nineteenth- and early twentieth-century mathematics, on which he has published research papers, articles and books, including *Mathematics Unbound: The Evolution of an International Mathematical Research Community*, 1800-1945, edited with Karen Hunger Parshall, *The London Mathematical Society Book of Presidents*, 1865-1965, written with Susan Oakes and Alan Pears, and *Mathematics in Victorian Britain*, edited with Raymond Flood and Robin Wilson. In his spare time, he enjoys reading, travel, and spending time with his wife and young son.

Trevor Evans Award

The Trevor Evans Award, established by the Board of Governors in 1992 and first awarded in 1996, is made to authors of expository articles accessible to undergraduates and published in *Math Horizons*. The Award is named for Trevor Evans, a distinguished mathematician, teacher, and writer at Emory University.

Margaret Symington

"Euclid Makes the Cut", *Math Horizons*, Volume 19, Number 3, February 2012, pages 6 – 9.

Can you tell the difference between terms used in either dermatologic surgery or geometric topology? Margaret Symington challenges us to do just that and thus engages us immediately in the close relationship between these two seemingly unrelated areas. She describes how Dr. Joshua Lane and she teamed up to make precise his improvement on a skin graft procedure. Dynamic geometry software and theorems from Euclid revealed the optimal way to cut a lens-shaped skin patch so as to improve the healing process. The article is accessible to anyone who has taken high-school geometry and shows a direct and current application for one of the oldest mathematical subjects.

Response from Margaret Symington

I was amazed and excited to receive word that I had won the Trevor Evans Award. I am grateful to the MAA for this generous recognition, and honored to be listed among so many mathematicians who I consider role models.

This article exists because Dr. Joshua Lane, a dermatologic surgeon, understands that mathematics helps us see more deeply. He did not need mathematics to help him in the operating room, but he correctly sensed that some interesting mathematics was lurking in his geometrically insightful choice to cut up and rearrange the pieces of a skin graft before sewing up a wound. My goal in this article was to convey that nugget of mathematics and some of the humor inherent in our collaboration. I am indebted to the editors of *Math Horizons* for wisely rejecting my first attempt but encouraging me to try again. Humor is tricky and it took a few tries to find a format and tone that would do justice to my collaboration and the geometry it revealed. I feel lucky that Dr. Lane sought a mathematician, found me, engaged me in lots of brainstorming sessions, and led me to a gem of a problem. I appreciate the work that my student Jonathan Crosby did to support our exploration of the geometry of bisected lenses and am grateful for the feedback that my colleagues Curtis Herink and Phillip Bean provided on preliminary drafts. Finally, I owe many thanks to Meg Dillon for making sure that the final draft was in top form.

Biographical Note

Margaret Symington studied mathematics (A.B.) and engineering (A.B. and M. Sc.) at Brown University and then taught high school for two years before earning a Ph.D. in symplectic geometry and topology from Stanford University. After a post doc at the University of Texas, a visiting position at the University of Illinois, and an assistant professor position at Georgia Tech, she moved to Mercer University where she has been on the faculty since 2005.

At Mercer, she joins faculty from all disciplines in teaching core general education courses that emphasize writing instruction – and have nothing to do with mathematics. Currently she is helping faculty develop their own variations of a core sophomore-level course in which students explore the topic of community from a variety of disciplinary perspectives.

She is a “cut and paste” topologist who is interested in classical geometry and all aspects of geometric topology, including contact geometry and topological aspects of integrable systems. She enjoys any problem that involves visualization and has particular expertise in using toric geometry to understand symplectic four-manifolds.

Paul R. Halmos - Lester R. Ford Awards

The Paul R. Halmos-Lester R. Ford Awards recognize authors of articles of expository excellence published in *The American Mathematical Monthly.* The awards were established in 1964 as the Ford awards, named for Lester R. Ford, Sr., a distinguished mathematician, editor of *The American Mathematical Monthly,* 1942-1946, and President of the Mathematical Association of America, 1947-1948. In 2012, the Board of Governors designated these awards as the Paul R. Halmos-Lester R. Ford Awards to recognize the support for the awards provided by the Halmos family and to recognize Paul R. Halmos, a distinguished mathematician and editor of *The Monthly,* 1982-1986.

Robert T. Jantzen and Klaus Volpert

"On the Mathematics of Income Inequality: Splitting the Gini Index in Two", *The American Mathematical Monthly*, Volume 119, Number 10, December 2012, pages 824 – 837.

This article starts with the stunning fact that a certain hedge fund manager earned more in 2010 than 50,000 math professors combined. Followed by a graph showing us the percent of annual national income received by the top 1% of wage earners since 1913, this paper easily entrances the reader into exploring various measurements and characteristics of income inequality. Using concrete examples, the authors give clear definitions of Lorenz curves and the Gini index. This index is a number that gives an indication of income inequality in an economy, but its computation requires more information than would normally be available from government sources. The authors use the 2009 U.S. quintile income data to show the challenge of modeling, in a valid and meaningful way, this economic situation with the incomplete data. Going back and forth between economic examples and mathematical models, we are led to a Lorenz curve that both fits the data plus uses meaningful parameters. Most of this is done using just knowledge of functions and their integrals, yet there is enough mathematical rigor and economic data that readers have the pleasure of investigating a mathematical concept in depth and feeling on top of current events.

Response from Robert T. Jantzen and Klaus Volpert

Tackling a problem somewhat outside of our expertise in a curiosity-driven collaboration and actually reaching an interesting new perspective on the issue has been a rewarding experience, especially since it speaks to a wide audience at an elementary level about an important societal problem. We want to express our heartfelt appreciation for this award. It is not often that we, as academics confined to a world of scholarly writing that only other experts can digest, are able to speak to a much broader readership and then actually be recognized for it. Doing so with a friend makes it all the more special.

Biographical Notes

Robert T. Jantzen is professor of mathematics at Villanova University, straddling the fence between physics and mathematics while working in the field of classical general relativity. Having slipped from mathematics into physics as an undergraduate at Princeton during the golden age of general relativity in the 1970's, his graduate work in physics at UC Berkeley was supervised by Abraham Taub in the mathematics department. He has employed the tools of differential geometry and Lie group theory, first to elucidate properties of spatially homogeneous cosmological models, and later of stationary axisymmetric spacetimes like black holes. A backdrop to this career has been the inspiration of a lifetime of academic commuting to the land of Italian geometers like Luigi Bianchi and Tullio Levi-Civita, now joined by one of their contemporaries, Corrado Gini.

Klaus Volpert is an associate professor at Villanova University. He enjoys teaching pure mathematics for its elegance and beauty, and applied mathematics for its power and urgency, and he is most happy when the two come together. He received the university's Lindback Award for Distinguished Teaching in 2009. His research interests have morphed over time from acoustics (during his high school days in Lindau, Germany) to spectral sequences (in his graduate work with Richard Koch at the University of Oregon) to problems at the intersection of mathematics with economics and finance. Outside of academia his greatest joy is making music with his family, Heewon, Hannah and Peter.

Dimitris Koukoulopoulos and Johann Thiel

"Arrangements of Stars on the American Flag", *The American Mathematical Monthly,* Volume 119, Number 6, June-July 2012, pages 443-450.

What do the American flag, the multiplication table, and the average number of prime factors of an integer have in common? Koukoulopoulos and Thiel illuminate these connections in their fascinating article. Reasonable star patterns on the American flag correspond to special factorizations; the density of such factorizations is less than the density of values in a multiplication table; Paul Erdös showed this density asymptotically approaches zero by considering the average number of prime factors of an integer. The conclusions are robust, applying to a broad class of star patterns. Along the way, the authors discuss multiple refinements of results on the average number of prime factors of an integer. The authors combine the history of star patterns on the flag with significant number theory propositions, a happy marriage of an easily understood concrete model with commendable mathematical generality. This paper exemplifies the *Monthly's* goal to "inform, stimulate, challenge, enlighten, and even entertain" its readers.

Response from Dimitris Koukoulopoulos and Johann Thiel

It is a great honor to receive the Halmos-Ford award for our article. We owe a great deal of thanks to our friend Sylvia Carlisle, who brought Chris Wilson's *Slate* article, *13 Stripes and 51 Stars,* to our attention. The motivation for our work came when she wondered why there were no “nice” flag patterns for 29, 69, or 87 stars (suggesting that there must be some number theoretic reason behind it). From this question, we came to realize that flag patterns are connected to Erdős's multiplication table problem.

We would also like to thank A.J. Hildebrand, who very enthusiastically urged us to turn our observations into a paper. Finally, many thanks to Kevin Ford, whose lectures introduced us to Erdős's multiplication table problem, as well as the underlying theory of the distribution of divisors of integers.

Biographical Notes

Dimitris Koukoulopoulos is an Assistant Professor at the University of Montreal. He received his bachelor’s degree from the Aristotle University of Thessaloniki before moving to the University of Illinois at Urbana-Champaign for his doctoral studies. He wrote his thesis on Erdős's multiplication problem and it’s generalizations under the direction of Kevin Ford. Prior to joining the faculty of the University of Montreal, he spent two years as a postdoc at the Centre de Recherches Mathématiques at Montreal. His interests lie in analytic, multiplicative, additive, elementary, and probabilistic number theory.

Johann Thiel is an Assistant Professor at the United States Military Academy in West Point, NY. He received his bachelor’s and master’s degrees from the University of Florida before attending the University of Illinois at Urbana-Champaign to continue his graduate studies. There, under the supervision of A. J. Hildebrand, he developed his appreciation for number theory, where his main interests currently lie.

Lionel Levine and Katherine E. Stange

"How to Make the Most of a Shared Meal: Plan the Last Bite First", *The American Mathematical Monthly*, Volume 119, Number 7, August-September 2012, pages 550-565.

This paper provides an entertaining and remarkably transparent discussion of the "Ethiopian Dinner Game": Two players take turns eating morsels from a common platter. The players may have different utility values (i.e. tastiness) for the morsels but each knows the utility values of the other. What strategy should a player use assuming that they are not cooperating and that both players wish to maximize the sum of the utility values of the morsels they get to eat? The subject of the paper is a strategy for each of the players discovered by Kohler and Chandrasekaran which is based on what authors of this paper call the "crossout strategy": *When it is your turn, eat your opponent's least favorite remaining morsel on your own last move*. Working backwards prescribes the choices of each player. The authors give a new rigorous visual proof that this pair of strategies forms Nash equilibrium, that is, neither player can benefit by changing their strategy unilaterally. The authors give new proofs that the crossover strategy pair is a *subgame perfect equilibrium* and *Pareto efficiently computable*. Along the way, the authors provide a lucid and enjoyable introduction to perfect information game theory.

Response from Lionel Levine and Katherine E. Stange

We're honored to receive this award. The wider message of our article is that mathematics lurks everywhere, just below the surface, waiting to be discovered. Our universe hums mathematics. We first heard that hum 17 years ago at the PROMYS program and have been attuning our ears to it ever since. We hope our article inspires readers to look for mathematics in unlikely places!

Biographical Notes

Lionel Levine is an assistant professor at Cornell University. He lives in Ithaca, NY with wife Karola and two kids (age 1 and 2). He is proud of teaching Peano arithmetic to his son ("tomorrow, the day after tomorrow, the day after the day after tomorrow...")

Katherine E. Stange received her Ph.D. under Joseph H. Silverman at Brown University, despite an interruption to volunteer in Russia and Tibet, and is now an assistant professor at the University of Colorado, Boulder. When she's not thinking about number theory, she enjoys bicycling up mountains with her husband and tricycling along bike paths with her young son.

Dan Kalman and Mark McKinzie

"Another Way to Sum a Series: Generating Functions, Euler, and the Dilog Function", *The American Mathematical Monthly*, Volume 119, Number 1, January 2012, pages 42-51.

Despite its great fame, many proofs, and well known history, this paper shows that all is not known about Euler's well known result from 1735 that the sum of the reciprocal squares is $\pi^2/6$. In fact, in this paper the authors wrap their presentation of an unfamiliar but very intuitive proof of the result in a fascinating historical mystery. The proof combines very natural ideas from calculus and generating functions to arrive at what the authors call "the roadblock". The roadblock can be removed but only via two identities–both of them due to Euler. The puzzle then remains: "Did Euler know this proof?"

An engaging historical section acknowledges L. Lewin's *Polylogarithms and Associated Functions* from 1981 as the source of the argument to come. The authors then proceed with the calculus derivation that leads to the roadblock that

$$\sum_{k=1}^{\infty} \frac{1}{k^2} = -\int_0^1 \frac{\ln(1-z)}{z}\, dz.$$

They gracefully employ a Dilog identity of Euler's, which he might possibly have known in 1730, and his famous identity $e^{\pi i}= -1$ to sum the series. The meat of the paper is then a very careful and lucid section that makes the Eulerian style argument above completely rigorous. The paper finishes with the historical puzzle. This article brings a beautiful but unfamiliar proof of Euler's result to the public eye while also illustrating how powerful an intuitive proof combined with the necessary rigorous argument can be. Finally the authors succeed in bringing the mathematical mind of Euler to life when they speculate about whether he knew this proof, and if he did know it why it was not published.

Response from Dan Kalman and Mark McKinzie

We are deeply honored and appreciative that our paper has received the Halmos-Ford Award. Seeing our thoughts on Euler and the dilogarithm appear in print in the *American Mathematical Monthly* was, in itself, highly gratifying. For that work to be awarded the Halmos-Ford Award is a delightful surprise.

The sum of the reciprocals of the squares, and the wealth of related ideas and methods, is a fascinating subject. Euler himself must have been strongly attracted to it, as he returned to the subject repeatedly over a span of 50 years. It is a pleasure to make our small contribution to sharing this story with the mathematical community.

We are indebted to the scholars whose labors make Euler's work accessible to a broad audience, and those who contributed directly or indirectly to our research, including Bill Dunham, Ed Sandifer, Rob Bradley, V. S. Varadarajan, Ranjan Roy, Dominic Klyve, Lee Stemkoski, and Erik Tou. We are also indebted to the MAA for supporting the study of Euler's work by publishing books, offering minicourses and PREP Workshops, hosting the Euler Archive, and of course, publishing journals like *The Monthly*. Finally, we offer our thanks to the editors and referees of *The Monthly* for their help in production of the article.

Biographical Notes

Dan Kalman has been a member of the mathematics faculty at American University, Washington, DC since 1993. Prior to that he worked for eight years in the aerospace industry and taught at the University of Wisconsin, Green Bay. Kalman has a B.S. from Harvey Mudd College and a Ph.D. from University of Wisconsin, Madison. He has been a frequent contributor to all of the MAA journals, has published two books with the MAA, and has served the MAA in various capacities, including as an MAA associate executive director, on the MAA Board of Governors, on the editorial boards of both MAA book series and journals, and as a cast member of both productions of MAA - the Musical.

Mark McKinzie earned his Ph. D. in mathematics from the University of Wisconsin in 2000. His dissertation on formalist techniques in the early history of power series was completed under the supervision of Michael Bleicher and fostered an ongoing fascination with the mathematical work of Edmond Halley and Leonhard Euler. He taught at Monroe Community College for five years, and in 2004 joined the Department of Mathematical and Computing Sciences at St. John Fisher College. When not thinking about mathematics and its history, he enjoys traveling with his family, learning new recipes and cooking techniques, and solving kakuru puzzles.

Merten M. Hasse Prize

The Merten M. Hasse Prize is for a noteworthy expository paper appearing in an Association publication, at least one of whose authors is a younger mathematician. The prize is named after Merten M. Hasse, an inspiring and dedicated teacher of the anonymous donor who gave funds to MAA in 1986 to support the prize honoring such teachers. The Hasse prize is designed to be an encouragement to younger mathematicians to take up the challenge of exposition and communication.

Henryk Gerlach and Heiko von der Mosel

"On Sphere-Filling Ropes," *American Mathematical Monthly*, Volume118, Number 10, December 2011, pages 863-876.

In the paper "On Sphere-Filling Ropes," authors Henryk Gerlach and Heiko von der Mosel address the problem of finding the longest closed curve of given positive minimal thickness of a rope which covers the sphere. This is one of those rare articles that inspire the reader to ponder the details of solving a readily understood problem. For each possible thickness of the rope it was previously known that there is at least one length maximizing curve, but the argument is not constructive. The authors present explicit solutions for a number of cases. Their initial construction involves a set of uniformly thick and pairwise disjoint horizontal circles covering the sphere. The sphere is cut by a vertical great circle, and then one side of the cut sphere is rotated in an attempt to form a single rope on the sphere by joining ends of those cut thick circles. For a countable number of thicknesses, such ropes can be constructed, and they provide a solution to the problem. A uniqueness theorem shows that these solutions are the only solutions (up to rotations of the sphere) of the problem for each thickness.

The article includes a fine introduction that explains the problem in the context of other related problems and applications. The final section reviews the results and goes on to describe multiple open problems. In between the introduction and final section, there are helpful transitions between the main ideas where the authors review what has been established and point out what will come next. The mathematical ideas are clearly expressed and well organized. Figures throughout the paper greatly enhance the text.

Response From Henryk Gerlach and Heiko von der Mosel

Why did we wonder how to cover a sphere with a rope? We were interested in ideal knots on the three-dimensional unit sphere in R^4, but at the beginning we only had computer code to simulate ropes in R^3. While going from R^3 to R^4 is straightforward, we were wondering whether there might be side effects when restricting to the three-sphere. As a toy problem, we numerically tackled the question "what are the longest ropes on the two-dimensional unit sphere?". The numerics worked but were inconclusive. In a clear moment, the solution constructed from stacked circles became apparent, and after some hard work, we were able to prove uniqueness of these solutions.

We are deeply honored to receive the Merten Hasse Prize. And we would like to thank those people who made it possible: first, the anonymous referee for his valuable suggestions, and the editor Daniel J. Velleman who patiently pushed us to polish the article. We further would like to thank John H. Maddocks, who had proposed to consider ideal knots in S^3 a long time ago, and who also advised us later to submit the article to *The American Mathematical Monthly*. Of crucial help in writing the software and visualizing the results were various open source programs. A big thank you to the free and open source software community! Finally we would like to thank the German and Swiss national science foundations, DFG and SNSF, for their generous financial support.

Biographical Notes

Henryk Gerlach earned his diploma at the University of Bonn in 2005. He received his Ph.D. in 2010 from the École Polytechnique Fédérale de Lausanne under the guidance of John H. Maddocks and Peter Buser. He is currently working as a business intelligence consultant in Switzerland. During his job he struggles for mathematical beauty and simplicity in a sea of ugly real world data, deadlines, and bureaucracy. In his free time, he still thinks about geometric knot theory and other mathematical problems as they come up, jogs along Lake Geneva, or cooks with friends.

Heiko von der Mosel completed his Ph.D. under the supervision of Stefan Hildebrandt at the University of Bonn in 1996. He is a professor of Mathematics at RWTH Aachen University, and his research is devoted to the calculus of variations and geometric analysis. In recent years he investigated the analytic aspects of geometric knot theory and its interesting connections to harmonic analysis and differential geometry, as well as its applications to theoretical physics and biology.

George Pólya Awards

The George Pólya Awards, established in 1976, are made to authors of articles of expository excellence published in the *College Mathematics Journal*. The Awards are named for George Pólya, who was a distinguished mathematician, well-known author, and professor at Stanford University.

Jacob Siehler

“The Finite Lamplighter Groups: A Guided Tour”, *The College Mathematics Journal*, Volume 43, Number 3, May 2012, pages 203-211.

Does the imperative of technical accuracy compel mathematical exposition to be impersonal and officious? Not if you’re Jacob Siehler. He introduces us to his pals, the lamplighter groups, in a manner that feels like an after school chat at the corner bar.

The finite lamplighter group L_n has *n* lamps arranged in a circle with a lighting mechanism. An operation consists of rotating the lighter and then possibly toggling one of the lamps on-off. Siehler urges us to get our hands dirty, to play around with these operations to see how they behave. He leads us to see what conjugates, centers, and commutators “look like”. At first it seems difficult to identify the conjugate elements. Surprise! To recognize the conjugacy class of an element that rotates *k* steps, we identify two-colored necklaces of length gcd(*n,k*). The number of rotation *k* classes is the same as the number of length gcd(*n,k*) necklaces. Guided by this insight, we soon are comfortable using necklaces to describe the center and commutator subgroups. We feel like we really know these groups.

The finite lamplighter groups provide appealing examples of nonabelian groups just a touch beyond the dihedral groups. Siehler has given us a wealth of material suitable for classroom use in a beginner course. Before leaving us, he suggests a list of exercises and open questions. Read the list, and even more questions readily come to mind. Compelling mathematics raises more questions than it answers.

Response from Jacob Seihler

As a student at Virginia Tech, I spent considerable time in a favorite professor's office, and when my brain reached its saturation point, I would often look up at the *multiple* Pólya awards on the wall and indulge in a bit of daydreaming. "But no, surely I couldn't ever…"

Well, it appears that I have after all, and while I am as surprised as anyone, I am absolutely delighted to have earned the recognition. My article on the lamplighter groups began in an empty classroom, where I gradually filled up the slate blackboards with the results of my curiosity, working all the way around the room in multiple colors of chalk, punctuating the best bits with exclamation points, which I am always prone to overuse. At some point, finally, I looked around at the Large Mass of Disorganized Mathematics and said, "This is *so cool!* I have to tell somebody about this!!!", and I dashed out of the room to do so immediately. I believe something similar once happened to Archimedes, although he did not receive the Pólya award for it.

I would not have the sense to recognize interesting mathematics or the means to tell anyone about it if not for the authors, editors, teachers, and colleagues who have generously shared their own enthusiasm, and quite patiently helped me to channel my own. Thank you. A browse through the prior years' Pólya-winning papers has reminded me how much more there is yet to learn, and how joyful the process can be.

Biographical Note

Jacob Siehler received his B.S. in mathematics and computer science at Frostburg State University, and his PhD. in mathematics from Virginia Tech, where he studied topological quantum field theories with Frank Quinn. From there, he went to Washington & Lee University where he taught until 2012. He lives near Lexington, Virginia with a Belgian sheepdog who has never been employed to grade Siehler's calculus homework for him, despite the rumors.

David Applegate, Marc LeBrun, and Neil J. A. Sloane

“Carryless Arithmetic Mod 10”, *The College Mathematics Journal,* Volume 43, Number 1, January 2012, pages 43-50.

In the fabled Carryless Islands of the South Pacific, inhabitants use a type of arithmetic that is so close, yet so far from our ordinary integer arithmetic. The “carefree” residents of these islands have the perverse habit of adding and multiplying numbers with no carries into other digit positions. It is within this whimsical setting that Applegate, LeBrun, and Sloane take readers on an exploration of this culture’s mathematics and along the way, discover some interesting sequences and number-theoretic results.

The authors begin by listing the first twenty carryless primes (non-units whose only factorizations are of the form $u\, x\, p$, where u is a unit and p is an integer), and mentioning that, due to some strange factorizations of the numbers (for example, $2 = 2\, x\, 51$), it is difficult to verify directly, or even by computer, that their list is correct. Instead, they cleverly use algebra to create an algorithm which not only proves the accuracy of their list, but also generates all carryless primes. This number system also differs from ours in that there exist numbers with an infinite number of divisors, and there is a formula for the number of k-digit carryless primes.

This article is an innovative and engaging treatment of a topic that will naturally inspire readers to ask and explore similar questions. Instructors can easily use this material in a first course on number theory or abstract algebra, and the open questions at the end will provide students with ideas for research projects.

Response from David Applegate, Neil J. A. Sloane, and Marc LeBrun

It is a great honor to receive an award named after this distinguished mathematician, author of some of our favorite books (especially *Aufgaben und Lehrsatze aus der Analysis*, *Inequalities*, and *How to Solve It*), and the founder of the modern theory of combinatorics.

Biographical Notes

David Applegate received his Ph.D. in Computer Science from Carnegie Mellon, and has been at AT&T Shannon Labs since 2000. His research interests include combinatorial optimization, the Traveling Salesman Problem, and other mathematical diversions.

Marc LeBrun was confirmed as an ardent amateur mathematician at age ten, when Martin Gardner graciously answered his fan letter. He is delighted to find professional colleagues who share his interests in recreational arithmetic, and is an enthusiastic contributor to the On-Line Encyclopedia of Integer Sequences.

Neil J. A. Sloane (home page http://neilsloane.com) was at AT&T Bell Labs and later AT&T Shannon Labs from 1969 to 2012. He has written many books and articles on mathematics, engineering and statistics. He also runs the On-Line Encyclopedia of Integer Sequences.

The 72nd William Lowell Putnam Mathematical Competition

December 1, 2012

The William Lowell Putnam Mathematical Competition is an annual contest of the Mathematical Association of America for college students established in 1938 in memory of its namesake. Each year on the first Saturday in December, over 2000 students spend six hours (in two sittings) trying to solve twelve problems.

The Five Highest Ranking Individuals

1. Benjamin P. Gunby, *Massachusetts Institute of Technology*
2. Eric K. Larson, *Harvard University*
3. Mitchell M. Lee, *Massachusetts Institute of Technology*
4. Zipei Nie, *Massachusetts Institute of Technology*
5. Evan M. O’Dorney, *Harvard University*

Team Winners

1. Harvard University
   Eric K. Larson, Evan M. O'Dorney, and Allen Yuan
2. Massachusetts Institute of Technology
   Benjamin P. Gunby, Brian C. Hamrick, and Jonathan Schneider
3. University of California, Los Angeles
   Xiangyi Huang, Tudor Padurariu, and Dillon Zhi
4. Stony Brook University
   Thao T. Do, Dat Pham Nguyen, and Kevin R. Sackel
5. Carnegie-Mellon University
   Micheal T. Druggan, Albert Gu, and Linus V. Hamilton

The United States of America Mathematical Olympiad

The USAMO (United States of America Mathematics Olympiad) provides a means of identifying and encouraging the most creative secondary mathematics students in the country. It serves to indicate the talent of those who may become leaders in the mathematical sciences of the next generation. The USAMO is part of a worldwide system of national mathematics competitions, a movement in which both educators and research mathematicians are engaged in recognizing and celebrating the imagination and resourcefulness of our youth. The USAMO is a six-question, two-day, nine-hour essay/proof examination. This year it was held on April 30-31, 2013.

Winners (in alphabetical order)

- Calvin Deng, North Carolina School of Science and Math, NC
- Andrew He, Monta Vista High School, CA
- Ravi Jagadeesan, Phillips Exeter Academy, NH
- Pakawut Jiradilok, Phillips Exeter Academy, NH
- Kevin Li, West Windsor-Plainsboro High School South, NJ
- Ray Li, Phillips Exeter Academy, NH
- Mark Selke, William Harrison High School, IN
- Bobby Shen, Dulles High School, TX
- Zhuoqun Song, Phillips Exeter Academy, NH
- David Stoner, South Aiken High School, SC
- Thomas Swayze, Canyon Crest Academy, CA
- Victor Wang, Ladue Horton Watkins High School, MO

Henry L. Alder Awards for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member

The Alder awards were established in January 2003 to honor beginning college or university faculty whose teaching has been extraordinarily successful and whose effectiveness in teaching undergraduate mathematics is shown to have influence beyond their own classrooms. An awardee must have taught full time in a mathematical science in the United States or Canada for at least two, but not more than seven, years since receiving the Ph.D. Henry Alder was MAA President in 1977 and 1978 and served as MAA Secretary from 1960 to 1974.

Kumer Das

Kumer Das, of Lamar University, is an outstanding classroom instructor whose significant impact beyond his classroom includes program development, undergraduate research, and curriculum development. Dr. Das teaches a wide variety of undergraduate and graduate courses, creatively incorporating technology, Problem Based Learning, and the Modified Moore Method. He continually refines his courses with real-world applications, and regularly invites industry professionals to present to his classes. Dr. Das has been a leader in developing Lamar's active actuarial mathematics program. He has also designed and implemented a new degree plan in mathematics with a statistics concentration, which has attracted more than twenty new majors in the past four years. Dr. Das is a prolific undergraduate research mentor, having worked with more than thirty students on research projects, resulting in three referred student publications and forty student presentations at regional and national meetings. Because of his cross-disciplinary research collaborations, he has been able to successfully recruit students from a variety of backgrounds to do research in the mathematical sciences. Dr. Das is a departmental curriculum leader, having served as College Algebra, Calculus, and Trigonometry course committee chair. Dr. Das is a volunteer math teacher at a local elementary and middle school, and he is an award-winning advisor of several Lamar student organizations. Dr. Das is an energetic, enthusiastic, passionate, sincere, and patient professor, who is credited with positively impacting both his students' mathematics skills and their self-confidence.

Response from Kumer Das

It is a great honor to receive the Alder award from the MAA. I am most grateful to my wonderful colleagues at Lamar University. Without the advice, guidance, and inspiration of my colleagues, my professional life would be incomplete. I am also grateful to many wonderful students at Lamar with whom I get to teach, learn, and do research. I would like to use this opportunity and thank all institutions (Dhaka University, Bangladesh; Auburn University, Lamar University, University of North Carolina at Greensboro, and Statistical and Applied Mathematical Sciences Institute (SAMSI)) I have been fortunate to be affiliated with as a student, as a faculty and as a researcher. I also owe a debt of gratitude to my parents and siblings, especially my father who was an award winning high school teacher. Finally, I would like to thank my wife, Reena, and our children, Pranjol and Purba.

Biographical Note

Kumer Pial Das obtained his PhD in Mathematical Statistics from Auburn University in 2005. He joined the Department of Mathematics at Lamar University in 2005.

Currently he is an associate professor of statistics. He is a Project NExT fellow. He is also the current president of Conference of Texas Statisticians. His research interest is in the area of statistics, actuarial mathematics and probability theory. Currently, he is on sabbatical working with researchers at the Statistical and Applied Mathematical Sciences Institute (SAMSI), an NSF funded institute, on methods for the analysis of large medical data sets. He is very much involved in undergraduate and graduate research. He credited his parents, both of whom were teachers, for his passion for teaching.

Rachel Levy

Rachel Levy, of Harvey Mudd College, shines as an exemplary communicator of mathematics to diverse audiences. Her popular soap and slope activity has reached thousands of children and adults through venues like the USA Science and Engineering Festival. She thoughtfully designs educational experiences for her students, and promotes wider conversations about pedagogy, especially at Harvey Mudd College where she chairs the College's Teaching and Learning Committee. Dr. Levy's students benefit from her singular teaching style encompassing creative writing and presentations about mathematics, tips about meta-cognition and problem solving, and assignments tuned to be realistically messy. She has mentored over thirty student research projects and guided many of these students to produce research publications, while coaching students to enjoy and to share mathematics. Her reputation for mentoring communication in research is confirmed by her recent appointment as the editor for the Society for Industrial and Applied Mathematics (SIAM) Undergraduate Research Online journal. With her colleagues in Mathematics, Engineering and Chemistry, she is investigating the inverted classroom, quantifying learning outcomes for students who watch lectures at home and devote class time to activities. Dr. Levy's students love her for the way she mentors all aspects of their journey to adulthood, both academic and personal.

Response From Rachel Levy

I am grateful to the MAA for this award that celebrates teaching, especially since it took me 10 years to gather the courage to attend graduate school in mathematics. During those years, my students at Learning Disabilities Services at the University of NC Chapel Hill and in Middle and High School at Carolina Friends School taught me many lessons that continue to serve me well as a college professor. My own teachers and teaching colleagues have provided generous affirmation, inspiration, and education. To all of them and to my family and friends I give my gratitude. As an undergraduate, I never imagined that I would earn a PhD in Mathematics, find a home in a wonderful mathematics department, and be graced with an honor such as the Alder Award.

Biographical Note

Rachel Levy's passion is communication. She has a BA in English and mathematics from Oberlin, an MA in instructional design from UNC-CH and a MA/PhD in Applied Mathematics from North Carolina State University. At Harvey Mudd College she regularly teaches Math Forum which prepares mathematics majors to design and deliver excellent talks. In addition to mathematics, she regularly teaches first-year writing. She serves as chair of her college's Teaching and Learning Committee and on the Society for Industrial and Applied Mathematics (SIAM) Education Committee. Levy facilitates project-based learning for students at all levels, from end-of-class projects in first-year differential equations to year-long industrial projects for teams of seniors. She encourages her research students to share mathematical fluid mechanics with a variety of audiences through conferences, outreach programs, and formal research papers. Her online project *Grandma got STEM* shares the power and talent of geeky grannies with its international readership.

Christopher Storm

Christopher Storm, of Adelphi University, is cited as a creative, thoughtful, and engaging instructor whose impact on the teaching of mathematics goes far beyond his classroom and his institution. His students praise him for his enthusiasm, dedication, and creativity, as well as his ability to convince them that struggling with difficult mathematics pays off in greater understanding. His classrooms incorporate a variety of styles, from inquiry-based learning to small-group discussions, all designed to excite his students and to model the process of critical inquiry that he applies to his own teaching. Both inside and outside his department, Dr. Storm's colleagues praise him for his campus-wide leadership as chair of Adelphi's First Year Experience Committee, which resulted in many improvements to the first year seminars taken by incoming freshmen, and for his "To Infinity and Beyond" course for Adelphi's Honors College. He received Adelphi's Faculty Excellence Award in Teaching, awarded annually to one untenured faculty member per year. Finally, Dr. Storm has also contributed to the broader mathematical community, with three chapters in an MAA Notes volume, an *MAA Focus* article on encouraging active learning, several published applets and activities on topics in analysis, and working as an active member of the National Science Foundation grant MathVote: Teaching Mathematics with Classroom Voting. For Christopher Storm, teaching is a great delight.

Response from Christopher Storm

I find myself at my best as a teacher when I and my students are having fun while doing mathematics. I attribute a large portion of my success as an educator to students who are not only willing to come along for the ride but to take over the wheel. It is their passion and excitement that has fueled my own.

Many people have supported me in my development as a teacher. While I cannot thank all, I would like to highlight a few: Chuck Straley for using Moore method teaching with high school students, Kenneth Bogart for his patience and good questions, Project NExT and the MAA, Holly Zullo and Kelly Cline for inviting me to join their work on classroom voting, my colleagues and department chair for their constant support, and, of course, my wife and family who forgive me for many late evening e-mails to students.

I am honored to receive the Alder Award from the Mathematical Association of America.

Biographical Note

Chris Storm received his Ph.D. in mathematics from Dartmouth College in 2007, under the direction of Dorothy Wallace. While there, he had the opportunity to take a teaching seminar that encouraged active learning and inquiry-based learning strategies. He is an Exxon-Mobil Project NExT Sun Dot (2007) Fellow. At present, Chris is an Assistant Professor and Associate Chairman in the Department of Mathematics and Computer Science at Adelphi University. He is also part of the research team on the National Science Foundation grant "MathVote: Teaching Mathematics with Classroom Voting." His mathematical interests include number theory, combinatorics, and combinatorial games. In his free time, he enjoys playing bridge and hiking.

Mary P. Dolciani Award

The Mary P. Dolciani Award recognizes a pure or applied mathematician who is making a distinguished contribution to the mathematical education of K-16 students in the United States or Canada. The award is named for Mary P. Dolciani Halloran (1923-1985), a gifted mathematician, educator, and author, who devoted her life to developing excellence in mathematics education. A leading author in the field of mathematical textbooks at the college and secondary school levels, she published under her professional name Dr. Mary P. Dolciani. This award is made possible by a gift from the Mary P. Dolciani Halloran Foundation.

Hyman Bass

As a research mathematician who is making distinguished contributions to the mathematical education of K-16 students. Hy Bass is Distinguished University Professor of Mathematics at the University of Michigan. He received the National Medal of Science in 2008; that formal citation includes the following: "For his fundamental contributions to pure mathematics, especially in the creation of algebraic K-theory, his profound influence on mathematics education, and his service to the mathematics research and education communities." Since serving on the Mathematical Sciences Education Board at the National Academy of Sciences in 1991, he has written many influential papers about mathematics education. He has also been collaborating with Deborah Loewenberg Ball at the University of Michigan since 1996 on the mathematical knowledge and resources entailed in the teaching of mathematics at the elementary level, developing teaching training programs devoted to both content and pedagogy. He has served on many important committees on education. He has exhibited strong leadership in putting issues in K-8 mathematics education in front of mathematicians through his speeches, writings, and policy influence within many mathematical bodies, including the AMS Committee on Education and MSRI's Education Advisory Committee. Recently, he co-organized the 2012 and 2013 Critical Issues in Mathematics Education workshops on the Common Core State Standards. He has been a tireless advocate for increasing dialogue, understanding, and respect between mathematicians, educators, and school teachers.

Response From Hyman Bass

I am deeply grateful and honored to be awarded the Dolciani Prize. The work of mathematicians in education, exemplified by Mary Dolciani, has a distinguished tradition, going back to figures like Felix Klein, Hans Freudenthal, and George Polya. In our own time, I have taken both knowledge and inspiration from many others, such as Herb Clemens, Paul Sally, Roger Howe, and Bill McCallum. But my greatest debt for my work in education goes to my colleague and mentor, Deborah Ball, whose work most consummately partners the two words, mathematics education.

Biographical Note

Hyman Bass is the Samuel Eilenberg Distinguished University Professor of Mathematics and Mathematics Education at the University of Michigan. He has served as the President of the American Mathematical Society and of the International Commission on Mathematical Instruction and as Chair of the Mathematical Sciences Education Board at the NRC. He is a member of the U.S. National Academy of Sciences, the American Academy of Arts and Sciences, the Third World Academy of Sciences, and the National Academy of Education. In 2006 he received the U. S. National Medal of Science. His mathematical research spans various domains of algebra, notably algebraic K-theory and geometric group theory. His work in education (largely with Deborah Ball) focuses mainly on mathematical knowledge for teaching, and on the teaching and learning of mathematical practices, such as reasoning and proving, and discerning and developing mathematical structure, in K-16 classrooms.

Index of Award Recipients

(Alphabetically)