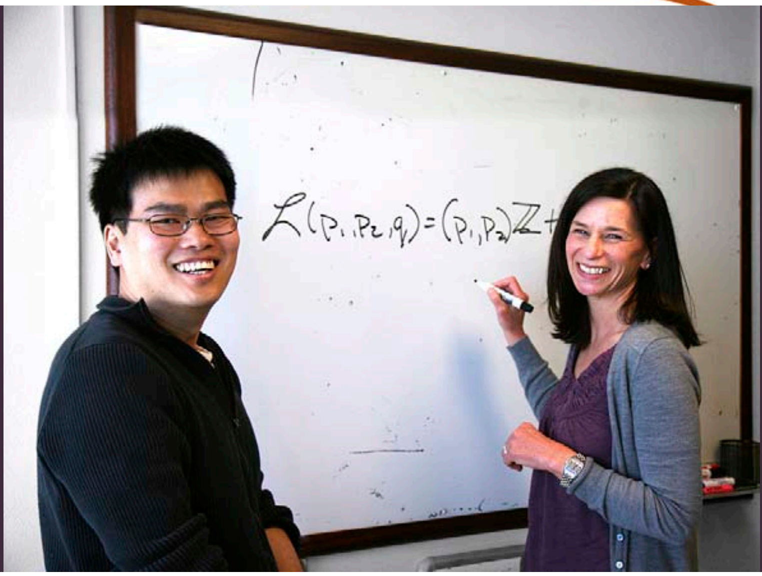
SAN FRANCISCO STATE UNIVERSITY
DEPARTMENT OF MATHEMATICS

MATH news

Spring 2016

We publish this newsletter to acquaint our community and graduates with developments here. Our faculty wishes to emphasize the connection between their research and their work as teachers. MATHnews will include only a selection of available news items. For many others, consult the news section on our website: http://math.sfsu.edu/

On later pages



Prof. Yitwah Cheung *Ms. Deborah Damon*

Deborah Damon: Re-entry

Our alumna Deborah Damon was born in Scotts Valley, and educated in public schools there. She had a rough childhood; three sisters did not finish high school. But she won a scholarship to UC Berkeley: "I knew that if I wanted to escape I needed to concentrate on studies." She started preparing for an engineering career, but developed a love for our subject instead, and completed a double major: applied mathematics and economics. Deborah secured employment as a research analyst in financial services, and became a portfolio manager, expert on zero-coupon bonds. In due time, she left that profession to become a mother. Her three children are now college-educated and starting professional careers.

Deborah headed back to mathematics: "I'm terrified of losing the ability to think," she remarked. The only available mathematical job was at Marin Catholic High School, near her home. She found that she really liked teaching, and decided to relearn her mathematics and enter community-college teaching. While caring for her aged mother, she retook lower-level courses and regained her confidence. Deborah entered our program to complete the upper-division requirements, and then to earn a master's degree. Coming back was indeed difficult: "I don't think as quickly as others, or maybe I expect to understand more deeply. It was a little hard to be always the oldest person in class, a bit of an outsider. But I never felt any singularity as a woman, anywhere." At first intimidated by the thought of writing a thesis, she finally undertook a project with Prof. Yitwah Cheung related to his research on continued fractions. That subject is not covered in our standard courses, so she dived into a famous and difficult text, mastered the subject, and understood and solved the suggested problem, completing her thesis in 2011. During this process Deborah's drive to achieve deep understanding led to her simplification of some of the proofs in Cheung's own work. He praised her professionalism and reports that she has proceeded considerably beyond the material in her thesis and has discovered how certain symmetries arise in his constructions: "This helped me, and let my research go forward." Deborah offers potential students this advice: "Read—force yourself to understand."

James T. Smith

A New Statistical Learning Course

There is no doubt that data scientist is one of the hottest jobs in this age of big data. When searching "data scientist" on the Linkedin website one finds more than 38,000 results. From Uber to Google, high tech companies are consistently looking for data scientists. They correctly foresee that data scientists can uncover information that can enhance their profitability. Gathering this information is therefore crucial to the survival and development of any company. There is also high demand for the services of data scientists in other areas such as medicine, marketing, finance and the media.

To better prepare San Francisco State students for the great opportunities arising in the San Francisco Bay Area, the Mathematics Department is offering a new course MATH 448: Introduction to statistical learning and data mining, beginning this spring 2016.

Statistical learning, a recently developed area in statistics that complements parallel developments in computer science, refers to the process of extracting important patterns and trends from complex datasets using modern statistical tools. Here are some examples of the learning problems that this new discipline examines:

- Is an email spam?
- What is the risk for any given person to develop a specific disease?
- How can a handwritten number, such as a zip code, be recognized in a digitized image?
- What is the predicted price of a stock 6 months from now?

This course will be taught by Dr. Tao He, who just joined the department in 2015 after completing her Ph.D. in Statistics and the dual Ph.D. in Quantitative Biology at Michigan State University. The course is intended for anyone who is interested in applying modern statistical methods to analyze data and generate predictions from identified patterns in the data. The mathematical level of the course is modest and introduction to the statistical programming language R will also be provided. Students will obtain hands-on experience by analyzing real data sets with skills learned throughout the course.

Fascinated by data? Interested in modeling? The opportunity is knocking. Get yourself enrolled as soon as possible to get more valuable training before you enter the job market.

Tao He

On our Lecturer Colleagues

Our department regularly employs about twenty lecturers who teach about half of our non-remedial courses. Several of them have been with us for many years and sometimes for decades. Needless to say, they play an essential role in our success as a department. I met with two of them, Elizabeth Chemouni and Michael Maxwell to learn more about how they view their work and their place in our department.

Elizabeth received her Master's degree from our department 15 years ago. Since then, she has been teaching at SF State and at Berkeley City College. Here, at SF State, she has taught courses for the elementary curriculum (Math 165 and 565). Nowadays, she is co-teaching our online calculus with Dr. Arek Goetz. Elizabeth seems to like the online format of education a lot. She mentioned the Piazza online forum as a particularly helpful tool for student learning. The reason, she says, is that it incites students to participate rather than to listen passively to a lecture. Elizabeth enjoys working in Mathematics education. She likes "demystifying" mathematics.

I asked her how she feels about our department and our permanent faculty. Her spontaneous response was music to my ears: "You guys are cool!"

Michael Maxwell has been with us for about 10 years. He is one of our lecturer colleagues who hold a doctorate. He has also taught at San Jose State and at SF City College. Here, at SF State, he has been teaching our Business Calculus, Elementary Statistics and all levels of Calculus. He prefers teaching the more advanced courses in part because of the frustration he sometime feels when working with very underprepared students in lower level classes. We both lamented the low mathematical abilities that are apparent in so many of our incoming students: although initiatives such as StatWay are designed to move away from the mechanics of algebra towards more reasoning and conceptualizing with Mathematics, veterans of that project often do not meet our standards of competency and tend to have poor quantitative reasoning skills.

I also asked him how he feels about our department: it is the best he has worked in, he said.

Jean-Pierre Langlois

SF Math Circle: A Place to Share your Passion for Mathematics

The SF Math Circle (SFMC) is an enrichment program designed to increase the quality and quantity of students who become mathematics educators and researchers, or who simply love and use mathematics in their studies, work and daily activities.

The SFMC is administered through the Center for Science and Mathematics Education (CSME) at SF State. The current Directors are Addie Schnirel (CSME employee and MA in Mathematics alum), Emily McCullough (SF State Mathematics graduate student and CSME employee), and Dr. Paul Zeitz who is chair of the Department of Mathematics and Statistics at the University of San Francisco.

SFMC and the SFSU Department of Mathematics

Since 2009, graduate students from SF State's Math Department have been involved with the SF Math Circle. Through a five year NSF math fellowship program at SF State (2009-14), called Creating Momentum through Communicating Mathematics, or $(CM)^2$, nine math graduate students were mentored and trained as math circle instructors each year. Undergraduate students from SF State's thriving pre-service teacher community have also been involved as volunteers, several of whom have since become lead instructors for SFMC.

SFMC welcomes graduate and undergraduate students to participate in their program, as well as professors. SFMC trains and mentors volunteers & instructors to participate in math circles and to embrace the program's non-traditional math learning philosophy. For these SF State students, SFMC provides a meaningful way to share one's passion for mathematics with youths from the greater SF community, as well, SFMC is a good source of financial support. SFMC is always eager to have students and professors of Mathematics participate in our program, either as guest instructors, or as ongoing instructors, or as mentors to our student instructors.

Math Graduate student Josh Rhodes with an elementary class at SF State – students working with sequences on long strips of paper.

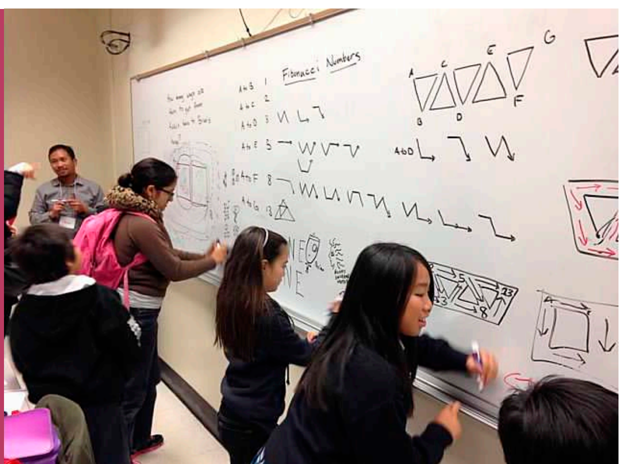
What is a Math Circle?

A math circle is a form of enrichment that originated in Eastern Europe about a century ago, characterized by several features that distinguish it from a simple math club. First, it is vertically integrated: young students may interact with older students, college students, graduate students, industrial mathematicians, professors, even world-class researchers, all in the same room. The circle is not so much a classroom as a gathering of young initiates with elder tribespeople, who pass down folklore.

Some Examples of Mathematical activities Popular at SFMC:

EXAMPLE 1 – The Game of Nim: Students are introduced to the game of Nim through a simple variety known as One Pile Nim. They get an opportunity to play for a little while in order to become familiar with the game. The instructor will then lead a discussion of strategy and ask students to share thoughts with questions such as "Is it better to go first or second?" or "What if we start the game with only 3 chips?" By making the problem smaller, recording information and reusing/recycling known conclusions, students develop a winning strategy and can conclusively answer the question "Is it better to go first or second?" for a generic game of One Pile Nim starting with n chips. In the weeks following, the instructor(s) may introduce other versions of Nim, including a variety known as "Puppies and Kittens." The focus of discussion for these follow-up sessions is problem-solving strategies and how each strategy did or did not help us learn about the game.

EXAMPLE 2 – Intro to Topology: (Part 1) Using Mobius bands and a different number of twists, student observe what kind of surfaces occur by cutting ½ down the strip and ⅓ down the strip. The question arises: "How does the number of twists affect the number of sides and edges that a Mobius strip has?" Torus knots can also be discussed. (Part 2) The next topic explores the use of diagrams in constructing different surfaces. Students can explore the gluing diagrams of the sphere, torus, double torus, and the cylinder. The instructor can ask, "How would the world be different if we lived on these surfaces?" To further the exploration of this question, the students play tic-tac-toe on these surfaces. You might ask yourself, "What does three-in-row look like on a torus?" (Part 3) The discussion now turns to other ways of breaking down surfaces. The instructor can ask, "What are the basic shapes we need to construct a sphere or a torus?" We introduce a disk and a "pants" shape and ask, "What could we construct with 1 pair of pants and 1 disk, 2 pairs of pants and 1 disk, and so on?" These three parts are usually broken up into 1-3 sessions (each session occurring weekly), depending on student interest and pace.



Activity on Fibonacci numbers at SF State.

EXAMPLE 3 – Pick's Theorem: Pick's Theorem provides a formula for calculating the area of a lattice polygon in terms of the number of lattice points in the interior of the polygon and the number of interior points on the boundary of the polygon. Using geoboards and the area formula for rectangles and right triangles (the extension of the area formula to all triangles can be observed and made sense of in this activity), students investigate this lattice point enumeration problem and get a taste of geometric combinatorics and Ehrhart theory. The main role of the instructor in this activity is to help the class find and see patterns among the data they collect. Instructors will guide the students to investigate how the area changes when you fix the number of boundary points and vary the number of interior points, and vice versa.

At SFMC, we present problems that require investigation, which is both an art and a science, and which requires the application of psychological strategies such as concentration, confidence, and creativity. Math circles teach students these skills, not with formal instruction, but by doing math and observing others doing math. Students learn that a problem worth solving may require not minutes, but possibly hours, days, or even years of effort. They work on some of the classic folklore problems, and discover how these problems can help them investigate other problems. They learn how not to give up; how to turn errors or failures into opportunities for more investigation.

How is SFMC different from other Math Circles?

Dr. Paul Zeitz of USF and Dr. Matthias Beck of SF State started SFMC in 2004. Other Math Circles existed at the time, but they were far from common. The National Association of Math Circles reports that there are currently 180 Math Circles across the nation, a number that has grown quite a bit in the last 12 years. The idea for the SFMC was to create a math enrichment program that was not primarily aimed at "already-enriched" kids. A rough definition of an already-enriched kid is someone whose parents spend significant amounts of time online in the evening searching for enrichment opportunities for their children. The children that the SFMC hoped to reach would not necessarily have these advantages, perhaps because their parents did not own a computer, or because their parents worked at night, or did not speak English, or perhaps because their parents were no longer around.

Exploring hypercubes through Zome Tool bubbles.

Most math circles are populated by already-enriched kids, not because the organizers desire this but because it is much easier to do so. SFMC has the explicit goals of working to attract underserved students and continues to evolve our strategic plans to better serve this goal. In addition to our fee based program at SF State for Elementary students, SFMC offers a free program for Middle School students at Lowell High School and a free program for High School students at June Jordan School for Equity.

Our sites and program structure have changed over the years depending on financial support, teacher-coordinator support at SF Unified School District sites, and so on. At this time, we are running programs in four locations, with a total of 7 sessions per week, serving well over 300 students per year. The program runs during both fall and spring semesters, with a summer camp as well.

How is SFMC different from other STEM enrichment in the Bay Area?

SFMC is based on exposing children to the nature of doing mathematics by connecting them with people who love to do mathematics. At SFMC, our goal is to expose youths to the full range of mathematics. We introduce children to problems in modern algebra, topology, cryptography, probability and more! We provide problems that are accessible to students, but that come from college level content. We often introduce open problems as well, not expecting students to solve them (they can try!) but so that youths are aware that the field of mathematics is evolving and still contains exciting and valuable problems. This is unique in that most other enrichment programs are focused on passing classes or scoring well on tests and competitions. No other mathematics enrichment program in SF focuses on the enjoyment of mathematics. Most "fun" enrichment programs focus on robotics or coding. Many of the children in our program report that SFMC is fun!

Additional Programmatic History and Funding

The SFMC was founded in 2004 by the Mathematical Research Sciences Institute (MSRI) with Dr. Mattias Beck of SFSU's Department of Mathematics and Dr. Paul Zeitz, the Chair of the Department of Mathematics and Statistics at the University of San Francisco. MSRI provided funding from Moody's Foundation and the Bechtel Foundation. In 2009 Dr. Mattias Beck brought the (CM)2 program to the SFSU Mathematics Department which provided funds for graduate students to participate in the SF Math Circle. Since the (CM)2 grant has ended, and MSRI is no longer involved, SF Math Circle is supported by CSME, program fees, small grants, and fundraising.

If you are interested in learning more please contact Addie Schnirel at adde@sfsu.edu

You can also view our website at: www.sfmathcircle.org.

Addie Schnirel, Emily McCullough, and Paul Zeitz

Joseph Gubeladze: Transitions

Students in Joseph Gubeladze's SF State classes are led into a complex mathematical world by a teacher who made his way there via an unusual and zig-zagging path. With mental microscopes students follow him deep into fascinating theories. With wide-angle lenses, they can glimpse how some social forces fostered his scientific progress, but others would impede it. Joseph took advantage of timely opportunities to overcome economic chaos, ensure intellectual growth, and allow his family to flourish. His initiative has led to advances in science and to increased opportunity for SF State students to explore higher mathematics and make their own way into its depths and delights.

As the displayed map suggests, Joseph's story depicts a journey not just intellectual, but also cultural and geographical. He was born in 1961 in Tbilisi, capital of the Republic of Georgia, a mountainous country of less than five million on the Black Sea between Russia and Turkey. It had been part of the Russian empire for more than 170 years. Joseph's mathematical facility gained him a place in a special high school, a benefit of the Soviet emphasis on education in science. His parents, an agricultural instructor and a pediatrician, encouraged him to follow that talent, even though the economic promise of a career in science did not match its social prestige. Joseph's family life and schooling were entirely in the Georgian language: in that country the Russians had never been able to substitute theirs for the Georgian. His school emphasized traditional Georgian culture, which remains a mainstay for him even today.

Joseph's early research, from 1981 to 1989, was published in Russian, mostly in Georgian journals. But Anderson's doctoral advisor and one of the creators of K-theory, Richard G. Swan, noticed it and began publicizing and refining Joseph's work. That spurred Joseph to publish a major survey paper in English in 1990, and let him qualify that year for the highest Soviet degree, Doctor of Science. Swan's major report was published by the American Mathematical Society in 1992. The positive reception of Joseph's research in the West was decisive for his career.

In 1982 Joseph married a fellow mathematics student, Manana, and they started a family. As the Soviet Union dissolved in 1991, Georgia asserted its independence, and the country plunged into civil war, which lasted three years. During much of that time, its economy did not function. Many scientists gave up academic employment, but Joseph remained, employed solely as a researcher at the Georgian Academy of Sciences. His minimal salary didn't suffice for a family.

Fortunately, Joseph's interest and expertise overlapped that of mathematicians in Germany who had noticed Swan's reports. Winfried Bruns invited Joseph to visit Osnabrück. Bruns's main interest was in applying

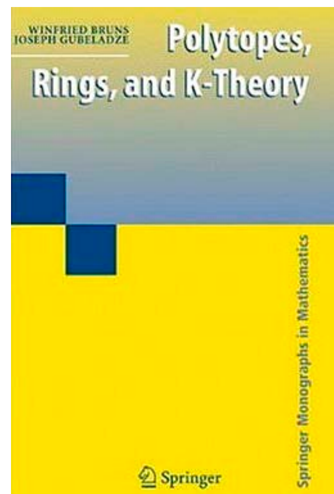
K-theory

The study of systems of equations in algebra and calculus includes that of their graphs in higher-dimensional analytic geometry. By 1890 these studies had begun to employ advanced algebra, far beyond the familiar high-school subject. The need to correlate results obtained by concrete geometric methods with those obtained via abstract advanced algebra led to complicated questions in algebraic topology and algebraic geometry. K-theory is an algebraic technique invented around 1950 to handle these. It employs structures more complex than those used to handle vectors in elementary geometry and physics. Gubeladze showed that in a certain large class of those structures, analogous coordinate methods are still possible.

Manana and Joseph

algebraic methods to assess the complexity of polytopes—higher-dimensional analogs of polygons and polyhedra. Joseph obtained research fellowships to support his family in Germany for four years in Germany during 1995–2001. In collaboration ever since, he and Bruns have produced twenty research papers. Their work lies at the interface between algebra and geometry, and has expanded beyond their original individual emphases.

What was hardest about emigrating here? *Teaching classes!* Joseph had never before offered instruction below post-doctorate level; he had to start an essentially new career as a teacher. Seriously considering what he had to learn, he made major use of his recollections of his own teachers and tried hardest to avoid what had troubled him most as a student. What was that? "Acting like a monarch in class!"—certainly not part of any SF State tradition. (Joseph assured us that student-instructor relationship in Georgia has greatly improved since the soviet era.) He reports, "I'm really happy to have ended up in the Bay Area. The atmosphere is cosmopolitan, easily accommodating various historical backgrounds, and I almost feel at home."



Joseph teaches a heavy load: large calculus classes, graduate-level algebra, and lending help and a sympathetic ear to graduate students with thesis projects in higher algebra. He explains the complex ideas of mathematics in a way that is congenial to beginning students, and leads them to understanding and achievement. Joseph has been promoted first to Associate and then Full Professor, was a member of our Academic Senate during 2008-2011. His family have redistributed themselves. Eldest daughter Nino has graduated from SF State, was employed in San Francisco and eventually returned to Georgia. Her sisters Ana and Tamar have also returned to Georgia, but temporarily – to marriage and motherhood, and to medical school. Now they are back to the US together with Joseph's grandsons. The two boys remain here: Jimmy and Lazare study at SF State and work in the city.

Since Joseph's arrival, two other faculty with similar research interests have joined us: Matthias Beck in 2004 and Federico Ardila in 2005. With Joseph and Prof. Hosten, they form the Algebra-Geometry-Combinatorics Group, which is providing our graduate students and advanced undergraduates unprecedented deep access to current research work in mathematics. They are collaborating on research, offer seminars almost weekly, and have numerous master's theses underway. Several graduates of this group have achieved major distinction in PhD programs and already in postdoctoral research.

In 2009 Joseph published a research monograph with his collaborator, Prof. Bruns. Although his interests are now drifting to other areas, others are taking up some of its open problems. Recently Joseph has been also considering possible applications of his algebraic-combinatorial methods to theoretical problems in quantum physics. He has a concrete working plan and looks forward to future interaction with physicists. But he predicts that finding collaborators in a different discipline will be harder.

Asked what he misses most after his transition to SF State, Joseph responded, "Close relatives and really close friends, and the landscape of the Great Caucasus range." California's mountains remind him of that, but they're not the same. He compensates in part through serious participation in joint grant projects with research mathematicians and students in Georgia. Asked what is most needed for him to help advance the SF State mathematics program, Joseph responded that the increasing role of research here, far greater than that of a generation ago, collides with local budget realities. For faculty and students to continue their current high level of achievement in research and studies, some means must be found to restore the security of funding that is threatened by continuing fiscal crises.

James T. Smith

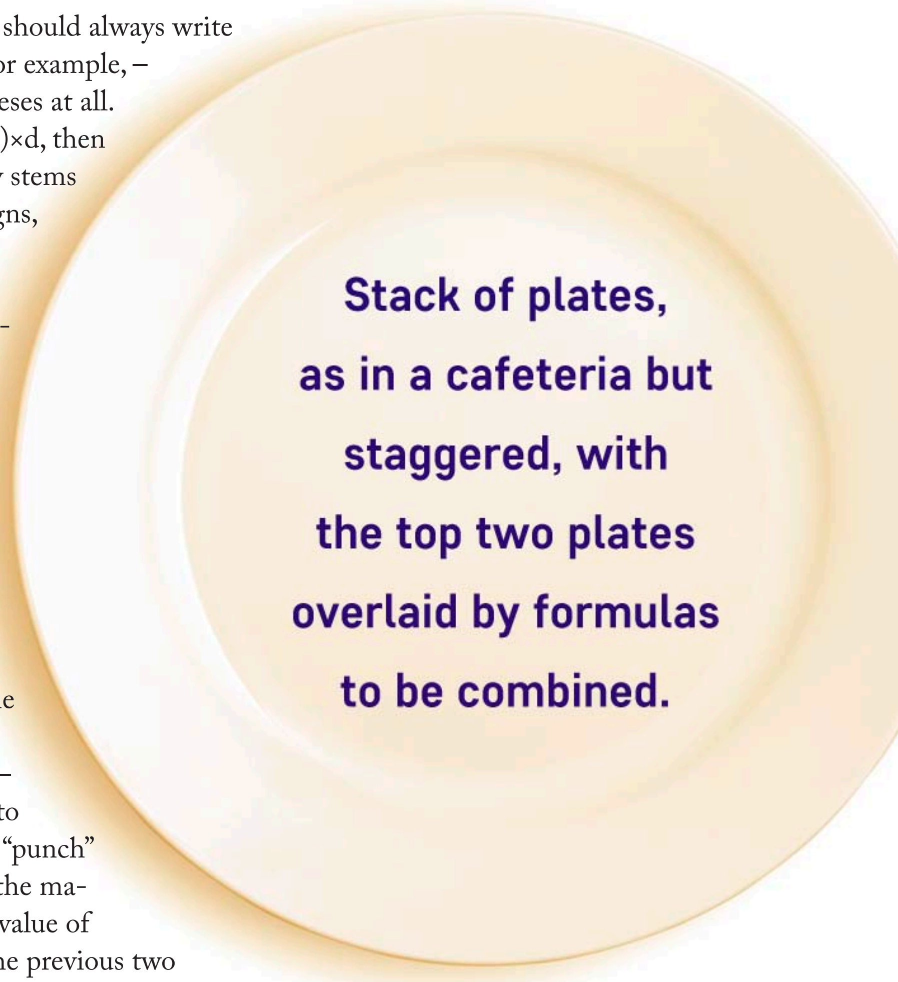
Mathematical Note

Polish and Reverse Polish Notation

Reading about hand calculators or computer programming, you may have encountered these terms. What's this about?

During World War I Poland was emerging as an independent country. Polish mathematicians were determined to make it a research center of world rank. They emphasized a discipline where they were already strong: mathematical logic. During the 1920s, the logician Jan Łukasiewicz was investigating how to measure the complexity of formulas such as (a+(b −1))×d that you meet in algebra class. Does complexity have to do with the nesting of parentheses? Not directly. Read on.

Łukasiewicz and his colleagues noticed that if we should always write the operation sign before the numbers it combines—for example, –b1 instead of (b – 1) —then we wouldn't need parentheses at all. Our formula (a+(b – 1))×d would become first (a+ –b1)×d, then (+a–b1)×d, then finally ×+a–b1d. Evidently, complexity stems from the number and arrangement of the operation signs, not the parentheses.



The Poles' achievements in several areas of logic quickly made them famous. They wrote many logic formulas this way in their research journal *Fundamenta Mathematicae*, probably to attract attention as much as to analyze complexity. That journal became tops in the world in its field, and this style widely known, as Polish notation.

Not easy to read, is it?! But someone noticed that something suddenly rings a bell if you always write the operation sign after the numbers it combines—for example, b1– instead of b – 1. With this reverse Polish notation, that trial formula (a+(b – 1))×d would become first (a+b1–)×d then (ab1–+)×d, and finally ab1–+d×.

No bell yet? Find someone familiar with Hewlett–Packard hand calculators. Read this formula from left to right, say "enter" before each symbol for a number and "punch" before each operation sign. The HP user will envision the machine's main-storage display showing first the entered value of a, then b, then 1, then b – 1 (the result of combining the previous two entries), then (a + (b –1)) —same idea—then finally (a+(b –1))×d. Ding: there's the answer! This shows that reverse Polish notation is equivalent to the system you learned in algebra: whatever you do with one you can do with the other.

Here are some remarks that may intrigue you into inquiring further. Łukasiewicz was not just a mathematician: he served as a cabinet minister in the first independent Polish government, and as a professor of philosophy. Desktop calculators were introduced in the 1910 decade and this input technique developed for them soon after that; reverse Polish notation became familiar during the 1950s. The main storage unit of that sort of calculator is analogous to the pushdown stack of plates at the start of the serving lines in Polish cafeterias today; the display shows the top plate, and the operations always replace the top two plates with one containing the result. The idea of a pushdown stack is one of the most basic in computer architecture, and reverse Polish notation is the underlying idea of several very powerful computer languages, such as the PostScript language that a computer uses to describe this document to a printer.

James T. Smith

Department News

Prof. **Matthias BECK** was one of only three mathematicians nationwide to receive the 2013 Mathematical Association of America's celebrated Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching. It is given annually to college and university faculty members with an extraordinary record of teaching, whose influence has extended beyond their institutions. "Prof. Beck is not only an outstanding teacher but also has a distinguished record of scholarly research," said Sheldon Axler, former Dean of Science and Engineering. "He is yet another example showing that our best teachers are usually our best researchers, and vice versa." Beck has dedicated his career to preparing students to teach mathematics effectively at the primary, secondary, or higher-education level. At SF State, he is known both as a tireless student mentor and for his ability to teach subjects ranging from teacher preparation to complex mathematics such as combinatorics and the theory of polytopes. His own research involves discrete and computational geometry and analytical number theory, and he is the author of two textbooks for intermediate and advanced undergraduate students.

Prof. Emeritus **David B. MEREDITH** died in December 2012 from complications during heart surgery in San Francisco. He had just completed the SF State early retirement program. Dr. Meredith spurred the development of our graduate program, and served as our Chair, 2002–2006. Always heavily involved in academic affairs, he served as Chair of the university Academic Senate, 2006–2007. Family and friends of Dr. Meredith have established a scholarship fund in his honor.

Selected Alum Notes

Steven NERNEY, BA 1966, earned an MS in Physics from SF State in 1968, and a PhD in astro-geophysics from the University of Colorado in 1974. He pursued a scientific career at NASA Ames Research Center in Mountain View and at Ohio University, Lancaster. Now retired in Boulder, Colorado, Nerney is a performing musician. He has dedicated his recent folk-music CD to **Lawrence CHANG**, BA 1968, known in those years as **Larry TRUONG**. Larry died in 1983 after a distinguished but too brief career, including service as assistant professor in our Department; he is a member of the SF State Alumni Wall of Fame.

Dennis MORITZ, BA 1971, visited the Department recently. He earned an MS in computer science from the University of California at Berkeley and has pursued a career in analysis and software development for financial services. In 2004 he founded his own company, the San Francisco firm Advantage for Analysts.

Mahyar AMOUZEGAR, BS 1987, is Dean of the College of Engineering at California State Polytechnic University, Pomona. He earned doctorates in electrical engineering and operations research at the University of California at Los Angeles in 1991 and 1994. Before coming to Pomona in 2011, he worked for the RAND Corporation and served on engineering faculties in California and New Zealand.

Seth BRAVER, BA 1999, teaches mathematics at South Puget Sound Community College in Olympia, Washington. Braver earned the PhD in history of mathematics at the University of Montana in 2007. The Mathematical Association of America has recently published his book *Lobachevsky Illustrated*, on non-Euclidean geometry.

Katherine Marie (Kaytee) BOCK, BS 2002, is now a senior manager of business development at the Nevro

Corporation in Menlo Park. The company is introducing technology to improve the role of spinal cord stimulation in the treatment of chronic pain.

Candice PRICE, MA 2007, is now Assistant Professor of Mathematics at Sam Houston State University. She earned a PhD degree from the University of Iowa in 2012, with a dissertation entitled A Biological Application for the Oriented Skein Relation. She organized a session on Women Math Warriors at the January 2014 Joint Mathematics Meetings in Baltimore, Maryland.

Emily McCULLOUGH, BA 2009, taught mathematics at Mission High School in San Francisco, serving as a partner teacher in the Department's NSF-sponsored (CM)2 program for enriching the mathematical experiences of our students in collaboration with teachers and students from San Francisco public schools. Now she has returned to the Department as a graduate student, and is continuing to work with students and teachers in that program.

Tia BAKER, MA 2013, is now a mathematician with the United States Navy.

For many other notes, go to http://math.sfsu.edu/alum_news.php

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see the webpage
http://math.sfsu.edu/donation.php

We thank you for your generosity!

David Bao, Chair

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