



# Mathematical Matters

The Newsletter of the Pacific Northwest Section of the MAA  
Spring 2016

## PNW MAA and NUMS at Oregon State University

**April 1-2, 2016**

The Spring meeting of the PNW MAA Section will be held at Oregon State University in Corvallis on April 1-2, 2016. The 8th annual Northwest Undergraduate Mathematics Symposium (NUMS) will again be held in conjunction with the Spring meeting. NUMS is a regional mathematics conference providing a venue for students to give talks and present posters.

The invited speakers for this meeting are Karen Saxe of Macalester College, Brian Hopkins of Saint Peter's University, David Pengelley of Oregon State University, and Stuart Boersma of Central Washington University. Abstracts of each talk, and brief speaker bios, are included starting on page 2.

Mini-courses offered are "Teaching and Learning Mathematics from Primary Historical Sources", by David Pengelley of Oregon State University and "Codes and Ciphers" by Stuart Boersma of Central Washington University and Cheryl Beaver of Western Oregon University. Descriptions of these start on page 4.

Conference registration and abstract submission are now open at

<http://math.oregonstate.edu/pnwmaa2016>

**New: The deadline has been extended to March 15!**

The meeting will feature the following proposed Special Sessions.

[NUMS Student Presentations and Poster Session](#)

[Research in Undergraduate Mathematics Education](#)

[Algebra and Number Theory](#)

[Developing Student Intuition With Physical Models](#)

[Junior Faculty Research](#)

[Teaching Tricks, Techniques and Discoveries](#)

[Thinking Outside the Circle: Alternate Outreach](#)

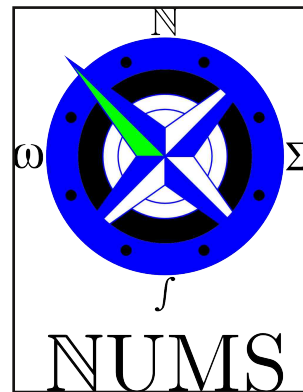
Student activities include Math Wrangle (contest), pizza party, Math Club panel discussion, career panel discussion, student presentations and poster session (including cash prizes for best presentation and poster!). Continued on page 2.

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Questions can be sent to  
nums@math.oregonstate.edu. More  
information regarding registration, including  
housing and hotel information, schedule and  
maps and directions can be found on our  
website

<http://math.oregonstate.edu/pnwmaa2016>

See you in Corvallis!



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## Spring 2016 Meeting Invited Addresses

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### Friday Evening Address:

#### **How efficiently can one untangle a double-twist? Waving is believing!** **by David Pengelley**

Can you do the Philippine candle dance, the Dirac belt trick, or the Feynman plate trick? Whether your answer is yes or no, this event will engage you in this and far beyond in discovering and understanding the most mathematically efficient way to untangle a double-twist in 3-space. Limber up!

**David Pengelley** is professor emeritus at New Mexico State University, and courtesy faculty at Oregon State University. His research is in algebraic topology and history of mathematics. For several decades he has collaborated on NSF-funded programs developing pedagogies and materials for teaching with student projects and with primary historical sources, in both traditional undergraduate courses and specially created honors courses. He dreams and advocates that all students, in all courses,



could benefit by learning mathematics from studying primary historical sources. He has coauthored three books, on student projects in calculus and on learning great mathematics from primary sources. He also created a graduate course

on the role of history in teaching mathematics. David relies on student reading, writing, and mathematical preparation before class to enable active student work to replace lecture. He has received the Mathematical Association of America's Deborah and Franklin Tepper Haimo teaching award, loves backpacking and wilderness, is active on environmental issues, and has become a fanatical badminton player.

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### Saturday Morning Address:

#### **Cryptologic Tidbits by Stuart Boserma**

Cryptology offers an ideal setting to give students a powerful and successful experience in mathematics. Cryptologic examples allow students to connect new content with prior knowledge, and provide students the opportunity for productive struggle with challenging material. Cryptologic contexts offer students multiple entry points to rich questions

and provide all students an opportunity to engage with the material, to propose unique problem solving strategies, and to build upon the ideas and conjectures of their peers. Cryptologic applications allow students to take ownership of their problem solving strategies and increase their confidence as learners. Continued on page 3.

Oh yeah...cryptology is fun! In addition to providing some justification for the above claims, I will present a variety of examples from cryptology that could easily find their way into existing courses in probability, statistics, quantitative reasoning, linear algebra, and abstract algebra.

**Stuart Boersma** received his B.S. from the University of Puget Sound, his Ph.D. from Oregon State University, and is currently the chair of the mathematics department at Central Washington University. He is a Project NExT Fellow (green dot), has been a member of the Pacific Northwest Section of the MAA since 2000, served as chair of the section from 2005-



2007 and was the section governor from 2009 – 2011. He enjoys reading and contributing to Math Horizons and looks forward to regularly presenting at regional and national meetings. Most recently, he has served as a lead author on the Charles A. Dana Center's STEM Prep Pathway curriculum. Stuart Boersma is also a co-author of Case Studies for Quantitative Reasoning: A Casebook of Media Articles and is a co-director of the annual cryptanalysis competition Kryptos. Stuart was also the 2013 recipient of the PNW MAA Distinguished Teaching Award.

## Saturday Afternoon Address: The Symmetric Group and Fair Division: Does Knowledge Matter? by Brian Hopkins

Sports drafts and divorce settlements are examples of situations where players take turns selecting indivisible goods. Like other topics in fair division, the situation is made more interesting because people may value the goods in different ways. In this talk, we focus on the case of two players, where the machinery of permutations is surprisingly applicable. How many possible outcomes are there? In what circumstances do both players get their best possible outcomes? How can one best take advantage of knowing the other's preferences? What happens when a player's motivation switches from greed to spite, the common good, or selfless altruism? In this colorful talk, we'll sample some applied algebraic combinatorics and address these issues along with the provocative question of the title.



**Brian Hopkins** is a professor of mathematics at Saint Peter's University in Jersey City, New Jersey, and has taught game theory and fair division at New York University as an adjunct in the department of politics. He is also active in teacher professional development, especially with the Institute of Advanced Study's Park City Mathematics Institute. Research interests include combinatorial number theory, Ramsey theory on the integers, and mathematics applied to social sciences. Hopkins is the editor of \*The College Mathematics Journal\* and received the 2015 Deborah and Franklin Tepper Haimo Award for Distinguished Teaching of Mathematics.

## Banquet Address: Measuring Inequality by Karen Saxe

Whether a resource -- such as income -- is distributed evenly among members of a population is often an important political or economic question. The Occupy Movement has recently drawn more attention to the fact

that income inequality in the United States is increasing. How can we measure this inequality? How can we decide whether the distribution of wealth in this country is becoming more or less equitable over time?



How can we decide which country has the most equitable income distribution? This talk describes one tool, the Gini index, used to answer these questions. Aimed at students, will use integral calculus. Karen is principal investigator on the NSF-funded Common Vision project, an initiative aimed at improving undergraduate learning in the mathematical sciences, especially in courses typically taken in the first two years. At the end of her talk, she will briefly describe the project. She will be happy to answer questions about the talk, Common Vision or both!

**Karen Saxe** is DeWitt Wallace Professor of Mathematics at Macalester College. She grew up in New Jersey, went to college in New York, and attending graduate school in Oregon. Karen joined the Macalester faculty in 1991, and served as Department Chair 2007-2013. She is serving as Acting Chair for spring 2016. She teaches calculus (all levels), real analysis, complex analysis, functional analysis, and interdisciplinary courses on game theory and mathematics in politics. She has been awarded the Mathematical Association of America North



Central Section's Distinguished Teaching Award, and the Macalester College Excellence in Teaching Award. She has served as Second Vice President of the MAA (2014-2016) and is current Editor of the MAA's Anneli Lax New Mathematical

Library. Karen has been a resource in Minnesota on redistricting, consulting with city governments, and served on the Minnesota Citizens' Redistricting Commission, created to draw congressional districts following the 2010 census. She also serves on the Advisory Board for Transforming Post-Secondary Education in Mathematics (TPSE Math), an initiative sponsored by Carnegie Corporation of New York and the Alfred P. Sloan Foundation, aiming to effect constructive change in mathematics education at community colleges, 4-year colleges and research universities. On her most recent sabbatical she served as the 2013-2014 AMS/AAAS Science and Technology Policy Congressional Fellow.

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## Friday Afternoon Mini Courses:

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### **Teaching and Learning Mathematics from Primary Historical Sources by David Pengelley, Oregon State University**

**Abstract:** Why would one consider having students learn their mathematics directly from studying primary historical sources? In this hands-on workshop, participants will collaboratively engage in both the student and instructor sides of studying primary sources, in the form of guided student project modules that include mathematical context, original source

excerpts, tasks for students, and biography. Multiple project modules from lower division courses for mathematics majors will be tackled, with discussion and evaluation from both the student and instructor points of view. More background via links at <https://www.math.nmsu.edu/~history/#discrete>.

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### **Codes and Ciphers**

**by Stuart Boersma, Central Washington University & Cheryl Beaver,**

**Abstract:** The codebreaking competition, KRYPTOS, is the week following the PNW-MAA meeting. Come and hear about KRYPTOS, learn about some ciphers, and test your skills at cryptanalysis! Helpful online

cryptanalysis tools will be shared with participants together with some tried and true pencil and paper techniques. This minicourse is designed primarily for students, so please encourage your students to attend!

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# Notes from the Governor

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**By Jennifer Nordstrom**

Greetings from your PNW Section Governor!

One of my roles as your governor is to serve as a connection between our section and the national MAA. I recently attended the Joint Mathematics Meetings in Seattle. It was great to see so many section members there! One of the issues emphasized at the JMM was the need for the national MAA to find ways to bring desirable services to its members. An exciting initiative along these lines is the restructuring of the Departmental Membership. This now includes an unlimited number of student members. This is a great way to connect our students with the MAA. If your department is not already a member, I encourage you to join.

I have enjoyed serving on a national MAA committee, and would like to encourage other members to think about serving on a national committee. We currently have about 27 section members on national committees. I would love to significantly increase our participation. It is a great way to broaden your connection with the mathematical community and help with the

mission of the MAA. There are many different committees and subcommittees, see <http://www.maa.org/about-maa/governance/council-and-committees-list>. If you are interested in serving on a committee or subcommittee, please contact me and let me know some possible interests.

I hope to see many of you at our upcoming section meeting in April. I also hope to see our section well represented at the next MAA MathFest. As the MAA continues the celebration of its 100th year, the meeting returns to the city where it was founded, Columbus, Ohio, August 3-6.



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## **Upcoming meetings:**

**2016 Oregon State University**

**2017 Gonzaga University**

**2018 Seattle University**

**Lewis and Clark College (tentative)**

**University of Alaska Anchorage (tentative)**

**Western Washington University (tentative)**

# The Riverpoint Advanced Mathematics Partnership: Improving Learning in Algebra 1

By Jackie Coomes

From summer 2012 through fall 2015, Eastern Washington University Department of Mathematics faculty designed and led a project to improve the teaching and learning of Algebra 1 in the Spokane area. A final analysis of the Riverpoint Advanced Mathematics Partnership – Algebra (RAMP-A) project showed that it supported improved learning for Spokane area Algebra 1 students. Three faculty from EWU, Jackie Coomes, Hyung Sook Lee, and Ron Gentle, partnered with two WSU College of Education faculty, Janet Frost and Kristine Lindeblad, on the \$850,000 project, funded jointly by the Office of Superintendent of Public Instruction and the Washington Student Achievement Council.

Throughout the three years, the project focused on helping teachers and their students develop coherent and deep

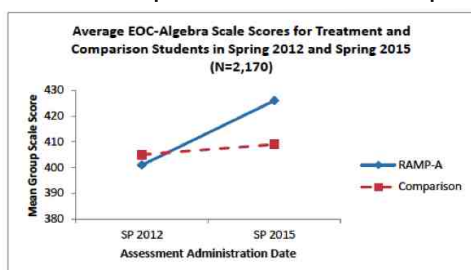


Figure 1. Average EOC-Algebra scale scores of high school students of RAMP-A teachers and students in comparable schools in spring 2012 and spring 2015.

understandings of algebra and functions, specifically targeting ideas in the Common Core State Standards that were new to



teachers. To develop these understandings, teachers worked on math problems during the nine days of workshops each year, and discussed ways of developing students'

mathematical habits of mind while they learned algebra. The tasks and other project materials can be found at the dissemination website: <https://sites.ewu.edu/jcoomes/>.



Jackie Coomes

The final report showed significant improvement in students' learning of Algebra 1. The external evaluator for RAMP-A, Dr. Cathleen Kennedy, reported, "Analyses of the spring 2012 and 2015 state EOC-1 assessment data indicate a beneficial impact of the program on students of RAMP-A high school teachers. As illustrated in the Figure, in spring 2015 students of RAMP-A

teachers in seven participating high schools (the solid blue line) achieved a higher average scale score than the average scale scores of the seven comparison schools (the small-dashed red line). In spring 2012, before the RAMP-A program launched, the average EOC-1 scale score was 401 points in the RAMP-A schools and 405 points in the matched comparison schools. In spring 2015, the average for students of the same RAMP-A teachers was 426 and the average of the students in the comparison schools was 409. In 2012, comparison students performed better than treatment students, with an effect size (Cohen's  $d$  using pooled standard deviation) of  $d = -0.09$  ( $p = .052$ ). By the end of the project, in 2015, treatment students performed better than comparison students, with an effect size of  $d = 0.33$  ( $p < .01$ )."



Hyung Sook Lee



Ron Gentle



# **2016 PNW MAA Distinguished Teaching Award Winner Vesta Coufal**



By Shannon Overbay

Vesta Coufal of Gonzaga University has been awarded the 2016 Pacific Northwest MAA Teaching Award. During her four years at Ft. Lewis College and eight years at Gonzaga, Vesta has been a leader in innovative teaching. Her work not only directly helps her own students, but also benefits other faculty members at the local, regional, and national levels. Throughout her career, Vesta has generously shared her teaching endeavors with others through workshops and discussion groups.

After completing her PhD at the University of Notre Dame, where she was twice awarded the Outstanding Graduate Student Teacher Award for Excellence in Teaching, Vesta was granted a 2004 National Project NExT Fellowship. Vesta had an immediate impact on NExT by organizing a session entitled Effective Use of Cooperative or Collaborative Learning in Collegiate Mathematics Classes. Since then, Vesta has participated in an Inquiry Based Learning (IBL) Workshop sponsored by the Educational Advancement Foundation, multiple R.L. Moore Conferences, and a Process Oriented Guided Inquiry Learning (POGIL) workshop. Vesta has used what she has learned to redesign courses and to conduct her own workshops to help other teachers implement these techniques.

Vesta strives to bring teaching and discussions about teaching to the forefront. When she arrived at Gonzaga, Vesta immediately became involved in the Gonzaga Center for Teaching and Advising (CTA) where she has worked to provide teaching support for faculty. Within the department, Vesta started a Mathematics Teaching Circle, where faculty

members share their teaching experiences over lunch in a non-threatening environment. She also started a Knot Theory research group as a collaborative learning community involving both students and faculty members. This group has produced numerous student conference presentations and a publication in the journal *Involve*. Regionally, Vesta has participated in and conducted Project NExT sessions dedicated to teaching. At the national level, Vesta gave a talk entitled Guided Inquiry in Calculus II at the 2016 Joint Meetings.

Whether it is introducing proof portfolios in a proof writing class or using POGIL worksheets in calculus, Vesta continually works to create a productive learning environment through the implementation of innovative teaching techniques. Through multiple venues, Vesta openly shares her successes and failures with various teaching approaches. By doing so, Vesta's work has benefitted numerous teachers at the local, regional, and national levels. We congratulate Vesta on her well-deserved teaching award.

# Kryptos<sup>6</sup> : A Series of Cryptanalysis Challenges

## April 7 – 11, 2016

- Codes and Ciphers by R.F. Churchhouse
- Codes, Ciphers and Secret Writing by Martin Gardner

KRYPTOS<sup>6</sup> is a contest open to undergraduate students. The theme of the contest is centered around the breaking, or cryptanalysis, of ciphers (secret writing). Each challenge presents contestants with a brief scenario

together with some ciphertext (encoded message). The goal is to discover the original English plaintext message!

Clues to help break the cipher may be contained in the actual ciphertext or in the details of the accompanying scenario.

While it is not the intent of this contest to test overly technical aspects of cryptanalysis or advanced mathematical

algorithms, some familiarity with basic codemaking and codebreaking is certainly helpful. Some useful sources include:

- Challenges from last year's contest.
- The American Cryptogram Association.
- Wikipedia entries for Cryptography and Cryptanalysis
- The Code Book by Simon Singh.
- Secret History: The Story of Cryptology by Craig Bauer

We had over 150 students participate last year and many have been clamoring for more!

Please announce this contest to your students! Visit:

<http://www.cwu.edu/math/kryptos/> for more information.

Registration will open about a month before the contest begins. No travel is necessary and all materials will be available on the web!

KRYPTOS is sponsored by the Pacific Northwest Section of the Mathematical Association of America together with Central Washington University and Western Oregon University.

The graphic features the Kryptos<sup>6</sup> logo at the top, which includes the word "KRYPTOS" in Greek letters and "A Series of Cryptanalysis" below it. Underneath is a circular arrangement of letters: W, I, D, P, P, V, C, I, V, F, C, H, A, L, L, E, N, G, E, S. Below the logo is a circular banner that reads "Intrigued by codemaking or codebreaking?". To the left of the banner, it says "Compete individually or in teams". To the right, it says "Solve one or all three challenges!". In the center, the dates "April 7 - 11, 2016" are displayed. Below the dates is a box with the text "visit http://www.cwu.edu/math/kryptos for complete contest information". At the bottom, a dark box contains the text "SPONSORED BY The Pacific Northwest Section of the Mathematical Association of America".



## Section News

### Washington

At Pacific Lutheran University, Daniel Heath and Tom Edgar are preparing to participate, as faculty advisors in Seattle University Mathematics Early Research (SUMmER) program, which will take place on Seattle University's campus between June and August (<https://www.seattleu.edu/scieng/math/reu/>). We are hoping a PLU student Daniel Heath will also participate.

Tom Edgar and Jessica Sklar are anticipating the publication of their paper A Confused Electrician Uses Smith Normal Form by the Mathematics Magazine later this year.

After 45 years on the faculty of Washington State University, Professor David Wollkind retired in August 2015. His research was concerned with the mathematical modeling of natural and engineering science phenomena; he has published 71 papers and has given over 100 talks throughout the U.S. and internationally. He was a popular teacher with undergraduates and graduate students and developed several graduate courses. His greatest legacy is his 23 Ph.D. students, all of whom have gone on to successful careers in higher education or industry.