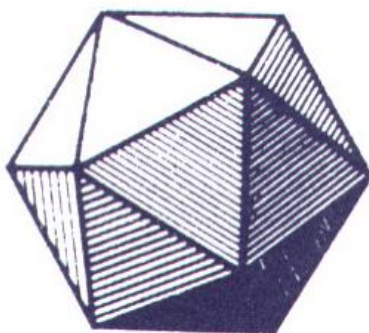


North Central Section (Founded in 1916)

Mathematical Association of America



Spring Meeting • April 21-22, 2017
Anoka-Ramsey Community College
Coon Rapids, Minnesota



Friday, April 21, 2017

6:30 – 8:30 **Registration** – SC 270 & 272
\$15 (Free for Students and Invited Speakers)

6:30 – 8:00 **Book Sales**, SC 278
Internet access: wireless access throughout campus

Evening Session – SC 270 & 272, Lee Erickson, Presiding
7:00 – 7:20 **R. Peter DeLong, Anoka-Ramsey Community College,**
Raytheon Company, US Navy
Unions of Partitioned Sets

7:25 – 7:45 **Cindy Kaus and Rikki Wagstrom, Metropolitan State University**
Engaging Mathematics Initiatives in the Twin Cities

7:45 – 7:50 **Welcome**
Dr. Kent Hanson, President, Anoka-Ramsey Community College and
Anoka Technical College

7:50 – 8:00 **Award for Distinguished College or University Teaching of Mathematics**

Invited Lecture

8:05 – 8:55 **Matthew Haines, Augsburg College**
Traveling through History with Story Problems

9:00 – 10:00 **Reception** – SC 203

Saturday, April 22, 2017

8:30 – 11:00 **Registration** – SC 270 & 272

8:30 – 11:00, 12:00-2:00 **Book Sales** – SC 278

Morning Concurrent Session I – S 235, Mark Omodt, Presiding

9:00 – 9:20 **Rob Thompson, Carleton College**
How Many Ways Can You Slice a Donut?

9:25 – 9:45 **Paul Zorn, Saint Olaf College**
Everybody Counts: Remembering Lynn Steen

9:45 – 10:00 **Break** – SC 203

10:00 – 10:20 **Jeremiah Bartz, University of North Dakota**
Digital Root Series and Juggling

10:25 – 10:45 **Jennifer Galovich, St. John's University and the College of St. Benedict**
Di-eigenals

Morning Concurrent Session II – S 245, Michelle Rogers, Presiding

9:00 – 9:20 **Brianna Kozemzak** (undergraduate), **Saint Mary's College, Notre Dame**
A Mathematical Model for Copper Homeostasis in *Pseudomonas aeruginosa*

9:25 – 9:45 **Daniel Stein and Jacob Weinstein** (undergraduates),
University of Minnesota-Twin Cities,
Newton-Okounkov Bodies of Bott-Samelson Varieties

9:45 – 10:00 **Break** – SC 203

10:00 – 10:20 **Joseph Shoulak** (undergraduate), **Anoka-Ramsey Community College**
Applying General Set Relations to Dice and Random Numbers

Morning Concurrent Session III – S 135

10:00 – 10:55 **Project ACCESS/Section NEXt Session**
Fenecia Foster, Southeast Technical Institute
Emphasizing Authentic Applications

Invited Lecture – SC 270 & 272, Javier Sanchez (ARCC Student), Presiding

11:00 – 11:50 **April Strom, Scottsdale Community College**

Covariation: A Way of Thinking about Functions

12:00 – 1:00 **Luncheon** – SC 203

1:00 – 1:55 **Quiz Show: Math Edition** – S135

1:15 – 1:45 **Business Meeting** – SC 270-272, Dr. Co Livingston, Section President Presiding

Afternoon Concurrent Session I S 235, Lexi Hinsverk (ARCC Student), Presiding

2:00 – 2:20 **Matthew Zabka, Southwest Minnesota State University**

Mathematics and Voting

2:25 – 2:45 **Thomas Q. Sibley, College of St. Benedict & St. John's University**

Is Equity Unusual...at Least in Total Products?

2:45 – 2:55 **Break** – SC 203

2:55 – 3:15 **Nathan Axvig, Concordia College**

Maximizing Weekends Off for Moorhead Police Officers

3:20 – 3:40 **Su Dorée, Augsburg College**

The Curious Case of 2s and 3s: Dynamics on Weak Compositions

Afternoon Concurrent Session II – S 245, Janine Goenner, Presiding

2:00 – 2:20 **Tim Prescott, University of North Dakota**

Adopting an Open Textbook for the Calculus Sequence

2:25 – 2:45 **Michele Iiams, University of North Dakota**

Creating a Reading Guide and Incorporating Active Learning to Accompany
Our Open Textbook

2:45 – 2:55 **Break** – SC 203

2:55 – 3:15 **Donna Flint, South Dakota State University**

A Totally Disconnected Set of Teaching

3:20 – 3:40 **Tony Dunlop, Normandale Community College**

General Education Mathematics Using Watershed Data. An “Engaging
Mathematics” Course

Local Organizing Committee:

Megan Breit-Goodwin (chair), Nina Bohrod, Pete DeLong, Lee Erickson, Janine Goenner, Jenna Kowalski, Adam Krenelka, Mark Omodt, Michelle Rogers

Abstracts

Invited Addresses

- **Matthew Haines**, Augsburg College, **Traveling through History with Story Problems**

“Two trains leave different stations heading towards each other at different speeds.” “The length of a rectangle is twice its width and its area is 50 square units.” Sound familiar? These scenarios begin two of several algebra problems that are part of the common experience of many students. Whether on a train, plane, or spaceship, we will travel through various eras of history to sneak a look at some of these common mathematical problems (and maybe a few less common) and their solutions in what one might call the Algebra Experience in education.

- **April Strom**, Scottsdale Community College, **Covariation: A Way of Thinking about Functions**

Several researchers, whose focus has been concentrated on the concept of function, have argued the powerfulness of covariational reasoning for developing robust conceptions of function (Carlson *et al.*, 2002; Confrey & Smith, 1995; Thompson, 1994a, 1994b). Confrey and Smith (1995) argue that covariation, as an alternative way of thinking about the concept of function, offers a more qualitative approach to describing in general the changes of one quantity in relation to another quantity. Carlson *et al.* (2002) defined covariational reasoning as the “cognitive activities involved in coordinating two varying quantities while attending to the ways in which they change in relation to each other” (p. 354). This talk will focus on making sense of changing quantities by exploring how they change in relation to each other as a way for helping students develop an understanding of rate of change.

Project ACCESS/Section NExT Workshop

- **Fenecia Foster**, Southeast Technical Institute, **Emphasizing Authentic Applications**

What is your response when a student asks, “Why do we have to learn this?” What outcomes do you want students to demonstrate, as a result of taking your class? In this workshop, you will test out authentic applications that have positively impacted student engagement and student learning, and you will learn strategies for developing your own applications that are relevant to your lessons and students. This Project ACCESS/Section NExT workshop is open to anyone interested in thinking about new ideas for the classroom.

Student/Faculty Activity

- **Quiz Show: Math Edition**

Everyone can participate in this quiz game, with questions ranging from math use in pop culture to first year calculus.

Contributed Talks

- **Nathan Axvig**, Concordia College, **Maximizing Weekends Off for Moorhead Police Officers**

The Moorhead Police Department contacted the Concordia Department of Mathematics in Fall 2016, wondering whether there was a mathematical way of creating duty schedules that give officers more weekends off while maintaining coverage requirements and respecting union rules. In this talk, we will discuss how we translated this scheduling problem into a linear optimization model. Several interesting (i.e., bothersome) quirks arose out of our initial attempts, and so time will be spent addressing the various ad hoc methods employed to overcome these oddities. This is joint work with students Ellen Kinney, Megan Marsolek, and Katrina Teskey.

- **Jeremiah Bartz**, University of North Dakota, **Digital Root Series and Juggling**

A digital root series is a certain recursive sequence whose recursive formula involves the modulo operation. In this talk we discuss some patterns observed when considering digital root series in different bases and connections with juggling sequences.

- **R. Peter DeLong**, Anoka-Ramsey Community College, Raytheon Company, US Navy, **Unions of Partitioned Sets**

When the union of partitioned finite sets is taken, we call a partition of the union *admissible* if all distinct parts of the original partitions remain distinct in every partition of the union. As repeated unions are taken, the enumerations of the admissible parts and the admissible partitions form algebras, and those algebras are the subject of this talk. Generating functions and an interesting isomorphism with $Z[x]$ are explored.

- **Su Dorée**, Augsburg College, **The Curious Case of 2s and 3s: Dynamics on Weak Compositions**

The “Boltzman Game” begins with N students who each have \$1. At each turn, two students are randomly selected and the first student gives \$1 to the second, if possible. In the long run, how often does a student have \$0, \$1, \$2, etc.? The answer uses Markov Chains, some elementary counting, and other tools from discrete mathematics. We will also take a quick look at the state graph on these so-called weak compositions and the induced dynamical system on partitions. (Joint work with Drs. Bob Hanson and Matt Richey from St. Olaf College).

- **Tony Dunlop**, Normandale Community College, **General Education Mathematics Using Watershed Data. An “Engaging Mathematics” Course**

A general education mathematics course (at the “Math for Liberal Arts” level) which uses data from a local watershed district to motivate mathematical topics will be described. The course was developed as part of the National Center for Science and Civic Engagement’s (NCSCE) “Engaging Mathematics” project. The structure and mathematical learning outcomes of the course will be outlined, followed by two or three of my favorite class projects. The talk will conclude with some learning outcome assessment data and student feedback.

- **Donna Flint**, South Dakota State University, **A Totally Disconnected Set of Teaching Ideas**

In this talk I will share a variety of activities (large, medium, and small) that I have found help my students and me stay interested, motivated and engaged in a wide variety of courses, ranging from College Algebra through Senior Capstone courses and in different formats ranging from face-to-face traditional courses to online courses. I won’t present any data demonstrating their value, I won’t give any student testimonies, I won’t try to convince you to implement my ideas, and I won’t always give you the answers. What I will do is show you some things I am doing that keep teaching new and exciting to me.

- **Jennifer Galovich**, St. John’s University and the College of St. Benedict, **Di-eigenals**

What happens to the diagonals of the unit square under a linear transformation? This is the story of how I answered that question incorrectly, and what happened next. Some answers emerged, but there are lots of unanswered questions.

- **Michele Iiams**, University of North Dakota, **Creating a Reading Guide and Incorporating Active Learning to Accompany Our Open Textbook**

The previous talk by Tim Prescott discussed UND’s adoption of a free open source textbook. This talk will present the associated reading guide and in-class activities that help students learn how to learn math.

- **Cindy Kaus** (Metropolitan State University), **Rikki Wagstrom** (Metropolitan State University), **Tony Dunlop** (Normandale Community College), **Victor Padron** (Normandale Community College) and **John Zobitz** (Augsburg College), **Engaging Mathematics Initiatives in the Twin Cities**

Engaging Mathematics is a three-year project of the National Center for Science and Civic Engagement supported by the National Science Foundation with faculty participants from seven post-secondary institutions around the country, including Augsburg College, Normandale Community College, and Metropolitan State University. This presentation will briefly summarize the objectives of the project, and then highlight the work of faculty at the three Twin Cities institutions in integrating civic issues into courses ranging from introductory statistics and algebra through calculus and differential equations. Student learning outcomes observed to date will also be discussed.

- **Brianna Kozemzak** (undergraduate), Saint Mary's College, Notre Dame, **A Mathematical Model for Copper Homeostasis in *Pseudomonas aeruginosa***

We constructed a compartmental model for copper homeostasis using a series of ODEs that describe the changes in amounts of cuproproteins in *Pseudomonas aeruginosa*. We performed a systematic comparison of several combinations of global and local parameter estimation algorithms to approximate kinetic parameters and the concentrations of proteins using a biochemical modeling software called COPASI. There is evidence that some parameters are highly interdependent and that knowledge of some protein levels is required to accurately estimate the kinetic parameters. In order to sufficiently fit our model to the experimental data, it was necessary to invoke up-regulation of some proteins.

- **Tim Prescott**, University of North Dakota, **Adopting an Open Textbook for the Calculus Sequence**

The UND Math Department adopted APEX Calculus, a free, open source textbook, in the Fall of 2016. We will discuss our process, the changes that we made, and the textbook's availability to others. The subsequent talk by Michele Iiams will present associated materials.

- **Thomas Q. Sibley**, College of St. Benedict & St. John's University, **Is Equity Unusual...at Least in Total Products?**

The product of all the elements of a non-Abelian group depends on the order. These possible total products have been known for over 30 years. We will make a foray into a related but previously unexplored question: When do the $n!$ possible orderings split equitably among the possible total products?

- **Joseph Shoulak** (undergraduate), Anoka-Ramsey Community College, **Applying General Set Relations to Dice and Random Numbers**

Say you're playing a board game with your friends, and you want to select one of 5 enemies at random, but all you have a 6-sided die. How would you do this? What if you want to choose a random card from a deck, but all you have is a coin? This paper answers those questions by proving theorems allowing you to relate most sets to all others, and along the way we will discuss dice-rolling examples and random-number-generating algorithms similar to the one used by the programming language Python.

- **Daniel Stein and Jacob Weinstein** (undergraduates), University of Minnesota-Twin Cities, **Newton-Okounkov Bodies of Bott-Samelson Varieties**

A central theme in algebraic geometry is to associate combinatorial objects to geometric objects (algebraic varieties). This allows researchers to answer geometric questions by transforming their problem into a combinatorial problem, and vice versa. One such bridge between algebraic geometry and combinatorics is the study of Newton-Okounkov bodies. In this talk, we will discuss how we computed the Newton-Okounkov bodies of special types of Bott-Samelson varieties (for certain choices of auxiliary data).

- **Rob Thompson**, Carleton College, **How Many Ways Can You Slice a Donut?**

What kinds of cuts can you make on a hollow donut that will separate it into exactly two pieces with no unnecessary cutting? More precisely, what graphs admit an embedding on a torus whose removal results in two components, but removing any subset of the embedding leaves a connected surface? In this talk we'll discuss this interesting problem at the intersection of graph theory, algebraic topology and junk food.

- **Matthew Zabka**, Southwest Minnesota State University, **Mathematics and Voting**

Freshman students often ask how it is possible to do research in mathematics. "Do you just come up with new equations?" Such questions stem from a lack of understanding of what mathematics really is. In this talk, we shall discuss how mathematics is used in voting and how game theory can illuminate some of mathematics' core ideas to almost any college student.

- **Paul Zorn**, Saint Olaf College, **Everybody Counts: Remembering Lynn Steen**

Lynn Steen, who died in June 2015, left a valuable mathematical legacy both locally and to mathematics itself. Lynn's mathematical contributions spread far beyond our section. He wrote many books and articles on the teaching, importance, culture, and public perception of mathematics, and became a prominent national figure. He served as MAA president and chaired the Conference Board of the Mathematical Sciences. I'll outline and illustrate a few of Lynn Steen's mathematical activities and interests, and some of their local and national effects. A long-time Steen colleague and admirer, the speaker can attest to Lynn's energy, generosity, and kindness. And that he wrote like an angel.

NCS MAA Fall 2017 Meeting: October 20-21, 2017 at University of Minnesota-Morris

Wifi Access:

Network: Guest
Username: maa@arcc.edu
Password: UKry (case-sensitive)

Wired Access (labs and instructor stations)

Username: ARCC-Guest
Password: April2016\$\$ (case-sensitive)



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For the next two weeks, you get 35% off when you [shop](#) titles from MAA Press. Enter discount code **NCS17** during checkout and a portion of the proceeds will also benefit your section.

This code is valid until Sunday, April 30, excludes some sale books, and cannot be combined with any other offers or discounts from the MAA.

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