Mathematical Association of America (Founded in 1915)

North Central Section (Founded in 1916)

Spring Meeting, April 24-25, 2015

Winona State University, Winona, Minnesota

Time	Room 1 (**SLC 120**)	Room 2 (**Stark 103**)
Friday (April 24) **Registration**(6:30 – 8:10pm): **Science Laboratory Center (SLC) Atrium**		**MAA Book Sale: (Stark 105)**
7:00 – 7:20 pm	**Steve Leonhardi**	**Aaron Wangberg**
7:20 – 7:40 pm	**Bret Benesh**	**Jerome Caldwell**
7:40 – 8:00 pm	**Dick Smith**	**Samuel Schmidt**
8:10 – 8:55 pm	Invited Lecture: **Dan Flath** (NCS 2014 Teaching Award Winner) (SLC 120)	
9:00 – 10:00 pm	Welcome Reception (Science Laboratory Center (SLC) Atrium)	
Saturday (April 25) **Registration**(8:30 – 11:10am): **Science Laboratory Center Atrium**		**MAA Book Sale: (Stark 105)**
9:00 – 9:05 am	Welcome: Dean **Charla Miertschin**, College of Science and Engineering, WSU	
9:05 – 9:45 am	Section NExT Invited Lecture: **Robert Cambell III** (SLC 120)	
9:45 – 10:00 am	MAA Centennial Video : **Steve Kennedy** & **Deanna Haunsperger** (SLC 120)	
10:00 – 10:25 am	Morning Break & MAA Centennial Celebration (SLC Atrium)	
10:25 – 10:45 am	**Paul Zorn**	**Ruth I Berger**
10:45 – 11:05 am	**Suzanne Dorée**	**Danrun Huang**
11:10 – 11:55 am	Invited Lecture: **Barry Cipra** (SLC 120)	
11:55 – 12:00 pm	Group Photograph	
12:00 – 1:00 pm	Lunch (East Hall of Kryzsko Commons)	
1:05 – 1:35 pm	NCS Business Meeting (SLC 120)	
1:40 – 2:00 pm	**Tom Sibley**	**Joyati Debnath**
2:00 – 2:20 pm	**Ke Zhu**	**Alexandra Nelson**
2:20 – 2:40 pm	**Bill Schwalm**	**A. Brotherton, B. Kiewatt, J. LeTourneau, X. Wang, S. Leonhardi**
2:40 – 2:55 pm	Afternoon Coffee Break (SLC Atrium)	
2:55 – 3:10 pm	**Chris Malone**	**Christopher Phan**
3:10 – 3:25 pm	**Huiya Yan**	**William Branson**
3:25 – 3:40 pm	**Damiano Fulghesu**	**Hyun Lim**
3:45 – 4:00 pm	**Lee Windsperger**	**Aaron Leinwander**
4:00 – 4:15 pm	**Pingping Zhang**	**Brandon Allen**

Friday, April 24, 2015

6:30 – 8:10 **Registration** – Science Laboratory Center (SLC) Atrium
$10 Regular (Students, First time attendees, and Speakers are free)
$5 for MAA-NCS section NExT members.

6:30 – 8:10 **Book Sales**, Stark 105
Internet access: wireless internet access is available upon request at registration table

Evening Concurrent Session I – SLC 120, Dr. Brant Deppa, Presiding
7:00 – 7:20 **Prof. Steve Leonhardi, Winona State University**
Game Theory and Sustainability

7:20 – 7:40 **Prof. Bret Benesh, College of Saint Benedict and Saint John's University**
Games on Groups: GENERATE and DO NOT GENERATE

7:40 – 8:00 **Prof. Dick Smith, University of Dubuque**
Square, Octagon and Triangular Numbers

Evening Concurrent Session II – Stark 103, Dr. Chris Phan, Presiding
7:00 – 7:20 **Prof. Aaron Wangberg, Winona State University**
A Geometric Viewpoint of Multivariable Derivatives

7:20 – 7:40 **Dr. Jerome Caldwell, University of Wisconsin, River Falls**
Appreciating Mathematics via Coding

7:40 – 8:00 **Prof. Samuel Schmidt, Winona State University**
PIC Math: Preparing Undergraduates for Mathematical Careers in Industry

Invited Lecture – SLC 120, Dr. Brant Deppa, Presiding
8:10 – 9:00 **Prof. Dan Flath, Macalester College**
Multiplication

9:00 – 10:00 **Reception** - **Science Laboratory Center (SLC) Atrium**

Saturday, April 25, 2015

8:20 – 11:10 **Registration** – Science Laboratory Center (SLC) Atrium
8:20 – 11:10, 12:00-1:40 **Book Sales** – Stark 105

Morning Session – SLC 120, Dr. Eric Errthum, Presiding

9:00 – 9:05 Welcome **Dr. Charla Miertschin, Dean, College of Science and Engineering, WSU**

9:05 – 9:45 **Section NExT Invited Lecture:**
Prof. Robert Cambell III, College of St. Benedict and St. John's University
From Graphs to Varieties, Codes Do it All.

9:45 – 10:00 **MAA Centennial Video: Steve Kennedy & Deanna Haunsperger, Carleton College**

10:00 – 10:25 **Morning Break & MAA Centennial Celebration (SLC Atrium)**

Morning Concurrent Session I – SLC 120, Dr. Joyati Debnath, Presiding

10:25 – 10:45 **Prof. Paul Zorn, Saint Olaf College**
CUPM's 2015 Curriculum Guide (Centennial Edition)

10:45 – 11:05 **Prof. Suzanne Dorée, Augsburg College**
Turning Homework Problems into Activities that Teach Mathematical Inquiry

Morning Concurrent Session II – Stark 103, Dr. Eric Errthum, Presiding

10:25 – 10:45 **Prof. Ruth I Berger, Luther College**
Grid City - Explorations in Taxicab Geometry

10:45 – 11:05 **Prof. Danrun Huang, St. Cloud State University**
Cracking Calculus Problems without Calculus

Invited Lecture – SLC 120, Dr. Joyati Debnath, Presiding

11:10 – 11:55 **Dr. Barry Cipra, Freelance Mathematics Writer**
SeVenn, EleVenn, and Beyond

11:55 – 12:00 **Group Photograph**

12:00 – 1:00 **Luncheon** – East Hall of Kryzsko Commons

1:05 – 1:35 **Business Meeting** – SLC 120, Dr. Joel Iiams, Section President Presiding

Afternoon Concurrent Session I – SLC 120, Dr. Chris Malone, Presiding

1:40 – 2:00 **Prof. Tom Sibley, College of Saint Benedict and Saint John's University**
Group Products

2:00 – 2:20 **Prof. Ke Zhu, Minnesota State University, Mankato**
Isometric Embeddings via Heat Kernel

2:20 – 2:40 **Prof. Bill Schwalm** and **Mizuho Schwalm, University of North Dakota**
Elliptic Functions and Solitons

Afternoon Concurrent Session II -- Stark 103, Dr. Steve Leonhardi, Presiding

1:40 – 2:00 **Prof. Joyati Debnath, Winona State University**
In Search of Criminals: Application of Mathematics in Forensic Sciences

2:00 – 2:20 **Alexandra Nelson, University of Minnesota, Twin Cities**
Athletic Schedule Design: An Application of Projective Geometry, Finite Fields, and Graph Theory

2:20 – 2:40 **Ashley Brotherton, Beth Kiewatt, Jeremiah LeTourneau, Xiaoqiong Wang,** and **Prof. Steve Leonhardi, Winona State University**
Using Debates To Study the History of Mathematics

2:40 – 2:55 **Afternoon Coffee Break** Science Laboratory Center (SLC) Atrium

Afternoon Concurrent Session III SLC 120, Dr. Sam Schmidt, Presiding

2:55 – 3:10 **Prof. Chris Malone, Winona State University**
Development of a Data Science Program

3:10 – 3:25 **Prof. Huiya Yan, University of Wisconsin, La Crosse**
Organize Practice Sessions for Putnam Math Competitions

3:25 – 3:40 **Profs. Damiano Fulghesu** and **Sayel Ali, Minnesota State University, Moorhead**
Frames

3:45 – 4:00 **Prof. Lee Windsperger, Winona State University**
Fostering Mathematical Diplomacy Using Math Circle Techniques and Explorations

4:00 – 4:15 **Prof. Pingping Zhang, Winona State University**
Exploring Middle School Students' Understanding on Concept of Areas through Two Problem Solving Scenarios

Afternoon Concurrent Session IV Stark 103, Dr. Barry Peratt, Presiding

2:55 – 3:10 **Prof. Christopher Phan, Winona State University**
Attempt to Implement Peer Instruction and Just-in-Time Teaching in Lower-Division Mathematics Classes

3:10 – 3:25 **Prof. William Branson, St. Cloud State University**
Newton's Method and Convergence in Real Analysis

3:25 – 3:40 **Hyun Lim and Prof. Jung-Han Kimn, South Dakota State University**
A Time-decomposition method for Hyperbolic PDEs; Applications to Physical Problems

3:45 – 4:00 **Aaron Leinwander, University of Wisconsin, Eau Claire**
Fitting alpha-skew Distributions to Insurance Data

4:00 – 4:15 **Brandon Allen, Winona State University**
Boundary Temperatures of Squares

Local Organizing Committee:
Eric Errthum (Chair), Joyati Debnath, Brant Deppa (Dept Chair), Steve Leonhardi, Chris Malone, Barry Peratt, Chris Phan, Sam Schmidt, Lee Windsperger

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Abstracts

Invited Addresses

- **Robert Campbell III,** College of Saint Benedict and Saint John's University
  From Graphs to Varieties, Codes Do it All

Coding theory stems from the simple question of how can we ensure that communication along a noisy channel is received correctly. We will look at the beginnings of coding theory and take a survey of the many creative solutions that arise from many different branches of mathematics. We will conclude by focusing on codes specifically from algebraic geometry and what current research in AG-codes is looking at.

Bio: Dr. Robert Campbell has been an assistant professor of mathematics at the College of St. Benedict and St. John's University for three years. Prior to working at CSB/SJU, he did his graduate studies at the

University of California, Irvine specializing in algebraic geometry and algebraic coding theory. During his time at UCI, Robert was awarded a pedagogical fellowship. Since receiving his PhD, Robert has continued his interest in professional and pedagogical development by becoming a Silver-12 Project NExTer. Robert has been very active with his local MAA section as well as nationally, giving talks, organizing paper sessions, and organizing panels.

- **Barry Cipra,** Freelance Mathematics Writer
  SeVenn, EleVenn, and Beyond

The speaker will report on results both old and new on the existence of rotationally symmetric Venn diagrams -- a problem that began as an undergraduate project in the 1960s, and continues to be a rich source of open questions accessible to undergraduates today.

Bio: Barry Cipra is a freelance mathematics writer based in Northfield, Minnesota. He is a Contributing Correspondent for Science magazine and writes regularly for SIAM News, the newsletter of the Society for Industrial and Applied Mathematics. He is the author of "Misteaks, and how to find them before the teacher does," published by AK Peters.

- **Dan Flath,** Macalester College
  Multiplication

If you ask your students "What can you multiply?", they might say , "You can multiply numbers and matrices". I will suggest a variety of other examples to excite beginning college students with. The last section of the talk presents an open problem about the relation of ordinary multiplication of integers and the Mobius function that you and your students can begin playing with immediately.

Bio: Dan Flath's first degrees were in electrical engineering, then he switched to math and number theory, then to group representations. In 1990 he joined the calculus reform movement and has been changing the way he thinks about and teaches calculus every year since. He teaches a wide variety of courses ranging from signal processing to differential geometry and statistics. He has enjoyed summer research on engineering inspired projects with teams of undergrads. Recently he has been modernizing his understanding of data science via Coursera, which has gotten him fascinated by online education. He has been at Macalester College for 13 years.

Contributed Talks

- **Brandon Allen,** Winona State University**, Boundary Temperatures of Squares**

The Dirichlet problem is unique to boundary value problems. The Dirichlet problem overall tells the temperature of each point of a surface we are looking at. We shall look at in this presentation some characteristics of heated squares in respect to the Dirichlet problem and some visualization techniques we can use to understand the Dirichlet problem's output.

- **Bret Benesh,** College of Saint Benedict and Saint John's University**,**
  Games on Groups: GENERATE and DO NOT GENERATE

Let G be a finite group. We will discuss two games on G, each of which is played by two players who alternately select (without replacement) elements of G to put in a common set. In the game GENERATE, the first player who generates G from the common set wins; in DO NOT GENERATE, the first player who generates G loses. We present a complete theory for the strategy and nim-numbers of DO NOT GENERATE based on the maximal subgroups of G; we will also present partial results for GENERATE.

- **Ruth I Berger,** Luther College**, Grid City - Explorations in Taxicab Geometry**

I will present some word problems that can be used in a Geometry class at the high school or College level, especially with pre-service teachers, to make students think about the definition of distance and the definitions of the figures known as conic sections in Euclidean Geometry. These real-world problems about distance measurement on a city grid introduce students to Taxicab geometry, an easily accessible topic that can lead to thought provoking questions at many different levels.

- **William Branson,** St. Cloud State University**, Newton's Method and Convergence in Real Analysis**

Newton's Method can produce a variety of examples of pointwise and uniform convergence. If $f(x)$ is a function on the real line, then let $N(x) = x - \frac{f(x)}{f'(x)}$, and $N^k(x)$ to be the k-fold composition of $N(x)$ with itself. To what does $N^k(x)$? Is the convergence pointwise, or uniform? Such questions and their investigations can be used in real analysis courses to strengthen students' understanding of pointwise and uniform convergence.

- **Ashley Brotherton, Beth Kiewatt, Jeremiah LeTourneau, Xiaoqiong Wang,** and **Steve Leonhardi,** Winona State University**, Using Debates To Study the History of Mathematics**

Many debatable questions arise in studying the History of Mathematics. For example, is mathematics advanced and developed more by the creative work of a few individual geniuses, or by supportive mathematical communities? Are mathematical advances stimulated more by theory or by applications? Carrying out a formal debate is an effective method of investigating such a question. We will present an abbreviated "mini-debate" illustrating this activity, and then comment on logistics and lessons learned.

- **Jerome Caldwell,** University of Wisconsin, River Falls**, Appreciating Mathematics via Coding**

Our "Liberal Arts Mathematics" class students build/code mathematical objects themselves. We include traditional and non-traditional topics presented in a variety of settings appealing to students of various interests and backgrounds. Students create art from polygons, construct random walks, simulate queues, relate traveling around the circle to the graph of the sine function, write logic-driven stories, and estimate the area under a curve…. Students use SNAP, UC Berkeley's visual, drag-and-drop programming language, ideal because it has no syntactical complexity and is browser based. As a consequence students have a friendly introduction to computer coding. SNAP will be demonstrated.

- **Joyati Debnath,** Winona State University**,**
  In Search of Criminals: Application of Mathematics in Forensic Sciences

Forensic mathematics has gained importance and popularity over the years among the scientists and professionals. It has become a new frontier among mathematicians, as more and more mathematical understanding is needed to solve crimes. These are mainly Blood Splatter Analysis, Time of Death, and Fingerprint Analysis among many others. Each of these uses elementary knowledge of mathematics such as content topics from Algebra, Trigonometry, Calculus and Graph Theory. This proposal resulted from a workshop on Forensics hosted by the Department of Homeland Security (DHS) during the summer of 2014. This presentation will focus on how we can use applications of mathematics in forensic sciences, prepare our students with deeper appreciation of mathematics and make mathematics more interesting and attractive.

- **Suzanne Dorée,** Augsburg College**,**
  Turning Homework Problems into Activities that Teach Mathematical Inquiry

What happens next? Does it always work? How many are there? What if we tried this instead? These questions are part of any mathematician's toolkit. But how do we ignite students'

curiosity and help them develop the art and skill of inquiry? Can we create opportunities for students to ask questions, make and test conjectures, and explore mathematics? I believe so. In this talk I'll share some practical, classroom-tested strategies you can use to transform standard textbook homework problems emphasizing procedural fluency and basic understanding into activities that teach inquiry, using examples from college algebra, linear algebra, and discrete mathematics.

- **Damiano Fulghesu** and **Sayel Ali,** Minnesota State University, Moorhead**, Frames**

A popular application problem in College Algebra is the picture frame problem, where the students are asked to solve a variation of the following exercise: "A picture frame is 24cm by 34cm. If the picture that is showing in the frame is 600 square cm, and the frame is of uniform width, what are the dimensions of the picture?" But what do we mean by "frame of uniform width"? In this talk we investigate possible definitions for "frame", "picture frame", and "uniform width", and compare them with the intuitive idea of picture frame.

- **Danrun Huang,** St. Cloud State University**, Cracking Calculus Problems without Calculus**

How many problems in a calculus book can we solve using only high school algebra and trigonometry? We explore each of the examples in the optimization and Lagrange multipliers sections of James Stewart's very popular calculus textbook. Students will be surprised by the power of our fast and simple methods which are rarely discussed in modern calculus textbooks. We find that Professor Pennings' famous dog Elvis actually doesn't need calculus or fancy inequalities to find his optimal path to fetch a tennis ball in Lake Michigan!

- **Aaron Leinwander,** University of Wisconsin, Eau Claire**,**
  Fitting alpha-skew Distributions to Insurance Data

The purpose of this project was to explore the use of the alpha-skew-normal distribution and the alpha-skew logistic distribution to other commonly used distributions in modeling insurance data. General properties of the distributions are looked at and initial tests are conducted to determine the validity of applying the more flexible alpha-skew distributions compared to more orthodox distributions such as the normal and skew-normal distributions. In the initial findings, looking at commonly used public data, both distributions seem to be comparable to other distributions. Alpha-skew-logistic seems to model the skew nature, while the alpha-skew-normal distribution appears to have more difficulties.

- **Steve Leonhardi,** Winona State University**, Game Theory and Sustainability**

Sustainable use of shared natural resources such as clean air, freshwater, and fish populations requires a difficult balance between self-interest and the public good, as described in Garrett Hardin's essay "The Tragedy of the Commons." Audience members will participate in simulations illustrating the conflicts making it difficult to preserve the value of natural resources and prevent climate change. Mathematical game theory will be used to model expected results from strategies chosen by parties in conflict, who may be individual consumers, businesses, neighboring states or countries, or present versus future generations.

- **Hyun Lim** and **Jung-Han Kimn,** South Dakota State University**,**
  A Time-decomposition Method for Hyperbolic PDEs; Applications to Physical Problems

Physical phenomena such as neutrinos and formation of singularity can be described with partial differential equations (PDEs), and those PDEs which come from physical systems have a hyperbolic system. Furthermore, the analytic solutions are not available. In this talk, we present a time-parallel numerical method to solve the PDEs with physically relevant results. The model problems are chosen in relativistic

quantum mechanical system: Schrödinger equation, Klein-Gordon equation, Dirac equation, and semilinear wave equation.

- **Chris Malone,** Winona State University**, Development of a Data Science Program**

McKinsey & Company (2011) estimated a shortage of 140,000 to 190,000 people with deep analytical skills by 2018. To put this into perspective – if you take all the students in the United States who will graduate this spring with a degree in mathematics, statistics, and computer science, over 50% of this anticipated shortage would remain. The Department of Mathematics and Statistics and the Department of Computer Science have recently created a new Data Science program to meet this growing demand. The development of this new program will be discussed. Plenty of time will be left for discussion.

- **Alexandra Nelson,** University of Minnesota**,** Twin Cities, **Athletic Schedule Design: An Application of Projective Geometry, Finite Fields, and Graph Theory**

This paper solves a problem faced by the Suburban East Conference of the Minnesota State High School League in 2009, of designing a consistent wrestling schedule to accommodate a new school. We adapt the application of projective geometry of finite fields to general scheduling problems, and develop an algorithm for determining a schedule. We prove that this algorithm may be completed, will yield the desired schedule, and can yield all possible schedules in the desired format. We will also model the schedule with bipartite graphs, and use edge colorings to complete the schedule with home and away assignments.

- **Christopher Phan,** Winona State University**, Attempt to Implement Peer Instruction and Just-in-Time Teaching in Lower-Division Mathematics Classes**

Following a visit to Winona State University by Peer Instruction innovator Eric Mazur, I attempted to implement Mazur-style Peer Instruction and Just-in-Time Teaching (JiTT) techniques in my Precalculus and Calculus classes. This attempt was not overall successful, but did provide insights that have improved my teaching. In my talk, I will give a very brief overview of these techniques, explained how I attempted to implement them, how my implementation was successful (and unsuccessful), what I learned from the experience, and how I intend to attempt another implementation in the future.

- **Samuel Schmidt,** Winona State University**,**
  PIC Math: Preparing Undergraduates for Mathematical Careers in Industry

This presentation is a reflection on my endeavor to teach a course in Mathematics intended to offer students experience working on actual problems from business, industry and/or government. Small groups of undergraduate math students spent a semester working on open ended problems using mathematical and statistical techniques. They held regular meetings with industry contacts and documented progress; much as they would if they were a working as a consultant. We will discuss the various differences between jobs in academia and those in the so called "real world" and I will share my own experience teaching this course as a mathematics professor with minimal background in industry.

- **Bill Schwalm** and **Mizuho Schwalm,** University of North Dakota**, Elliptic Functions and Solitons**

The "sine-Gordon" equation $u_{xx} + u_{tt} - \mu^2 \sin u = 0$ admits soliton solutions, which are patterns $u = u(x,t)$ that (in the simplest case) move without changing shape. One definition of a soliton is "a traveling non-dissipative wave that is neither preceded nor followed by another such disturbance." More generally we have considered other moving, non-dissipative patterns that do repeat, but for which one can take a solitary wave limit. These include periodic solutions in the form of Jacobi elliptic functions, which are

easy to find and interesting in several ways. In certain limits they become solitons. I show some solutions and describe some properties.

- **Tom Sibley,** College of Saint Benedict and Saint John's University**, Group Products**

The product of all the elements of an Abelian group is the same regardless of order, but not so with non-Abelian groups. What possible products are there using all possible listings of the elements of a finite non-Abelian group?

- **Dick Smith,** University of Dubuque**, Square, Octagon and Triangular Numbers**

This presentation features a square with two line segments drawn from each vertex to points ONE unit from the opposite vertex of the square. These eight segments produce an octagon. The ratio of the octagon to the square produces triangular numbers. The presentation will demonstrate the proof of this fact. It will also show that as the square gets very large that the octagon itself becomes a square. It also will show that the limit of the octagon squeezes down to an area of ½.

- **Aaron Wangberg,** Winona State University**, A Geometric Viewpoint of Multivariable Derivatives**

The new flavors of derivative in multivariable calculus are often studied independently, with the relationships between them explored algebraically. In this talk, we'll build a geometric representation of multivariable derivatives that incorporates gradient vectors, directional derivatives, and partial derivatives. We'll explore how this representation, which is coordinate independent and nicely generalizes to function on higher dimensional spaces, makes it easy to investigate various concepts involving multivariable derivatives.

- **Lee Windsperger,** Winona State University**,**
  Fostering Mathematical Diplomacy Using Math Circle Techniques and Explorations

Math courses should help students develop an appreciation of and ability for generalization, conjecture, and justification in addition to analytical and problem solving skills. Because of their impact on the perception of mathematics for future generations, liberal arts audiences and future middle school math teachers benefit from such courses. In this talk, I will discuss how I have used Math Circle techniques and activities to promote mathematical habits of mind and broaden students' concepts of mathematics and mathematics education.

- **Huiya Yan,** University of Wisconsin, La Crosse**,**
  Organize Practice Sessions for Putnam Math Competitions

In this talk, the presenter is going to share the experience of organizing practice sessions for Putnam math competitions. The practice sessions can enhance students' ability to solve challenging math problems and strengthen their understanding of abstract concepts in college math courses.

- **Pingping Zhang,** Winona State University**,**
  Exploring Middle School Students' Understanding on Concept of Areas through Two Problem Solving Scenarios

During the presentation the presenter will first introduce a concept developmental framework of areas which is grounded upon Vygotsky's Concept Formation Theory and Berger's Appropriation Theory. Then two 6th grade students' problem solving processes on an area problem – two squares are placed such that the corner on one square lies on the center of the other; describe the range of possible areas representing the intersections of the two squares – will be analyzed using the

framework. Scaffolding questions which were provided by the presenter to aid students' thinking at the moment will also be shared and elaborated.

- **Ke Zhu,** Minnesota State University, Mankato**, Isometric Embeddings via Heat Kernel**

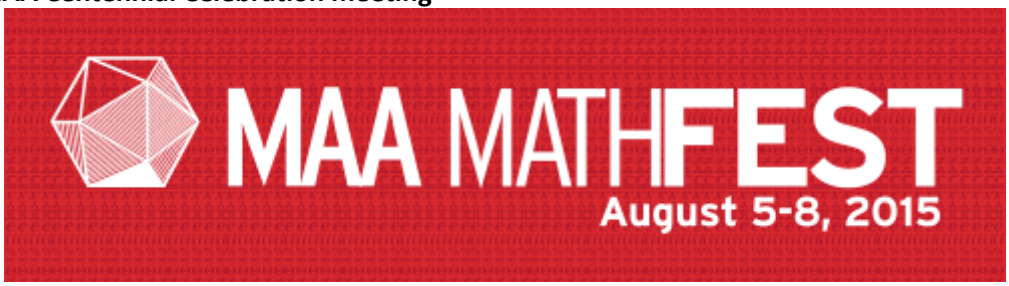
The Nash embedding theorem states that every Riemannian manifold can be isometrically embedded into some Euclidean space. Isometric means preserving the length of every path. For instance, bending without stretching or tearing a page of paper gives an isometric embedding of the page into Euclidean space, because curves drawn on the page retain the same arc length when the page is bent. Nash's proof involves sophisticated perturbations of the initial embedding, so not much is known about the geometry of the resulted embedding. In this talk, using the eigenfunctions of the Laplacian operator, we construct canonical isometric embeddings of compact Riemannian manifolds into Euclidean spaces, and discuss possible applications.

- **Paul Zorn,** Saint Olaf College**, CUPM's 2015 Curriculum Guide (Centennial Edition)**

The MAA's Committee on the Undergraduate Program in Mathematics (CUPM) has produced a new Curriculum Guide about every 10 years since the 1950s. The 2015 Guide – just in time for MAA's centennial – is now beginning to appear, partly in printed form and partly online. The 2015 Guide focuses specifically on designing up-to-date major programs in the mathematical sciences. I'll describe and sample from the new Guide, and also outline some ways in which CUPM Guides , and majors themselves, have changed over the last 60-odd years.

Upcoming Meetings

- **MAA Centennial Celebration meeting**



http://www.maa.org/meetings/mathfest August 5-8, 2015, Washington DC

- **Joint Math Meeting**, January 6-9, 2016, Seattle, WA
  http://jointmathematicsmeetings.org/meetings/abstracts/abstract.pl?type=jmm

North Central Section http://sections.maa.org/northcen/meetings.html

- Fall 2015, Bemidji State University, Bemidji, MN (October 23-24, 2015)
- Spring 2016, Macalester College, St. Paul, MN (April 15-16, 2016)
- Fall 2016, University of Minnesota, Minneapolis, MN (October, 2016)

MAA-North Central Section Centennial T-shirt sale: $10 at the registration desk (limited quantity!)