Lake Superior State University

Mathematics and Computer Science

650 W. Easterday Avenue

Sault Ste. Marie, MI 49783

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MAA Upper Peninsula Regional Fall Meeting

Lake Superior State University

September 12—13, 2008

Daniel Yorgov

Michigan Technological University

Cuda Based Exhaustive Search Construction of Golay Binary [24, 12, 8] Self-Dual Code

The latest generations of Graphic Processors architecture provides a raw parallel processing power comparable to many clusters and supercomputers. Recently this power became easier to use because of the introduction of NVIDIA CUDA technology. In this report, I introduce briefly the CUDA programming model and the underlying architecture. I utilize the CUDA technology on a low-end mass market GPU to construct the famous Golay binary [24, 12, 8] self-dual code by partial exhaustive search. I present the problem, discuss the algorithm, together with some optimization principles and evaluate the performance of the different strategies.

Thank you

for attending

Kimberly Muller
Lake Superior State University
Exploration, Discovery, Conjecture: How Technology Can Motivate Proof

One of the biggest challenges when approaching proof-writing is that students often do not know where to begin. In geometry, modern technology can be used to overcome this obstacle. With the Geometer's Sketchpad®, students are now able to explore geometric constructs and use these exploratory activities to form conjectures. They can then use their constructions to better understand the statement of theorems and provide insight into why the theorems are true. These discoveries can serve as a catalyst for the proof-writing process. This paper describes the author's approach to using Sketchpad to teach college geometry to pre-service teachers.

Allan Struthers
Michigan Technological University
Optimization and Loaded Dice

The standard Karush-Kahn-Tucker (KKT) necessary conditions for constrained optimization will be illustrated using interesting examples from the casino dice game "Craps".

Michigan Section MAA
Upper Peninsula Regional
Fall Meeting
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Featured Speakers

Neil Robertson,

Ohio State University

and

Matt Boelkins

Grand Valley State University

Hosted by

Lake Superior State University

Mathematics and Computer Science

Featured Speaker

Matt Boelkins

Associate Professor

Grand Valley State University

Chair of the Michigan Section—MAA

The Geometry of Polynomials: Classic Results, Recent Developments, and Problems Still Unsolved

Polynomial functions are the most basic in all of mathematics. Famous results such as the Stone-Weierstrass Theorem and the Fundamental Theorem of Algebra tell of their importance and some of the completeness with which we understand them. By "the geometry of polynomials", we indicate an interest in studying relationships among certain sets associated with polynomial functions, such as the relationship between the set of zeros and the set of critical points of a function. Classic results such as Rolle's Theorem and the Gauss-Lucas Theorem tell us something of how the critical points of a polynomial must be situated relative to the function's zeros. Within the last 10-15 years, several accessible, new results have been discovered that shed new insight on the dependence of various properties of a polynomial function on the location of its zeros, including the distribution of critical numbers relative to its zeros. In this talk, we will present several well-know theorems, proceed to more recent, less publicized results—including some proven by undergraduates—and conclude with a discussion of several open questions that involve polynomial functions.

Lorraine Gregory and Sherilyn Duesing

Lake Superior State University

Preparing to Teach Mathematics-Facilitating the Learning of Content and Pedagogy.

Using problem-based learning to help pre-service teachers construct profound understanding of mathematics and prepare to teach using problems and materials effectively. A 3-course sequence focusing on content knowledge and pedagogy will be described.

Raymond Jensen

Lake Superior State University

Integral Invariants on the Boundary of Conformally Compact Manifolds Under Constant Scalar Curvature Condition.

It is well-known that on the boundary of a $n+1$ dimensional conformally compact manifold X under Einstein Condition, using a formal power series technique, one may find conformal integral invariants on the boundary, from the volume formula for X. For example, when $n = 2$, the invariant is related to the integral over the scalar curvature of the boundary, which by the Gauss-Bonnet formula is related to the Euler number of the boundary, a conformal invariant. Here, we extend the Einstein Condition to include all conformally compact manifolds X under constant scalar curvature. It is shown that new invariants arise, involving the second fundamental form.

John Asplund

Michigan Technological University

Mutually Orthogonal Equitable Latin Rectangles

Let a matrix A_1 is an equitable $(r,c;n)$-rectangle on the symbol set S, where r is the number of rows, c is the number of columns and n is the number of symbols. Also, let A_2 be an equitable $(r,c;n')$-rectangle on the symbol set S', and A_3 is an equitable $(r,c;n'')$-rectangle on the symbol set S'' where $rc=nn'=n'n''$. Then $n=n'=n''$. Thus we can define a set of k mutually orthogonal equitable Latin rectangles, or a k-MOELR $(r,c;n)$ to be a set of k equitable $(r,c;n)$-rectangles on a symbol set S where $rc=n$^2, and for every ordered pair (s,s') contained in S cross S, there is a unique cell (i,j) such that $A_{m1}((i,j))=s$ and $A_{m2}((i,j))=s'$ for all m_1, m_2 contained in $\{1,2,\ldots,k\}$.

Carol Bell

Northern Michigan University

Using Functions to Create Pictures in Excel

Interesting pictures can be created when graphing functions in Excel by restricting the domain of the function. Examples of pictures that teachers created in a technology course will be provided along with information on how these ideas can be used to help students understand functions.

David Clark

Michigan Technological University

What in the world is a block design?

Block designs are one of the central structures in combinatorics. A block design is a set of points, together with a set of subsets of these points called blocks which must satisfy certain intersection and size properties. In this talk, we will see examples of several types of block designs, along with their links to coding theory, graph theory and finite geometries.

Featured Speaker

Neil Robertson

Distinguished Professor

Ohio State University

On the Perfect Graph Theorem

Graphs in this talk are finite and have no loops or multiple edges. Complementary graphs have complementary edge-sets and induced subgraphs are vertex-induced. Denote the complement of a graph G by G' and note that if H is induced in G then H' is induced in G'. A clique K is a complete subgraph of G and a hole H in G is a simple circuit with at least four vertices induced in G. We call K' and H' anticliques and antiholes of G. The clique number $w(G)$ is the largest size of a clique in G and the chromatic number $x(G)$ is the smallest number of anticliques required to cover all the vertices of G. Evidently, $w(G) \leq x(G)$. However, $w(G) = 2$ with $x(G)$ arbitrarily large is possible. A graph G is called perfect when $w(H) = x(H)$ for all induced subgraphs H. Graphs B with $x(B) \leq 2$ are a typical class of perfect graphs and odd length holes H are a class of minimally imperfect graphs. Moreover, their complements B' and H' share these respective properties. Berge conjectured in 1961 that (1) if G is perfect then so is G' and (2) if G has no odd holes or antiholes then it is perfect. Note that (2) implies (1) and (1) is a textbook theorem of Lovasz from 1972. Arguably, conjecture (2) was the most important open question in coloring theory not related to the four-color theorem. Research groups around Lovasz, Chvatal and Cornuejols, at separate times, made considerable progress on (2) and finally in 2003 (published in 2006) a group led by Seymour settled the problem affirmatively. This talk will informally describe the proof, some subsequent work and the important open questions in the area.

Friday , September 12, 2008
Registration and Refreshments
3:00 p.m.—East Superior Room, Cisler Center

Welcome and Opening Remarks

3:50 p.m. ______________________________**Dr. Anthony Blose, Dean**
College of Science, Technology, Engineering and Mathematics

Schedule of Speakers

4:00 p.m. ________________**Lorraine Gregory and Sherilyn Duesing**
Lake Superior State University
"Preparing to Teach Mathematics-Facilitating the Learning of Content and Pedagogy"

4:25 p.m. ____**David Clark**
Michigan Technological University
"What in the World is a Block Design?"

4:50 p.m. _______________________________________**Daniel Yorgov**
Michigan Technological University
"Cuda Based Exhaustive Search Construction of Golay Binary [24, 12, 8] Self-Dual Code"

Break

5:30 p.m. _______________________________________**Matt Boelkins**
Grand Valley State University
"The Geometry of Polynomials: Classic Results, Recent Developments and Problems Still Unsolved"

Dinner

6:30 p.m.______________________________**Studebakers Restaurant (Oak Room)**
Dutch Treat

Saturday, September 13, 2008
Registration and Refreshments
8:30 a.m.—East Superior Room Cisler Center

Schedule of Speakers

9:00 a.m. ____________________________________**Kimberly Muller**
Lake Superior State University
"Exploration, Discovery, Conjecture: How Technology Can Motivate Proof"

9:25 a.m. ____**Carol Bell**
Northern Michigan University
"Using Functions to Create Pictures in Excel"

Break

10:00 a.m. _____________________________________**Neil Robertson**
Ohio State University
"On the Perfect Graph Theorem"

11:00 a.m. ___________________________________**Raymond Jensen**
Lake Superior State University
"Integral Invariants on the Boundary of Conformally Compact Manifolds Under Constant Scalar Curvature Condition."

11:25 a.m. _____________________________________**Allan Struthers**
Michigan Technological University
"Optimization and Loaded Dice"

11:50 a.m. ______________________________________**John Asplund**
Michigan Technological University
"Mutually Orthogonal Equitable Latin Rectangles"

Lunch (for those who wish to stay)

12:30 p.m. ____________________________________**Restaurant TBA**
Dutch Treat