

5-2009

ACMS 2009: Abstracts

Association of Christians in the Mathematical Sciences

Abstracts for Invited Talks

THURSDAY MORNING, MAY 28, 2009

CORAY EVENT CENTER

9:00 a.m. - *“Calculus as a High School Course”* *David Bressoud.*

10:00 a.m.

Over the past quarter century, 2- and 4-year college enrollment in first semester calculus has remained constant while high school enrollment in calculus has grown tenfold, from 50,000 to 500,000, and continues to grow at over 6% per year. We have reached the cross-over point where each year more students study first semester calculus in US high schools than in all 2- and 4-year colleges and universities in the United States. There is considerable overlap between these populations. Most high school students do not earn college credit for the calculus they study. This talk will present some of the data that we have about this phenomenon and its effects and will raise issues of how colleges and universities should respond. I will also discuss how Macalester College is responding to this challenge.

10:20 a.m. - *“Computer Gaming: The Good and the Bad”* **Lori Carter and Anna Hail**

11:00 a.m.

The computer gaming industry has had a tremendous impact on the field of computer science. Many of our students choose to major in computer science because of their fascination with computer games. The desire to produce faster, more realistic computer games has been a driving force in pushing processor speeds and memory capacity. Students are motivated to learn challenging programming features using assignments based around computer game design. On the other hand, for many, computer gaming has become a dangerous obsession. Degrees have been forfeited, jobs lost and families neglected because of problematic gaming. This talk looks at the benefits of computer gaming along with the results of research regarding problematic computer gaming recently conducted at Point Loma Nazarene University. We will share some fascinating statistics concerning the extent of the problem in universities, who is at risk, why students play and why professors of mathematics and computer science should be particularly interested.

11:05 a.m. - *“Mathematics Research with Undergraduates:*

11:55 a.m. *Stories of Personal Success”*

James Sellers

For the past fifteen years of my career, I have enjoyed working with undergraduates on mathematical research projects of various types, from senior capstone experiences and research-intensive independent study courses to full-fledged research projects. I have found each of these experiences truly enriching, especially those endeavors which ended with refereed publications. (I have been privileged to write half a dozen papers with undergraduate co-authors!) In this talk I will share many of the details of these experiences. I will strive to answer the "why" and "how" of doing mathematical research with undergraduate students, from my perspectives at a small school (Cedarville University) and a large school (Penn State University). My hope is that I will inspire you to complete such projects with your students and that you and I will get to talk about some mathematics along the way.

FRIDAY MORNING, MAY 29, 2009

CORAY EVENT CENTER

9:00 a.m. - ***“Stories from the Development of Real Analysis”*** ***David Bressoud***

10:00 a.m.

Analysis is what happened to calculus in the 19th century as mathematicians discovered that their intuition of how to apply calculus was failing them, especially as their repertoire of infinite series expanded. The conceptual difficulties that they encountered are precisely where we should expect our own students to have trouble. Understanding how these controversies were resolved illuminates many of the definitions, axioms, and theorems that baffle our students. This talk will focus on one or more of three broad issues that arose during this century and that caused both controversy and confusion as they were straightened out: What do we mean by convergence of a series of functions and when, for the purposes of calculus, can we treat an infinite sum of functions as if it were a finite sum? How did our modern understanding of the Fundamental Theorem of Calculus arise, and what does it really say? And how did we get the Heine-Borel Theorem?

10:30 a.m. - ***“Revisiting What Euler and the Bernoullis Knew About Infinite Series”***

11:15 a.m.

James Sellers

All too often in first-year calculus classes, conversations about infinite series stop with discussions about convergence or divergence. Such interactions are, unfortunately, not often illuminating or intriguing for students. Interestingly enough, Jacob and Johann Bernoulli and Leonhard Euler (and their contemporaries in the late 17th and early 18th centuries) knew quite a bit about how to find the “exact” values of numerous families of convergent infinite series.

In this talk, I will demonstrate some “exact” results in this vein and gently argue that we should show more of this kind of material to our first-year students. The talk will be accessible to anyone interested in mathematics.

11:20 a.m. - ***“ACMS – Some Reflections of What We Uniquely Have to Offer”*** ***Jim Bradley***

12:00 noon

This talk will present the speaker’s vision for the mission of ACMS. It will consider some plausible connections between mathematics and theology and some big questions that Christian mathematicians might fruitfully explore. It will also examine the current cultural norms of the mathematics guild, why these are problematic for Christians, and some possible ways ACMS members might respond.

THURSDAY - ABSTRACTS FOR CONTRIBUTED PAPERS

MSC ROOM 302

MSC ROOM 103

MSC ROOM 105

MSC ROOM 202

1:40 pm	<p>Exploring the Limits of Computing Through Exhaustive Search Jeff Lehman</p> <p>Many computing problems can be solved by identifying all possible moves or combinations of events and then picking the best solution. Such problems provide fertile ground for exploring problem representation, storage requirements, and computational complexity. This session describes insights from an investigation of two search problems, the Rubik's cube and the 15-puzzle.</p>	<p>Monoids for Math Majors</p> <p>Brian Beasley Inspired by an MAA PREP workshop on "The Art of Factorization in Multiplicative Structures", this talk will treat the basics of congruence monoids and arithmetical congruence monoids with their potential for a Modern Algebra or capstone course.</p>	<p>The Heavens and the Scriptures in the Eyes of Johannes Kepler Dale McIntyre</p> <p>This paper will demonstrate Kepler's absorption in the Scriptures by exploring his understanding of them as gleaned from the many biblical quotations, paraphrases, and allusions found in his scientific works and personal letters. His views on the Bible's authority, interpretation, and bearing upon knowledge of the cosmos, will be addressed. A biographical sketch will also emphasize Kepler's call to vocation, position on the creeds, and personal character.</p>	<p>Publishing and Using an Online Textbook</p> <p>Roberto Bencivenga</p> <p>This talk will examine possibilities offered by an online publishing company that allows development of online course tools in addition to a professional and appealing book of printed notes. The online resources include audio lectures, interactive practice tests, online assignments, and more. The website will be demonstrated, and the experience of preparing material and using the online content explained.</p>
2:10 pm	<p>Recent Improvements to the Red Black Binary Search Algorithm. John Hayward</p> <p>The Red Black (RB) binary search algorithm has logarithmic behavior for search, insert, delete. In 2008, R. Sedgwick offered a variation called Left Learning Red Black (LLRB). The improved algorithm reduces implementation code from 400 lines to less than 80. This talk will compare LLRB to the earlier AVL and RB approaches.</p>	<p>Unwind with Knots</p> <p>Catherine Crockett</p> <p>With the goal of introducing knot theory and interesting applications, this talk will start with basic ideas of knots and links. It will then explore a few knot invariants with examples leading to a discussion of knot theory applications including work with DNA.</p>	<p>Mathematical Maturity and Christian Faith Development Angela Hare</p> <p>Strong math reasoning skills can deepen students' grasp of scriptural truth and their sense of vocation for stewardship, service, and worship. Although math over time has transformed communication, economics, and health care, few schools direct students to consider how to use math to serve others and promote justice. How do specific math concepts contribute to mature Christian faith?</p>	<p>Can Critical Thinking be Redeemed?</p> <p>Jeremy Case</p> <p>At a time when education is moving away from content towards assessment, how does mathematical deduction, analysis, problem solving, and clarification of assumptions fit in? Can positive features of critical thinking be retained without dismissing God's authority in personal values and decision making?</p>
3:55 pm	<p>AlgebraInvestigator</p> <p>Al Hibbard</p> <p>A Suite of five Mathematica notebooks provide a structured means of investigating groups, rings, morphisms, permutations, and ring extensions. While the notebooks depend on the AbstractAlgebra package, one does not need to learn the command syntax since many investigations can be done by clicking on buttons or modifying already existing parameters or commands.</p>	<p>About Furuta's Inequality and Aluthge Transform on Pseudo-Hilbert Spaces Loredana Ciurdariu</p> <p>The aim of this paper is to show Furuta's inequality in pseudo-Hilbert spaces using the same method as in Furuta's <i>An Elementary Proof of an Order Preserving Inequality</i>. We will also study the gramian hyponormality and p-hyponormality for the Aluthge transform known from the Hilbert spaces as being the operator $\tau = T ^s U T ^t$ where $s, t \geq 0$</p>	<p>Arithmetic Sequences, Diophantine Equations, and the Number of the Beast Bryan Dawson</p> <p>Revelation 13:18 invites anyone with "understanding" to "calculate the number of the beast". This session reviews historical attempts using arithmetic sequences and gives conditions by which a name is "beastable" by those methods. Do these approaches make it reasonable to identify the beast based on such calculation alone?</p>	<p>Pictures From Sabbatical Trips: Ideas for Classrooms, Interaction Areas, and Math Labs Mark Colgan</p> <p>Visits to 25 colleges suggested design ideas for classrooms, interaction areas, office areas, math ed areas, and tutoring centers. Pictures will show creative classroom set-ups, innovative labs, functional office areas, and fun interaction spaces. Ideas include portable white boards, booth furniture, artwork, floor tiling, and hanging decorations.</p>
4:25 pm	<p>Sage: Math in Your Dorm Room, from Calculus to Research Karl Crisman</p> <p>Sage (open source, free software) is suitable for discovery and computation in intro courses such as calculus or linear algebra, while also being ideal for upper-level courses or undergraduate research. Its notebook interface, accessed via a web browser, enables effortless document sharing and comments by multiple users.</p>	<p>Approximating the Sums: a New Modification of the Euler-Maclaurin Formula Tom Price</p> <p>A proposed algorithm for approximating the sum of a series offers considerable reduction in computational effort. Based upon the Euler-Maclaurin formula, the method replaces the terms of a series with simple, easily constructed quantities that facilitate the calculation of integrals and derivatives associated with the Euler-Maclaurin scheme.</p>	<p>Integrating Faith and Learning with First-Year Students Doug Phillippy</p> <p>A five year project to develop a text aimed at introducing first-year math majors to mathematics aims to give students a broad view of the discipline with potential career directions from within a Christian perspective. This talk will survey the text, recent additions, student responses to it, and future directions.</p>	<p>A Neglected Standard: History of Mathematics in the Service of Math. Ed. Cal Jongsma</p> <p>An integrated approach that more intrinsically connects the historical development of mathematics with its content enables students to learn how an idea or method emerged while simultaneously exposing (i) the dynamic nature of mathematics along with (ii) its connections to other fields, and (iii) its cultural embeddedness. Examples will be given from a textbook currently in development.</p>

FRIDAY - ABSTRACTS FOR CONTRIBUTED PAPERS

	MSC ROOM 302	MSC ROOM 103	MSC ROOM 105	MSC ROOM 202
1:30 pm	<p>Design Tolerant Computer Systems kim Kihlstrom Parallels will be drawn between fire protection and computer security system firewalls, security layers in protocol stacks, and security-hardened regions for critical data. Survivable computer systems have continuity of operations as one mission-critical objective.</p>	<p>A Mathematical Model of the Human Sleep Cycle Michael Remppe Not a simple process, sleep is an interplay between several brain regions. Mathematical and computational models give insight into how interactions between different neuron groups give rise to sleep and wake states. Studies show that the brain contains mutually inhibitory connections between sleep-active and wake-active regions. This talk explores a biological mathematical model of these regions consistent with this mutual inhibition idea.</p>	<p>Professor Peacock's Symbolical Algebra: Glimpses into the Life and Work of a Mathematical Reformer Richard Stout George Peacock (1791-1858) is often viewed as a reformer. Many math histories mention his <i>Treatise on Algebra</i>, in which he distinguishes old arithmetical algebra from his new symbolical algebra. This new approach makes Peacock's text into an important step to new algebraic structures. What features make Peacock's work revolutionary especially when compared to other algebra texts of the period?</p>	<p>Integrating Dynamic Software into Middle, High and College Geom. Classes J. Blauw, L. Zylstra, Dave Klanderma Under the direction of their Math 321 (Geometry) professor in a senior honors project, two students created 10 lesson units that incorporate Geometer's Sketchpad activities and worksheets. Challenges to using dynamic classroom software still exist, and it remains critical to integrate these tools with research-based best practices pedagogy and a deep knowledge of geometry topics.</p>
2:00 pm	<p>Computer Modeling - From Networks to Finance to Climate Earl Rodd Starting from the definition of a computer model and different approaches to creating them, the theory will be expanded by examples from simple analytic models applied to computer networks. Principles developed in the context of limitations / challenges of all computer models will be applied to problems with financial risk models and various weather and climate models.</p>	<p>A Quick Way to Find the Arc Length Btwn Two Points of the Logarithmic Spiral Peter Rothmaler When computing arc length between two points (r_1, θ_1) and (r_2, θ_2) of the logarithmic spiral, one normally integrates with respect to the angle θ. An easier approach to finding the arc length for this special curve is to integrate with respect to r. The pathway for changing from one variable to the other will be explored.</p>	<p>Galileo's Solution to Dante's Riddle Andrew Simoson In his <i>Inferno</i>, Dante travels to the earth's center and climbs down Satan's body. Dante poses Satan's height as a riddle: "And to [Satan's] arm alone the giants were less comparable than to a giant I." Earlier Dante had given 3 clues to the height of giants. In a public lecture, Galileo solved the riddle by using clue #1, the height of a pine cone, and Albrecht Durer's estimate for human proportions. Galileo's result will be compared to those given by the other 2 clues.</p>	<p>Are Mathematical Entities Real? Phil Lestmann This talk will introduce ontological questions related to mathematics. After surveying the views of Plato and Aristotle, other possible philosophical perspectives will be considered including realism, nominalism, conceptualism, and empiricism with their relative strengths and weaknesses. The discussion will conclude with a possible biblical foundation for mathematical ontology.</p>
3:55 pm	<p>Foundations for Machine Ethics Gene Rohrbaugh Robotic agents now appear in appliances, as physically assistive robots, and in military uses. Agents gain utility as autonomy increases, but giving decision power to machines may lead to unacceptable choices. Machine ethics deals with implementing constraints on autonomous robotic agents. What do proposed constraint frameworks imply for: (i) conditions under which agents need explicit ethics modules, (ii) forming primitive notions required for ethical decisions?</p>	<p>A Psalm a Day Anthony Tongen How do you read a Psalm a day? A Proverb a day is easy, since there are only 31 chapters. But Psalms has 150 chapters. Finding an algorithm to choose one a day becomes a more challenging problem. Possible selection rules can involve connections to modulo arithmetic, the discrete or integer logistic map, or might involve approaches analogous to determining the day of the week of a given historical date. What Psalm shall I read today?</p>	<p>Theistic Modal Structuralism (TMS) Walter Schultz As a précis of TMS, this paper offers a Christian philosophy of math. TMS is theistic and structuralist in 3 ways. 1) Instead of an abstract object in God's mind, a natural number is a place in a structure N satisfying 2nd order Peano Arithmetic PA. 2) it treats N to be exemplified by God's plan, an infinite, strict linear order of world states. 3) Each world state is a structure of structured-unities of dispositions and powers - aspects of God's ways of acting.</p>	<p>Vocations Class for Math/CS Majors Donna Pierce This course targets sophomores thinking of math or CS majors. Students assess their skills, interests and values so as to match these to possible careers. By readings, field trips, and interviews, students interact with professionals to gain "a day in the life" view. They grow thru internships, cover letter and resume writing, and by planning coursework. In order to develop holistic views of a discipline, students consider related ethical and professional career issues.</p>
4:25 pm	<p>Supplemental Vocabulary Acquisition in the DeSymbol Logic Translator Nancy Tinkham DeSymbol translates first-order predicate logic expressions into English. Students first translate English sentences into symbolic logic notation. DeSymbol translates the logic back into English to check their work. The newest DeSymbol version adds the ability to expand the system's vocabulary via a web interface. Each user's specialized vocabulary can then be used in logic expressions.</p>	<p>The Relation between Arithmetic and Self-Weighted Means Cliff Wagner It has been claimed that colleges report misleading statistics when describing average class size. The self-weighted mean has been proposed as an improved measure. A new simplified proof shows the relation between arithmetic and self-weighted means, and a common oversight is corrected. Along the way, one of Chebyshev's classical inequalities will be explored.</p>	<p>Historical Perspectives on Probability Kevin Vander Mouten This presentation will elaborate a Christian perspective on probability and chance via an exploration of the historical development of the subject of probability and statistics.</p>	<p>Discussing Vocation as a Part of a Senior Capstone Class Maria Zack Many of us in Christian higher education seek ways to help students discern their own sense of call. At the 2007 ACMS meeting Greg Crow and Maria Zack participated in a panel on vocation, and they published a related paper in the <i>Journal of the ACMS</i>. This talk discusses lessons learned from incorporating some of their ideas into their senior capstone course.</p>