Abstracts for Invited Talks

In the Shadow of Desargues

Annalisa Crannell, Franklin & Marshall College, PA

Those of us who teach projective geometry often nod to perspective art as the spark from which projective geometry caught fire and grew. This talk looks directly at projective geometry as a tool to illuminate the workings of perspective artists. We will particularly shine the light on at Desargues' triangle theorem (which says that any pair of triangles that is perspective from a point is perspective from a line), together with an even simpler theorem (you have to see it to believe it!). Given any convoluted, complicated polygonal object, these theorems allow us to draw that object together with something that is related to it— its shadow, reflection, or other rigid symmetries—and we'll show how this works. (If you enjoy doodling or sketching, bring your pencil, a good eraser, and a straightedge.)

Math and Art: The Good, the Bad, and the Pretty

Annalisa Crannell, Franklin & Marshall College, PA

How do we fit a three-dimensional world onto a two-dimensional canvas? Answering this question will change the way you look at the world, literally: we'll learn where to stand as we view a painting so it pops off that two-dimensional canvas seemingly out into our three-dimensional space. In this talk, we'll explore the mathematics behind perspective paintings, which starts with simple rules and will lead us into really lovely, really tricky puzzles. Why do artists use vanishing points? What's the difference between 1-point and 3-point perspective? Why don't your vacation pictures don't look as good as the mountains you photographed? Dust off those old similar triangles, and get ready to put them to new use in looking at art!

Can Computers Reason?

Matthew Dickerson, Middlebury College, VT

Modern computers can execute complex programs that quickly process vast quantities of data. The philosophy of physicalism as espoused by well-known modern figures such as biologist Richard Dawkins, philosopher Daniel Dennett, or engineer-futurist Raymond Kurzweil tells us that humans are simply complex biochemical computers. But can computational devices (however fast or powerful) reason? That is, can they determine what is true in any normative or valid way? At the core, this is a philosophical question, and not an engineering or technical one. This talk will argue that the answer is "no" - ironically by drawing upon and critiquing the very words of Dawkins, Dennett, and other well-known physicalists. But if computers are not capable of reason, then either humans are equally incapable of reason or else physicalism must be false.

On Mind, Body, and Abstractions: The Ecologies of Physicalism vs. Christianity

Matthew Dickerson, Middlebury College, VT

The philosophy of physicalism, in denying a spiritual reality, reduces the mind to a biological brain. Ironically, Raymond Kurzweils physicalist vision of the future, while affirming only a body, actually devalues both the human body and the created world. A Christian worldview offers a stronger bases for a healthy care of creation. An exploration of why suggests as a side warning to mathematicians and computer scientists that there might be a danger in loving abstractions too much.

Abstracts of Contributed Talks

On the use of applets when teaching about the Enigma machine

Brandon Bate, Houghton College, NY

The Enigma machine, along with the heroic efforts required to break it, constitutes one of the most interesting topics in the history of cryptography. In this talk, I will share my approach to presenting this material, which makes use of applets which mimic both the Enigma machine and the Polish bombes (the electro-mechanical devices constructed by the Polish Cipher Bureau to break Enigma). By utilizing such software, students not only encrypt messages using Enigma, but also break encrypted messages using the same techniques employed by the Polish Cipher Bureau. In doing so, students gain a deeper understanding of the group theory underlying the cryptanalysis of the Enigma machine and find an appreciation for the practical power of mathematics.

The Mysterious Mathematical Madame X

Brian Beasley, Presbyterian College, SC

Agnes Meyer Driscoll, a 20th century pioneer of cryptanalysis, served first in the United States Navy and later in the Armed Forces Security Agency for a total of forty-one years. Yet few details are available about her cryptographic work and her personal life. Driscoll's expertise in both mathematics and foreign languages enabled her to break several complex Japanese code systems in the 1920s and 1930s. However, she could not duplicate that success later with the German Enigma machine. Why did Driscoll resist the offer of British assistance with Enigma? What effect if any did a serious automobile accident have upon her? More questions than answers concerning "Madame X" remain; this talk will provide a brief summary of both the known and the unknown in the life of this fascinating individual.

Using Free Web-based Google Software to Enhance Your Course

Nick Boros, Olivet Nazarene University, IL

We will discuss how one can use Google Drive (Docs, Sheets, Slides, Forms, etc.), Google forums, and Google hangouts in place of a learning management system and also in a way that improves upon such existing approaches. We will also discuss how they can be used to improve the classroom experience in general: creating "Clicker"-type questions and surveys, all the way to easy ways of forming groups and giving students convenient ways of best contributing in group activities.

Random Numbers and God's Nature

James Bradley, Calvin College, MI

In this talk, I start with mathematical Platonism, an ancient stream of thought that views numbers as transcending physical reality. I join this to recent insights into mathematical randomness from theoretical computer science. Joining these streams—one ancient, one recent—yields the surprising conclusion that randomness, defined in a particular way, is part of the nature of God. I then explore some of the implications of this conclusion for our understanding of the doctrine of God's infinitude.

Understanding Everyday Use of the Computer: How Philosophy can be Practical

Nick Breems, Dordt College, IA

The issues which must be considered when attempting to understand the totality of behavior when a human uses a computer are both multifarious and diverse. We thus have difficulties in gaining insight into the meaning that use of the computer creates in our lives, particularly in everyday use. Such understanding is important because insight based on holistic understanding is our best hope for exploiting the God-created potentials for human flourishing that is part of the promise of computing technology. As computer and internet technologies continue to embed themselves in the fabric of our everyday living, the number and complexity of use situations grows, and all facets of these situations must be apprehended and appreciated in order to respond wisely and act normatively.

In this presentation, I will summarize the Human Use of Computers Framework (HUCF) developed by Basden (2008), a tool for producing insight into complex everyday computer use situations, and show several examples of this framework in use. This will demonstrate how the HUCF can help prevent overlooking areas that are crucial for understanding the human experience of using the computer, and will exhibit the practical implications of a philosophically-based tool for understanding.

Biology Inspired Computing Exercises

Lori Carter, Point Loma Nazarene University, CA

Research has shown that computing courses taught within a context aid in retention. Biology in general and genetics in particular is a context full of interesting problems to solve computationally. Additionally, the field of biology has vast collections of data available to be manipulated and analyzed. This presentation will give examples of biology-related programming problems that can motivate students at a variety of levels

---

Mathematics without Apologies by Michael Harris–A Review

Jeremy Case, Taylor University, IN

The subtitle of *Mathematics without Apologies* by Michael Harris is a "Portrait of a Problematic Vocation," and that problematic vocation involves pure mathematics. What do pure mathematicians do, and why should they do it? Harris critiques the usual answers of truth, beauty, and potential applications as he gives a contemporary revision of G.H. Hardys *A Mathematicians Apology.* Described as a post-post-modern book, *Mathematics without Apologies* provides a cultural, sociological, philosophical and psychological landscape of the profession and the life of a mathematician. We will explore whether a romantic view of the profession satisfactorily answers the questions and how it might compare to a Christian perspective.

Math Teachers' Circle: A Bridge from the College to the Community

Thomas Clark, Dordt College, IA

Although much of the training pre-service mathematics teachers receive is either in mathematical content or educational theory and pedagogy, research indicates that mathematical knowledge for teaching (MKT), which lies in a sense at the intersection of the two, is a factor in teacher quality. Unfortunately, none of the recent improvements in teacher preparation necessarily affect in-service mathematics teachers. One successful program affecting in-service teachers nationwide is the Math Teachers' Circle Network.

In this presentation I will discuss some of the ways in which a math teachers' circle can be a benefit to the college and the community. The mission of my institution involves "equipping the broader community" as

well as our own students. Starting a circle in my area is one way I have been living out this mission. Math teachers' circle brings faculty, teachers, and students together to solve interesting mathematical problems. I will discuss the ways in which a circle can help local teachers to improve their teaching through deepening their mathematical knowledge, students to learn firsthand from teachers what it is like in a classroom, and faculty to have an impact beyond their own classrooms into the community as well as learn a few things themselves. Finally I'll provide some resources for those interested in learning more about math teachers' circles.

The God of Mathematics

Annalisa Crannell, Franklin & Marshall College, PA

In the summer of 2009, Crannell taught a seven-week adult Sunday School class called "The God of Mathematics." She designed this course both for the congregants of her own church (Wheatland Presbyterian Church) and also as an outreach to her local community (Lancaster, Pennsylvania). The class explored ways that mathematical understanding can provide metaphors that might help to illuminate faith; it included gentle introductions to infinity, paradox, symmetry, and non-orientable manifolds, among other topics. In this contributed talk, Crannell will discuss both the design of the course and some reactions to it from congregants and the community.

Quantitative literacy - What is it and what can we do with it?

Catherine Crockett, Point Loma Nazerene University, CA

Simply stated quantitative literacy, also known as quantitative reasoning, can be described as the ability to understand quantitative data and then use it to create sound arguments supported by that data. Until the later part of the twentieth century, there wasnt much focus in university-level education on competency in quantitative literacy (or QL). However, that changed after the findings of several national and international surveys exposed deficiencies in QL in the general population. During spring 2015, I spent my sabbatical exploring quantitative literacy. The objective for my sabbatical was to research current best practices for the teaching and assessing of QL, plan the implementation of those practices into existing GE math courses at PLNU and learn how QL fundamentals can be integrated university wide in the GE program. The goal of this presentation is to give an introduction to QL and examples of how to incorporate QL into your existing courses.

A Successful Implementation of the Flipped Classroom in Mathematics

Bryan Dawson, Union University, TN

The structure of a successful implementation of the flipped classroom for Calculus I and II and for Introduction to Analysis will be described. Examples of recorded lectures and the technology that produces them, lecture exercises, and in-class activities will be given. Student results and reactions will also be discussed.

Lessons Learned Modeling Killer Whales

Matthew Dickerson, Middlebury College, VT

A look at many interesting questions that have arisen in a collaborate research project on a spatially explicit individual-based (or agent-based) model of transient killer whales in southeast Alaska. We will survey some of the research questions that motivated the work, at some of the questions that the initial model has addressed (and how we approached them), and at some of the new questions raised by the work and the obstacles to overcome in order for the work to advance.

Designing for Mistrust

Eric Gossett, Bethel University, MN

The 2014 ACM North Central Region programming contest contained a problem about a group of v bandits who want to use multiple locks to seal their treasure and distribute keys in such a way that no group of less than m bandits can open all the locks. The problem asks for an algorithm that will determine the number of locks needed for any set of parameters (v, m).

I will present an analytic solution that produces a minimum number of locks, a recurrence relation solution, and a constructive algorithm that can print out a table showing the locks and which subset of bandits hold keys for each lock. Each table forms a balanced incomplete block design (BIBD). The parameters of the BIBD can be uniquely determined from v and m.

Software Engineering: Teaching Challenges

Paul C. Grabow, Baylor University, TX

The term software engineering can be traced to the late 1960s in response to large-scale, software development problems. Since then it has evolved as a discipline, both within industry and the academy. There have been distinct educational successes: "Standard practice" has matured (and found its way into more textbooks), the ACM and IEEE Computer Society have published curriculum guidelines, computer science programs commonly offer at least one software engineering course, and software engineering degrees (undergraduate or graduate) are more common. However, software engineering still presents a challenge. The term itself has become contorted by companies (and society in general); software has become far more diverse (along with the environments in which software engineers work); industrial software processes are not easily replicated in the classroom; what students are expected to know (once they are employed) has expanded significantly; software tools change rapidly (affecting student expectations); and the discipline involves far more than "good programming" (or a large programming project). This talk describes these challenges – and suggestions for dealing with them – in light of my 30 years teaching software engineering in a university.

Inviting the Nations In: Aiding International Graduate Students at Clemson

Rachel Grotheer, Clemson University, SC

The teaching of undergraduates by graduate students is an essential component of the mathematics graduate program at many universities. As a result, many universities require international students to demonstrate proficiency in spoken English in order to maintain their assistantships and status in the program. At Clemson, we have recognized that this requirement existed without any support from the university to enable the students to meet the requirement. In collaboration with the departments graduate chair and a few other faculty members, we have developed a class to aid international graduate students in developing their spoken English skills, as well as their awareness of cultural norms and differences, to help them succeed not only as graduate teaching assistants, but in all aspects of their professional and personal life in the United States. In this talk we will give an overview of the program, its early success, and the importance of and challenges in encouraging, supporting and welcoming students from all nations into a graduate mathematics program.

Computer Science Doxology

Joe Hoffert, Indiana Wesleyan University, IN

In both the secular and Christian academic communities computer science has generally not been associated with Christianity. One approach to the interaction of faith and computer science is to look at the various areas of computer science that reflect God's character. This presentation proposal presents examples of computer science subdisciplines and how they give glory to God.

Software System Development and Aesthetics: Software patterns "beautify" software code via repetition and abstraction. Patterns can be combined as "sentences" of a "language" to communicate higher levels of abstraction. The beauty and communication of patterns point to God's beauty and relationship.

Artificial Intelligence and Imago Dei: The complexity of humans points to our Creator's depth and complexity. AI illuminates the complexity of human thought and points to what it means to be human, to be separate from computational machines. AI also points to the creativity of humans as endowed by God.

Chaos and Order with Information: People are inundated with information. Database management systems (DBMSs) were created to bring order out of the chaos of data. This endeavor highlights the goodness of order which reflects God's bringing order out of chaos in creation. DBMSs also show human finitude since we need tools to manage the data we have created.

Website Development and Relationships: Website development underscores the importance of human relationships as a means of communication. Humans are relational because they are made in the image of a relational Triune God. Website development doxology values people's time and perspectives.

Symbolic Powers of Ideals: Problems and Progress

Mike Janssen, Dordt College, IA

Symbolic powers of ideals have been the focus of much recent study in commutative algebra and algebraic geometry. Problems in algebraic geometry (e.g., Warings problem) and commutative algebra (e.g., the question of containment in ordinary powers of ideals) have motivated much of this work, but symbolic powers also have applications to other fields, such as computer science, combinatorics, and graph theory. We will explore the algebraic and geometric questions that have motivated the study of symbolic powers of ideals and share recent results in this direction.

Can You Make a Christian Video Game?

Michael Janzen and Josh Noble*, The King's University, AB

We explore the possibility of creating a video game that evidences Christian content and principles. Our focus is on the playing experience and inherent meaning of a game, as opposed to the social or time costs of playing video games. We decompose aspects of video games to components: story, code execution, rules, and appearance. We further consider two distinct types of appearance: sensory and action. We apply this decomposition to four types of games: single player puzzles, multiplayer conflict, single player sandbox games, and multiplayer sandbox games. We conclude that story is subject to the same critique as other media, code execution is not amenable to morally good or bad values, while rules and appearance can carry Christian content and principles. We include a sketch showing equivalence of code execution between different games, where some are objectionable while others are not. This sketch follows an approach where we reduce the code execution of one game to the other.

Pressure and Impulse in Student Learning: What I Learned From Teaching Physics

Kim Jongerius, Northwestern College, IA

In the fall of 2014, a one-semester gap between the departure of one physics professor and the arrival of the next afforded me the opportunity(?) to teach a first-semester, calculus-based physics class. The thirty-year gap between the last (of three) physics courses I had taken myself and this course I was to teach, combined with a two-week notice prior to the start of the semester, placed me in the interesting position of learning alongside my students. Wading through an unfamiliar text, trying to understand publisher-produced lecture slides, learning from and getting frustrated with online homework, entering review sessions fearful of what students might askall these things gave me a much clearer understanding of and empathy with the student experience and prepared me to make effective changes in other courses I teach.

God: One and Infinite

Daniel Kiteck, Indiana Wesleyan University, IN

I see the most mathematically significant verse as Deut. 6:4 where God says He is ONE. (And I don't believe that it is an accident that the greatest commandment to love God with all we are immediately follows.) What is the concept of "one" in relationship to God? Is God dependent on the concept of "one?" What if "one" is ultimately always a comparison going back to God? God is also commonly viewed as infinite. How is this connected to our understanding of the mathematical continuum? Could this help us see how God is foundational both to discrete and continuous mathematics? These and related topics and questions will be explored.

Experiencing a Paradigm Shift: Teaching Statistics through Simulation-based Inference

Dave Klanderman, Mandi Maxwell, Trinity Christian College, IL
and *Nathan Tintle*, Dordt College, IA

For decades, statistics has been taught as an application of formulas, making use of normal and other distributions, and relying heavily on algebraic skills of students, in short, emphasizing mathematical thinking. More recently, several textbook author teams have published statistics books that place an increased emphasis on simulation and randomization methods, and a corresponding decreased emphasis on the algebraic manipulation in formulas (e.g., Lock et al., 2012; Tintle et al., 2015) as a way to encourage better statistical thinking. This session describes simulation-based inference curricula more fully, reports on the necessary steps towards implementation of such an approach, and provides both qualitative and quantitative comparisons of this new pedagogical approach with a more traditional approach. Appropriate justification of this approach to teaching and learning statistics is also provided, along with providing an overview of recent trends to shift to this approach in statistics courses taught at the high school, junior college, and university levels across North America, including a number of Christian colleges and universities affiliated with ACMS.

The Mathematics of Evolution

Steven R. Lay, Lee University, TN

Like many universities, Lee University has a non-major's course for liberal arts students. The course typically includes a potpourri of topics: logical thinking, scientific notation, linear functions, estimation, and probability. At Lee, we have found a way to conclude the course that applies these varied topics to an issue designed to engage student interest and promote critical thinking. We have developed a series of three lessons on "The Mathematics of Evolution." The first lesson is on radiometric dating. The second lesson is on the

origin and progression of life. And the third lesson deals with the nature of the DNA genetic code. In this presentation we will provide examples from each lesson, as time permits. In so doing, we will address the following questions:

1. What are the dangers in sampling data over a short period of time (say 100 years) and extrapolating this over a much longer period (say a million years)?
2. What is the probability that a "simple" life form was produced by a series of random actions and how long might this be expected to take?
3. What is the probability that a "lower" life form evolved into a "higher" life form through a sequence of random mutations?
4. What does the poly-functional nature of the DNA code say about the long-term viability of species? Are we evolving upward or devolving downward?

Optimizing the *Introduction to Proofs* course: semantics, syntax, and style

Bryant Mathews, Azusa Pacific University, CA

For professional mathematicians, theorem-proving is a process that combines intuition, deduction, and communication. Put another way, mathematicians rely on their facility with both semantic and syntactic reasoning and on their familiarity with standard proof-writing style. In teaching our Discrete Mathematics and Proof course, I have found that my students often struggle with each of these aspects of the proving process. When they lose track of the meaning of the statements involved in a proof, they have trouble developing an effective strategy. When they ignore the logical structure of the statement to be proved, they fail to identify and apply relevant proof techniques. When they lack fluency with mathematical language and writing style, they struggle to clearly communicate their reasoning to others.

Traditionally, math students have been expected to develop these three theorem-proving skills by "immersion:" by watching "native speakers" prove theorems and then trying it out themselves. This approach has much to commend it, but it seems not to work very well (or, at least, not quickly enough) for students who are less prepared to "pick up" the new "language." These students need a "coach" to separate out the three skills from one another for demonstration, practice, and feedback, and then to put them back together again. In this talk, I will describe the methods and materials I use to help improve students' intuition, deduction, and communication, with a particular focus on how I train students to integrate these three modes of thought.

Ten Mathematicians Who Recognized Gods Hand in their Work

Dale McIntyre, Grove City College, PA

Scottish philosopher David Hume (1711-1776) once observed that

> "Whoever is moved by *faith* to assent to [the Christian religion], is conscious of a continued miracle in his own person, which subverts all the principles of his understanding, and gives him a determination to believe what is most contrary to custom and experience." [Hume]

Evidently Humes cynical pronouncement did not apply to Euler, Cauchy, Cantor, and other profound thinkers who believed God had commissioned and equipped them to glorify Him in their pursuit of truth through mathematics And based on their extraordinary achievements the principles of their *understanding* do not appear to have been *subverted* too badly!

Leading mathematicians of the past commonly affirmed that God created and sovereignly rules the universe and that He providentially sustains and nurtures His creatures. Despite Hume's assertion, history teaches us that faith often informs rational inquiry and vice versa. In many cases Christian commitment stimulated intellectual activity; sometimes mathematical understanding led to spiritual insight. In this paper, ten of history's most influential mathematicians express the role faith in God and religious conviction played in their work *in their own words*.

[Hume, David, *An Enquiry Concerning Human Understanding*, LaSalle, IL: Open Court, 1966 (First Published 1748), p. 145.]

Mystery of the Infinite: Developing a Mathematical Summer Scholars Program

Christopher Micklewright, Eastern University, PA

For the past two years, the Templeton Honors College, at Eastern University, has been conducting a Summer Scholars Program for high school students. The program, which has offered courses in a variety of topics, brings students to campus for an intensive residential program, coupled with pre-program and post-program work, for which students can earn college credit. In summer 2014, I helped to develop a mathematically based course, to include rigorous study of discrete mathematics, as well as a variety of lectures and extracurricular activities integrating faith and philosophy with mathematics. In this presentation, I will give an overview of the program, highlighting some of the successes as well as noting some of the challenges. It is my hope that this presentation will facilitate productive conversation and collaboration with others who might be involved in developing similar programs.

Overview of the Consumer Price Index Sampling

Moon Jung Cho, U.S. Bureau of Labour Statistics, NE

The U.S. Consumer Price Index (CPI) is a complex product that combines economic theory with sampling and statistical techniques. It uses data from several surveys to produce a measure of average price change for the consumer sector of the American economy. Production of the CPI requires the skills of many professionals, including economists, statisticians, computer scientists, data collectors, and other supporting professionals. In my presentation, I will overview the CPI sampling and highlight its intricacy.

Preparing Students to Read a Calculus Textbook

Doug Phillippy, Messiah College, PA

Consider the exercise of reading the textbook before class. While most educators agree that this practice leads to better learning, too often students enrolled in a calculus class do not find pre-class reading a valuable use of their time, and their commitment to doing so fades. Why is this? As instructors, we hope that these students will be well-versed in the fundamental concepts of the subject by the time they prepare for their final exam, but as they progress through the course and encounter new concepts, they may not be ready for the technical language of the standard calculus textbook. Further, their conceptual understanding of the subject matter *why is it important?, how is it relevant?, does this connect to something I already understand?* is probably not well developed. As a result they may not be ready for an explanation that includes precise terminology, presupposes a students interest in the end application, and fails to make explicit ties to prior knowledge. This talk will describe an alternate approach to reading a calculus text that places its reading after the lecture. The main focus of this talk will be the pre-lecture reading assignment and activities that are not intended to replace the reading of the calculus text but simply displace it to after the lecture.

Math, God and Politics - A Fight over Geometry in 19th Century Italy

Donna Pierce, Whitworth University, WA

In 1839 a polemic, reminiscent of the Renaissance public challenges over mathematical problems, was issued by the leader of the synthetic school of geometry, Vincent Flauti, to the analytical school, headed by Fortunato Padula. Three geometric problems were proposed, all carefully chosen to guarantee a victory for the synthetic school. The judges were from the Royal Academy of Sciences, men also favorable to the synthetic method. Why then did the analytics take up this challenge, and who were the real victors? This was not just a fight over the 'correct' way to do geometry, it was a fight over politics, a changing society, and most importantly, the Godly way to do mathematics. In this talk we will learn the goals and motivations of the synthetic school and the analytical school, the means they used to achieve those goals, and the final outcomes for mathematics and Italy.

Forming a consulting group

Thomas E. Price, University of Akron, OH

When I began consulting, I unwittingly limited the contracts available to me by underestimating and under promoting my abilities. Over the years, my consulting experiences have taught me that my mathematical training and related skills prepared me for a broader variety of contract work than I had originally thought. I also learned how to better market myself and the skill sets of my subcontractors. The goal of this presentation is to encourage and assist those interested in contract work by summarizing the strategies I used to develop a gratifying and productive consultancy.

David and the Census (II Sam 24, I Chr 21): Lessons for Mathematicians

John Roe, Penn State, PA

This is something I've been thinking about for a while, the idea being that this story shows us counting (the quintessence of mathematics) as an example of "technique" in the sense of Ellul: not simply a neutral analysis, but something which imports its own value system which may or may not be appropriate.

Parables to a Mathematician

Melvin Royer, Indiana Wesleyan University, IN

Jesus frequently used parables in His ministry, usually short narratives illustrating the outcomes of people's choices. In John 3:12 and Matthew 13:10-15, He explained that one reason was to be sure that people who genuinely wanted to understand His message would be able to do so. Since most of His audience was familiar with an agrarian economy, Jesus spoke extensively of wheat, fish, trees, wine, debt, tenants, lamps, etc. Many people have speculated on parables Jesus might have used had He lived in a different society. This non-scholarly (but hopefully thought-provoking) talk will propose parables targeted toward groups of mathematicians with various levels of Christian background. One parable for Christian "beginners" is as follows:

To introduce the ratio test for the convergence of infinite series, a calculus professor asked the class to discuss in groups the convergence of $\sum_{n=1}^{\infty} \frac{n^{400}}{2^n}$. One group reported divergence by the n-th term test. When questioned, they displayed a calculator graph of the sequence $a_n = \frac{n^{400}}{2^n}$ for $1 \leq n \leq 100$, showing monotonic increase. The professor suggested trying even larger values of n; the group then reported that (a_n) is monotonic

for n as large as 300, at which point their calculator had a numerical overflow. Overhearing this discussion, several other groups switched their answers to divergent. The ratio test was then discussed. Anyone who hears this should pay attention.

Exploring appropriate computing for education in developing nations

Derek Schuurman, Redeemer University College, ON

This presentation will describe a pilot project involving the use of the Raspberry Pi for use in Christian elementary schools in Nicaragua. Some of the existing computers and software currently used in computing labs will be described along with some of the challenges that are faced. The features of the Raspberry Pi will be described along with how it might be a well-suited technology for use in schools in developing nations. Some feedback from a pilot project involving 30 Raspberry Pi's will be shared along with ideas for prospective future projects.

Mathematical Lessons from Finland and Sweden

Rebecca Seaberg, Bethel University, MN

I will describe lessons learned from visiting mathematics classrooms in Finland and Sweden for a month during the spring of 2013. Finland has become well-known for educational success in international comparisons; Sweden is similar to Finland in many ways but more like the U.S. in educational results (both are around average compared to other OECD (Organization for Economic Cooperation and Development) countries). Two major differences that set Finland apart is the high level of respect given the teaching profession within society and the greater educational requirements for becoming a teacher. All Finnish secondary mathematics teachers must have a Masters Degree in mathematics. Swedish teachers complain of lack of respect for the profession and as in the U.S., a bachelors degree is all that is necessary. Some other differences in Finland are fewer teaching hours required so that more time is available for lesson planning and focus on students, teachers often work with their students for three years, enabling closer relationships, a strong emphasis on problem solving in the math curriculum and de-emphasis on memorization, and a focus on equity and cooperation rather than competition. Both Finland and Sweden have more opportunities for vocational education at the upper secondary level and more students choose to focus there as well, in contrast to the prevailing thought in the U.S. that almost everyone should go to college. I will conclude with some changes both Sweden and the United States are making that resemble Finnish methods.

The *Best* Religious Calendar

Andrew Simoson, King University, TN

Many religions have deep roots in the rhythms of the moon. And ever since at least the fifth century BC man has known that the moon repeats itself every $n = 19$ years. Is this integer value n the best of all choices? Easter follows such a calendar. We briefly show that 19 is *second* best. And then we run time backwards, and give a rationale as to why a certain species of cicada has a life cycle of 17 years. The answer involves the moon, the Farey series, and Kepler's laws of motion.

The Math Olympian, by Richard Hoshino – A Review

Moriah Magcalas, University of Waterloo, ON, and
Kyle Spyksma, Redeemer University College, ON

This presentation will be a review of the novel *The Math Olympian* written by ACMS member Richard Hoshino.

The Remarkable Mrs. Somerville

Richard Stout, Gordon College, MA

As a woman growing up in the late eighteenth century, Mary Somerville (1780-1872) was denied access to most formal education and getting a university education was completely out of the question. Yet her interests in nature, science, and mathematics, coupled with an intense curiosity and tenacious desire to learn led her to eventually be known and respected by scientists, mathematicians, and intellectuals in both Britain and France. She is one of the important woman in the history of mathematics, even though she did not publish original work. However, she was a talented writer, producing several significant works, including *Mechanism of the Heavens*, a translation and amplification of Laplaces great work, and, at the end of her life, a series of *Personal Reflections*. Reading through her reflections gives an interesting glimpse into her personality, her opportunities for social networking, and some of what motivated her work. In this talk I hope to use these reflections to summarize aspects of her life and to introduce her work. We will see how, as a self-taught woman, she was able to gain access to the upper echelons of scientific society and how, as a committed Christian, her faith was evident in both her life and her work.

Data Mining as an undergraduate course

Deborah Thomas, Bethel University, MN

Data mining is an important area of research today. Our students are therefore better prepared if they are exposed to it while pursuing their undergraduate degree. However, the typical level of such a course is too rigorous for the average undergraduate student. In my talk, I will present the curriculum we developed to teach data mining to Juniors and Seniors as a seminar course. In the course, we discussed a variety of algorithms and their purposes. We focused on the algorithms described in Top 10 algorithms in data mining by Wu, et. al. We used a variety of software packages to solve the problems, including the Weka library, Java and Excel. Some students also used Mathematica and Python. A big focus of the course was the final project, where the students were given one of three different datasets from the Bethel University library archives. There were no restrictions on how to solve the problems and what they could use to answer the questions posed. I will describe the datasets in detail, the questions we were trying to answer and the strategies the students used to answer the questions. I will conclude with some of the results of their research and how their work might be expanded to be submitted to a publication in the future.

Reading Scripture Logically

Derek Thompson, Taylor University, IN

This is a talk for undergraduates currently taking (or who have taken) discrete mathematics, and/or for professors who teach mathematical logic. After covering biconditionals and logical arguments, I take some class time give this talk about the importance of applying the logic they've learned to how they read Scripture, so that they can always be prepared to give an answer (1 Peter 3:15), demolish arguments against God (2 Corinthians 10:5), and to correct, rebuke, and encourage (2 Timothy 4:2).

Physical activity in a Theory of Computing class

Nancy Tinkham, Rowan University, NJ

Physical activity breaks, sometimes called brain breaks, are beginning to gain attention among K-12 teachers as a way to keep their students alert and engaged in the classroom. In the Fall 2014 semester, faced with the task of teaching an introductory course in Theory of Computing in a once-a-week, 2 1/2-hour format, I decided to try incorporating physical activity into my own classroom. Time is precious in the college classroom, so any physical activities have to be directly related to the course material. I will describe some physically active exercises that I used in the classroom to teach students about regular expressions, finite automata, and other theoretical concepts. During the semester, I found that these exercises helped students to have fun and to stay connected to the material, even at the end of this long, late-night class. I also found that the exam averages and the overall course average were higher in Fall 2014 than they had been during the previous four years of teaching this night class. This invites further experimentation with the technique in future semesters.

Mathematics of wooden pliers

Anthony Tongen, James Madison University, VA

Functional wooden pliers can be constructed from a rectangular block of wood using ten cuts, with negligible loss of volume. These cuts form a hexagonal joint, with two reflectional symmetries, around which the pliers can open. A two-dimensional model describing the mechanics of the three-dimensional pliers was constructed based on the lengths of the cuts and the angles at which the cuts are placed. This model fully predicts whether or not pliers constructed with an arbitrary set of cuts can open and, if so, how far those pliers will open, based solely on the parametrization of the hexagonal joint by a characteristic length, λ, and an angle, θ. Additionally, techniques from linear algebra and analysis are utilized to determine the set of possible pivot points and to derive a closed form solution for the maximum angle of opening, given an arbitrary pivot point.

Mathematics as Culture-Making Activity

Kevin Vander Meulen, Redeemer University College, ON

Drawing on Andy Crouch's book *Culture Making: Recovering Our Creative Calling*, as well as the neo-Calvinist position in the second half of the chapter 'Ontology' in *Mathematics Through the Eyes of Faith*, I reflect on the nature of doing mathematics and its implications. I plan to explore the non-neutral character of mathematics in the context of the cultural mandate and the nature of naming.

---

10 Statisticians, 20 Slides, 30 Centuries

Clifford H. Wagner, Pennsylvania State University at Harrisburg, PA

A slide presentation for introducing an elementary statistics course, this survey covers three thousand years in the history of statistics, with attention to personalities, techniques, and ethical issues.

Learning Catalytics - Students Engaging in the Classroom

Aaron Warnock, Highline College, WA

Come try out Learning Catalytics - a new classroom response system that allows students to respond to questions using any web-enabled device such as smartphones, tablets, or laptops. Learning Catalytics accepts free response, mathematical expressions, and even drawn or graphical submissions, which goes well beyond the multiple-choice limitations of traditional classroom response systems. Teachers will love how the system can automatically group students based on their dissimilar answers for discussion and resubmission. Aggregate student responses can be anonymously displayed on the board for even further discussion. This is a great way to engage every student in answering classroom questions (rather than calling on them one at a time). In addition to its mathematical strengths, Learning Catalytics is powerful beyond the classroom and can be used to facilitate group submission of assignments in a hybrid or online setting. Bring your electronic devices to participate or look on with a friend!

Cultivating Mathematical Affections: The Influence of Christian Faith on Mathematics Pedagogy

Joshua B. Wilkerson, Texas State University, TX

The goal of this paper is to make the case that Christian faith has an opportunity to impact the discussion on best practices in mathematics not primarily through the cognitive discussion on objectives and standards, but through the affective discussion on the formation of values, the cultivation of mathematical affections not merely knowing, but also loving, and practicing the truth, beauty, and goodness inherent in mathematics. First I will outline the work being done on affect in mathematics education, examining what values are actually endorsed by the community of mathematics educators. After summarizing this work on affect it will be clear that, even in the words of leading researchers, the field is lacking any cohesive, formal approach to analyzing and assessing the affective domain of learning. In part two of this paper I will argue the thesis that Christian faith offers solutions to the frustrations and shortcomings admitted by researchers on affect in mathematics education. Christian faith offers insight into how mathematical affections might actually be shaped. Here I will draw heavily on the work of philosopher James K.A. Smith and make explicit connection between his work and the mathematics classroom. Finally, I will conclude with a call to action discussing how we as Christian educators might begin to have fruitful contributions to and dialogue with the current research being done in mathematics education.

Supercomputing for Everyone - Easy Distributed Grid Architecture for Research

Brent Wilson, George Fox University, OR

Current distributed systems present several challenges to both scientists and students who may not be very skilled at programming parallel applications for use on such systems. Grid computing is a cost effective means of providing supercomputing computation for both scientists and students of computing. Easy Distributed Grid Architecture for Research (EDGAR) is a grid computing solution that meets two critical constraints, namely ease of application programming for users and also platform independence in its implementation. Satisfying these two constraints makes EDGAR one of the only time and cost effective grid computing solutions. EDGAR creates an easily used, high performance solution for scientists and students in solving computationally intense problems and provides easy access to supercomputing. This presentation introduces EDGAR and demonstrates its ease of use.

A Triune Philosophy of Mathematics

Dusty Wilson, Highline College, WA

What is mathematics and is it discovered or invented? The Humanist, Platonist, and Foundationalist each provide answers. But are the options within the philosophy of mathematics so limited? Rather than viewing and describing mathematics in a mutually exclusive manner, each of these approaches includes components of truth from a greater triune philosophy of mathematics. This talk will introduce this inclusive triune paradigm through which to explore fundamental questions about mathematics.

Home Primes and Foreign Primes

Nicholas Zoller, Southern Nazarene University, OK

Home primes and foreign primes are produced by a simple recipe that blends prime factorizations with recursion. The *home prime* of a positive integer n is formed by concatenating the prime factors of n in non-decreasing order. If the resulting integer is prime, then we have found the home prime of n. If not, then we repeat the process as many times as needed to obtain a prime. For instance, $35 = 5 \cdot 7$. After concatenation, we have $57 = 3 \cdot 19$, which is followed by $319 = 11 \cdot 29$, which is followed by 1129, which is prime. Thus, the home prime of 35 is 1129. To obtain the *foreign prime* of a positive integer n, we form the next integer by concatenating the prime factors of n in nonincreasing order. For example, starting with $35 = 7 \cdot 5$, we next consider $75 = 5 \cdot 5 \cdot 3$, followed by $553 = 79 \cdot 7$, followed by 797, which is prime. Thus, 797 is the foreign prime of 35. In this talk we give some results about home primes and foreign primes for integers $n < 100$. As one might expect from the arbitrary nature of the concatenation process, there are few easily discernible patterns.

A Subject-Centered Approach to Integrate Faith and Learning

Valorie L. Zonnefeld, Dordt College, IA

K-12 mathematics educators, with the National Council of Teachers of Mathematics at the forefront, have moved from teacher-centered to student-centered classroom pedagogies. This move was made in an effort to engage students more deeply in their learning. As a high school teacher at the beginning of the 21st century, I made this change as well, but have since become increasingly uncomfortable with aspects of student-centered teaching. I now believe that the choice between student-centered and teacher-centered approaches is a false dichotomy. In this session we will explore Parker Palmer's conception of a subject-centered classroom, what a subject-centered classroom looks like in mathematics, and how a subject-centered classroom can be a more faithful way to integrate faith and learning.

Abstracts for Panels and Workshops

Hybrid Classes in Mathematics and Computer Science

PLNU Group, Point Loma Nazarene University, CA

Panel Members
Ryan Botts: Associate Professor of Mathematics Point Loma Nazarene University
Lori Carter: Professor of Computer Science PLNU
Catherine Crockett: Assistant Professor of Mathematics PLNU
Greg Crow: Professor of Mathematics PLNU
Jesus Jimenez: Professor of Mathematics PLNU
Maria Zack: Professor of Mathematics and Chair of the Mathematical, Information, and Computer Science Department, PLNU

Offering hybrid (also called blended) courses is an approach being considered by many universities. A hybrid course combines both online and in-class learning activities, generally reducing the total in-class time required. The assumed benefits include increased time-flexibility for students, the opportunity for students to learn at their own pace, less pressure on precious classroom space, and the opportunity to introduce additional pedagogical strategies that address different styles of learning.

Three years ago the Mathematical, Information, and Computer Science department at Point Loma Nazarene University embarked on the adventure of designing and offering courses in the hybrid format. To date, four courses have been offered in the hybrid format: Introduction to Computer Programming, Introduction to Statistics, Math for Elementary Teachers, and Problem Solving (our GE course for upper division students). This panel will discuss the process of building the courses, the experience of teaching them, the feedback received from students, and the real benefits and drawbacks observed.

Following up with *The Mind and the Machine*

Joe Hoffert, Indiana Wesleyan University, IN

An informal conversation, with Matthew Dickerson, chaired by Joe Hoffert, reflecting on the Matthew Dickerson's book *The Mind and the Machine: What It Means to Be Human and Why It Matters*. How should Christians respond to transhumanism (e.g., what venues would this take, how to engage with respect, whether or not to respond publicly, reacting/responding vs. proactive ongoing research/pedagogy)?

Graduate Student Workshop 1: "The Application"

Amanda Harsy-Ramsay, Lewis University, IL

- The timeline of applying for jobs and where to find job postings
  - How to stay organized and keep on top of deadlines
- Advice for writing the following:
  - CV, Cover Letter
  - Teaching Philosophy Statement
  - Research Statement
  - Faith Statement and other supplemental material for some Christian universities

- Advice about obtaining letters of recommendation
  - Who to ask? When to ask?
  - Advice for assisting letter writers for non-mathjobs.org
- End with a breakout writing session for them to work on any of these documents

---

Graduate Student Workshop 2: "Pre-Campus Interviews"

Amanda Harsy-Ramsay, Lewis University, IL

- Typical questions and general advice for pre-campus interviews
  - Phone Interview
  - Skype Interview
  - The JMM Interview
- Advice about what questions to ask during a pre-campus interview
- Advice about what to wear to a pre-campus interview
- End session with practicing interviews

Graduate Student Workshop 3: "The On-Campus Interview"

Amanda Harsy-Ramsay, Lewis University, IL

- General Advice
  - What to wear? What to bring?
  - What does a typical interview day(s) look like?
- Preparing to meet with faculty members, students, Deans, Provosts, and Presidents
  - What questions to ask
- Preparing your Research Talk
  - How to make it accessible, undergraduate student friendly, and cool.
- Preparing your Teaching Demonstration
- Break out into groups to practice describing your research to a non-expert

---

Graduate Student Workshop 4: "Questions and Answers"

Amanda Harsy-Ramsay, Lewis University, IL

The organizers and possibly other invited ACMS participants will hold a panel where they will take questions and describe their personal experiences with the job search. In particular we will discuss how we recognized Gods provision during this stressful season of life.

Final Goal: Depending on how many students and organizers we have, I would like to put together a mentoring network where we pair up graduate students with faculty members from the ACMS.