Department of Mathematics

April 30, 2009

STEINMETZ SYMPOSIUM TOMORROW

As you (likely!) know, all classes are cancelled tomorrow. Instead, you are encouraged to attend talks, performances, poster sessions, etc. during the Steinmetz Symposium. Below is the information for the nine mathematics talks.

Speaker: **Sarah Britton**, sponsored by **Professor Lesh** **9:00 in Bail 201**

Title: **The Elliptic Curve Factoring Algorithm**

Abstract: The security of many cryptosystems relies on the difficulty of factoring a number that is a product of two prime numbers (usually hundreds of digits long) so it is important to understand ways that one might attempt to find divisors of these large composite numbers. The Elliptic Curve Factoring Algorithm, first developed by H.W. Lenstra, is a method to factor numbers using elliptic curves over a finite field. By taking an equation for an elliptic curve (of the form $y^2=x^3+Ax+B$) and performing addition on the points on the elliptic curve over a finite field, we are sometimes able to find a factor. The validity of the algorithm is dependent on Hasse's Theorem, which we will also describe.

Speaker: **Margaret Callahan**, sponsored by **Professor Plofker** **9:20 in Bail 201**

Title: **Leonhard Euler and the Motion of Comets in Parabolic Orbits**

Abstract: Eighteenth-century mathematician Leonhard Euler made many contributions to the areas of mathematics and the sciences during his lifetime. Much of Euler's work has yet to be translated and interpreted. Of such works, I chose to translate, from Latin to English, Euler's paper concerning "The Motion of Comets on Parabolic Orbits, Keeping the Sun at the Focus." This talk will address Euler's contributions to the field of astronomy, in particular, how Euler applied mathematical techniques (that were, at the time, revolutionary) to tackle astronomical problems. Euler dealt with the issues surrounding the motion of comets by employing the calculus of analytical geometry, as well as the geometric figures of classical geometry. Although a mathematical purist, Euler was certainly a skilled applied mathematician, and added a great deal to our understanding of the workings of the universe.

Speaker: **Sarai Canario**, sponsored by **Professor Plofker** **9:40 in Bail 201**

Title: **Mathematical Explanation of Pendulum Motion**

Abstract: The pendulum was studied by Galileo, Huygens, Newton and many others who saw the potential of it as a scientific object. Galileo discovered the near isochrony of the simple pendulum. Huygens found a way to make the swinging of the pendulum strictly isochronous. The cycloidal pendulum provided this strict isochrony. Thanks to their interest in and study of the pendulum, we can now explain the motion of the pendulum using mathematics.

Speaker: **Chelsea Ziobro**, sponsored by **Professor Plofker** **10:00 in Bail 201**

Title: **Euler's Rechenkunst (Arithmetic)**

Abstract: The eighteenth century mathematician Leonard Euler found the arithmetic books of his day wanting, thus he wrote his Rechenkunst in 1738. This book was written for students in Gymnasium, in order to properly instruct them in the nature and properties of the numbers, through a thorough knowledge of their foundation. His full work contains nine chapters covering all the basic arithmetic operations for whole and fractional numbers. This talk discusses the Vorbericht (preface), and first and second chapters, on the nature of numbers and addition of whole numbers respectively.

Speaker: **John Robens**, sponsored by **Professor Tønnesen-Friedman** **10:30 in Bail 201**

Title: **Analysis and Exploration of Mathematical Models Pertaining to Changes in Body Weight**

Abstract: Based on previous ideas, an energy control system within the body is found to self-regulate body mass for most individuals, but when a weight increase occurs, there is feedback that further promotes weight gain and may cause it to become unstable. Breaking down the model into a few cases, bifurcation diagrams were developed using the feedback to further explore the unstable situations. It was determined that instability in weight gain is quite obtainable, and that the best way to prevent instability is to maintain an adequate physical activity level.

Speaker: **Peter Bonventre, Steven Neier,** and **John Robens**, sponsored by **Professor Wang** **10:50 in Bail 201**

Title: **Mathematical Modeling on Cell Phone Energy Usage**

Abstract: During the 2009 Mathematical Contest in Modeling (MCM), we modeled the energy consequences of the cell phone revolution. We worked on various aspects of the energy consumption of cell phones by people, involving many different methods of usage including charging, standby, and manufacturing. Our process involved stages of lots of research, followed by simple models which gained complexity as we added more aspects to the solution. Overall, we modeled the energy transition from the current US usage of cell phones and landlines to a strictly cell phone infrastructure. We then modeled the ideal infrastructure for a pseudo-US based on our earlier calculations and models, and found that exclusive cell phone use was more energy-efficient than any combination of cell phones with cordless landline phones. We also modeled the energy waste of various household electronics and appliances from standby power consumption. Finally, we combined our model from cell phone energy consumption with models for US population and economic growth to determine the cell phone usage for the next 50 years. This contest was an enlightening experience that we would like to share and encourage others to participate in the years to come.

Speaker: **Kate Colantuono**, sponsored by **Professor Niefield** **11:10 in Bail 201**

Title: **Phi: The Irrational Number**

Abstract: Irrational numbers outnumber the rational numbers in the set of all real numbers, and they also dominate much of the mathematical world, as evident through the golden ratio. The golden ratio, or Phi, is an irrational number that was first defined in a line segment by Euclid. It is apparent in other geometric shapes, including a circle, an isosceles triangle, and a golden rectangle. In this talk, we will discuss the origin of the golden ratio and its relationship to the Fibonacci sequence, 0,1,1,2,3,5,8,13,…This will demonstrate how the golden ratio is prominent in many interesting mathematical concepts.

Speaker: **Michael Topka**, sponsored by **Professor Niefield** **11:30 in Bail 201**

Title: **Batting Around with Continued Fractions**

Abstract: Baseball is one of America's favorite pastimes. As in any sport, baseball is very competitive on a professional level. Statistics are frequently used to determine how a player performs. For example, a batting average is often used and can be described as the number generated by the ratio of hits to at-bats. This number describes a player's offensive abilities.

What specific ratios are able to produce these numbers that are used to rank these players? There are an infinite number of hits to at-bats that lead to a particular batting average. Using the unique properties of continued fractions,

Speaker: **Andrew MacKenzie**, sponsored by **Professor Zwicker** **11:50 in Bail 201**

Title: **The Mediancentre-Borda Rule and One-Way Monotonicity**

Abstract: In voting theory, it is typical to characterize and distinguish among voting rules by considering desirable voting properties. Such properties include participation, which asserts that no honest person would find it beneficial to abstain from voting, or the majority condition, which asserts that if a majority of votes rank a certain alternative first, that alternative will win.

Some properties for some rules can be particularly difficult to prove; we will consider such a property and rule here. We will consider the MCBorda rule and the property of one-way monotonicity. After briefly defining this rule and property, we will explain a particular computer algorithm and how its implementation generated failures of one-way monotonicity in an irresolute "tie-breaking" sense, proving that the property did not hold for this rule. We will present various violations and observe patterns between them. If time allows, we will discuss several implications of the failure of this property.

Problem of the Newsletter: Find all solutions (x,y) of the equation $x^y=y^x$ for **real** numbers x,y >0. Submit your solution to Professor Friedman.