Spring 2011 74th Series

M*A*T*H COLLOQUIUM

Wednesdays 4 p.m ❖ Darwin 103 ❖ Coffee, Tea & Cookies @ 3:45 p.m.

Sonoma State University Department of Mathematics and Statistics presents a series of informal talks open to the public.

"Mathematics is the process of turning coffee into theorems" Paul Erdös

Feb 9 **A Six Color Problem** — **Tristram Bogart, MSRI/San Francisco State**

If we want to color the regions of a map on the plane or the sphere, how many colors do we need to ensure that we can avoid assigning the same color to any two adjacent regions? This simple question was raised by Francis Guthrie in 1852, but answered only in 1976 by Kenneth Appel and Wolfgang Haken with the help of a gigantic computer calculation. Yet variations of the problem obtained by replacing the sphere with another surface turn out to be easier, if less useful to mapmakers. Following a delightful 1934 paper of Philip Franklin, we will solve this coloring problem on the torus and on its twisted relative, the Klein bottle.

Feb 16 **The Case for Ranked-Choice Voting (aka Independent Run-off)** — **Rick Luttmann, Sonoma State University**

We will explore ranked-choice voting, an alternative to this country's most popular voting system of "plurality," and learn about the ways in which ranked-choice compares favorably to a plurality system. We will look at some elections in which it would have made a difference, such as the Minnesota gubernatorial election in 1998 (which Jesse Ventura won), and the infamous Gore-Bush debacle in Florida in 2000. Instant-runoff is now in use locally, and though it is used widely in jurisdictions in and outside the US, it has proven controversial here.

Feb 23 **What I Learned Running the Oakland Math Circle** — **Jamylle Carter, Diablo Valley College**

The Oakland Math Circle was an after-school mathematics enrichment program for African-American middle-school students in Oakland, California. By partnering with museums and community organizations, the Oakland Math Circle used hands-on activities to make advanced mathematics accessible and enjoyable for the students involved. I will share what I learned in creating and running the Oakland Math Circle during the 2007-2008 academic year.

Mar 2 **What *Can't* You Do with a Math Degree?** — **Recent Mathematics Graduates**

We will hear from Mathematics graduates who have begun successful careers in varied fields, including finance, marketing, teaching, and scientific research. Each will help us understand the ways in which their undergraduate mathematics has been useful in their chosen career, what additional experiences and education have been helpful, and what they love about their work. We'll have plenty of time for questions, and pizza with the speakers afterwards!

Mar 9 **Student Projects from Mathematica Class** — **Elaine Newman, Sonoma State University**

You thought Mathematica could only take derivatives and integrate? Come see the amazing student projects from the Fall 2010 Mathematica class, Math 180.

Mar 16 **Discovering and Processing Numbers Found in the Wild** — **Dean Gooch, Santa Rosa Junior College (SSU Math alum)**

One cannot help but notice that numbers are everywhere. This talk will focus on the numbers that we encounter every day. We will show what is suggested by some numbers and their prime factorizations. Factoring "tricks" and their justifications will be demonstrated. We will also see an example of the Sieve of Eratosthenes.

Mar 23 **How Fast Does a Continued Fraction Converge?** — **Clem Falbo, Joseph, OR; Professor Emeritus, Sonoma State University**

All irrational numbers are roots of simple quadratic equations. We compute the rate at which continued fraction (CF) solutions to these equations converge to their solutions. It turns out that this rate depends only upon the coefficient of the linear term and not upon whether or not the limit is rational or irrational. Another concept called the Nearest Rational Approximation (NRA) converts decimals into non-periodic CF, and measures the number of steps needed to get rational approximations of irrational numbers to within specified errors. Surprisingly, the NRA reveals infinitely many counter examples to the claim that the "Golden Ratio is the most irrational number."

Mar 30 **Jumping Champions for Prime Gaps** — **Dan Goldston, San Jose State University**

Consider the sequence of primes: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, . . . and now consider the differences or gaps between the consecutive primes here: 1, 2, 2, 4, 2, 4, 2, 4, 6, 2, ... The most common difference for primes up to x is called a jumping champion, so for example when x=11 the jumping champion is 2. For x>947 the jumping champion is always 6 at least past x= 1,000,000,000,000,000, but nothing beyond this has been proved about jumping champions. Despite this, it is conjectured that aside from 1 the jumping champions are 4 and the primorials 2, 6, 30, 210, 2310, . . . = 2, 2×3, 2×3×5, 2×3×5×7, 2×3×5×7×11, ... We will explore some theoretical support for this conjecture.

Apr 6 MATH FEST **First Person Solvers: Mathematics Education in the Video Game Era** — **Keith Devlin, Stanford University**

To date, online video resources such as Kahn Academy and math education video games such as DimensionM have been seen as supplementary resources to traditional instruction. In the coming decade we will see classroom pedagogy change in dramatic ways. This talk will look ahead to the coming revolution. Based in part on the speakers new book Mathematics Education for a New Era: Video Games as a Medium for Learning, published in February 2011 by AK Peters.

Apr 13 **N-ary Expansions of Digits and Fractal Dimensions** — **John Rock, California State University Stanislaus**

Consider the set of points in the unit interval whose non-terminating binary expansions contain certain proportions of zeros and ones. With an appropriate definition of proportion, such sets are fractal; that is, they have fractional dimension. In this talk, we will see how the unit interval can be partitioned into fractal subsets whose points have non-terminating N-ary expansions which satisfy certain conditions determined by probability vectors with N rational components. These fractal subsets have non-integer dimension which can be computed using a method motivated by the theory of complex dimensions of fractal strings and the study of symbolic dynamics.

Apr 27 **Connecting Mathematics Understanding and Language Development for English Learners** — **Harold Asturias, Lawrence Hall of Science UC Berkeley**

Teachers who know the mathematics they teach are better equipped to teach it to their students. But they also need to understand the language challenges that mathematical academic English presents to English language learners. During this session we will discuss some ideas about the interplay of language, culture, and mathematics understanding.

May 4 **Colors that Count** — **Nick Dowdall, San Francisco State University (SSU Math alum)**

We call a collection of points ("vertices") connected by lines ("edges") a graph, and by a coloring of a graph we mean a coloring of the vertices so that every edge has two different colors at its endpoints. The function that counts the number of ways a graph may be colored has long been known to be a polynomial and is referred to as the chromatic polynomial of a graph. We explore coloring problems in certain ("signed") graphs, which were originally introduced to model problems in social psychology.

May 11 **Computational Fluid Dynamic Simulations for the Launch Environment** — **Jeffrey Housman, Applied Modeling and Simulation, NASA Ames Research Center (SSU Math alum)**

Time-accurate Computational Fluid Dynamics (CFD) simulations are important for the successful launch of new and existing space vehicles. Accurate prediction of certain aspects of the launch environment, such as ignition overpressure (IOP) waves and launch acoustics, is paramount to mission success. We will discuss two simplified test cases. The first test case models the IOP waves generated from a 2D planar jet located above a 45-degree flat plate, while the second case investigates launch acoustic noise generated from the jet of a 2D axisymmetric rocket impinging on a flame trench and interacting with a mobile launcher.

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Talks may change: Please confirm with the Department of Mathematics and Statistics