FALL 1999

FIFTY-FIRST SERIES

M*A*T*H

COLLOQUIUM

The Mathematics Department of Sonoma State University
presents a series of informal talks open to the public

Wednesdays at 4:00 pm — Darwin Hall Room 108 — Coffee at 3:45 pm

SEPTEMBER 8 **MUSICAL APPLICATION OF THE FIBONACCI SUMMATION SERIES**

Don Walker, Archivist, University of the Pacific, will present a summary of such applications by well-known and unknown 20th century composers. He will include a critical evaluation of results achieved and a discussion of potential for further creative applications. The presentation will include brief sound excerpts.

SEPTEMBER 15 **PROJECTIONS BODIES: AN OUTSTANDING CONJECTURE**

Sam Brannen, Mathematics, Sonoma State University, will discuss one of the outstanding problems in the field of affine isoperimetric inequalities, Petty's conjecture concerning the relationship of the volume of a convex body to that of its projection body. He will describe projection bodies and Petty's conjecture and then present the known partial results which appear to confirm the conjecture.

SEPTEMBER 22 **THE POWER OF SYNERGY: USING SURVIVAL ANALYSIS FOR BUSINESS FORECASTING**

Ai-Chu Wu, Mathematics, Sonoma State University, will describe the survival analysis approach and show that this method is significantly better than the current method, capacity planning. Capacity planning is based on accurately forecasting the timing and dollar volume of orders and relies on individual project managers to predict the probability of success for each deal, which consistently overestimates actual results.

SEPTEMBER 29 **AN INTRODUCTION TO FUZZY LOGIC**

Benjoe Juliano, Computer Science, CSU-Chico, will showcase some fundamentals of fuzzy logic and fuzzy set theory. Dr. Juliano will discuss background information and a brief historical survey. An overview of some applications will be presented, focusing on the area of fuzzy control.

OCTOBER 6 **COMPUTATIONAL FIELD SIMULATION**

Jeffrey Housman, Mathematics Undergraduate, Sonoma State University will discuss the relatively new and innovative third branch in scientific discovery, Computational Field Simulation (CFS). The talk will include a brief history, some work done at the ERC at Mississippi State, and a look into the future.

OCTOBER 13 **BERTRAND'S PARADOX**

Elaine McDonald, Mathematics, Sonoma State University, will investigate Joseph Bertrand's 1889 simple probability question which has many seemingly reasonable answers! The root of the paradox lies in defining what is meant by choosing something at random. We will explore various solutions given by mathematicians over the century.

OCTOBER 20 **THE PROPORTION OF THE GOLDEN MEAN IN THE PENTAGRAM**

Steve Wilson, Mathematics, Sonoma State University, will see how the proportion of the golden mean arises in nature, is used in architecture, and will explain how it appears in the pentagram and other geometric figures.

OCTOBER 27 **STATISTICAL PROCESS CONTROL**

Susan Herring, Mathematics, Sonoma State University, will discuss quality control, statistical process control, total quality management and just-in-time management. A brief history of quality control will be presented, as well as a discussion of how quality control can be applied to fields as diverse as manufacturing and teaching. This talk is appropriate for all audiences.

NOVEMBER 3 **AN INTRODUCTION TO CONTINUOUS MODELS**

Sunil Tiwari, Mathematics, Sonoma State University, will discuss the topic of ordinary differential equation models, their formulation, analysis, and interpretation. He will analyze how appropriate assumptions simplify the problem, how important variables are identified, and how differential equations are tailored to describing the essential features of a continuous process. Examples of continuous processes: bacterial growth in a chemostat, delivery of drugs by continuous infusion, glucose-insulin kinetics, compartmental analysis, simple harmonic motion, etc., will be used.

NOVEMBER 10 **POLYHEDRAL POTPOURRI**

Jeff Hrdlicka, MathMagician, Starmast Productions, ruminates on 3-dimensional models, including the 4-dimensional analog of a dual-pair star tetrahedron and the 5-dimensional extensions of the tetrahedron and the cube. Other topics will include polyhedra with non-planar faces, infinite polyhedra, and the extension of the Hamiltonian path on a polyhedron into higher dimensions.

NOVEMBER 17 **THE CLINICAL TRIAL METHOD**

Rodney Wong, Statistics, UC Davis, will present an analysis of the controlled, double blind, prospective, randomized clinical trial, which has become the scientific standard for the approval of new drugs in this country. He will discuss the history of the clinical trial method and the ethical and statistical issues raised in a clinical trial of AIDS patients for which he was the study statistician.

DECEMBER 1 **JUST IN TIME FOR THE MILLENNIUM...OR ARE WE?**

Edith Mendez, Mathematics, Sonoma State University, asks why should we celebrate a new millennium just because a sixth century monk set up our calendar that way? Why keep time at all? How have people kept time over the years and days and minutes and...?

SONOMA STATE UNIVERSITY

Parking permits (1.50) are required Monday through Thursday 6 am to 10 pm.
No public parking is permitted in reserved spaces at any time.

SPRING 2000 FIFTY-SECOND SERIES

M*A*T*H COLLOQUIUM

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

Wednesdays at 4:00 pm **Darwin Hall Room 108** **Coffee at 3:45 pm**

FEBRUARY 9 **ALL OR NOTHING**
Jean Bee Chan, Sonoma State University, will explore the quintessential question of experiments versus proofs.

FEBRUARY 16 **DIVIDING POLYGONS BY LINES**
Steve Chiappari, Santa Clara University, discusses how to divide a polygon's interior into subregions by line segments emanating from vertices and passing through a point interior to a side. In this talk, he will discuss two related problems concerning the maximal number of such subregions possible under various conditions. In each case, he will produce a polygon with the maximal number of subregions.

FEBRUARY 23 **CALCULUS TOOLKITS**
Bill Barnier, Sonoma State University, will exhibit student work presented in the Fall 1999 MATH 180 class. Megan Appold-Peterschmidt, Jon Berman, Joshua Bragg, Bryan Davis, Vicki Dye, David Hasson, Angela Milano, Katryn Norvell, and Carmen Thompson will demonstrate colorful, easy to understand and enlightening interactive "toolkits" written by them using Mathematica.

MARCH 1 **RELATIONSHIPS AMONG TEACHERS' BELIEFS, TEACHING METHODS AND STUDENT ACHIEVEMENT**
Fred Utter, Mathematics, Sonoma State University, will discuss the results of an investigation which looked at associations among teachers' pedagogical content beliefs, their approach to teaching, and student achievement in a high school Advanced Placement Calculus setting. He will focus on the statistics employed to measure and develop the categories used in classifying the data for this study.

MARCH 8 **LINEAR OPERATORS: APPLICATIONS FROM CALCULUS AND DISCRETE MATHEMATICS**
Dean Gooch, Mathematics, Santa Rosa Junior College, will give examples of how linear operators can be used to solve problems from calculus, differential equations and recurrence relations. He will reveal a general technique for finding the solution to $\sum_{n=1}^{\infty} n^j$ where j is any nonnegative integer.

MARCH 15 **USING INTER-RATER RELIABILITY TO ASSESS VARIABILITY AMONG CLINICAL INVESTIGATORS IN CENTRAL NERVOUS SYSTEM CLINICAL TRIALS**
James Robinson, Eli Lilly Pharmaceutical Company, will provide a brief overview of the general Pharmaceutical Product Development process and will focus specifically on the role statisticians play in the creation, testing, and approval of new drugs. He will also discuss how one can assess the variability among clinical investigators who participate in Central Nervous System (CNS) Clinical Trials.

MARCH 22 **DYNAMICS OF MICROSTRUCTURE AND FLOW INTERACTIONS**
Hong Zhou, Mathematics, UC Santa Cruz, will explain how many complex materials such as polymers and liquid crystal polymers are processed as "melts" in special geometries and flow, both for technical purposes and in natural biological functions. He will describe constitutive laws for flows of rod-like molecules and then apply the moment averaged equations of Doi and co-workers to probe interesting phenomena.

MARCH 29 **CROSSING THE THRESHOLD WITH NEURAL NETWORKS**
Renee Renner, Computer Science, CSU Chico, will provide an introduction to artificial neural networks (ANNs), their foundations, development, benefits and limitations. She will further investigate ANNs as components of larger intelligent systems, with a look at specific applications, demos and issues surrounding minds, brains and machine intelligence.

APRIL 5 **MIDPOINTS AND SYMMETRY: NOT JUST YOUR AVERAGE PROBLEM**
Alan Weinstein, Mathematics, UC Berkeley, will explore some geometrical averaging problems which are harder than they seem at first sight. What is the correct "average" of the vertices of a triangle? What is the "average" of a pair of nearby curves in space?

APRIL 12 **SPRING RECESS**

APRIL 19 **THE EDGE OF THE UNIVERSE/NON-EUCLIDEAN WALLPAPER**
MATH FESTIVAL
Frank Farris, Mathematics and Computer Science, Santa Clara University, introduces the poincare Upper Half-Plane as a model of the universe with an edge. He will demonstrate the many properties of this space and will construct wallpaper for its inhabitants. He asks how this can be done if you and your measuring devices shrink as you approach the edge, making it infinitely far away? Knowledge of complex numbers is helpful, but not required for this talk.

APRIL 26 **BIG PICTURE MATHEMATICS**
David Ballard, Mathematics, Sonoma State University, asks if science has science fiction, why can't there be a corresponding mathematics fiction? After a rapid (Euro-centric) review of all mathematics, past and present, he will attempt to predict the look of mathematics 100 years from now.

MAY 3 **SOLVING FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS USING CONTROL THEORY**
Daniel Ostrov, Mathematics, Santa Clara University will discuss how the physics behind partial differential equations motivates a mathematical condition which enables us to select a unique solution to those PDEs. He will also present a control theory representation of this unique solution which can be used to select a unique solution even if the PDE's dependence on space and time is discontinuous.

MAY 10 **RIGHT-ANGLED TILINGS AND COXETER GROUPS**
Rick Scott, Mathematics, Santa Clara University, will explain the concept of right-angled tiling. Given a 3-dimensional convex polyhedron P, he will show that a decomposition of 3-space into cells is a right-angled tiling by P if (1) each cell is (combinatorially) equivalent to P, and (2) exactly eight cells meet at each vertex. He will discuss the question: for which polyhedra P does there exist a right-angled tiling by P?

SONOMA STATE UNIVERSITY
Mathematics Department
(707) 664-2368 http://www.sonoma.edu/math

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SEPTEMBER 6 CHAOS AND REGULARITY

Arek Goetz, Mathematics, San Francisco State University, will illustrate basic concepts and some open questions in dynamical systems-their interplay with geometry and number theory. The talk will feature an interactive multimedia presentation and will be accessible to undergraduate students.

SEPTEMBER 13 BEYOND CALCULUS: SOAP FILMS AND HIGHER DIMENSIONS

Helen Moore, Mathematics, Stanford University, will dip more wire frames into soapy water and formulate the soap film's attempt to minimize area as a calculus optimization problem. She will use multivariable calculus plus some other ideas that will be explained and look at soap films in higher dimensions! Moore will discuss several different results, including current progress on the Gauss map problem for minimal surfaces. This talk should be accessible to any undergraduate student who has had single-variable calculus.

SEPTEMBER 20 THE VIRTUAL CLASSROOM - STATISTICS VIA THE INTERNET

Ira Lansing, Mathematics, College of Marin, teaches a section of Introduction to Probability that is 100% online. What are some of the pros and cons of this medium? The presentation will include a tour of the software and hardware that is used and a visit to the "classroom," along with a discussion of the problems and advantages afforded by a virtual classroom.

SEPTEMBER 27 GROUP MEMBERSHIP, SELF-WORTH AND TREATMENT QUALITY

Heather Smith, Psychology, Sonoma State University, discusses past and current research into how quality of treatment is linked to support of authorities and acceptance of their decisions, particularly when the authority represents a valued ingroup. The findings of two experiments and a correlational study support the argument that treatment quality in an ingroup context is particularly important because people derive their sense of self, in part, from knowing that a group they value regards them as respected members.

OCTOBER 4 A FIGURE EIGHT FOR THE THREE-BODY PROBLEM, CHOREOGRAPHIES FOR THE N-BODY PROBLEM

Richard Montgomery, Mathematics, UC Santa Cruz, will discuss his discovery of a new periodic orbit for three equal masses moving in the plane according to Newton's laws of gravity. In this orbit, three equal masses chase each other around a fixed figure eight shaped curve in the plane. Very few periodic orbits are known for the full three-body problem and, mathematically speaking at least, his may be the most important periodic orbit after those discovered by Euler and Lagrange.

OCTOBER 11 THE KURATOWSKI CLOSURE-AND-COMPLEMENT PROBLEM AND SOME EXTENSIONS

Eric Langford, Mathematics, CSU Chico, will discuss this classical problem which asserts that in any topological space, no more than fourteen sets can be formed from a given set, using the operations of closure and of complementation. Sets for which this maximum is obtained are called "14-sets" and easy examples can be found on the real line. We will characterize such 14-sets and examine related problems that occur when interiors, intersections, and unions are allowed.

OCTOBER 18 ARROW'S IMPOSSIBILITY THEOREM

Rick Luttmann, Mathematics, Sonoma State University, will explain and prove one of the most celebrated theorems of our era, the so-called Impossibility Theorem of Kenneth Arrow, proved when he was a Stanford economics professor in 1950 and for which he won the Nobel Prize. The theorem basically says that if you want to devise a voting system that satisfies certain minimal and obviously desirable criteria, the only possibility is to appoint a dictator.

OCTOBER 25 SHOW ME THE DO-RE-MI

Rick Kavinoky, Mathematics, Santa Rosa Junior College, will demonstrate a few of the many interesting connections between math and music. How are frequencies assigned to the notes of a major scale? Why is the interval of a "fifth" so important? Why is the octave divided into 12 intervals? He will show how the Discrete Fourier Transform (DFT) helps us "see" sound by breaking it into its frequency components and will also show how the DFT and filters can be implemented in software (MATLAB) to turn your computer into a musical instrument tuner.

NOVEMBER 1 THE SUN, THE MOON AND CONVEXITY

Sam Brannen, Mathematics, Sonoma State University, asks whether the path the moon makes around the sun is convex. He will model lunar paths and find the conditions for convexity, concluding that the path our moon makes about our sun is locally convex.

NOVEMBER 8 ON TRISECTION, QUINTISECTION,...ETC.

William Barnier, Mathematics, Sonoma State University, will discuss the angle trisection problem (which dates from the fifth century BC and was not solved until 2200 years later) along with its generalization, the p-section problem, where p is an odd prime number. This talk will be accessible to anyone with an interest in the "three classical problems of antiquity."

NOVEMBER 15 EXTRAORDINARY EXPONENTIALS, FRACTIOUS FRACTIONS, INSOLENT INFINITIES, PROLIFIC PRODUCTS, RADICAL RADICALS AND STUPENDOUS SUMS

George Ledin, Computer Science, Sonoma State University, fascinated since his teenage years with monster formulas involving infinite sums and products and continued fractions, will present some of his weirdest results, all nicely verified by elegant computer programs and some actually proven with clever mathematical methods. If F. Vieta's famous 2/pi formula is like a firecracker, Ledin's stuff is like fireworks.

NOVEMBER 29 ATM vs. IP - CELEBRITY DEATH MATCH (Not!)

Lauren May, Director of Data Technology at Next Level Communications, will discuss two major communications protocols, Asynchronous Transfer Mode and Internet Protocol. Can peace and harmony be found between the extremes? Concepts to be discussed include multiplexing, switching, routing and quality of service. Technologies examined will include the Digital Subscriber Line, the World Wide Web, switched digital video, streaming IP media, and Multiprotocol Label Switching (MPLS).

SONOMA STATE UNIVERSITY
Department of Mathematics (707) 664-2368 www.sonoma.edu/math

SPRING 2001 FIFTY-FOURTH SERIES

M*A*T*H COLLOQUIUM

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WEDNESDAYS at 4:00 P.M. DARWIN HALL ROOM 108 COFFEE at 3:45 P.M.

February 7 **How Mathematical Ability Evolved.** Keith Devlin, Dean of the School of Science, Saint Mary's College of California, and Senior Researcher, Center for the Study of Language and Information, Stanford University, will discuss his latest book, *The Math Gene: How Mathematical Thinking Evolved and Why Numbers Are Like Gossip*. When we do mathematics, we must be using mental capacities that evolved long before mathematics came along. What are those abilities and what survival advantages led to their finding their way into the human gene pool? And if everyone has these abilities—as an evolutionary account will imply—why do so many people find math impossibly hard?

February 14 **Calculus Toolkits.** Bill Barnier, Mathematics, Sonoma State University, will introduce students Matthew Adkins and Andrew McFarland, Kenneth Cabeen and Carey Eheler, Nicole Damele, Nicholas Hoffman, Lisa Moran, Donald Siemon, Patty Smith and Yolanda Woods, and Amy Zigler from the Fall 2000 Math 180 class, who will demonstrate colorful accessible Mathematica "toolkits" that illustrate concepts like the definition of the derivative or perform a useful function such as encryption.

February 21 **Mathematical Models on the Atomic Scale.** Doug Martin, Chemistry, Sonoma State University, will discuss how scientists measure properties of invisible molecules. Often, mathematical models are developed which allow scientists to interpret their data. In this talk we will see an example of this process in action. Along the way we will ask if there is a difference between what mathematicians call "mathematical modeling" and scientists call "science".

February 28 **The Fundamental Theorem of Arithmetic without the Axiom of Infinity.** Steve Wilson, Mathematics, Sonoma State University, investigates the role the Axiom of Infinity plays in the Fundamental Theorem of Arithmetic and how to get around it.

March 7 **The Search for the Scorpion Submarine.** Stan Benkoski, Mathematics, West Valley College, will discuss the mathematics used in the search for the Scorpion (a nuclear powered submarine) which disappeared without a trace in 1968 during a westbound transit across the North Atlantic. The search for the Scorpion lasted for 5 months and one observer called it the "most difficult search operation ever undertaken and pressed to a successful conclusion." The mathematics of the search included hyperbolas, Monte Carlo techniques, Bayes Theorem, and Lagrange multipliers.

March 14 **Probabilistic Models of Queuing Networks.** Amber Puha, Mathematics, CSU San Marcos, will introduce some simple models that attempt to mathematically describe the behavior of some queuing systems. Waiting in line is a fact of life—do you want the answers to questions like "how long should a job expect to wait in line?", or "in the long run, how many jobs should one expect to be in the system at any one time?" Students who have had one semester of probability should have an appropriate amount of preparation to follow this talk.

March 21 **Calculus, Topology and the Discovery of Interior Fixed Points.** Robert Brown, Mathematics, UCLA will trace a portion of the history of calculus and topology to illustrate two themes. The first is that topology, a branch of mathematics that was developed in the 20th century, can be viewed in part as a natural extension of mathematicians' efforts, from the 17th century onward, to clarify the foundations of calculus. The second is that, in contrast to sciences in which a new theory supplants all previous ones, in mathematics new developments generally arise as extensions of previous discoveries. No prerequisites beyond calculus will be required in order to understand this talk.

March 28 **Applications of the Two-Parameter Poisson-Dirichlet Distribution.** Matt Carlton, Statistics, Cal Poly SLO, will discuss the statistical and biological applications of this family of distributions. This includes a larger class of discrete random measures, a new distribution on the probability simplex, and various results applicable to species sampling.

April 4 **A Set Theoretic Cosmology for Mathematics.** David Ballard, Mathematics, Sonoma State University, will describe and discuss a current ongoing collaborative mathematical research effort which may actually provide mathematics with a likely story of itself. The Hopi, the Navajo, the Eskimo all have their own creation myth. The Judeo/Christian/Islamic folk also have theirs. Even the physicists (BANG!!, right?). What about mathematics?

April 11 **Spring Break**

April 18 **Screening Test Methodology.** Wes Johnson, Statistics and Chair of the Graduate Group in Epidemiology, UC Davis, will discuss some recent progress in screening test methodology. The standard goals are to find individuals in a population that have a particular characteristic of interest, like HIV infected blood units that have been donated for transfusion, or drug users in the transportation industry. It is also of interest to estimate various parameters, like the sensitivity and specificity of the screening tests, the prevalence of the characteristic in the population and the prevalence in the screened population.

April 25 **Product Forecasting.** Mike Bryan, Sales Analyst, Amy's Kitchen in Santa Rosa, will present the process of product forecasting through the use of statistical methods.

May 2 **Genetic Algorithms.** Scott Gordon, Computer Science, Sonoma State University, will discuss computer programs that evolve solutions to problems by emulating the processes of biological evolution: mutation, genetic crossover, natural selection, and survival of the fittest. They have been used in geological exploration, scheduling, semiconductor layout, and many other real-world applications. Various genetic algorithms will be described, including some that have been developed here at SSU.

May 9 **Phi on the Boundary of Algebra and Geometry.** Jeff Hrdlicka, Mathemagician, Starmast Productions, will explore some of the many connections between algebraic and geometric structures. Just as the most interesting areas of the Mandelbrot set occur at its boundary, so the realms where algebra and geometry intersect provide interesting mathematical perspectives, especially when the intersection includes the golden ratio phi.

May 16 **How's Your Credit?** Elizabeth Shamseldin, Fair, Isaac and Company in San Rafael, will discuss the process of creating and managing the statistical models used in the consumer credit industry, including credit score models. She will talk about issues from data management to model building with an explanation of what your credit score really means. Accessible to all students.

Talks may change owing to unforeseen circumstances, and it is advisable to check with the Mathematics Department to see if the particular talk you want is being given at the time and date scheduled.

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SEPTEMBER 5

BAYESIAN AND CLASSICAL STATISTICAL INFERENCE-A COMPARISION

Brian Jersky, Professor and Chair, Mathematics, Sonoma State University. Traditionally, classical statistical inference, e.g. hypothesis testing, has been used to examine new therapeutic drugs. In this talk, I will demonstrate the use of Bayesian analysis to enhance inference. This has an impact on assessing the efficacy of drugs.

SEPTEMBER 12

STRAIGHT LINES ON CURVED SURFACES

Rick Luttmann, Professor, Mathematics, Sonoma State University will talk about various meanings that can be assigned to the concept of "straightness" so that it will be meaningful on curved surfaces, and will then investigate some of the strange lore of "straight lines" (officially called "geodesics") on such familiar surfaces as spheres, cylinders, cones, toruses, and saddles.

SEPTEMBER 19

AN INTRODUCTION TO THE THEORY OF COMPUTATION

Lynn Stauffer, Professor of Computer Science, Sonoma State University. This talk will introduce the study of the types of problems that can and cannot be solved by computers. The area of complexity theory, that is, classifying problems by how difficult a given problem is to solve, will be covered. Many problems, such as computer security, rely on the fact that a problem is known to be difficult. In the case of security, reliance on the difficulty of factoring large numbers is essential. Turing machines, Church's Thesis, decidability, reducibility, P, NP, and NP-Completeness are included in the topics to be surveyed.

SEPTEMBER 26

TEACHING WITH THE BRAIN IN MIND

Susan Herring, Professor of Mathematics, Sonoma State University. Recent studies have answered many questions about how the brain functions when learning new material. This talk will discuss why a student "blanks out" on an exam, the best way for students to learn, and the importance of a student-centered classroom. It will be of general interest to teachers and learners alike.

OCTOBER 3

FISH, FROGS, AND FIRES

Haiganoush K. Preisler, USDA Forest Service. The complexity of data currently collected by environmental scientists, in particular data collected by modern instruments such as satellites and geographic positioning systems, demand the use of computer intensive statistical and graphical techniques. In this presentation, I will describe some of the projects I have worked on during my years as a forest service statistician.

OCTOBER 10

TO BE ANNOUNCED

Serkan Hosten, San Francisco State University.

OCTOBER 17

JUST HOW FAST ARE YOU GOING? CAN YOU TALK YOUR WAY OUT OF THAT TICKET?

Neil C. Schwertman, Department of Mathematics and Statistics, CSU Chico. A question that occasionally appears on various tests is: On a highway, if you pass the same number of cars as pass you, is your speed the mean or the median? There is a bit more to this question than is apparent at first glance. We will investigate this question and if it is possible to estimate your speed percentile based on the number of cars you pass or pass you.

OCTOBER 24

DEVELOPING MATHEMATICS TEACHING AND LEARNING IN SOUTH AFRICA

Karin Brodie and Lynn 'Slo' Slonimsky, University of the Witwatersrand. South Africa is currently in the process of a curriculum reform process which aims to transform the apartheid education system into a more equitable and effective system. The reform process makes major demands on teachers, including the development of more learner-centered practices. Drawing on data from a recent research project with teachers who attended a two-year, in-service program, we will talk about some of the possibilities and difficulties that the curriculum changes create for mathematics teachers, and the implications for developing better mathematics learning in South Africa.

OCTOBER 31

GENETIC ALGORITHMS

Scott Gordon, Professor of Computer Science, Sonoma State University. Genetic Algorithms are computer programs which evolve solutions to problems by emulating the processes of biological evolution: mutation, genetic crossover, natural selection, and survival of the fittest. They have been used in geological exploration, scheduling, semiconductor layout, and many other real-world applications. The speaker will show how an SSU student used a genetic algorithm to find solutions to the classical Knight's Tour problem.

NOVEMBER 7

MIXED METAPHORS: UNDERGRADUATE LANGUAGE AND UNDERSTANDING IN CALCULUS

Eric Hsu, San Francisco State University will discuss recent work on the role of metaphor in the development of mathematical understanding. What is the role of a learner's spontaneous metaphors? Can we distinguish between the use of metaphor by "novices" and "experts"? Specific examples are taken from a study at U.T. Austin tracking the language and reasoning of college calculus students.

NOVEMBER 14

BEADS AND BITS - NECKLACES AND GF(2^N)

Kevin Cattell, Agilent Technologies, INC. Extension fields? Attached roots? Wouldn't you rather put beads on strings? Come see a pair of isomorphisms between two-colored necklaces and the non-prime finite fields GF(2^n), and learn some interesting counting results along the way.

NOVEMBER 21

THANKSGIVING HOLIDAY

NOVEMBER 28

WAVELETS: THROUGH THE EYES OF AN INTERPOLATING POLYNOMIAL

Jeffrey Housman, University of California, Davis will briefly discuss wavelets (a basis for L2) and more specifically construction of wavelets through polynomial interpolation. This will be extended to Super Compact Multiwavelets from the ideas of Beam, Warming, Harten, and Lee. Finally, he will discuss applications of Super Compact Multiwavelets to data compression, specifically for 3D computational fluid dynamics simulation data at NASA.

Talks may change: Please confirm with the Mathematics Department before a specific talk.

SONOMA STATE UNIVERSITY
Department of Mathematics

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SPRING 2002

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FEBRUARY 6 **TITLE: A VIEW OF AN ART GALLERY** **Jean Bee Chan**, Professor of Mathematics, Sonoma State University, will discuss the Art Gallery Question: How many surveillance cameras are needed so that every point in the gallery is seen by some camera?

FEBRUARY 13 **WHAT IS AN ACTUARY?** **Diana Carroll** and **Julie Duncan** of Towers Perrin, will discuss the actuarial profession. They will explain what an actuary does, what actuarial exams are all about, and what you can do now to prepare for an actuarial career. Typical projects in actuarial consulting will also be presented. This is your chance to find out why the Wall Street Journal has consistently ranked the job of an actuary as the number 1 or 2 job in the U.S. Questions from the audience will be welcomed and encouraged.

FEBRUARY 20 **MATHEMATICA TOOLKITS** **Bill Barnier**, Professor of Mathematics, Sonoma State University, will introduce student projects done for the Fall 2001 Math 180 class. Kim Asuncion, Laura Chrisco, Marie Artesse, Maria Capetanos, Debbie Koehler, Kimberly Laabs, Izaak Eberst, Michael Laufer, Aba Mbirika, and Paul Taylor will exhibit colorful and accessible Mathematica programs that demonstrate applications of mathematics in a variety of areas.

FEBRUARY 27 **HISTORY OF THE WESTERN CALENDAR** **Jim Pedgrift**, Professor of Mathematics, Sonoma State University, will trace the history of the Western Calendar from pre-history to 1582 C. E., when our modern calendar was given final form. We will see how an elementary understanding of mathematics can inform and deepen our understanding of history.

MARCH 6 **ELLIPTIC CURVE CRYPTOGRAPHY** **George Ledin,** Professor of Computer Science, Sonoma State University. The U.S. government will be switching to elliptic curve cryptography for all its public key cryptography, plans to buy from the commercial sector, and will require higher levels of assurance than is usually demanded of commercial software. What is cryptography? What is Elliptic Curve Cryptography? What are Elliptic Curves and why are they used in cryptography? Why should such topics be studied by computer scientists, mathematicians, and engineers? Profressor Ledin will attempt to answer these questions and others.

MARCH 13 **BASIC NON-LINEAR EQUATIONS** **Enrique Izaguirre,** Professor of Physics And Astronomy, Sonoma State University. Nonlinear equations and its applications in physics and biology: A brief overview of the theory of discrete and differential nonlinear equations is presented. This introductory lecture is an exploration of the applications of nonlinear equations in nonlinear optics, fluids, neurobiology, and pattern formation. During the talk, the outlines of a collaborative undergraduate research program at SSU will be discussed.

MARCH 20 **AN INTRODUCTION TO CHAOS THEORY** **Rick Luttmann**, Professor of Mathematics, Sonoma State University, will talk about the origins of the subject with Poincare in the late 19th century, studying the three-body problem; developments in the 20th, including the work of Mandelbrot (fractals, and the set that bears his name), Lorenz (weather prediction and strange attractors), and Feigenbaum (the cascade of bifurcations). Professor Luttmann will discuss some of the applications of this rich new theory to the sciences -- everything from economics (stock prices) to astronomy (formation of galaxies), quantum physics (atomic structure) to medicine (heartbeat rhythms) -- which have been united by this subject as they haven't been since the calculus in the 17th century

MARCH 27 **CONFIDENCE INTERVALS FOR A BINOMIAL PARAMETER** **Brian Jersky**, Professor of Mathematics, Sonoma State University. In elementary statistics, a confidence interval for the proportion of successes in a series of Bernoulli trials is developed. This interval is easy to present and motivate and to compute. Unfortunately, it is not safe to use, as the actual coverage probability of the interval fluctuates widely compared to the claimed coverage. Alternative intervals are presented which are more reliable, though somewhat more difficult to calculate.

APRIL 10
MATH FESTIVAL **PLUS AND TIMES, PI AND PRIMES** **Henrik Lenstra,** University of California, Berkeley, and Universiteit Leiden. There is an easy recipe for achieving fame and wisdom. The speaker will explain how anybody familiar with the ABCs of arithmetic can help mathematics make progress.

APRIL 17 **STEINER SYMMETRIZATION AND PETTY'S PROJECTION BODY CONJECTURE** **Sam Brannen**, Professor of Mathematics, Sonoma State University. In 1971 Petty conjectured a minimum value for the ratio of the volume of a projection body to a certain power of the volume of the original convex body, with the minimum value attained only by convex bodies affinely equivalent to a ball. A series of Steiner symmetrizations can turn any convex body into a ball, and therefore Petty's conjecture can be proven by showing that Petty's ratio is always decreased by Steiner symmetrization. We will show that for three-dimensional convex rotation bodies, the value of Petty's ratio is decreased by a particular Steiner symmetrization.

APRIL 24 **VEDIC MATHEMATICS** **Sunil Tiwari**, Professor of Mathematics, Sonoma State University, will talk about Vedic Mathematics. "Veda" is a Sanskrit word meaning the fountainhead of unlimited store-house of all knowledge. According to the Hindu religion, the Vedic period goes back to 4000 BC. The four Vedas and four Upavedas contain all the knowledge that mankind needs to know. One of the Upavedas -- *Sthapatyaveda*, is an encyclopedia on engineering and mathematics. We will go over some of the *Sutras* (mathematical formulae and tricks) from Sthapatyaveda. This talk is accessible to all students.

MAY 1 **TBA**

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FALL 2002

FIFTY-SEVENTH SERIES

M*A*T*H COLLOQUIUM

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

WEDNESDAYS at 4:00 P.M. | **DARWIN HALL ROOM 108** | **COFFEE at 3:45 P.M.**

SEPTEMBER 4 **FRACTALS IN NATURE, Tom Falbo**, Professor of Mathematics, Santa Rosa Junior College, and SSU Mathematics Alumnus: a light-hearted presentation on fractal geometry focusing on natural occurrences from the microscopic to the celestial. A number of real examples will be accompanied by a PowerPoint presentation.

SEPTEMBER 11 **MATHEMATICAL SCULPTURE, Eugene Wachspress**, Professor of Mathematics, University of Tennessee, (Retired): A numerical solution to field problems by the finite element method led to a basis for design of sculpture. The motivation for the mathematics, some of the fundamental geometric concepts underlying the construction, and artistic implementation will be described. The finite element method relies on continuous patchwork polynomial approximation. The construction rests heavily on the theory of "divisors" introduced in Algebraic Geometry. This theory relates to the manner in which curves and surfaces intersect. The sculpture consists in a "seed" corresponding to the element, the extension outside the element of the curves along which its faces intersect, and an outlying "adjoint" surface defined by the multiple points of these curves. A few renditions will be displayed.

SEPTEMBER 18 **THE ROLE OF A STATISTICIAN IN CLINICAL TRIAL DEVELOPMENT, James Robinson**, Biostatistician at IDEC Pharmaceuticals (San Diego), and SSU Mathematics Alumnus: an overview of the Clinical Trial Development Process for pharmaceutical and biotechnology products and the purpose of a statistician at each stage. This will include a brief description on Phase I-IV clinical trial designs, analyses and interpretations for pharmaceutical and biotechnology products. The speaker will also provide a couple of real life examples that will show how statistics were applied to Clinical Trial Development.

SEPTEMBER 25 **NON-LINEAR DIFFERENTIAL SYSTEMS AND POPULATION MODELING, Paul Taylor,** SSU Mathematics Alumnus: No population is an island. Populations are a part of an ecosystem, and depend on that ecosystem as much as the ecosystem depends upon it. Systems of non-linear differential equations are used to describe these relationships, and to infer information about the future of the ecosystem.

OCTOBER 2 **THE MEANS JUSTIFY THE EXTREMES, Terry Shell,** Professor of Mathematics, Santa Rosa Junior College: Many problems that are traditionally done with calculus (especially maxima/minima problems) can be done with just algebra and geometry, and often more elegantly. The Arithmetic-Geometric Mean Inequality will play the starring role.

OCTOBER 9 **FINITE GROUP BEHAVIOR (FGB) - A SOFTWARE PACKAGE FOR BEGINNING GROUP THEORY, Ed Keppelmann,** Professor of Mathematics, University of Nevada at Reno: FGB is a Windows program developed at the University of Nevada Reno by the speaker and a former student, Bayard Webb. The program is ideal for those just learning about groups. Features include the ability to create subgroups, cosets, and homomorphisms between any two groups in the program's library, which currently contains many abelian groups and all non-abelian groups of size 40 or less. The program is free and now used by about 50 schools in the USA, Canada, and many countries in Europe and Asia. In addition to demonstrating the features of the program, some recent research made possible by the software will also be briefly discussed.

OCTOBER 16 **STABLE THREE-BODY ORBITS, Richard Montgomery,** Professor of Mathematics, University of California at Santa Cruz and SSU Mathematics/Physics Alumnus: Very few periodic orbits are known for the full three-body problem. In December 1999 Alain Chenciner (Paris) and the speaker found a new periodic orbit for three equal masses moving in the plane according to Newton's laws of gravity. In this orbit, three equal masses chase each other around a fixed figure-eight curve in the plane. It is dynamically as stable as possible (KAM stable) for Hamiltonian systems with such a high degree of freedom. The goal of the talk is to describe the orbit, and what led us to look for it. We will also describe solutions to the equal-mass N-body problem in which the N masses (N up to 799 so far) chase each other around a fixed curve in the plane. The curves have the form of flowers, spirograph designs, eights, chains, and so on.

OCTOBER 23 **POLYA'S ENUMERATION THEOREM, Andrew McFarland,** SSU Mathematics Student: An overview of Polya's Enumeration Formula, a method of counting objects which takes into consideration their geometrical symmetry: two objects that appear to be different from one perspective may be identical when viewed from an other. Example problems will illustrate the simplicity and power of this 65 year old formula. Burnside's theorem will also be discussed.

OCTOBER 30 **MATH IN THE DARK AGES, Edie Mendez,** Professor of Mathematics, SSU: "During the Dark Ages, the world slept and nothing was going on mathematically," right? WRONG! Come meet some of the mathematicians of the Dark Ages. Our number system was developed and popularized, great progress was made in algebra, math was applied to astronomy and optics, calendars were refined, and much, much more.

NOVEMBER 6 **FLATTENING THE WORLD - AN INTRODUCTION TO THE MATHEMATICS OF MAPPING THE EARTH, John Martin,** Professor of Mathematics, Santa Rosa Junior College: From Ptolemy to Mercator and from Gauss to Robinson, mathematicians have been actively engaged in the problem of creating flat maps for our spherical world. In this talk, we will explore some of the mathematics and the controversies surrounding this fascinating endeavor.

NOVEMBER 13 **THE USE OF SYMMETRY BY WESTERN COMPOSERS, James T Smith,** Professor of Mathematics, San Francisco State University: See and hear — with new multimedia techniques — how Bach and Beethoven used geometric symmetries, and how Schoenberg's twelve-tone music is based on them.

NOVEMBER 20 **MODULAR FORMS IN WEILS' PROOF OF FERMAT'S LAST THEOREM, Sinai Robins,** Professor of Mathematics, Temple University. Fermat's last theorem follows from the Taniyama-Shimura (T-S) conjecture, now a theorem. In turn, the T-S conjecture is the "hard" part of an if-and-only-if statement, namely, that every elliptic curve "comes from" a weight-2 cusp form, and that every weight-2 cusp form defines an elliptic curve. Here we describe the "easy" part, also known as Eichler-Shimura theory, where we get to start with the weight-2 cusp form and construct the elliptic curve. (T-S is the converse: it begins with the elliptic curve and constructs the weight-2 cusp form, via Andrew Wiles and Richard Taylor.) There is a lot of beautiful terrain to cover. We will outline the procedure with an example, complete with the decimal approximations to the periods of the elliptic curve.

NOVEMBER 27 **THANKSGIVING BREAK**

DECEMBER 4 **THE POWER, USE, AND BEAUTY OF STATISTICS, Ai-Chu Wu,** Professor of Mathematics, SSU, and her Math 165 Students: This is a collection of students' semester projects for Math 165, Elementary Statistics. These projects are aimed at both general objectives (connect math to daily activities, develop analytical and problem-solving skills, communicate math concepts and solutions) and specific objectives, (given a situation that requires data-based decision making, be able to correctly identify the question, collect the data needed, analyze the data, make a conclusion, and present the result).

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SPRING 2003

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FEBRUARY 5 **XOR, Ken Yanosko,** Professor of Mathematics, Humboldt State University: In mathematics, when we use the word "or" we usually intend the "inclusive or", which has the meaning "and/or". But there are in fact many contexts in which "or" should be taken to denote the "exclusive or", with the meaning "or but not both". In this talk we will investigate some applications of the "exclusive or", "xor", in logic, algebra, cryptography, and game theory.

FEBRUARY 12 **CREDIBILITY THEORY, Jerry Klenow,** Professor of Mathematics, Sonoma State University, independent consultant and a Fellow of the Casualty Actuarial Society: For how many years must a driver remain "claim free" in order to earn a meaningful discount on insurance rates? When new information becomes available, how much "weight" should be assigned to it relative to the broader, historical, data base? If two different sources of data are being used to answer the same question, how much "weight" should be given to each? Actuaries address these issues using a set of procedures that have been developed under the topic known as Credibility Theory.

FEBRUARY 19 **MATHEMATICA TOOLKITS, Bill Barnier,** Professor of Mathematics, Sonoma State University, & his Fall 2002 Math 180 Students (Jessica Doran, Vicente Duarte, Jennifer Flory, Sarah Minnick, Jason Murphy, Helene Nehrebecki, Edward Roubal): Student projects done for the Fall 2002 Math 180 class will exhibit colorful and accessible Mathematica programs that demonstrate applications of mathematics in a variety of areas. Pizza after Colloquium.

FEBRUARY 26 **HOW DOES THE BRAIN COMBINE DIFFERENT SOURCES OF INFORMATION?, Marty Banks,** Professor of Vision Science, Optometry, & Psychology, UC Berkeley: We use more than one source of sensory information when estimating properties of the environment. For example, the eyes and hands both provide relevant information concerning an object's shape. The eyes estimate shape using binocular disparity (differences in the images to the two eyes) and pictorial cues (also used by painters). The hands supply shape information by means of tactile and proprioceptive cues. One can show, using Bayes' rule, that there is a statistically optimal way to combine information from different sources. We find that the brain follows this statistically optimal strategy under a wide variety of situations.

MARCH 5 **WHAT'S THE MATH ON RAP?, Helene Nehrebecki,** Student in Mathematics, Sonoma State University: The math of rap and hip-hop begins with the math of music. Experiments performed by Pythagoras show how frequencies are intentionally made so music is possible. Included will be a demonstration on measuring frequencies on a chromatic scale. Ratios of major musical chords, designing instruments, a brief history of pop music, and math behind non-offensive hip-hop lyrics and keyboard hooks will be discussed. COME FOR THE HIP-HOP, STAY FOR THE MATH! Pizza after Colloquium.

MARCH 12 **GAMMA AND A PRODUCT OF SINES, David Sklar,** SOLA Optical and City College of San Francisco: This talk is about a surprising trigonometric identity that arises in the theory of Euler's Gamma function. We'll look at a short, relatively elementary, proof using the geometry of the unit circle, cyclotomic polynomials, and some basic algebra of complex numbers. Then we'll review enough of the theory of the Gamma function to see how our trig identity can be derived from Gauss's multiplication formula.

MARCH 19 **TEACHER'S PETS, Charles Biles,** Professor of Mathematics, Humboldt State University: This is a little collection of some gems I've collected over the last couple of years. The talk is meant for undergraduates and should be accessible to sophomore math majors. Even freshpeople will get something out of it. This is not one of those heavy-duty talks whose intention is to blow people out of the water — just the opposite.

MARCH 26 **THE BINOMIAL THEOREM, INDICATORS, AND THE BELL CURVE, Matthew Carlton,** Professor of Mathematics, Cal Poly San Luis Obispo: In this talk, we will show how the binomial theorem plays a role in probability and exemplifies two important statistical tools: indicator variables and the Central Limit Theorem. The talk is geared toward undergraduates and doesn't assume prior statistics knowledge.

APRIL 2 **DUALITY AND SYMMETRY OF HYPER-GEOMETRIC PROBABILITIES, James Jantosciak,** Professor of Mathematics (Retired), Brooklyn College: The inherent duality and symmetry of the hypergeometric probability distribution is explained in the context of problems commonly encountered. For instance, among 15 students, 12 are seniors and 9 are math majors. What is the probability that 7 students are senior math majors?

APRIL 9 **SPRING BREAK**

APRIL 16 **MATH FESTIVAL — COMPUTING WITH WORDS AND PERCEPTIONS – A PARADIGM SHIFT IN COMPUTING AND DECISION ANALYSIS, Lotfi A. Zadeh,** Professor in the Graduate School, Computer Science Division, Department of Electrical Engineering and Computer Sciences, U C Berkeley: Computing with words and perceptions, or CWP for short, is a mode of computing in which the objects of computation are words, propositions and perceptions described in a natural language. Perceptions play a key role in human cognition. Humans — but not machines — have a remarkable capability to perform a wide variety of physical and mental tasks without any measurements or any computations. Everyday examples of such tasks are driving a car in city traffic, playing tennis and summarizing a book. One of the major aims of CWP is to serve as a basis for equipping machines with a capability to operate on perception-based information.

APRIL 23 **THE CENTIMETER SOLUTION IN GPS SURVEY, William Poe,** Professor of History, Sonoma State University: A description of the mathematical aspects of achieving the centimeter level of precision in a GPS survey. Some preliminary description of the way that the GPS system works will be necessary. I will demonstrate the post-processing software that I use. The actual algorithms used by the software are proprietary to each manufacturer and are closely guarded trade secrets.

APRIL 30 **THE MILLENNIUM PROBLEMS, Keith Devlin,** Stanford University, and author of *The Millennium Problems: the seven greatest unsolved mathematical puzzles of our time*, published by Basic Books (2002). In 2000, The Clay Mathematics Institute, a privately funded research center in Cambridge, Massachusetts, announced that $7 million in prize money awaited the individuals who first solved the seven most difficult open problems of mathematics: the Millennium Problems. The problems were selected by a small group of internationally acclaimed mathematicians, who felt that they are the most significant unsolved problems of contemporary mathematics. They lie at the center of major areas of mathematics and have resisted attempts at solution by many of the best mathematicians in the world. What are these problems, and what are your chances of solving one of them and pocketing the $1 million prize?

MAY 7 **IMAGE PROCESSING OF RADAR IMAGES USING MATLAB, Raquel Maderazo,** Raytheon Corp, LA: Image processing applications for radar images will illustrate jobs available in engineering for math majors. There will be a little pitch for Raytheon!

MAY 14 **COMBINATORICS OF STRING RE-WRITING SYSTEMS, Bala Ravikumar,** Professor of Computer Science, Sonoma State University: String rewriting is a fundamental concept in linguistics, in computation and in proof theory. In this talk, we will look at some simple string rewriting systems and attempt to answer questions about characterization of reachable configurations, shortest path to reach a specific configuration, number of reachable ones, etc. Examples will be chosen that highlight specific techniques. Some of the results are new, while others are well-known. Pizza after Colloquium.

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FALL 2003 FIFTY-NINTH SERIES

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WEDNESDAYS at 4:00 P.M. DARWIN HALL ROOM 108 COFFEE at 3:45 P.M

SEPTEMBER 3 **THE GOLDEN RATIO — A CONTRARY VIEWPOINT;** Clem Falbo, Professor Emeritus of Mathematics, Sonoma State University. This talk discusses several false or insupportable claims made about the "golden ratio," φ. We illustrate that φ is not, in general, the shape of spirals in sea shells, and particularly it is not the shape of the nautilus. We will show that *every* number $R>1$, used as a "ratio," shares all of the alleged "special properties" of φ, including subdividing any rectangle into similar rectangles, and appearing as the limit of the ratio of successive terms in some Fibonacci-like recurrence equation. ***Pizza after Colloquium.***

SEPTEMBER 10 **THE MATHEMATICS OF SURFING;** Richard Werner, Mathematics, Santa Rosa Junior College. I will briefly discuss ocean waves and why they break. The majority of the talk will focus on the balance of forces that allow a surfer to catch and ride a wave. The proofs are heavily dependent on vector calculus, but students who have not had this class will still be able to understand the results. The presentation will include numerous video clips and still photos.

SEPTEMBER 17 **DYNAMICS AND GEOMETRY OF MICROSCOPIC STRUCTURES IN PIECEWISE ROTATIONS;** Arek Goetz, Professor of Mathematics, San Francisco State University. In this multimedia talk, we will invite the audience to take an exciting tour of fractal structures arising from the action of piecewise rotations. These structures are produced on a computer using rigorous algorithms with roots in basic algebraic number theory. The talk will be accessible to sophomore undergraduate students.

SEPTEMBER 24 **GROUP ACTIONS IN NUMBER THEORY;** Tyler J. Evans, Professor of Mathematics, Humboldt State University. Students having had a semester course in abstract algebra are exposed to the elegant way in which finite group theory leads to proofs of familiar facts in number theory. In this talk, we will describe two such proofs using the action of a group on a set. The talk will be self contained, and in particular no knowledge of group theory is necessary.

OCTOBER 1 **A STATISTICAL ANALYSIS OF THE 2000 FLORIDA ELECTION**; Brian Jersky, Professor of Mathematics, Sonoma State University. The controversy over the 2000 Florida election will never be resolved, but statistical analysis can help us examine the evidence and make up our minds about the result. In this talk, we will look at the results of the Presidential election in Florida, using statistical models to clarify the complex issues that arose. The topic of the talk is accessible to all, though some technical details will not be. ***Pizza after Colloquium***.

OCTOBER 8 **WHY VS HOW**; Paul Zeitz, Professor of Mathematics, University of San Francisco. Many proofs are logically sound, in that each step follows from the previous one, yet the proof as a whole sheds very little light on whatever was proven. We call such proofs Hows, in contrast to Whys, which are proofs that dramatically get to the heart of the matter. This talk will examine some important Whys that are less well-known than they should be, and also look at some Hows that are begging for a Why.

OCTOBER 15 **THE RIEMANN HYPOTHESIS (or WHO WANTS TO BE A MILLIONAIRE?);** Eddy Roubal, Student in Mathematics, Sonoma State University. An overview of the Riemann Hypothesis (student accessible). We will explore the significance of the hypothesis — how it ties in to the distribution of primes and the prime number theorem — and the 143-year history of attempts to solve it.

OCTOBER 22 **NEURO-FUZZY SYSTEMS DEFUZZIED**; Benjoe Juliano, Professor of Computer Science, California State University Chico. Neuro-fuzzy systems are used for modeling and control applications. The unification of neural networks and fuzzy models is facilitated by a common framework called adaptive networks. In this talk, fundamental concepts pertinent in the development of fuzzy models known as ANFIS (Adaptive-Network-based Fuzzy Inference System) will be discussed. Design methods for ANFIS in both modeling and control applications will also be introduced.

OCTOBER 29 **IT'S ONLY NATURAL;** Jeff Haag, Professor of Mathematics, Humboldt State University. The natural exponential and logarithmic functions are good friends of ours. They are entertaining and fun to hang around with, and always willing to help if we have problems. But like any friends, we probably don't know them as well as we think. When we gather for this talk, we'll hear lots of stories about these old friends. Some of the stories are alluded to in calculus or more advanced courses, but often the exciting parts are mired in the midst of more mundane material. We'll stick to the juicy parts. We'll come away more familiar with and more appreciative of our old friends, the natural logarithm and exponential functions.

NOVEMBER 5 **MATHEMATICS CAREER DAY;** SSU Math Alums. What can you do with a degree in Mathematics? For four answers, come to this colloquium (for more, see November 19). Alums who are in the midst of successful careers in high school teaching, computer architecture, university teaching/research, and financial management will talk about their career paths, and share ideas for interested students. There will be plenty of time for questions. ***Pizza after Colloquium.***

NOVEMBER 12 **ETHNOMATHEMATICS OF BASIC NUMBER SENSE;** Daniel Orey, Professor of Mathematics and Multicultural Education, California State University, Sacramento. Many Americans experience mathematics negatively; corresponding experiences by students in other countries are much less one-sided. We will discuss findings from an in-depth study of algorithms used by mathematics learners from several countries, including the complex interaction between the languages spoken and the algorithms used that combine to form individual abilities or disabilities in mathematics.

NOVEMBER 19 **DON'T WANT TO TEACH...SO WHAT NOW?** Lisa Moran, Renee Raabe, & Jodi Raggio, SSU Mathematics Alumnae (class of 2002) share their "real world" experiences in finding jobs outside of the classroom. With degrees in Statistics, Applied and Pure Mathematics, they are currently working in the auditing and actuarial fields. They are here to answer questions such as what is an Actuary? What is the starting salary? What exactly does an Auditor do? Which cities or locations will provide me with the most opportunities? How can I prepare for interviews? What can I expect in the first few years on the job? If you do not want to teach, yet still want to utilize your math degree, this is a great opportunity to get your questions answered and see what your options are. ***Pizza after Colloquium.***

DECEMBER 3 **PRACTICAL APPLICATION OF STATISTICS IN SEMICONDUCTOR MANUFACTURING;** Samuel Freeman, Ph.D., & Lisa Zavieh, Ph.D., Microwave Technology Center, Agilent Technologies. Statistics play a pivotal role in the design and manufacture of integrated circuits. Come and see how statistics are used in Agilent's manufacturing facility to provide process monitoring, quality control and assurance, and reliability determination.

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SPRING 2004

M*A*T*H COLLOQUIUM

SIXTIETH SERIES

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WEDNESDAYS at 4:00 P.M. — DARWIN HALL ROOM 108 — COFFEE at 3:45 P.M.

FEB. 4 **THE MINISTRY OF SILLY WALKS** ***Thomas Mattman, Mathematics and Statistics, CSU***

Chico The pattern your footprints leave when you walk along the beach is an example of a Frieze pattern. Using this idea, Conway has given the Frieze patterns names such as jump and spinning hop . If you ve ever tried performing spinning sidle for friends or students, you ll know that some of these walks are pretty silly. But are they REALLY silly? For this we turn to the masters of silliness, the British comedy troupe Monty Python s Flying Circus. We will analyse the Ministry of Silly Walks skit to understand which of Conway s walks are truly silly.

FEB. 11 **MATH 180 PROJECTS** ***Bill Barnier, Professor of Mathematics***

introduces students Jessica Balli, Cory Champagne, Frank Cortese, Lori Dempel, Kim Ginthum, Kristen Holub, Melissa Newcomb, and Sean Pearson from his Fall 2003 Math180 class who will present Mathematica projects examining drug dosage, biology, Pythagorean triples, water buckets, life expectancy, the lottery, blood alcohol level, and truth tables.

Pizza after talk in Darwin 127

FEB. 18 **A META-PROBLEM** ***Bill Barnier, Professor of Mathematics, SSU***

will present the meta-problem: How to find a really nice cubic function. After defining really nice he will derive an elliptical solution similar to a circular derivation of Pythagorean triples.

FEB. 25 **MATHEMATICS, NAVIGATION, AND THE GLOBAL POSITIONING SYSTEM** ***Bob Kleinhenz, Consultant***

The talk is centered on the mathematics that lie underneath the Global Positioning System (GPS).˚ The discussion will cover the basic measurements performed by a GPS receiver along with the model used to convert each measurement into a position solution.˚ Along this way, elementary notions of orbits and earth coordinate systems are discussed. ˚The dominant error sources in the GPS mathematical model are mentioned and the methods of overcoming these errors are presented.˚ The talk concludes with a brief discussion of the algebraic and spectral properties of PN codes.˚ PN codes are broadcast by GPS satellites and serve as identification for each satellite.

MARCH 3 **PROBLEMS ON THE BORDER BETWEEN GEOMETRY & NUMBER THEORY** ***Don Chakerian, University of California Davis***

We discuss some problems (mostly unsolved) concerning configurations of points that are at integer or rational distances from each other. For example, is there a point inside a unit square where distances to the vertices are all rational numbers?

MARCH 10 **DEMONSTRATIONS OF STABILITY: UNDERSTANDING BIFURCATIONS** ***Elizabeth Burroughs, Mathematics, Humboldt State***

If you sit in the front row, you might get wet! Using such household items as a tennis racquet, soap bubbles, a hairdryer, and a glass of water (not all at the same time), we will consider a variety of stability problems. A physical system is described as stable when a small perturbation to a steady state settles back to that steady state, and unstable otherwise. A physical system undergoes a bifurcation when there is an abrupt change in the nature of the solution as a given parameter changes. Because bifurcations are associated with an exchange of stability, we can locate bifurcations by tracking the stability of solution branches. We will consider the three simplest bifurcations: the turning point bifurcation, the Hopf bifurcation, and the pitchfork bifurcation, and study a simple equation that describes each one.

MARCH 17 **MAGIC SQUARES AND ORTHOGONAL ARRAYS** ***Donald Kreher, Mathematics, Michigan Technological University***

A *magic square* is an *n* by *n* array of integers with the property that the sum of the numbers in each row, each column, and the main diagonals is the same.˚ This sum is the *magic sum*.˚ Magic squares have had a long and colorful history.˚ They have attracted the attention of emperors, hobbyists, magicians, and even mathematicians.˚In this talk we give an introduction to recursive constructions in the context of magic squares and orthogonal arrays.

MARCH 24 **MATHEMATICAL ANALYSIS OF DNA SEQUENCES** ***Elaine McDonald, Mathematics & Holly Skolones, Biology, SSU***

will present their collaborative work using hidden Markov models applied to sequence alignment problems.˚˚ This talk will begin with a brief introduction to biology and probability models, and move to a description of the algorithms used to find probable alignments between different DNA sequences.˚ Holly will describe how she uses these powerful programs, routinely used by biologists, to identify bacterial species compositions of vernal pools.˚ This talk is intended for an interdisciplinary audience of mathematicians, computer scientists, and biologists, including students.

Pizza after talk in Darwin 127

MARCH 31 **Cesar Chavez Day**

APRIL 7 **Spring Break**

APRIL 14 **PENROSE TILINGS** ***Brigitte Lahme, Mathematics, Sonoma State University***

The familiar tilings of the plane (or your kitchen floor) are *periodic*:˚ They repeat the same pattern over and over again.˚ *Penrose tilings* are infinite tilings that *cannot* tile the plane in a periodic manner.˚ They are interesting to chemists because they model a recently-discovered structure called *quasicrystals*, and account for a previously-unexplainable 5-fold symmetry which these structures exhibit.˚ Given a set of Penrose tiles, there are uncountably many ways in which those tiles can fill the plane none of them periodic.˚ W e will explore properties of Penrose tilings, ways of generating them, and difficulties in working with such an unwieldy object!

APRIL 21 **USING MATH IN CELL BIOLOGY: HOW DO CALCIUM CHANNELS WORK?**
Bori Mazzag,Computational Biology, College of William & Mary

This talk will explore an example of how mathematics can be useful to molecular biologists.˚ We will build a simple probabilistic model of a channel opening, releasing calcium and closing, and discuss how we can simulate such a model numerically.˚ We will investigate how specific biological assumptions about the model translate into mathematical statements, and we will examine the prediction of the modified model.˚ At the end of the talk, we will sneak a peak at related biological questions that can be answered using the introduced methods. The talk will assume no previous biology, and the mathematics employed will be accessible to a general audience.

APRIL 28 ***MATH FESTIVAL DAY˚*** **SEARCHING FOR THE SHORTEST NETWORK** ***Ronald Graham, Mathematics, UC San Diego***

There are many situations in which one would like to connect a collection of points in some space by a network having the minimum possible total length. Such problems have a long and distinguished history, and occur in such areas as the design and analysis of telecommunications networks, oil pipeline networks, and heating and air conditioning duct systems, algorithms for molecular phylogenetics, and the layout of circuits on VLSI chips, to name a few. In this talk, we survey what is known and what is not known about this problem, and how it has been impacted by current developments in theoretical computer science.

MAY 5 **UNCOVERING THE LATENCY IN LATENT VARIABLE MODELS** ***Karen Nylund, Education & Information Studies, UCLA***

Latent variable modeling is a statistical modeling framework that is widely used in the social sciences to study variables that are not directly observable. This student-friendly talk will explore latent variable models and will include: defining what a latent variable is (which˚include those one might know, but not consider to be a latent variable), their relationship to traditional regression models, and practical examples˚from˚education and psychology. These examples will demonstrate the flexibility and wide application of latent variable models. A basic understanding of regression is the only statistical background needed to follow this talk.

Pizza after talk in Darwin 127

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