

M*A*T*I

THE MATHEMATICS DEPARTMENT OF SONOMA STATE UNIVERSITY
PRESENTS A SERIES OF INFORMAL TALKS OPEN TO THE PUBLIC

**Darwin 108 Lobby
Coffee at 3:45 p.m.**

SEPTEMBER 7 THE NEW GE COURSE IN ETHNOMATHEMATICS AT SONOMA STATE
Dr. Rick Luttmann, Professor of Mathematics at Sonoma State University, will describe a new general education course. The mathematical achievements of other peoples will be explored and the differences and similarities between the mathematics of several cultures such as African, Native American, and Polynesian will be discussed.

SEPTEMBER 14 SURPRISING PROBLEMS FOR THOSE NOT EASILY SURPRISED
Dr. Martin Bonsangue, Associate Professor of Mathematics at Sonoma State University, will consider historical problems in mathematics that have surprising, but not trick, solutions. Applications of several of these ideas will also be presented including questionable procedures used to determine outcomes of competition, such as that used in the Olympic figure skating (Kerrigan v. Baiul) and professional baseball (batting champions).

SEPTEMBER 21 A 1990'S PERSPECTIVE ON THE ACTUARIAL PROFESSION
Mr. Sharwin Kersh, Ernst & Young in Los Angeles, will discuss areas of actuarial opportunities and how actuaries make themselves more marketable in the current economic environment. A brief case study will be presented to show how the assets and liabilities of an insurance company can be integrated to achieve reserve adequacy and act as a decision tool for management.

SEPTEMBER 28 IS "COMMERCIAL MATHEMATICS" MATHEMATICS?
Dr. James Ramaley, Vice President, Circulations Systems, Ziff-Davis Publishing Company, New York, will talk about mathematics in commerce. There are a handful of companies which are actively recruiting mathematicians and these are usually interested in computer-related jobs or in statistics. Does that mean that most of the mathematics taught as "pure" mathematics is thought to be useless in a commercial environment? This talk will focus on how both methods of mathematics can be brought to bear in the commercial arena.

OCTOBER 5 ALTERNATIVE ASSESSMENT MODELS IN MATHEMATICS METHOD COURSES
Dr. Dan Orey, Associate Professor of Mathematics at CSU-Sacramento, will talk about alternative assessments in mathematics and compensatory education courses. His final exam question is given the first day of class: "How are you going to use this stuff in your next field placement?" He has found that the difficulty in this open-ended question lies in the student's background of only giving the instructor/teacher what the teacher wants, not in the opportunity to express what he or she really knows, and set goals for what he or she does not know.

OCTOBER 12 IN NUMBER THEORY, SIMPLE QUESTIONS RARELY HAVE SIMPLE ANSWERS
Dr. Ed Schaefer, Department of Mathematics, Santa Clara University, will answer the following question: When is the product of two consecutive integers equal to the product of three consecutive integers? More interesting, perhaps, than the question itself is the method of solution, which will introduce the audience to the beautiful subject of elliptic curves.

OCTOBER 19 RAMSEY THEORY
Mr. Jim Pedgrift, Lecturer in Mathematics at Sonoma State University, will present some results from Ramsey Theory. This theory is a subdiscipline of combinatorics which studies the properties of structures, which when large enough, contain a prescribed substructure.

OCTOBER 26 "OLD NEW WAYS," OR THE "HARVARD CALCULUS" AT SAN JOSÉ STATE
Drs. Bem Cayco and Tatiana Shubin, Department of Mathematics, San José State University, will talk about reform in the teaching of calculus. Much has been said and written about the new ways of teaching calculus, but there is always room for more. The speakers will share their experience in introducing "Harvard calculus" style of teaching the subject at the San José State University.

NOVEMBER 2 WHAT IS ALGEBRAIC GEOMETRY?
Dr. Larry Green, Lecturer in Mathematics at Sonoma State University, will use geometry to classify algebraic equations. He will discuss smooth and non-smooth curves and how they fit into the geometry.

NOVEMBER 9 IMAGINE THAT!
Mr. John Martin, Mathematics Department, Santa Rosa Junior College, will discuss some useful (and some not so useful) applications of complex numbers.

NOVEMBER 16 MODELING: TRYING TO COVER ALL THE BASES
Mr. David Miller, mathematics and physics student at Sonoma State University, will discuss the broad range of subject knowledge which is needed to mathematize real systems, and how diversity in a task group increases its effectiveness by reducing overlap of expertise and increasing the total range of knowledge available to the team.

NOVEMBER 30 SMALL-SAMPLE CONFIDENCE INTERVALS FOR NON-NORMAL DISTRIBUTIONS
Dr. Brian Jersky, Assistant Professor of Mathematics at Sonoma State University, will talk about the development of confidence intervals for a specific non-Normal distribution, namely the Log-normal distribution. This is of great practical significance, because the Log-normal distribution is a very good approximating distribution for a wide range of observed data. He will illustrate this by applying the technique to finding confidence intervals for the gold content of a new mine.

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SONOMA STATE UNIVERSITY

COLLOQUIUM

"Mathematics is the process of turning coffee into theorems"

Darwin 108 Lobby
Coffee at 3:45 p.m.

Professor James Friel, California State University, Fullerton, believes that mathematics is too often viewed as an esoteric subject that only a few can understand. To counter that notion, he will give some easily understood examples that will demonstrate the beauty and power of mathematics to anyone.

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JANUARY 31	<p>LIE ALGEBRAS: A GENTLE INTRODUCTION Julie Glass, Mathematics, California State University, Hayward, will introduce some of the basic notions involved in finite-dimensional Lie algebra theory (named after nineteenth-century Norwegian mathematician Sophus Lie = “Lee”). A method of associating a matrix and a graph to each of a certain family of Lie algebras will be discussed. With this correspondence it is possible to classify all such Lie algebras -- no small feat! Finally, a slight change in the matrix results in an infinite-dimensional Lie algebra.</p>
FEBRUARY 7	<p>MARRIAGE, MOUNTAINS, AND GRAPHS David Moulton, Mathematics, University of California, Berkeley, will discuss two problems that at first glance have nothing to do with graph theory, but which can be solved using elementary properties of graphs. The first involves two jealous mountain climbers, and the other the pairing off of couples.</p>
FEBRUARY 14	<p>“APPLES OR ORANGES” AND OTHER SOCIAL CHOICE FUNCTIONS Richard Dean, Mathematics, Caltech (Emeritus), will provide a mathematical setting for what economists call Choice Functions. Beginning with examples (some suggested by the audience) illustrating simple set-theoretic definitions and axioms, the talk will proceed to semi-groups and lattices whose pictures display the surprisingly rich mathematical structure of these functions.</p>
FEBRUARY 21	<p>LINEAR OPERATORS: APPLICATIONS FROM CALCULUS AND DISCRETE MATHEMATICS Dean Gooch, Mathematics, Santa Rosa Junior College (and SSU alumnus), will present linear operators that naturally occur in calculus and discrete mathematics. Tricks will be demonstrated for finding certain "difficult" integrals quickly and formulas for the sums of the powers of integers will also be generated. Matrix representations of linear operators and their inverses will be utilized.</p>
FEBRUARY 28	<p>ANGLE TRISECTORS Underwood Dudley, Mathematics, DePauw University, will show how to trisect angles, how not to trisect angles, and how to deal with those people who think that they have done the impossible, that is, trisected the general angle with straightedge and compass alone.</p>
MARCH 6	<p>CALCULUS APPLICATIONS: GET REAL Ann Herbst, Mathematics, Santa Rosa Junior College, will explore how real some applications used in calculus courses can be. Do beer drinkers know less math than vegetable lovers? Should lifeguards know calculus?</p>
MARCH 13	<p>MATH RENAISSANCE: LESSONS FROM A SEVENTH GRADE CLASSROOM Barry Sullivan, Hall Middle School, Larkspur, and formally Cluster Leader in the Math Renaissance Program, will describe a seventh-grade lesson on measures of central tendency. He will illustrate how the 1992 California Math Framework looks in a middle-school setting, and give a brief overview of the Math Renaissance Program.</p>
MARCH 20	<p>COMPLEX ADAPTIVE SYSTEMS Rose St. John, Mathematics, Bucknell University (and not long since, SSU), will introduce a mathematical framework for modeling such complex systems as ecosystems, economies, and mammalian central nervous systems, which are comprised of many diverse agents and meta-agents, continually learning and developing strategies for adaptation. Advances in non-linear mathematics, computer science, complexity theory, and chaos theory suggest powerful mathematical tools and approaches for these complex adapting systems.</p>
MARCH 27	<p>SOME NUMBER THEORY BY CHANCE Paul Zeitz, Mathematics, University of San Francisco, will introduce the concept of conjecturing theorems in number theory by probabilistic considerations, and will address such questions as: If you pick two positive integers “randomly,” what is the probability that a “randomly” chosen number is perfect? Or abundant? We will learn how to think about such problems and how <u>not</u> to think about them; about the appropriate roles of rigor and intuition; and about computer experiments both insightful and “bone-headed.”</p>
APRIL 3	<p>CAPILLARY SURFACES WITH AND WITHOUT GRAVITY Robert Finn, Mathematics, Stanford University, will describe some work he has done on capillary phenomena. The appearance of a column of liquid in a capillary tube can change dramatically and even discontinuously, depending on the shape of the tube section and also on whether or not a gravity field is present. Some general theory and its application to particular examples will be discussed, and results from kitchen sink, NASA drop tower, and NASA space experiments designed to test the theory will be described.</p>
APRIL 17	<p>MOLASSES, MOTORCARS, AND PRECISION METROLOGY Allan B. Cruse, Mathematics and Computer Science, University of San Francisco, will describe some mathematical and computation questions that arise when one tries to determine quickly how nearly a mechanical object conforms to the shape of an ideal geometric solid.</p>
APRIL 24	<p>PROOFS WITHOUT WORDS: EXERCISES IN VISUAL THINKING Jim Pedgrift, Mathematics, Sonoma State University, will discuss the concept of “proof without words:” pictures or diagrams that help the observer see why a particular statement may be true, and also suggest how one might go about proving it true. Together we will investigate several visual clues designed to stimulate mathematical thought.</p>
MAY 1	<p>THEMES AND VARIATIONS: MELODY AND MUSIC IN MATHEMATICS Rick Marks, Mathematics and Education, Sonoma State University, will develop the theme that J.S. Bach’s “The Art of the Fugue” is a metaphor for the structure of mathematics. The patterns of theme and variation in numerous areas of mathematics echo similar patterns in Bach’s music and, in both cases, recognizing the connections leads to greater appreciation. The mathematics in this talk are accessible to all SSU students.</p>



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THERE WILL BE NO SPEAKER ON APRIL 10 - SPRING RECESS
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- SEPTEMBER 4
- PICTURES IN MATHEMATICS
Ross L. Finney, author and lecturer, will show with entertaining examples using (mostly) precollege mathematics, how pictures can make invisible relationships visible, provide geometric metaphors for concepts that are hard to quantify, dramatize dynamic processes, and prove things without words.
- SEPTEMBER 11
- FINDING YOUR WAY AROUND A CONVEX HULL
Roger House, Mathematics MA candidate, San Francisco State University, and alumnus, Sonoma State University, will introduce some basic elements of computational geometry: Can every polygon be partitioned into triangles? How many "ears" does a polygon have? What is the convex hull of a set of points in the plane? How do you find the convex hull of a set of points?
- SEPTEMBER 18
- STUDENT PROJECTS IN CALCULUS
Bill Barnier, Mathematics, Sonoma State University, will describe some calculus projects he constructed while on Sabbatical, such as the Bike Race, Light Source, Decelerate, and Fence Cost. The talk will emphasize graphs and should be widely accessible.
- SEPTEMBER 25
- MIXING CIRCLES
Kathy Hann, Mathematics, CSU Hayward, will discuss the isoperimetric inequality: Of all curves of a fixed length, the circle encloses the largest area. We will examine an elegant proof of this theorem due to Santalo, which uses properties of mixed areas. During this investigation, we will get a glimpse of interesting areas and volumes and their uses.
- OCTOBER 2
- THE SQUARE ROOT OF "NOT": LOGIC GATES AND QUANTUM COMPUTING
Ken Yanosko, Mathematics, Humboldt State University, will describe the design of computing circuits using the classical Boolean operations "and," "or," and "not." He will then discuss recent speculations about the design of circuits based on the quantum nature of electrons. Would a "quantum computer" be able to solve classically intractable problems? Mathematical algorithms that are currently being developed suggest that the answer may be "yes."
- OCTOBER 9
- RIEMANN ZETA FUNCTION, RIEMANN THETA FUNCTION, AND MODULI THEORY OF RIEMANN SURFACES
Motohico Mulase, Mathematics, UC Davis, will review some basic facts of the Riemann zeta and theta functions, in particular, the deep relation between the two functions. Then Riemann's idea of the moduli spaces of Riemann surfaces will be introduced. The goal of the talk is to explain the unexpected relation between the two functions that has been discovered through recent research on the moduli spaces from the point of view of quantum field theory.
- OCTOBER 16
- FIELDS OF CONSTRUCTIBLE NUMBERS
Gordon Latta, Mathematics, Naval Postgraduate School, will explore how we characterize numbers constructible via straight edge and compass and apply same to the construction of regular polygons with p (= prime) sides. Gauss' construction of the 17-sided polygon will be discussed.
- OCTOBER 23
- WHICH POLYHEDRON IS BEST?
Jane Sangwine-Yager, Mathematical Sciences, St. Mary's College, will investigate the isoperimetric question for classes of polyhedra. It is well known that among all k-sided polygons with fixed perimeter, the regular one encloses the largest area. The answers to very few of the equivalent questions in 3-space are known.
- OCTOBER 30
- BUBBLES AND DOUBLE BUBBLES
Joel Hass, Mathematics, UC Davis, will discuss the historical and current understanding of the mathematical properties of soap bubbles. There will be a quiz (with prizes) testing the bubble knowledge of the audience.
- NOVEMBER 6
- GOODBYE DESCARTES?
Keith Devlin, Dean of Science, Saint Mary's College, will survey attempts to develop a mathematics of thought and language, which began with Aristotle and Zeno in ancient Greece and progressed through the work of Leibniz and then Boole to the mathematical logic and linguistics of the twentieth century. What will the twenty-first century bring by way of new development in this area?
- NOVEMBER 13
- WOMEN IN MATHEMATICS AT CAMBRIDGE
Shawnee McMurran and Jim Tattersall, Mathematics, Providence College, will discuss the lives and accomplishments of three women who contributed to *The Educational Times* of Cambridge University in the late 19th century: Hertha Ayrton (first woman nominated to the Royal Society of London), Charlotte Scott (first woman to receive top honors on the Tripos exam), and Philippa Fawcett (who scored above the Senior Wrangler on the 1890 Tripos). Selected problems from *The Educational Times* and the 1880 and 1890 Tripos exams will be investigated.
- NOVEMBER 20
- CRYPTOLOGY: FROM SPARTA TO THE BAY AREA
George Ledin, Computer Science, Sonoma State University, will give a brief overview of cryptography and cryptanalysis and will describe current developments in both secret key (DES and IDEA) and public key (RSA and DHM) cryptography.
- DECEMBER 4
- INDUCTION MODELS REVISITED
Leon Henkin, Mathematics, UC Berkeley, will examine how induction models were devised in 1960 to show that a widely used proof by mathematical induction is incorrect, even though it starts from hypotheses that are clearly true, and reaches a true and important conclusion. 29 years later, a problem "left to the enterprising reader" in the 1960 paper was called into question by one of them.
- DECEMBER 11
- PARTIAL DIFFERENTIAL EQUATIONS: A NEW METHOD
Howard Swann, Mathematics, San Jose State University, will review his current work on an extension of the finite element method for solving partial differential equations. An accessible survey with elegant pictures is promised.

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- FEBRUARY 5** **A GALLERY OF GEOMETRIC GEMS**
Jean Bee Chan, Mathematics, Sonoma State University, will take the audience on an illustrated tour of interesting results from the ancient arts of plane geometry.
- FEBRUARY 12** **TOPOLOGICAL AUTOMORPHISM GROUPS**
Sergei Ovchinnikov, Mathematics, San Francisco State University, will present the topological properties of permutation groups. He will show that various classical topologies are equivalent in this case and establish a relation between connectedness properties of chains and their automorphism groups. Various compactness criteria will also be introduced, followed by a discussion of applications to abstract system and measurement theory.
- FEBRUARY 19** **3-D COMPUTER GAMES – A NEW DIMENSION**
Scott Anderson, SSU alumnus and LEGO Project Producer, Mindscape, Novato, will discuss the issues involved in adding another dimension to computer games. 3-D pushes personal computers to the max, and brings a slew of new problems. In this talk, the speaker will present some of the creative solutions to the challenges of bringing a 3-D world to life on the screen.
- FEBRUARY 26** **STATISTICAL EVIDENCE FOR EXTRASENSORY PERCEPTION**
Jessica Utts, Statistics, University of California at Davis, was one of two experts the US Congress asked to evaluate 24 years of government-sponsored research on psychic phenomena. In her report, released by the government in November 1995, she concluded that the evidence for psychic functioning was strong enough that if it were in a "normal" area of science, the results would be considered conclusive. She will describe the experiments and results, as well as the broader question of how conclusions are reached in sciences that rely on statistics. No prior knowledge of statistics will be assumed.
- MARCH 5** **MAKING DECISIONS UNDER UNCERTAINTY: THE THUMB TACK PROBLEM**
Kevin Christian, Applied Decision Analysis, Menlo Park, will focus on quantitative techniques for making intelligent decisions in an uncertain environment. Several ideas from an area of operations research called decisions analysis will be introduced, including decision trees, subjective probability, and value of information. \$20 will be won by an audience member (yes, it could be you) who correctly guesses whether a flipped thumbtack will land point up or point down.
- MARCH 12** **PRINCIPAL COMPONENTS ANALYSIS AND THE MAJOR LEAGUE MVP**
James Robinson, a senior undergraduate in Mathematics, Sonoma State University, will use an advanced multivariate statistical technique known as principal components analysis to try to rank major league baseball's Most Valuable Player Award recipients from the first players to receive the award until the present.
- MARCH 19** **THE PYTHAGOREAN PROPOSITION AND THE ENDURING BEAUTY OF MATHEMATICS**
John Martin, Mathematics, Santa Rosa Junior College, will explore the history of the theorem and the beauty that it reveals. Charles Dodgson (aka Lewis Carroll) once said, "The Pythagorean Theorem is as dazzlingly beautiful now as it was the day when Pythagoras first discovered it."
- MARCH 26** **MATHEMATICAL WEB SITES**
Mary Anne Sobieraj and Jeff Silverman, Mathematics, Sonoma State University, will discuss some fascinating web sites which are wholly devoted to mathematical topics (such as statistics, the Pythagorean Theorem, the TI-85, etc.), and will explain how to access and use them.
- APRIL 2** **CLOSED FOR SPRING BREAK**
- APRIL 9** **NUMBER THEORY IN PRE-COLUMBIAN MESO-AMERICA**
Rick Luttmann, Mathematics, Sonoma State University, will present some material from his course in Ethnomathematics on the Mayan calendar. Due to the penchant of the Mayans for running parallel cycles of different orders, many challenging number-theoretic problems come up in reading their calendrical inscriptions.
- APRIL 16** **SIMPLE GROWTH RULES ON THE INTEGER GRID**
Janko Gravner, Mathematics, University of California at Davis, will examine a simple iterative rule that is a source of many interesting problems, some yet unsolved: Start with a set of occupied points on the integer grid. Add all points which have at least a specified number of already occupied points in their neighborhoods. Then iterate. Related growth rules, some with quite complex behavior, will also be introduced.
- APRIL 23** **THE STORY OF π**
MATH FESTIVAL Don Chakerian, Mathematics (Emeritus), University of California at Davis, will give a historical overview of the approximations of π , with an emphasis on the work of the Indian genius Srinivasa Ramanujan and his influence on some recent calculations of π to several billion decimal places.
- APRIL 30** **EULER'S RELATION IN N DIMENSIONS**
Kevin Callahan, Mathematics, CSU Hayward, will examine the combinatorial relationship between faces, edges, and vertices in a convex polytope. This is your chance to see an inductive proof of Euler's Relation in n dimensions. Find out why the alternating sum of faces, edges, and vertices is 2.
- MAY 7** **MY RELIGION OF MATHEMATICS**
Paul Halmos, Mathematics, Santa Clara University, will discuss questions such as the following and offer some possible views on their answers: Is mathematics true? Is mathematics useful? Is mathematics consistent? Is infinite regress bad? Is research in mathematics still possible? Are there any major unsolved problems in mathematics?



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SEPTEMBER 10 MYTHS OF MATHEMATICS

Morris W. Hirsch, Mathematics, U C Berkeley, will discuss the notion that Mathematicians, like members of any community, have certain beliefs about what they do, which they take for granted and rarely examine critically. Occasionally these myths run up against harsh reality. In this talk I will examine such myths, including the Myth of Truth (that every mathematical statement is true or false); the Myth of Proof (that there is a well-defined notion of correct proof); and the Myth of Computers (that a good approximate answer to any problem can be found by a computer calculation).

SEPTEMBER 17 WHO SOLVED THE PROBLEM, YOU OR YOUR COMPUTER?

Clement Falbo, Mathematics, SSU, will tell of the LOVE-HATE relationship between one mathematician and his "Symbolic Math Processing" software. We will have an open discussion on how this software changes the type of problems we should ask students to solve. What do we mean by a Problem? a Solution? Is Understanding still important? What, if anything, should we ask students to Memorize? Is Drill dead? Are Proofs passé?

SEPTEMBER 24 HILBERT'S THIRD PROBLEM

Dan Wheeler, Mathematics, San Francisco State and formerly Sonoma State, will discuss the following question: Given two tetrahedra of equal bases and altitudes, is it always possible to dissect one into a finite number of parts in such a way that these parts may be reassembled to form the other?

OCTOBER 1 STUDENT PROJECTS IN CALCULUS

Bill Barnier, Mathematics, and Doug Martin, Chemistry, SSU, will describe several student projects in calculus. The presentation will be graphic and should appeal to anyone with an interest in mathematics and its applications. Calculus background is not necessary.

OCTOBER 8 COMPLEX CURVATURE

Tristan Needham, Mathematics, USF, will discuss a new type of (complex) curvature which can be associated with conformal mappings of the plane. This concept provides an elegant method of recognizing an harmonic function just by looking at a picture of its level curves. The talk should be accessible to any undergraduate who has taken complex analysis.

OCTOBER 15 WEIGHTED VOTING, MEASURES OF POWER, AND EQUAL REPRESENTATION

Jim Pedgrift, Mathematics, SSU, will consider mathematical consequences of a series of one-person-one-vote decisions handed down in the 1960's by the U.S. Supreme Court, setting forth a new standard of constitutional fairness for systems of elected representation at the state and local level. Some very interesting mathematical problems were created in the attempt to quantify and measure power and representation.

OCTOBER 22 CRYPTOGRAPHY: THE ART AND SCIENCE OF CODE-BREAKING

Karen Fraser, Learning Skills Services, SSU, will explain how the power of secret codes has saved lives, won wars, and made fortunes! She will help you learn to encode and decode secret messages. A mathematical and historical exploration of several types of ciphers, this lecture will demonstrate how to crack monoalphabetic, polyalphabetic, and product ciphers, as well as many others.

OCTOBER 29 POLYHEDRAL TRIGONOMETRY

Jeff Hrdlicka, MatheMagician, of Starmast Multimedia, will take trigonometry, a useful two-dimensional tool, and use it to examine two-dimensional sections of three-dimensional polyhedra. The relationships among the various sections reveal a variety of elegant formulae, including the miter-bevel settings for cutting polygonal picture frames, methods for creating tunnels through polyhedra, rectangular and spherical coordinates for the Platonic and Archimedean polyhedra, and an n-spherical distance formula.

NOVEMBER 5 INVENTING 'WHEN': MATHEMATIZING TIME

Nelson (Buzz) Kellogg, Hutchins, SSU, will discuss some of the fascinating philosophical problems that arise in quantifying time.

NOVEMBER 12 CHAOS FROM SIMPLE TRIG

Rick Luttmann, Mathematics, SSU, will examine a simple trigonometric function, and show how iteration can lead to chaos. The example illustrates all of the characteristic phenomena of chaos theory.

NOVEMBER 19 A SIMPLIFIED AXIOM SYSTEM FOR CHAOS

Eldon Vought, Mathematics, Chico State, will discuss a recent discovery in Chaos Theory by five mathematicians in Australia. A common definition of chaos in a dynamical system is that the system possesses (1) transitivity, (2) a dense set of periodic points, and (3) sensitive dependence on initial conditions. Now it appears that (3) is a consequence of (1) and (2). The talk examines the proof and some of the motivations that led to this discovery. The topic involves elementary topology with a nice application of the triangle inequality.

NOVEMBER 26 THANKSGIVING RECESS

DECEMBER 3 THE INDOOR SPORT OF PRIME NUMBER HUNTING

Landon Curt Noll, cryptographer, Information Security Infrastructure Team, Silicon Graphics Inc, Mountain View, and two-time holder of the world's record for largest known prime, will discuss the search for larger and larger primes. Today, hunters seek prime numbers that approach a million digits in size. We will survey the mathematics as well as the tricks of the trade used by those who seek new large primes.

DECEMBER 10 BAYESIAN vs CLASSICAL STATISTICS: AN OVERVIEW

Brian Jersky, Mathematics, SSU, will present the underlying assumptions of Classical Statistical theory and compare them to those underlying Bayesian Statistics. Both reveal interesting and enlightening insights into uncertainty, and so there is no real disagreement between the two schools of thought. Applications to confidence intervals and hypothesis testing will be shown. This talk is appropriate for most students.



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FEBRUARY 11 ARCHIMEDES: WHAT DID HE DO BESIDES CRY ‘EUREKA?’

Sherman Stein, Emeritus Professor of Mathematics, University of California, Davis, will discuss some of Archimedes’ exploits, specifically his treatment of the lever and his analysis of the equilibrium of floating bodies. If we tilt an object that is partially submerged, will it fall over or will it come back to its initial position? Archimedes looked into this question for a special class of objects and, in so doing, became the first naval architect.

FEBRUARY 18 HISTORY OF THE CENTRAL LIMIT THEOREM

Amy Rocha, Professor of Mathematics and Computer Science, San Jose State University, will trace the discovery of one of the most important and astonishing theorems in statistics, beginning with the problem of inference that originally motivated Bernoulli, through De Moivre’s discovery of the normal curve, and culminating in Laplace’s unfolding of the theorem in its full generality.

FEBRUARY 25 WAVELETS AND APPLICATIONS

Shidong Li, Professor of Mathematics, San Francisco State University, will present the fundamentals of wavelet theory and algorithms. Applications in acoustic and seismic signal processing, signal/image compression, and data transmission will be discussed.

MARCH 4 PITFALLS OF CURVE FITTING

Erik Burd, Lead Windows Tester, Wolfram Research, Inc., and SSU Math alum ‘94, will present common problems encountered in curve fitting based on his experience in the scientific software industry. Some sample problems from actual customers will be discussed.

MARCH 11 THE ANALYTIC FOUNDATIONS OF EUCLIDEAN GEOMETRY

Steve Wilson, Professor of Mathematics, SSU, will examine the question: Does a Cartesian plane really satisfy the axioms of Euclidean Geometry?

MARCH 18 RANDOM PARTITIONS WITH APPLICATIONS TO POPULATION GENETICS

Jim Young, Professor of Mathematics, SSU, will present a way to construct a family of random partitions that may serve as sampling distributions for population genetics models that incorporate selective forces, providing an alternative to the often controversial hypothesis of selective neutrality in population genetics theory.

MARCH 25 COMPUTING WITH HARMONIC FUNCTIONS

Sheldon Axler, Professor and Chair of Mathematics, San Francisco State University, will describe the mathematics behind algorithms for computing solutions to many problems involving harmonic functions. One such problem: Given a polynomial in n variables, find the harmonic function on Euclidean n -space that agrees with the given polynomial on the unit sphere.

APRIL 1 A MATHEMATICAL MODEL OF YEAST

Nereo Loresto, Graduating Senior, Mathematics, SSU, will present a mathematical model of yeast in a closed system using a combination of three ordinary differential equations. He will qualitatively capture the characteristics of the rate of change in the quantities of sugar, alcohol, and yeast.

APRIL 8 IS MATH ALL FUN AND GAMES?

Julie Glass, Professor of Mathematics, California State University, Hayward, will discuss examples of elementary games and related mathematics. The topics will be taken from presentations in a Senior Seminar course in Spring, 1997.

APRIL 15 SPRING BREAK

APRIL 22 RELATING GEOMETRY AND ALGEBRA IN NEW WAYS
MATH FESTIVAL

Peter Hilton, Distinguished Professor Emeritus of Mathematics, State University of New York, Binghamton, and Distinguished Professor of Mathematics, University of Central Florida, and Jean Pedersen, Professor of Mathematics, Santa Clara University, will show how the geometry of the equilateral Pascal triangle suggests algebraic relations between binomial coefficients. They extend both the geometry and algebra into three dimensions.

APRIL 29 CLASSIFYING 3-DIMENSIONAL SPACES

Abigail Thompson, Professor of Mathematics, University of California, Davis, will discuss recent progress on understanding 3-dimensional spaces starting with the idea of gluing together a collection of tetrahedra along their edges.

MAY 6 TOTALLY POSITIVE MATRICES

Jane Day, Professor of Mathematics and Computer Science, San Jose State University, will discuss some tests for deciding whether or not a matrix is totally positive. Such matrices arise in many applications.



SONOMA STATE UNIVERSITY

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No public parking is permitted in reserved spaces at any time.

FALL 1998

FORTY-NINTH SERIES

M*A*T*H COLLOQUIUM

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

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

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

SEPTEMBER 9 SUPPLY CONTRACTS IN A CAPACITY-CONSTRAINED SUPPLIER OLIGOPOLY

Elizabeth C. Junqueira, graduate of SSU Mathematics Department and Doctoral Candidate, University of California, Berkeley, will explore a model of the supplier's problem of how much to produce and how to allocate inventory among multiple buyers to achieve various objectives.

SEPTEMBER 16 BACK TO THE FUTURE

Clement E. Falbo, Professor of Mathematics, Sonoma State University, will show how a particle acts when its velocity at a given time is proportional to its position in reversed time. Differential equations with time warps will be discussed.

SEPTEMBER 23 BIOLOGICAL FILTERS

Angela Cheer, Professor of Mathematics, University of California, Davis, will discuss the study of animal gills and hairy arrays through simulation of fluid flow around these structures. This recent work uses state-of-the-art computational fluid dynamics technology.

SEPTEMBER 30 WOMEN ARCHITECTS, MATHEMATICS, AND THE RATIONALIZED HOUSEHOLD IN GERMANY, 1900-1930

Despina M. Stratigakos, Doctoral Candidate, Department of History and Art, Bryn Mawr College, will discuss the state of mathematics education in Germany in the early 1900s and how mathematics was applied to domestic architecture and housework in the form of ergography, the science of fatigue.

OCTOBER 7 GENERALIZED DEBRUIJN SEQUENCES: WHEN BINARY CIRCLES JUST AREN'T ENOUGH ANYMORE

Tony Barcellos, Professor of Mathematics, American River College, will discuss directed graphs and problems encountered in counting them. DeBruijn sequences are a special combinatorial construct that appear in several places in mathematics.

OCTOBER 14 BEES DO IT

Rad Dimitric, Visiting Scholar, University of California, Berkeley, will discuss two- and three-dimensional mathematical aspects of bee cell construction.

OCTOBER 21 GENERAL EQUILIBRIUM IN AN EDGEWORTH BOX

Jane B. Millar, Professor of Mathematics, Santa Rosa Junior College, will discuss how to find bliss in an Edgeworth box with a little help from economic theory and calculus when endowed with less than optimal amounts of bread and wine.

OCTOBER 28 A SINGULAR VIEW OF THE GAMMA FUNCTION

David Sklar, Senior Optical Designer, SOLA Optical USA, former Mathematics faculty of SSU, will discuss some well-known properties of the Gamma Function and a weak version of the Weierstrass Factorization Theorem. They will be used to illuminate some beautiful formulas connecting gamma functions, exponentials, and trigonometric functions.

**NOVEMBER 4 A SOCIETY OF QUESTIONERS AND QUESTIONEES:
ON A FORGOTTEN ARGUMENT AGAINST SAMPLING HUMAN POPULATIONS**

Zeno G. Swijtink, Professor of Philosophy, Sonoma State University, will raise the question: Is statistics a handmaiden of technocrats or a tool for self-governance by citizens? He will also address problems with the year 2000 United States census.

NOVEMBER 11 PERIODIC POINTS

Edward C. Keppelmann, Professor of Mathematics, University of Nevada, Reno, will introduce the concept of periodic points of a function from a set to itself. Some interesting estimates on the number of periodic points will be explored.

NOVEMBER 18 LEAST STATISTICALLY-DEPENDENT BASIS AND ITS APPLICATION TO IMAGE MODELING

Naoki Saito, Associate Professor of Mathematics, University of California, Davis, will describe how to compute a close-to-the-best coordinate system for rapid image compression and modeling. An application to modeling of human faces will be explored.

NOVEMBER 25 HOLIDAY

DECEMBER 2 EIGENVALUES, EIGENVECTORS, AND GRAPH PARTITIONING

Peter Pacheco, Associate Professor of Mathematics, University of San Francisco, will show how some heuristic algorithms help solve the NP-hard problem of graph partitioning. One of the best heuristic algorithms involves an eigenvalue and an eigenvector of a matrix.



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M * A * T * H

COLLOQUIUM

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FEBRUARY 3 0-1 MATRICES: THEY AREN'T JUST FOR BREAKFAST ANYMORE

Gerhard Paseman, Prado Internet Access, Inc., Hayward, will take us on a personal journey exploring a problem involving determinants. Side tracks into combinatorics, algorithms, and applications are involved. Some results and current status in combinatorial matrix theory will be given. Prerequisite: Must know what the determinant of a matrix is. Warning: Some personal reminiscences involved!

FEBRUARY 10 TRIANGLES, BRAIDS AND THE N-BODY PROBLEM

Richard Montgomery, University of California, Santa Cruz (and SSU alumnus), will discuss the Three-Body Problem, which is an unsolved, and perhaps unsolvable, problem left over from Newton's day. He will explain how the shape space for planar triangles forms a two-sphere, and why this sphere and its geometry are relevant to the three-body problem. He will finish by describing the generalization of this shape space to N-gons and the N-body problem and how the braid group (important in knot theory) enters into the picture.

FEBRUARY 17 FUN WITH BUBBLES!

Helen Moore, Mathematics, Bowdoin College (on sabbatical at Stanford University), will give an elementary introduction to the beautiful mathematical models of soap films, including a hands-on demonstration. It would be useful to know some calculus. The goal is to teach you a bit of the mathematics involved in the field of minimal surfaces. By the end of the talk you will be able to understand some current research in this field.

FEBRUARY 24 CENSUS OR SAMPLING: THE SURPRISING TRUTH

Brian Jersky, Mathematics, SSU, will show why sampling is a better way to find out how many people there are in the United States than trying to count them all. This is without a doubt scientifically true. However, there are political reasons why some people would prefer a census rather than a sample, and he will briefly mention these too. It will be up to the audience to decide which method they prefer.

MARCH 3 THE PASCH PROPERTY AND PARAMETRIC EQUATIONS

Steve Wilson, Mathematics, SSU, will show how the Pasch Property can be used to tack down a tricky little detail in the definition of arc length, and how this problem can lead to the theories of parametric equations and convex bodies.

MARCH 10 HYPATIA: HERETIC? MARTYR? MATHEMATICIAN?

Edith Mendez, Mathematics, SSU, in conjunction with Women's History Month, will discuss the historical figure of Hypatia, who is known more for her gruesome death in 415 C.E. than her life. As we sift through the legends surrounding her, do we find a heretic, a martyr or a mathematician?

MARCH 17 ENUMERACY: THE ART OF LITERATE COUNTING

Tom Roby, Mathematics, Cal State Hayward, will explain that there's more than one way to count a set. Doing so often leads to interesting proofs of equations that come up all over elementary and advanced mathematics. Often such proofs can be expressed as a story. For example, to pick a subcommittee of 3 from a ten-member committee is the same as picking 7 members NOT to be on the committee, so "10 choose 3" is the same as "10 choose 7", or generally "n choose k" is the same as "n choose (n-k)". He will consider a variety of identities with particularly beautiful enumerative proofs.

MARCH 24 WHAT IS THE LEBESGUE INTEGRAL AND WHY SHOULD YOU CARE?

Clement Falbo, Mathematics, SSU, before he rides off into the sunset of retirement, will give an introduction to countable and uncountable sets, sets of measure zero and the measure of a set on the x-axis; how Lebesgue made his own case for the superiority of his integral over the Riemann Integral; and what kind of functions are Lebesgue Integrable, but not Riemann integrable. He will also discuss applications.

MARCH 31 “THIS ISN’T HOW I LEARNED MATH IN HIGH SCHOOL:” THE INTERACTIVE MATHEMATICS PROGRAM

Rick Marks, Mathematics, SSU, will present a sample unit and a four-year overview of the IMP, an innovative, problem-based high school curriculum designed to help all students learn powerful mathematics.

APRIL 7 SPRING RECESS

APRIL 14 SOAP FILMS IN NATURE AND IN MATHEMATICS

Roseanna Pearlstein, University of California, Santa Cruz, will discuss some very beautiful familiar objects which arise in nature and are likely to be familiar to most people: soap films. She will try, with the help of colorful pictures, to give a feeling for why soap films are especially fascinating to mathematicians. Without going into technicalities, she will try to motivate two major mathematical questions related to the study of soap films: existence and uniqueness.

APRIL 21 HOW TO WALK UP STAIRS (Tentative)

Jeff Sachs, Wagner Consultants, Santa Clara [Abstract to follow]

**APRIL 28 GEOMETRY FROM THE CUBE’S POINT OF VIEW
MATH FESTIVAL**

Don Chakerian, Mathematics, University of California, Davis (Retired), will explain how viewing a solid geometry problem in the framework provided by an appropriate auxiliary cube often results in surprising simplifications. He will give some examples involving triangles, tetrahedra, and the packing-spheres problem.

MAY 5 AN ADVENTURE IN MODELING

Jeffrey Housman and Rebecca Schram, current Math majors at SSU, will discuss a project they have been working on: a look at elementary flow models in heat, electricity and water. Their model will use finite differences, finite element, and analytical methods for solution.