

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 p.m.

Darwin Hall, Room 108

**Coffee at 3:30 p.m.
Darwin 108 Lobby**

- SEPTEMBER 13 **OH WHAT A TANGLED MESS: A GEOMETRIC APPROACH TO LINKING**
Dr. Fred Hickling of Santa Clara University will discuss wire and rope puzzles and how to tell whether they can be untangled.
- SEPTEMBER 20 **SO YOU THINK YOU KNOW TRIG?**
Dr. Rick Luttmann of Sonoma State University will examine a simple trigonometric function and show how iteration can lead to chaos.
- SEPTEMBER 27 **INTERESTING USES OF COMPUTERS IN TEACHING MATHEMATICS**
Dr. Diane Resek of San Francisco State University will discuss how computers can help students learn difficult mathematical concepts.
- OCTOBER 4 **POLITICS AND PI**
Professor James Pedgrift of Sonoma State University will examine some mathematical modeling for political analysis.
- OCTOBER 11 **MATH FOR FUN AND PROFIT OR FAST CONVOLUTION**
Dr. Donald R. Short of San Diego State University will present an overview of digital signal processing and develop a fast convolution algorithm for multiplying very large numbers.
- OCTOBER 18 **WHY ARE SOME DISCRETE OPTIMIZATION PROBLEMS EASY? (AND HOW CAN WE TELL WHICH ONES?)**
Dr. John Blattner of California State University at Northridge will describe two models for easy problems and give some indication of what to do in the hard cases.
- OCTOBER 25 **CC – THE CALCULUS CALCULATOR**
Dr. David Meredith of San Francisco State University will demonstrate a computer program that could change the way mathematics is taught. Copies of this shareware program will be traded for blank disks (5-1/4") after the talk.
- NOVEMBER 1 **SOME PERFECTLY GHASTLY RANDOM NUMBER GENERATORS**
Dr. Mark Durst of Lawrence Livermore National Laboratory will review some dreadful algorithms used over the years for generating pseudo-random numbers and discuss a theory that enables us to avoid such disasters.
- NOVEMBER 8 **COUNTING DIVISORS**
Professor Warren Ruud of Santa Rosa Junior College will consider the problem of approximating the average number of divisors of a set of positive integers.
- NOVEMBER 15 **CLASS GROUPS**
Dr. Hendrik Lenstra of the University of California at Berkeley will discuss class groups (introduced by Gauss in 1801) and their uses.
- NOVEMBER 29 **THE MATHEMATICS OF ENCODING DATA ONTO STORAGE DEVICES**
Dr. Brian Marcus of the IBM Almaden Research Center will describe the data storage mechanisms and the mathematics of encoding data reliably.
- DECEMBER 6 **HOW NOT TO LIE WITH STATISTICS**
Mr. Raymond M. Wong of Pacific Gas & Electric Company will discuss the use and abuse of statistics in the utility industry.



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- FEBRUARY 14** **WHAT CAN YOU DO WITH A RUSTY COMPASS?**
Mr. John Martin, Mathematics Department, Santa Rosa Junior College, will show that compass and straightedge construction problems can offer some real challenges. He suggests you will be surprised at what you can do if you bend the rules.
- FEBRUARY 21** **IS THERE CHAOS IN ECONOMICS?**
Ms. Jane Millar, Mathematics Department, Santa Rosa Junior College, will discuss dynamical systems in economics. The level of material should be suitable for both non-economist mathematicians and non-mathematician economists.
- FEBRUARY 28** **NUMBER THEORY, FORMER QUEEN OF MATHEMATICS, CURRENT BRIDE OF COMPUTER SCIENCE**
Number Theory is the study of numbers and their properties. It is the oldest branch of mathematics. It is also the newest of the mathematical fields that has found rich applications in computer science. George Ledin Jr, Professor of Computer Science at Sonoma State University, will describe how Number Theory is exploited by computer scientists in various areas, such as cryptography and algorithm analysis.
- MARCH 7** **DUALITY PRINCIPLE OF YIN AND YANG -- AND ITS APPLICATIONS**
Dr. Sin-Min Lee, Mathematics and Computer Science Department, San Jose State University, will explain the duality principle of the Yin and Yang and its applications in art, industry, and sciences. Twenty-five hundred years ago, a Chinese philosopher, Lao Tzu, proclaimed, "The ten thousand things carry Yin and embrace Yang. They achieve harmony by combining these forces." Dr. Lee will tell how he uses the principle and how it led him and his students to some discoveries in mathematics.
- MARCH 14** **THE DOOR-CLOSING PROBLEM, AND NUMBER THEORETIC FUNCTIONS**
Dr. Herbert S. Wilf, Mathematics Department, University of Pennsylvania, will discuss a problem of opening and closing doors, and its relationship to functions of classical number theory.
- MARCH 21** **FROM MAGIC SQUARES TO RADIO ASTRONOMY**
Dr. Sharon Cabaniss, Mathematics and Computer Science Department, San Jose State University, will discuss graph labelings, their fascination as well as their interesting applications. Several tempting conjectures will be presented for magic graphs and graceful trees.
- MARCH 28** **MARIA GAETANA AGNESI AND THE FAMOUS WITCH**
Dr. Richard Montgomery, Mathematics Department, Southern Oregon State College, Ashland, will talk about a socially conscious 18th century professor of mathematics and the curve known as the "witch of Agnesi."
- APRIL 4** **THE FLIGHT OF A BASEBALL AND THE MATHEMATICS OF ROLLER COASTERS**
Dr. Terry Kiser, Mathematics Department, Chico State University, will investigate projectile motion and the Brachistochrone problem using Mathematica as examples of how the computer can be used to improve the teaching and learning of applied problems.
- APRIL 11** **WHERE WOULD YOU LIKE THE CENTERS OF YOUR CIRCLE TO BE?**
Dr. Hugh Edgar, Mathematics and Computer Science Department, San Jose State University, will present a leisurely introduction to the bizarre world of Ultrametric Geometry. He will present some applications to number theory, specifically to Diophantine equations.
- APRIL 25** **NEW DIRECTIONS IN MATHEMATICS EDUCATION**
Dr. Benedict Freedman, Mathematics Department, Occidental College, will discuss learning the language of mathematics the way natural languages are best learned, through structure, comprehension, and use.
- Mathematics Awareness Week - April 22 - 28, 1990**
- MAY 2** **MATHEMATICAL NOTATION**
Mr. Sumner Stone, Director of Typography, Adobe Systems in Mountain View, will discuss the history and uses of mathematical notation from ancient times up through the computer era.
- MAY 9** **THE BRACHISTOCHRONE PROBLEM AND THE CALCULUS OF VARIATIONS**
Mr. Craig Hildebrand, graduate student, Mathematics Department, University of California, Berkeley, will discuss the Brachistochrone problem and applications of the Calculus of Variations in Physics, Differential Equations, and Numerical Analysis.



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- SEPTEMBER 12** **LENGTH, AREA, VOLUME**
Professor Paul R. Halmos, Mathematics Department, Santa Clara University, asks if two figures in the plane have the same area, can you always cut them up into (a finite number of) congruent triangles? And whatever you think the answer is, does it remain the same when you go from the plane to 3-dimensional space? The discussion focuses on our intuitive concepts of length, area, and volume, and comes to startling conclusions based on strange properties of infinity.
- SEPTEMBER 19** **NATIVE AMERICAN MATHEMATICS**
Professor Rick Luttmann, Mathematics Department, Sonoma State University, will present a survey of some of the arithmetical and geometrical achievements of various New World cultures.
- SEPTEMBER 26** **THE NEW PLEASURES AND PITFALLS OF GRAPHING**
Professor Wade Ellis, Jr., Mathematics Department, West Valley Community College, Saratoga, will use *Mathematica* in discussing some of the pleasures and problems of the mathematical use of computer graphics software. The graphing capability of affordable and easily accessible graphing hardware and software will greatly increase our ability to investigate functions.
- OCTOBER 3** **PROJECTING THE FUTURE: DO ACTUARIES REALLY USE A CRYSTAL BALL?**
Mr. John Bertko, a Fellow of the Society of Actuaries, Coopers & Lybrand, San Francisco, and an expert on retiree health care costs, will discuss the methods that actuaries use to project future health care costs for you and your parents.
- OCTOBER 10** **NUMBERED COMPLETE GRAPHS, UNUSUAL RULERS, AND ASSORTED APPLICATIONS**
Professor Gary Bloom, Department of Computer Science, CCNY, and City University of New York Graduate Center, will show how a variety of physical processes can be modeled by assigning integer values to the points and edges of complete graphs. He will describe three such numberings, their relationship to "ruler models," and their applications in a variety of areas.
- OCTOBER 17** **PRESENTATION : REPRESENTATION :: PREACHING : TEACHING**
Professor Rick Marks, Mathematics and Education Departments, Sonoma State University, will give examples of pedagogical transformations of mathematical ideas and discuss the centrality of this process to mathematics teaching.
- OCTOBER 24** **EULER MEETS PASCAL**
Professor Jean Pedersen of Santa Clara University will show how to obtain interesting, and useful, relations involving the binomial coefficients using a certain auxiliary set of intergers.
- OCTOBER 31** **ELECTION METHODS: SOLUTIONS AND PROBLEMS**
Mr. James Pedgrift, Lecturer in Mathematics, Sonoma State University, will look at the strengths and weaknesses of several election methods and show how elections would be decided differently under different methods. He will also show how election methods can be given a mathematical description and discuss Arrow's Theorem.
- NOVEMBER 7** **PERFECT CONGRUENCES AND PERFECT SEMIGROUPS**
Professor Simon M. Goberstein, Mathematics and Statistics Department, Chico State University, will describe perfect congruences on semigroups. A semigroup is perfect if all its congruences are perfect. Groups are certainly perfect semigroups. Are there any other perfect semigroups? Professor Goberstein will answer this question and discuss the structure of general perfect semigroups.
- NOVEMBER 14** **HOW TO ARRANGE DATES WITH MATHEMATICS**
Professor Leon Henkin, Mathematics Department, University of California, Berkeley, will show how a mathematical analysis of stability leads to an algorithm that arranges for stable dates or college admissions, but not for dormitory roommates.
- NOVEMBER 28** **THE VIRTUE AND TRAGEDY OF BEING A NEOFIELD**
Professor Tatiana Shubin, Mathematics/Computer Science Department, San Jose State University, asks "What is a combinatorial design? What does it take to construct one? How much damage can one do to a finite field without destroying it altogether?" The talk will be an attempt to answer these questions which lead surprisingly deep into modern mathematics and have an amazingly wide variety of applications.
- DECEMBER 5** **ARCHIMEDES KNEW MATHEMATICS, ARCHIMEDES KNEW ASTRONOMY**
Professor Clem Falbo, Mathematics Department, Sonoma State University, will discuss the Sand Reckoner, the cattle problem and a few of the other remarkable mathematical problems posed or solved by Archimedes and his fellow travelers.

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- FEBRUARY 13 CAKE-CUTTING AND CONVEXITY**
Dr. T. P. Hill, Professor of Mathematics, Georgia Institute of Technology, will discuss both practical and theoretical results for several famous and several new "fair-division" problems, including ham-sandwich, cake-cutting and fair-border theorems. A number of open problems will be mentioned.
- FEBRUARY 20 ON SELF-ORGANIZATION PROBLEMS**
Professor Vladimir Naroditsky, Mathematics and Computer Science Department, San Jose State University, will give an introduction to the problems of self-organization. The spontaneous formation of well-organized structures out of germs or even out of chaos is one of the most fascinating phenomena and most challenging problems scientists are confronted with. When we try to explain or understand in some sense these extremely complex biological phenomena, it is a natural question whether processes of self-organization may be found in much simpler systems of the unanimated world.
- FEBRUARY 27 THE THEORY OF RELATIONS: THE MOTHER AND DAUGHTER OF MODERN LOGIC**
Professor Steven Givant, Mathematics Department, Mills College, Oakland, will present a short historical survey of the theory of binary relations, a beautiful mathematical theory that is really still in its infancy. The theory of binary relations, developed during the late 1800s by DeMorgan, Peirce, and Schröder, was a major factor in the development of modern logic. Yet, it was sadly neglected during this century until its resurrection by Alfred Tarski in the 1940s.
- MARCH 6 MEASURE THEORY AND MEASURE EXHAUSTION**
Dr. Alan Wessel, Mathematics Department, Santa Clara University, will present an introduction to measure theory including some tricks of the trade.
- MARCH 13 THE FAUSTMANN MODEL OF TIMBER HARVESTING**
Professor Dan Munton, Mathematics Department, Santa Rosa Junior College, will explore the Faustmann Model and some variations. Martin Faustmann, a forester, developed this mathematical model to determine the optimal age at which to harvest an even-age timber stand, where "optimal" is used in the economic sense.
- MARCH 20 FIVE GREAT MATHEMATICIANS**
Dr. Clem Falbo, Mathematics Department, Sonoma State University, will discuss the life, the times and some of the works of five of the world's great mathematicians.
- MARCH 27 GEOMETRIC FUN WITH DETERMINOIDS**
Professor George Ledin Jr, Computer Science Department, Sonoma State University, asks the question: If matrices can be rectangular, why not determinants?
- APRIL 10 REMINISCENCES ABOUT ARCHIMEDES, GALILEO, AND POLYA**
Dr. Les Lange, Emeritus Dean of Science and Professor of Mathematics, San Jose State University, has, in effect, sat at the feet of these three great scientists for over 45 years. He will talk about some interesting problems and solutions in this potpourri of reminiscences associated with them.
- APRIL 17 HOW DID THEY SOLVE THE FOUR-COLOR PROBLEM?**
Dr. David Barnette, Mathematics Department, University of California, Davis, will discuss the methods used by Appel and Haken in 1976 to solve one of the most famous unsolved problems in mathematics--the four-color problem. Although he will not present the entire proof (it is quite complex and involves about 1000 hours of computer time), he will discuss the methods used and why they led to a solution.
- APRIL 24 TO THE VECTOR GO THE CYCLES**
Dr. Linda Valdés, Mathematics and Computer Science Department, San Jose State University, will explore the problem of finding the number of cycles in certain cubic groups by using the cycle basis of graphs and other combinatorial techniques. The fundamental process illustrates an interesting model in teaching the basis of a vector space by means of illustration.
- MAY 1 THE LOST CIVILIZATION OF PRE-ARITHMETICAL MATHEMATICS**
Dr. David Ballard, Mathematics Department, Sonoma State University, will show that numbers (other than counting) were meaningless to the ancient Greeks. In their place, they erected a highly sophisticated theory of quantities. After describing this pre-arithmetical point of view, he will offer evidence of its wide spread persistence amongst mathematicians until recent times. Dr. Ballard will offer an updated theory of quantities using concepts from Modern Algebra and illustrate a number of the mathematical surprises which result.
- MAY 8 MAGIC SQUARES: NORMAL, SUPER, AND SEMI**
Professor Steve Waters, Mathematics Department, Pacific Union College, will discuss the construction of normal magic squares of various sizes, look at a famous super-magic square and its additional properties, and then use semi magic squares to help in an algebraic analysis of magic squares as a vector space of matrices.
- MAY 15 MORE ABSTRACT DATA TYPES--MODERN ALGEBRA AND COMPUTER SCIENCE**
Dr. David Butcher, Computer Science Department, Sonoma State University, will continue a previous M*A*T*H colloquium talk which surveyed current work in theoretical computer science that construes data structures in computer programs as implementations of abstract algebraic systems of the kind studied in modern algebra. Professor Butcher will present some of his recent work in this area and discuss some connections between abstract data types and object-oriented programming.

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- SEPTEMBER 11** **IS MIX INDEXED?**
Dr. Bill Marsh, Prime Arithmetics, San Francisco, suggests that even though Aho's indexed languages are more than 20 years old, some open questions remain. Undergraduates may solve some of them.
- SEPTEMBER 18** **SURGERY ON A 3-SPHERE**
Dr. Chung-Hsing Ouyang, Department of Mathematics, CSU, Hayward, will show how surgery on a 3-sphere is related to the study of three- and four-dimensional manifolds.
- SEPTEMBER 25** **UNREAL ANALYSIS: CLOSE ENOUGH FOR GOVERNMENT WORK**
Professor Anthony Barcellos, Department of Mathematics, American River College, Sacramento, says even the most basic mathematics becomes dangerous when used by those who don't know what they are doing. Several examples of egregious mathematics from the California State Legislature will be presented. These illustrations are simultaneously amusing and dismaying in the extreme.
- OCTOBER 2** **HELLY'S THEOREM AND SOME APPLICATIONS**
Dr. Tom Sallee, Department of Mathematics, University of California, Davis, will examine some of the geometric and non-geometric consequences of Helly's Theorem, which says that many situations involving convex sets in E^d can be solved by looking at only $d + 1$ sets.
- OCTOBER 9** **CRISES IN THE FOUNDATION OF MATHEMATICS**
Dr. Lidia Luquet, Department of Mathematics, St. Mary's College, Moraga, will explore the relationships among the discovery of incommensurable magnitudes, the invention of the calculus, and the discovery of paradoxes in set theory. According to H. Eves and C. Newsom, these three areas have brought about crises in the foundations of mathematics. It is no surprise that they generate difficult chapters in the mathematics curriculum.
- OCTOBER 16** **PRETTY, CONVINCING PROOFS**
Dr. Ruth Davis, Computer/Engineering Department, Santa Clara University, suggests the paramount issue in design of proofs is that of correctness. However, the aesthetics of presentation can often influence the design as well as the comprehensibility of a proof. After presentation of some general guidelines, two examples will exhibit the simplification achieved by the exploitation of symmetries in a problem.
- OCTOBER 23** **MAKING AND BREAKING SECRET CODES**
Dr. Steven Benson, Department of Mathematics, Santa Clara University, will talk about various elementary schemes for sending secret messages leading up to the RSA public key cryptosystem. All number theoretic preliminaries will be introduced. Dr. Benson states, "I am not an expert, just an interested observer."
- OCTOBER 30** **ALIVE AT LEADS: HOW TO TELL IF YOUR FAVORITE SYSTEM OF COMMUNICATING LOOP PROCESSES WILL DEADLOCK**
Dr. Barbara Simons, Research Staff Member at IBM Almaden Research Center, San Jose, will discuss ways in which systems of processes that communicate with each other can deadlock. Dr. Simons will also illustrate how in some cases the deadlock can be analyzed beforehand by the compiler.
- NOVEMBER 6** **HOW TO BUILD A GRAVITATIONAL FIELD OUT OF RUBBER BANDS AND COMPLEX NUMBERS**
Dr. Tristan Needham, Department of Mathematics, University of San Francisco, will offer a new geometric explanation of a beautiful but little known fact concerning the transmutation of central force fields by means of power mappings in the complex plane. In particular, we may produce a gravitational field simply by waving the magic wand $z \rightarrow z^2$ over a rubber band. This will provide a novel explanation of the elliptical motion of the planets with the sun at one focus.
- NOVEMBER 13** **THE SOUND OF MATHEMATICS**
Professor Paul Wellin, Department of Mathematics, Sonoma State University, will explore the use of sound in the presentation and study of undergraduate mathematics with *Mathematica*. Mathematical functions are often analyzed numerically or graphically. The technology now exists to *play* and to *hear* the sound of any function. In addition, current areas of research (including FM synthesis) and some open problems that can be analyzed with this technology will be suggested.
- NOVEMBER 20** **CAN YOUR COMPUTER ADD?**
Dr. Robert Plantz, Computer and Information Science Department, Sonoma State University, will discuss codes commonly used for storing numerical data in a digital computer and how the choice of a particular code affects the correctness of simple arithmetic operations on the data.
- DECEMBER 4** **LOST NUGGETS IN THE CALCULUS STREAM**
Dr. Jean B. Chan, Department of Mathematics, Sonoma State University, will revive a few historical calculus topics that seem to have slipped away from the current curriculum.
- DECEMBER 11** **FIBONACCI NUMBERS, LUCAS NUMBERS, AND BEYOND**
Dr. Peter Hilton, Department of Mathematical Sciences, State University of New York at Binghamton, will describe some very basic identities and certain other less obvious quadratic identities that can only be expressed, let alone proved, if we allow our sequences of numbers to go backwards as well as forwards. The theory of Fibonacci and Lucas numbers lends itself to maximal student participation in formulating conjectures and hypotheses.

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- FEBRUARY 12 AN ECONOMIC VISION FOR THE 21ST CENTURY: ITS IMPLICATIONS FOR CSU**
Dr. Howard Stauffer, Department of Mathematics, Humboldt State University, Arcata, will describe ideas from the recently published seminal book *The Work of Nations* by Professor Robert Reich of J. F. Kennedy School at Harvard University. This book outlines the economic problems facing the United States and the world and suggests interesting and unorthodox solutions for the 21st century. What must we do educationally at CSU to be a part of this solution?
- FEBRUARY 19 TESTING FOR EXTRA SENSORY PERCEPTION**
Dr. Francisco Samaniego, Division of Statistics, University of California, Davis will begin by having the audience participate in a guessing experiment designed to detect the presence of ESP. He will then explain how a statistician might analyze this data. A door prize will be awarded to the audience member whose performance is "most amazing."
- FEBRUARY 26 NUCLEAR WASTE, THE SPACE SHUTTLE, AND AIDS**
Dr. Timothy Kearns, Senior Associate, Applied Decision Analysis, Inc., Menlo Park, will introduce some tools of Decision Analysis that organizations use to help make complex decisions. Some examples include choosing a site for nuclear waste storage and allocating research funds. Computer software that represents decision problems clearly and provides tools to gain insight into these problems will be demonstrated.
- MARCH 4 NUMBERS, TERMS, AND TREES -- A FUNDAMENTAL INTERCONNECTION**
Dr. J. J. Le Tourneau, Prime Arithmetics, San Francisco, will show that the positive natural numbers, the commutative/associative algebraic $\langle 1,1,1 \rangle$ -terms, or the finite connected rooted (unordered) trees can each be used as the natural universe of isomorphic primitive abstract data types. We can then describe this abstract data type using only a finite number of first-order logical axioms. In the process, we also discover the first known perfect $O(\log(n))$ efficient hashing algorithm for trees or what might be more naturally called *discrete visual logarithms*.
- MARCH 11 DIVIDE AND CONQUER**
Dr. Rick Luttmann, Department of Mathematics, Sonoma State University, will discuss some topics from *The Theory of Warfare* developed by Lewis Frye Richardson including the proof that "divide and conquer" is a good strategy. Actual incidents from history such as Nelson at Trafalgar will be discussed. A spontaneous peace demonstration will be held 15 minutes before the lecture. Please bring your own picket signs.
- MARCH 18 STABILIZATION WITH RANDOM VIBRATION**
Dr. John Kao, Department of Mathematics, University of San Francisco, asks "Is it possible for random forces to actually stabilize an unstable dynamical system?" Usually to the scientist and engineer, randomness in nature is thought of as something troublesome. In particular, random forces often act to destabilize what would otherwise be nice, stable systems. There are numerous examples in which even small random forces had enormous destructive effects (consider as one the collapse of the Tacoma Narrows Bridge due to wind vibration in 1940). The answer to this question will demonstrate that, contrary to our natural prejudice, randomness can sometimes be a good thing
- MARCH 25 WHERE TO BEGIN -- AN EXAMPLE OF NEWTON'S METHOD**
Dr. John Ladwig, Department of Mathematics and Statistics, Chico State University, will show how the perennial difficulty of starting Newton's method appears again in an example inspired by the problem of teaching a computer to divide. Here Newton's method is to be used not once but every time a division occurs and so an automatic selection of the starter is needed.
- APRIL 1 IN SEARCH OF TRUTH**
Dr. George Hilton, Department of Mathematics, Pacific Union College, Angwin, will discuss how statistics serves as the language of modern science. Particular emphasis will be given to the remarkable success classical methods have achieved in spite of their inherent weaknesses.
- APRIL 8 SOME PROBABILITY AND STATISTICAL THOUGHTS FROM THE AIDS EPIDEMIC**
Ms. Ann Herbst, Department of Mathematics, Santa Rosa Junior College, will develop a simple estimate of the probability of being HIV+ after one sexual exposure to HIV. She will show how social scientists get answers to sensitive questions to estimate probabilities of HIV exposure. If time permits, she will discuss HIV testing accuracy.
- APRIL 22 SYLVESTER'S PROBLEM: AN INTRODUCTION TO DISCRETE GEOMETRY**
Dr. Guo-Hui Zhang, Department of Mathematics, Sonoma State University, will discuss the following problem posed by Sylvester in 1893: does there exist a finite set S of distinct points in the plane, not all in a straight line, possessing the property that the straight line joining any two points of S contains at least one more point of S .
- APRIL 29 ON POLYA'S ENUMERATION THEOREM**
Dr. Robert Bekes, Department of Mathematics, Santa Clara University, will discuss Polya's Enumeration Theorem from a group representation point of view. Using this approach and a little measure theory, some of these ideas are extended to infinite groups.
- MAY 6 CRISIS IN MATHEMATICS EDUCATION: A TEACHER'S PERSPECTIVE**
Dr. Karl J. Smith, Department of Mathematics, Santa Rosa Junior College, will discuss how problems in mathematics education have reached major proportions at all levels. Teacher shortages, the gap between rising standards and lowering competency levels, as well as lethargy in changing the curriculum, are all contributing to the problem. In order to find a solution, students, teachers, professors, parents, and members of the community must first recognize the problem and then work together for a solution.
- MAY 13 NEWTON TO PONTRYAGIN: QUICKFIX, BANG-BANG ECONOMIC POLICIES**
Dr. Stephen D. Lewis, Department of Economics, Sonoma State University, will explore the application of optimal control theory to the determination of dynamic economic policies with special emphasis on the minimum-time problem. Graphical results will be emphasized.

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- SEPTEMBER 16 LAGRANGE INTERPOLATION APPLIED TO MATRICES**
Dr. Jose Barria, Department of Mathematics, Santa Clara University, will discuss applications of the Lagrange interpolation theorem to the study of functions of matrices. Two particular equations will be considered:
 $\text{Alg } A = \text{Alg } p(A)$ and $\text{Alg } (A \oplus B) = \text{Alg } A \oplus \text{Alg } B$.
- SEPTEMBER 23 SECTIONS AND PROJECTIONS OF CONVEX BODIES**
Dr. Don Chakerian, Department of Mathematics, University of California, Davis, will consider several geometric problems related to the following question: Can we determine the shape of a three-dimensional object from a knowledge only of the shapes of its projections (shadows) on various planes?
- SEPTEMBER 30 WHAT IS THE EIGENVALUE SET FOR A SUM OF HERMITIAN MATRICES?**
Dr. Jane Day, Department of Mathematics and Computer Science, San Jose State University, will discuss the long-standing conjecture (which says how to describe the eigenvalues of every such sum in terms of those of two fixed $n \times n$ Hermitian matrices) and recent developments.
- OCTOBER 7 THE ARCHITECTURE OF GEOMETRY**
Mr. William Blackwell, A.I.A., Project Manager, Bechtel National, Inc., San Francisco, will present an architect's structuring of elementary geometry, the concept of space enclosure efficiency as an important characteristic of shape, and examples of the dramatic effectiveness of the application of the geometry of travel over a rectangular grid.
- OCTOBER 14 RETHINKING OLD SCHOOL METHODOLOGY WITH NEW SCHOOL TECHNOLOGY: TWO HEADS ARE BETTER THAN ONE**
Ms. Donna M. Smith and Mr. Phil R. Smith, Department of Mathematics, American River College, Sacramento, will demonstrate sample Theorist notebooks that they developed for Calculus I, II and III while focusing on the team teaching efforts in Calculus III. Collaboration provides support for curricular risk taking, greater utilization of individual talents, and increased experimentation with pedagogical shifts which result when teaching a CAS course solely in a computer lab.
- OCTOBER 21 WHAT ARE COMPUTER MICROWORLDS AND WHAT DO THEY HAVE TO DO WITH LEARNING MATHEMATICS?**
Dr. Laurie D. Edwards, Department of Education, Crown College, University of California, Santa Cruz, will describe a number of computer "microworlds," particularly in the area of geometry. She will present results from research on how middle- and high-school students have learned through interacting with these environments.
- OCTOBER 28 IRRATIONAL ROTATIONS AND DIRTY TABLES OF LOGARITHMS**
Dr. Paul Zeitz, Department of Mathematics, University of San Francisco, will use the pigeonhole principle to analyze irrational rotations on a circle. This will shed light on a seemingly unrelated problem, the distribution of initial digits and the ubiquity of the digit "1."
- NOVEMBER 4 THE CHANGING HIGH SCHOOL CURRICULUM AND ITS IMPLICATIONS**
Dr. Diane Resek, Department of Mathematics, San Francisco State University, will discuss how high school curriculum is changing and its implications for college teachers. The proposed changes involve what is taught, how it is to be taught, and who is to be taught.
- NOVEMBER 11 THE QUADRATIC, CUBIC AND QUARTIC FORMULAS**
Dr. Steve Wilson, Department of Mathematics, Sonoma State University, will derive and display the famous quadratic, cubic, and quartic formulas. Historical implications and particular examples will be discussed.
- NOVEMBER 18 DOES GENDER COUNT IN MATHEMATICS EDUCATION?**
Dr. Deann Christianson, Department of Mathematics, University of the Pacific, Stockton, will discuss recent studies that seem to indicate that women and girls are being shortchanged by the Mathematics Education Establishment. What changes are necessary so that everyone, regardless of gender, can reach their full potential in Mathematics?
- DECEMBER 2 THE ARITHMETIC OF APPORTIONMENT -- A LEGACY OF THE FOUNDING FATHERS**
Dr. Ken Rebman, Dean, School of Science, California State University, Hayward, will show how those unlikely collaborators, politics and mathematics, have each contributed in their own way to the lively, controversial, challenging, and surprising history of apportionment: politics provided the heat; mathematics shed some light. Elementary arithmetic analysis reveals what one astounded and irate legislator described as "this atrocity which mathematicians have elected to call a paradox."
- DECEMBER 9 THE SCHENSTED CORRESPONDENCE**
Dr. Tamsen Whitehead, Department of Mathematics, Santa Clara University, will look at the Schensted Correspondence and some generalizations of it. The Schensted Correspondence is a collection of bijections between matrices and Young tableaux. Combinatorially, it is quite natural, but it leads to very deep results in the representation theory of the symmetric group, including a combinatorial proof of the Cauchy Identity.

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SONOMA STATE UNIVERSITY

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 p.m.

Darwin Hall, Room 108

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

- FEBRUARY 10 GEOMETRICAL GEMS**
Daniel Wheeler, Loma Mar, California, will present a series of tantalizing elementary geometry problems with surprisingly short and elegant solutions. Copies of the problems will be available in the Mathematics office one week before the talk.
- FEBRUARY 17 DIFFERENTIAL EQUATIONS: HOW TO PROSPER WITHOUT EVER SOLVING ONE**
Dr. Rick Luttmann, Department of Mathematics, Sonoma State University, will discuss the philosophically elusive question of when you can say you have "solved" a differential equation and the unpleasant fact that few differential equations in practice can actually be "solved" in any sense. He will show, however, that enormous amounts of practical information can be extracted *from the equation itself*, without any need to discuss solutions per se. He will illustrate with examples from carbon dating, population growth, heating and cooling, resource management, and river drainages.
- FEBRUARY 24 MATHEMATICAL BACK ROADS**
Dr. Ken Lebensold, Mathematics and Science Learning Skills Specialist, Sonoma State University, observes that mathematical development usually proceeds by mapping the main roads (systematic analysis of a system) or charting a route from A to B (problem solving). He will explore the hidden potential of the back roads (interesting ideas and relationships usually not noticed or taken for granted).
- MARCH 3 STALKING ARTIFICIAL LIFE**
Dr. Rudy Rucker, Department of Mathematics and Computer Science, San Jose State University, will describe the new field of artificial life, which attempts to create or evolve more and more lifelike computer simulations. The talk will be illustrated with computer demonstrations.
- MARCH 10 WOMEN, MATHEMATICS, AND SCIENCE**
Professor Alice Kelly, Department of Mathematics, Santa Clara University, will discuss how science has affected women and how women have affected science.
- MARCH 17 A COUPLE OF THEOREMS ON SPOTTED OWLS**
Dr. Roland Lamberson, Coordinator, Environmental Systems Graduate Program, Humboldt State University, Arcata, will outline the modeling techniques used to study the dynamics of the Northern Spotted Owl population and present some general principles that have resulted from examination of the simulation output. Simulation modeling is the standard technique for analyzing the viability for an endangered species.
- MARCH 24 NEW ALGORITHMS FOR COLOR IMAGE PROCESSING**
Mr. Richard Crandall, Chief Scientist, NeXT Computer, Inc., Redwood City, will describe how the mathematics of wavelets can be applied to image compression, image enhancement, and movie animation. In recent years significant advancement has been made in the problem of image compression, including the discrete wavelet transform.
- MARCH 31 VACCINES AND ELEMENTARY RISK THEORY**
Dr. Judith Ekstrand, Department of Mathematics, San Francisco State University, will present a brief history of smallpox inoculations as a daring attempt at prevention. The risks and benefits involved in vaccines for swine flu and whooping cough will be explored.
- APRIL 7 CELEBRATION FOR PRESIDENT ARMINANA'S INAUGURATION** (No colloquium will be held.)
- APRIL 21 STATISTICAL LINGUISTICS**
Dr. Brian Jersky, Department of Mathematics, Sonoma State University. How can we estimate an author's total vocabulary from just one sample of text? This and other related questions will be answered in this lecture, showing how useful statistics is for fields as diverse as linguistics, bibliometrics and engineering.
- APRIL 28 MAGIC, COMBINATORICS, AND UNIVERSAL CYCLES**
Dr. Bradley Jackson, Department of Mathematics and Computer Science, San Jose State University, will present a few magic tricks. These will lead to a discussion of eulerian circuits and De Bruijn cycles. Then he will discuss other universal cycles in combinatorics, their applications and techniques for constructing them.
- MAY 5 PREPARING FOR CALCULUS BY MEANS OF INTERACTIVE VIDEO DISC TECHNOLOGY**
Dr. Edward M. Landesman and Dr. Ronald W. Henderson, Department of Mathematics, University of California, Santa Cruz, will demonstrate the principles of instructional design underlining McGraw-Hill's Preparing for Calculus. This is a series of interactive modules designed to help students understand mathematical concepts by means of real-world video exemplars of the concepts, modeling metacognitive processes, and provision of user-sensitive scaffolding to support students' problem-solving efforts.
- MAY 12 A MATHEMATICAL APPLICATION**
Craig Hildebrand, Ph.D. candidate, University of California, Berkeley. Anybody who has taken Calculus knows about Taylor Polynomials. These are a special case of interpolating polynomials, which are designed to agree with a given function at selected points. Osculating polynomials agree not only with a function at selected points but also with one or more of the function's derivatives at selected points. Using these tools and measurements taken from a motorcycle camshaft, he will try to design a polynomial that "fits" the data.

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- SEPTEMBER 15 TWO FIXED POINT PROPERTIES OF THE TWO-DIMENSIONAL DISC**
Dr. Robert F. Brown, Mathematics Department, University of California, Los Angeles, will discuss some of the many topological facts equivalent to Brouwer's famous theorem: every continuous function from the disc to itself must have at least one fixed point. He will then present a recently discovered "interior" fixed point property: some classes of smooth functions from the disc to itself that have fixed points on the boundary of the disc must have at least one fixed point on the interior of the disc as well.
- SEPTEMBER 22 MATHEMATICS OF M. C. ESCHER**
Mr. Dale Seymour, Dale Seymour Publications, Palo Alto, will use colored transparencies to demonstrate how basic tessellating shapes can be modified using slides, flips, and turns to create beautiful Escher-type art. Samples of Escher's work will be shown and analyzed.
- SEPTEMBER 29 KNOT THEORY AND THE NEW KNOT POLYNOMIALS**
Dr. John Sawka, Mathematics Department, Foothill College in Los Altos, will trace some of the efforts leading to the new, powerful, and easily computed polynomial invariants that have recently revealed connections between knot theory and statistical mechanics. Mathematicians have studied knots for more than a hundred years, investing much time and effort in the task of distinguishing and classifying knots.
- OCTOBER 6 SPHERE PACKINGS AND SPHERICAL GEOMETRY, KEPLER'S CONJECTURE AND BEYOND**
Dr. Wu-Yi Hsiang, Mathematics Department, University of California, Berkeley, will discuss the classical sphere packing problem and Kepler's conjecture on the densest packing in 3-dimensional Euclidean space. He will explain the type of spherical geometry needed for proving Kepler's conjecture.
- OCTOBER 13 BUILDING "BETTER" PRODUCTS**
Dr. Timothy Kearns, Applied Decision Analysis, Inc., Menlo Park, will discuss how mathematical models and statistical techniques are used by large corporations to help design new products such as automobiles, computers, and financial services.
- OCTOBER 20 THE MATHEMATICS OF MODELING FLUID INTERFACES**
Dr. E. Gerry Puckett, Mathematics Department, University of California, Davis, will describe several numerical algorithms for modeling the motion of a fluid interface, the mathematical analysis of these algorithms, and fundamental mathematical difficulties inherent in this problem. He will describe the essential role for mathematicians in the design, development and analysis of numerical algorithms, and their importance to science and technology.
- OCTOBER 27 COUNTING ON YOUR FINGERS!**
Dr. Sharon R. Ross, Mathematics Department, California State University, Chico, will share a variety of finger counting and calculating strategies from those invented by children to more obscure strategies invented by adults from many cultures.
- NOVEMBER 3 TEACHING MATHEMATICS AT THE COLLEGE LEVEL: CURRENT RESEARCH AND FUTURE DIRECTIONS**
Dr. Joanne Rossi Becker, Mathematics and Computer Science Department, San Jose State University, will present results of a major review of research on the teaching and learning of college level mathematics conducted by her and a colleague, Dr. Barbara Pence.
- NOVEMBER 10 PROBABILITY MODELS FOR ATHLETIC COMPETITIONS**
Dr. Neil C. Schwertman, Mathematics and Statistics Department, California State University, Chico, will describe how athletic competition affords many interesting opportunities to apply the principles of probability and statistics. Single elimination, double elimination, and an intriguing combination of both types of tournaments are investigated and illustrated by the NCAA Regional Basketball Tournament, the College Baseball World Series, and the Australian Football Grand Finals (like our Super Bowl) respectively.
- NOVEMBER 17 REMINISCENCES OF A MATHEMATOLOGIST**
Mrs. Alice C. Beckenbach of Los Angeles will share memories and non-serious poetry about the mathematical "greats" at Princeton University and the Institute for Advanced Study.
- DECEMBER 1 MOTION MEASUREMENTS IN MEDICINE**
Dr. Bill Hand, Motion Analysis Corporation, Santa Rosa, will describe how the careful measurement of motion provides the basis for calculations to predict many aspects of human health and natural phenomena.
- DECEMBER 9 HOW DID I APPLY MATHEMATICS AND STATISTICS AT HEWLETT PACKARD?**
Dr. Ai-Chu Wu, Sonoma County Quality and Engineering Services, Hewlett Packard, Santa Rosa, will present some interesting cases from different functional areas at HP: What question was asked; how it was translated into a mathematical and statistical problem; how it was solved; and how results were presented.

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