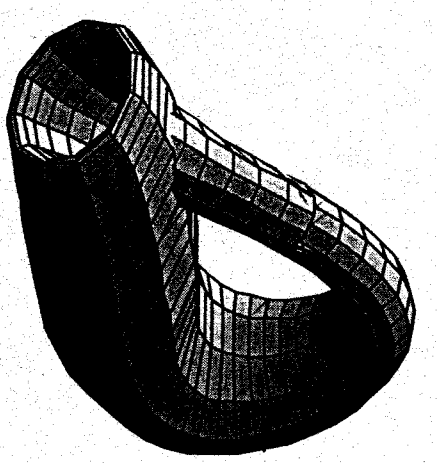
Iowa Section Newsletter



SPRING 1997

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VOLUME XIII No. 2 March 1997

Iowa Section MAA --Governor's Report

The Association has several major undertakings in early stages. Chief among these is the first summer meeting to be run by the MAA alone. This meeting is set for Atlanta, August 2-4. The organizers are optimistic about the ability of the Association to conduct a successful meeting but the results depend on a reasonable turn out. Keep this meeting in mind when planning your summer activities.

A second initiative to keep in mind is the International Mathematics Olympiad in 2001 which will be held in the United States. A separate organization is being set up to administer this activity.

Last November, the AMS joined the MAA and the NCTM in approving the Joint Office of Minority Programs. The search for a Director has been undertaken and the Office is expected to begin operations this spring. Look for announcements concerning this office in the near future.

The restructuring of the Washington Office and the outsourcing of the membership services has taken longer than expected. However, the staff believes that the bugs are now under control in the new system and this year will be the year that members will see improvement in this area.

If you are not a regular user of the MAA On-line service, let me encourage you to become one. You can find it at http://www.maa.org/ . Several of the items mentioned above are expanded on there, for example there is an early program for the August meeting. There are too many features for me to list here but two of my favorites are the weekly column by Ivars Peterson and the monthly column by Keith Devlin. In addition, there is news of general interest to mathematicians, e.g. a notice of an upcoming Nova program on Fermat's Theorem.

One additional notice for those planning ahead, SIAM will take part in the annual meeting in January of 2000, in Washington DC.

One area of concern is the number of young mathematics faculty members who are not joining the Association. If you have new faculty in your departments, encourage them to use the services of the Association and to consider membership as professional support.

I hope to see many of you in Ames at the April meeting.

Alex Kleiner
Governor, Iowa Section

Iowa Section MAA -- Treasurer's Report

March 1, 1997

	Debits	Credits	Balance
Starting Balance (3-28-96)			$1,697.06
1996 Spring Newsletter	$224.11		$1,472.95
Transfer from Competition Account		$340.84	$1,813.79
Refreshments for 1996 Competition	$ 40.84		$1,772.95
Writing of the 1996 Competition Exam	$300.00		$1,472.95
1996 Spring Meeting			
Registrations (54 @ $5)		$270.00	$1,742.95
Book Sales		$ 80.00	$1,822.95
Income from Student Dinners		$ 59.50	$1,882.45
1996 Meeting Expenses (& Dinners)	$159.50		$1,722.95
Book Sales	$ 80.00		$1,642.95
MAA Dues Rebate		$500.00	$2,142.95
Transfer from Competition Account		$200.00	$2,342.95
Writing of the 1997 Competition Exam	$200.00		$2,142.95
1996 Fall Newsletter	$161.08		$1,981.87
1997 Call for Papers	$120.98		$1,860.89
Interest		$ 16.64	$1,877.53
Ending Balance (3-28-96)			$1,877.53

Steve Nimmo
Secretary-Treasurer, Iowa Section

Iowa Section MAA -- Nominations Committee Report

The Iowa Section Nominations Committee (Charles Jepsen, Elgin Johnston and Charles Lindsay) has submitted the following nominations for the election to be held at the business meeting on April 12.

Chair-Elect:	Ruth Berger	Luther College
	Allen C. Hibbard	Central College
Public Information Officer:	R. B. Campbell	University of Northern Iowa

Joint Meetings of the Iowa MAA, ASA, and IMATYC
Iowa State University, Ames, Iowa
April 11 and 12, 1997

Friday, April 11

12:00 - 7:30	Registration and Book Exhibit	404 Carver
1:30 - 3:05	Statistics Session I	98 Carver
1:30 - 3:05	Mathematics Student Papers I	268 Carver
3:05 - 3:20	Break and refreshments	404 Carver
3:20 - 4:55	Statistics Session II	98 Carver
3:20 - 4:55	Mathematics Student Papers II	268 Carver
5:00 - 7:00	Dinner (on your own)	
7:30 - 8:30	MAA Keynote Lecture I: Roger A. Horn, University of Utah *"Reflections on Editing the Monthly"*	205 Pearson
8:30 - 10:00	Reception	Cardinal Room Memorial Union

Saturday, April 12

8:00 - 4:15	Registration and Book Exhibit	lobby outside 101 Carver
8:30 - 9:30	ASA Keynote Lecture: Linda Young, University of Nebraska at Lincoln *Title to be announced*	101 Carver
9:35 - 9:50	Break	lobby outside 101 Carver
10:00 - 10:50	MAA Keynote Lecture II: Roger A. Horn, University of Utah *"When Does A*A = B*B? And Why Should You Care?"*	101 Carver
10:50 - 11:30	Iowa MAA business meeting	101 Carver
11:00 - 1:00	Isolated Statisticians lunch and meeting	
11:30 - 1:00	IMATYC Lunch and Business Meeting	South Pine Room (off the Food Court, Memorial Union)
11:30 - 1:00	Lunch (on your own)	
1:00 - 2:30	Mathematics Contributed Papers I	118 Carver
1:00 - 2:30	Mathematics in the Computer Lab	449 Carver
1:00 - 2:35	Statistics Session III	132 Carver
2:30 - 2:45	Break	lobby outside 101 Carver
2:45 - 4:15	Session on technology in calculus	124 Carver
2:45 - 4:15	Session on mathematics education	128 Carver
2:45 - 4:20	Statistics Session IV	132 Carver
2:45 - 4:45	Mathematics Contributed Papers II	118 Carver

Friday Afternoon Sessions

(*In the case of papers with multiple authors, an asterisk identifies the author presenting the paper.)

268 Carver: Mathematics Student Papers I

1:30 - 1:45 Elizabeth Biermann, Cornell College
$e^{2\pi i}!=1^2$, *But What About n! in the Non-Trivial Case?*

1:50 - 2:05 Suzanne M. Shontz, University of Northern Iowa
Combinatorial Models of Smooth Algebraic Curves in the Real Projective Plane

2:10 - 2:25 John Hamman, University of Northern Iowa
What's hot and what's not in fuzzy logic?

2:30 - 2:45 Alexander Samuel, University of Northern Iowa
Solution by radicals: a different approach

2:50 - 3:05 Goran Krilov, Drake University
On Characterization of Arbitrary Shapes

98 Carver: Statistics Session I

1:30 - 1:45 Chris Carolan, University of Iowa
The Monotone Density Problem Revisited

1:50 - 2:05 Yuhong Yang, Iowa State University
Adaptive Function Estimation

2:10 - 2:25 Shuen-Lin Jeng* and William Q. Meeker, Iowa State University
Comparisons of Approximate Weibull Distribution Confidence Intervals for Type I Censored Data

2:30 - 2:45 Elizabeth Martha S. Paterno, Iowa State University
Likelihood-based estimation for the random effect model with measurement error

2:50 - 3:05 Amy J. Meyer* and Jean Opsomer, Iowa State University
Regression Model for Prediction of Erosion in the United States

98 Carver: Statistics Session II

3:20 - 3:35 Vera Boulaevskaia, Iowa State University
Predicting Nocturnal Sky Cover in Iowa

3:40 - 3:55 Pradipta Sarkar*, William Q. Meeker, R. Bruce Thompson, and Timothy A. Gray, Iowa State University
Probability of Detection Modeling for Ultrasonic Testing

4:00 - 4:15 Junyuan Wang, Iowa State University
Analyzing Ecological Trends with Multiple Natural Resource Databases

4:20 - 4:35 Chris Najim, University of Iowa
Weak Convergence Results for the Diameter of a Random Point Set

4:40 - 4:55 Joy Jordan, University of Iowa
Using Fenchel Duality to Find Constrained MLEs

268 Carver: Mathematics Student Papers II

3:20 - 3:35 Thomas Martin Oleson, Jr., University of Northern Iowa
Multiresolutional analysis in wavelet theory

3:40 - 3:55 D. Alex Olson , Drake University
Perron-Frobenius Theory for Small Matrices with Some Negative Entries

4:00 - 4:15 Sol Bobst, Drake University
The Leading Eigenvalues of Path Matrices

4:20 - 4:35 Taher Abualrub and Robert Oehmke, University of Iowa
Codes over Z_m

4:40 - 4:55 Terry Sargent , University of Iowa
q-expansion by minors

Saturday Afternoon Sessions

(*In the case of papers with multiple authors, an asterisk identifies the author presenting the paper.)

118 Carver: Mathematics Contributed Papers I

1:00 - 1:30 Irvin Roy Hentzel, Iowa State University
The converse to Pompieu's theorem.

1:30 - 2:00 Luz M. DeAlba, Drake University
Matrix Completions and the Lyapunov Equation

2:00 - 2:30 Milan Randic, Drake University
Novel Graph Matrices and Their Construction

449 Carver: Mathematics in the Computer Lab

1:00 - 1:30 Al Hibbard, Central College
Can a Computer Lab be a Component for Abstract Algebra?

1:30 - 2:00 David Streid, Maharishi University of Management
Using Technology to Make Students Think--
Three Examples from Calculus and Group Theory

2:00 - 2:30 Ruth I. Berger, Luther College.
Visualizing Linear Algebra with the ATLAST Matlab files.

132 Carver: Statistics Session III

1:00 - 1:15 Heather J. Smith, Iowa State University
Is There Evenhandedness in the Mississippi Delta?

1:20 - 1:35 Juan Jose Goyeneche*, Alicia L. Carriquiry, and
Wayne A. Fuller, Iowa State University
Estimating bivariate usual intake distributions

1:40 - 1:55 Jae kwang Kim* and Wayne Fuller, Iowa State University
Use of estimating funtions for estimating finite population parameters

2:00 - 2:15 Syed Kirmani and Vani Sundaraiyer*, University of Northern Iowa
On assessment of process capability in multivariate quality control

2:20 - 2:35 Karina Bauswell, Kevin Buesing*, Mike Custer, Jason Thompson,
and Brent Willis, University of Northern Iowa
Card Shuffling: A Computer-Graphics Approach

132 Carver: Statistics Session IV

2:45 - 3:00 Jens Eickhoff, Iowa State University
Pseudo point generation for NRI data

3:05 - 3:20 Jeremy Aldworth* and Noel Cressie, Iowa State University
A Comparison of Spatial Cumulative Distribution Function (SCDF) Predictors of a Spatial Process Sampled with Measurement Error

3:25 - 3:40 Cong Chen* and Jay Breidt, Iowa State University
A Spatial Autoregressive Model in Precision Agriculture

3:45 - 4:00 Soon Lau* and Peter J. Sherman, Iowa State University
Asymptotic Statistical Properties of Autoregressive Spectral Estimator for Random Processes with Mixed Spectrum.

4:05 - 4:20 Anindya Roy* and Wayne A. Fuller
A Likelihood Based Estimator for the First Order Vector Autoregressive Process

124 Carver: Session on technology in calculus

2:45 - 3:15 Brian Keller, Iowa State University
Our Changing Calculus Classrom

3:15 - 3:30 Heather Thompson and Chris Russell, Iowa State University
Hands On Lab: Simple Harmonic Motion

3:30 - 3:45 Chris Russell and Heather Thompson, Iowa State University
Hands On Lab: Differential Equations

3:45 - 4:15 Discussion (led by Brian Keller, Iowa State University)

128 Carver: Session on mathematics education

2:45 - 3:15 Bernadette M. Baker, Drake University
Cooperative Learning in College Algebra

3:15 - 3:45 Daniel Willis, Loras College
Some gems from the Schaum's Outline Series: "pure math" titles

3:45 - 4:15 Daniel Willis, Loras College
Some gems from the Schaum's Outline Series: "applied math" etc. titles

118 Carver: Mathematics Contributed Papers II

2:45 - 3:15 Cathy Gorini, Maharishi University of Management
The Natural Role of Mathematics in the Sciences

3:15 - 3:45 Kenneth R. Driessel, Iowa State University.
On a Mathematical Model of Ski Skating

3:45 - 4:15 Charles H. Jepsen, Grinnell College
Pythagorean Squares, Pythagorean Triples, and Elliptic Curves

4:15 - 4:45 Alexander Abian, Iowa State University
Measurable Hamel Bases

Abstracts for the Papers

Keynote Lectures:

Title to be announced
Linda Young, University of Nebraska at Lincoln

"Reflections on Editing the Monthly"
Roger A. Horn, Editor, The American Mathematical Monthly
Mathematics Department, University of Utah, Salt Lake City, UT

re-flec'tion, n. 1. a conclusion reached after much thought. 2. an imputation...Webster's Collegiate Dictionary, Fifth edition.

Conclusions rather than imputations are to be expected.

"When Does A*A = B*B? And Why Should You Care?"
Roger A. Horn, Editor, The American Mathematical Monthly
Mathematics Department, University of Utah, Salt Lake City, UT

The polar and singular value decompositions are instances of a useful general principle for complex or real matrices.

Mathematics Student Papers I

$e^{2\pi i}!=1^2$, *But What About n! in the Non-Trivial Case?*

Elizabeth Biermann, Cornell College

Is n! ever a perfect square? The obvious solution is yes. That is when you consider 0! and 1!. But for n>1 the answer is no. I will show an easy proof of this using a result of number theory, Bertrand's Postulate.

Combinatorial Models of Smooth Algebraic Curves in the Real Projective Plane

Suzanne M. Shontz, University of Northern Iowa

Viro's Construction Method is a method of representing smooth algebraic curves in the real projective plane. We use this method to investigate the topologies of algebraic curves. We are especially interested in the topological properties of M-curves (curves with maximal components). This research was done at the 1996 Summer Institute for Undergraduates at the Geometry Center in conjunction with Jeff Ford, Virginia Tech; Dr. Jesus De Loera, University of Minnesota, and Dr. Rick Wicklin, University of Minnesota.

What's hot and what's not in fuzzy logic?

John Hamman, University of Northern Iowa

Fuzzy logic is a way to assign specific truth values to statements. Once this assignment has been made there should be a method for determining the truth of the negation of the statement. This method or rule is called the negation function N. $N(x) = 1-x$ is the most common negation function, but not the only option. I will discuss what are reasonable assumptions to put on this negation function to create the following two axioms for negation functions:

1) Monotonicity [i.e., if $a<b$ then $N(a) < N(b)$]

2) Involutiveness [i.e., $N(N(a)) = a$ for all a]

Furthermore, I will discuss some of the applications where various negation functions from this class generated by these two axioms were used and the extent of their success.

Solution by radicals: a different approach

Alexander Samuel, University of Northern Iowa

We present a simple but elegant proof that the general equation of degree n, where $n \geq 5$, is not solvable by radicals. We say "simple" because the proof uses just three basic ideas:

1. the field containing n indeterminates can be "symmetrized"
2. the Galois group of a radical extension is solvable
3. the symmetric group Sn is not solvable

and it deviates from the traditional approach by not making use of tools such as normal extension, irreducible polynomials, splitting field, etc. More importantly, the proof is independent of the Fundamental Theorem of Galois Theory.

Reference: Stillwell, John. "Galois Theory for Beginners," TheAmerican Mathematical Monthly, vol. 101, no. 1, January 1994, pp. 22-27.

On Characterization of Arbitrary Shapes
Goran Krilov, Drake University

Shape is a generally recognized structural feature, yet remains elusive to rigorous definition and quantitative characterization. If one is to consider similarity in shapes one needs numerical characterization of the shapes considered. One such characterization will be outlined. It is based on the assumption that random points on the surface of an object, if scattered with sufficient density, will allow suitable characterization of the surface. Given n points on the surface first we construct n × n matrix, the elments of which are given by the separation between each pair of points. The average row sum of such matrix is structural invariant.

Additional invariants are obtained by considering matrices constructed using different powers of the separation between the points. The approach will be illustrated on the van der Waals surface of water molecule using several thousand random points.

Mathematics Student Papers II

Multiresolutional analysis in wavelet theory
Thomas Martin Oleson, Jr., University of Northern Iowa

Multiresolutional analysis is a central idea underlying wavelet theory. Wavelet theory has become a topic of great interest in the mathematical community. As a mathematician, computer scientist, and educator, wavelets caught my attention. This interest has spurred my research and thesis, titled "An Introduction to Wavelet Theory". A chapter of my thesis is dedicated to the idea of multiresolutional analysis; its development and related examples. This talk will be based upon that chapter.

What is a scaling function and multiresolutional analysis? Upon answering this question other concerns will be discussed. For instance, conditions on the scaling function can be mentioned and analyzed. Also, one can show that some of the conditions are a consequence of other conditions. Thus, the number of conditions that we need to check is reduced. Also, examples will be provided to make the abstract concept of a mutlresolutional analysis more clear.

I will be discussing ideas as they are viewed in a different perspective. The proofs that I will show are my attempts to make the subject matter easier to comprehend. Thus, this talk will provide the listener an introduction as it relates to wavelet theory multiresolutional analysis as discussed by Strichartz.

Perron-Frobenius Theory for Small Matrices with Some Negative Entries
D. Alex Olson, Drake University

The spectral radius of a positive matrix A, $\rho(A)$, is the unique positive eigenvalue of maximum modulus, also known as Perron Root. For irreducible nonnegative matrices A, $\rho(A)$, is also an eigenvalue of maximum modulus, although there may be other eigenvalues of equal modulus. In this paper we study 2×2 and some 3×3 irreducible matrices with some negative entries. We attempt to derive conditions on the nonzero entries of the matrix A so that the Perron root is an eigenvalue of maximum modulus.

The Leading Eigenvalues of Path Matrices

Sol Bobst, Drake University

The a_{ij} element of the path matrix P is defined by the subgraph g_{ij} of graph G containing all paths connecting vertex i and vertex j. In trees(acyclic graphs) the shortest paths are given by a unique chain p_{ij} of edges from vertex i to vertex j. When we select an invariant of the subgraphs g_{ij} (or pij for trees) the path matrix P takes the numerical form. The magnitudes of g_{ij} depend on the nature of the invariant selected. In this presentation I will report the leading eigenvalues of the path matrices when the leading eigenvalues of g_{ij} are taken as matrix elements g_{ij}. In particular I will discuss the results for trees having n=11 vertices. The leading eigenvalue of trees (up to n=11 vertices) appears unique and it shows some regularity with the pattern of the branching in acyclic graphs.

Codes over Z_m

Taher Abualrub and Robert Oehmke, Department of Mathematics, University of Iowa

In this paper we study cyclic codes over Z_m --i.e., ideals in the Group Ring Z_mG, where G is a finite abelian group of order n. By referring to the work done by Sirik Wasan, we restrict our self to the case where $m = q^c$ and $n = p^w$ for some prime numbers p and q. We show that Z_mG is Principal Ideal Ring for $m = q^c$ and $n = p^s$ where q and p are some prime numbers and p does not equal q. For the case p equal q we show that Z_mG is a Local Ring but not a Principal Ideal Ring.

q-expansion by minors

Terry Sargent, Department of Mathematics, University of Iowa

It is shown in part (1) how using the method of "q-expansion" by minors on a 3×3 quantum matrix yeilds a quantum det whose image in D^(*ab) is equal to the value of the Dieudonne' determinant for the same sized matrix. Part (2) describes how with the aid of Mathematica that the equality between a quantum determinant found with expansion by minors and the Dieudonne' determinant of a quantum matrix is preserved for values of N larger than 3.

Mathematics Contributed Papers I

The converse to Pompieu's theorem.

Irvin Roy Hentzel, Mathematics Department, Iowa State University

Given a triangle with edges a,b,c construct an equilateral triangle EFG and a point P such that |PE| = a, |PF| = b, |PG| = c.

Matrix Completions and the Lyapunov Equation
Luz M. DeAlba, Drake University

A partial matrix is a rectangular array in which some entries are specified while the remaining entries can be chosen freely. A completion of a partial matrix is a specific choice of values for the unspecified entries. In this talk we discuss conditions under which a partial symmetric real matrix X can be completed to a real symmetric matrix X^ that satisfies the matrix equation $X^ A + A^T X^ = C$.

Novel Graph Matrices and Their Construction
Milan Randic, Drake University

The adjacency matrix (A) and the distance matrix (D) are well known matrices used to represent graphs. During the last couple of years several novel matrices have been introduced in the literature, e.g., Wiener matrx (W), Hosoya matrix (Z), Restricted random walk matrix (RR), Path matrix (P), Detour matrix (De), Extended adjacency matrix (Ea), Layer matrix (L). Properties of these matrices will be outlined and some of the open problems will be discussed. We will also consider graphs embedded in the 3-D space (and in the plane as a special case) and outline how to arrive at useful characterization of 3-D structures by combining elements of graph theory and 3-D geometry.

Mathematics Contributed Papers II

The Natural Role of Mathematics in the Sciences
Cathy Gorini, Department of Mathematics, Maharishi University of Management

Many people have dealt with what Eugene Wigner termed the "unreasonable effectiveness of mathematics" when applied to the natural sciences. In this paper, I will present the idea that the role of mathematics in the sciences is natural and expected by looking at the nature of mathematics and the subject matter of the sciences from the point of view of Maharishi's Vedic Science.

On a Mathematical Model of Ski Skating
Kenneth R. Driessel, Mathematics Department, Iowa State University.

I shall discuss the dynamics of ski skating. In particular, I shall discuss the following optimization problem: Maximize average speed for a given power. I shall first need to develop a mathematical model of ski skating. Scientists should limit the scope of inquiry in order to achieve greater certainty about the questions answered. So I limit my attention to steady periodic skiing with no poles on a level plane. I also limit my attention to the physics of the motion (that is, I ignore most biomechanical considerations). In preparation for this lecture, I suggest that you think about the following questions: What is a typical average speed for an intermediate skier? What is a typical power for an amateur athelete? What are the important forces in ski skating? What are typical parameters associated with these forces? If you have time I also suggest that you look atthe references given below.

This will be an elementary talk; calculus and freshman physics are the main prerequisites.

References: Alexander, R. (1992) The Human Machine
McMahon, T. (1984) Muscles, Reflexes and Locomotion
Svensson, E. (1994) Ski Skating with Champions
Whitt, F. and Wilson,F. (1974) Bicycling Science

Pythagorean Squares, Pythagorean Triples, and Elliptic Curves

Charles H. Jepsen, Grinnell College

Does there exist a square with integer sides that can be dissected into four right triangles with integer sides? An attempt to answer this quickly leads to a question about primitive Pythagorean triples. Further analysis turns this into a question about rational points on a certain elliptic curve. The known answer to this last question provides a solution to the original dissection problem. This investigation arises from a research project this past summer with Roc Yang, now a sophomore at Grinnell.

Measurable Hamel Bases

Alexander Abian, Department of Mathematics, Iowa State University

A subset H of the set R of the real numbers is called a Hamel basis for R if every real number is uniquely expressed as a sum of a finite linear combination of elements of H with rational coefficients. It is shown that there exist Lebesgue measurable Hamel bases and any such Hamel basis is of measure zero. There are also non-measurable Hamel bases and any such basis is of inner measure zero.

Mathematics in the Computer Lab

Can a Computer Lab be a Component for Abstract Algebra?

Al Hibbard, Mathematics/Computer Science Dept., Central College, Pella, IA

In summary: YES! This session will be a hands-on opportunity to test out a series of Mathematica-based labs and packages for group and ring theory developed by myself and Ken Levasseur (UMass Lowell). One of the goals of these labs and packages is to provide pedagogically sound tools to be used to teach/learn abstract algebra. In particular, visualization of algebraic concepts is used wherever possible. No particular skills in Mathematica are presumed.

Using Technology to Make Students Think-- Three Examples from Calculus and Group Theory

David Streid, Department of Mathematics, Maharishi University of Management

Three examples are presented using Mathematica notebooks that require students to observe patterns and make deductions. Emphasis is given on discerning patterns in visual and related numerical information and then formalizing intuitive conjectures in precise mathematical language. An example is analyzing plots of the derivatives of exponential functions and related tables of values in order to derive a formula for the derivative functions.

Visualizing Linear Algebra with the ATLAST Matlab files.
Ruth I. Berger, Luther College.

The ATLAST project has developed some very nice Matlab routines (M-files) which can help students visualize Linear Algebra concepts such as span in R^2, linear transformations from R^2 to R^2, and eigenvectors of 2×2 matrices. I have used these visualizations in my classes and would like to share this information with those of you who have access to Matlab but are not aware of ATLAST.

Session on technology in calculus

Our Changing Calculus Classrom
Brian Keller, Mathematics Department, Iowa State University

This session will highlight some of the changes occurring in our calculus classroom as a result of new technology (TI-92) and the new AP calculus syllabus. Some experiences and results will be shared from a large scale investigation of the effects of the TI-92 on students performance in our engineering calculus sequence.

Hands On Lab: Simple Harmonic Motion **(15 min)**
Heather Thompson and Chris Russell, Mathematics Department, Iowa State University

Description of hands on lab: Participants collect data from an oscillating spring by using a CBL and TI-92 calculator.

Objectives: This data can be graphed and modelled using trigonometry shifts, amplitude, and frequency. Furthermore, through transformations of the data, the approximate rate of change can also be modelled and used to discover the derivative of a trigonometric function. Also, by plotting the approximate acceleration versus distance curves for the data, the linear relationship described by Hooke's Law (a differential equation) is demonstrated. Finally, time-permitting, Euler's method and this differential equation are combined to give an approximation for the data.

Hands On Lab: Differential Equations **(15 min)**
Chris Russell and Heather Thompson, Mathematics Department, Iowa State University

Description of hands on lab: Participants collect light intensity data through tinted plates on a window. In a second lab, voltage data is gathered from a simple circuit with a resistor and a capacitor.

Objectives: Participants find the linear relationship between light intensity and the rate of change of light intensity for the first experiment. Also there is a linear relationship between the voltage and its rate of change. Differential equations are derived which can be solved using the methods of calculus to achieve the light intensity and voltage curves.

Session on mathematics education

Cooperative Learning in College Algebra

Bernadette M. Baker, Mathematics and Computer Science, Drake University

Having students work in cooperative groups in College Algebra together with a "reform" College Algebra text have greatly altered the class activities, assignments, assessment, instructor preparation, and student motivation in this course. I will share some ideas that worked.

Some gems from the Schaum's Outline Series: "pure math" titles

Daniel Willis, Loras College

McGraw-Hill's Schaum's Outline Series contains many wonderful titles. Often overlooked (or ignored), these texts are available (new!) in inexpensive paperback editions for $15 or less. The speaker will introduce some of the "pure math" titles that he has found especially useful, e.g., Linear Algebra, Set Theory, Group Theory, General Topology, Real Analysis, Statistics, and Probability. For more information, check out schaum's on the web at www.schaums.com or www.mcgraw-hill.com.

Some gems from the Schaum's Outline Series: "applied math" etc. titles

Daniel Willis, Loras College

McGraw-Hill's Schaum's Outline Series contains many wonderful titles. Often overlooked (or ignored), these texts are available (new!) in inexpensive paperback editions for $15 or less. The speaker will introduce some of the "applied math" titles that he has found especially useful, e.g., Differential Equations, Partial Differential Equations, Fourier Analysis, Numerical Analysis, and Lagrangian Dynamics. For more information, check out schaum's on the web at www.schaums.com or www.mcgraw-hill.com.

Statistics Session I

The Monotone Density Problem Revisited

Chris Carolan, Department of Statistics, University of Iowa

More than forty years ago, Grenander(1956) found an appealing form for the MLE of a nonincreasing density function with known mode. Rao(1969) investigated the limiting distribution of the density estimate at a fixed point x, when the true density f() is differentiable at x and $f'(x) < 0$. Here, Rao was able to express this limiting distribution as a particular functional of Brownian motion with quadratic drift. Here, we find the limiting distribution of the density estimate at a fixed point x, when the true density is flat in some open neighborhood of x. Our density is expressible as a convolution of a closed form density and a normal density.

Adaptive Function Estimation

Yuhong Yang, Department of Statistics, Iowa State University

In this talk, we will fisrt explain what is meant by adaptation for function estimation and why it is useful. Both density estimation and nonparametric regression are considered. General results will be presented for adaptation with respect to function classes, for adaptation with respect to available estimation strategies, and for adaptation with respect to operating models.

Comparisons of Approximate Weibull Distribution Confidence Intervals for Type I Censored Data

Shuen-Lin Jeng* and William Q. Meeker, Department of Statistics, Iowa State University

In this paper we compare several different procedures for computing confidence intervals for parameters and quantiles of the Weibull distribution. The methods can be classified into three groups. 1. The normal approximation of (possibly transformed) maximum likelihood estimators. 2. The likelihood ratio statistic and its modifications. 3. Parametric bootstrap approach, including the use of bootstrap-type simulation to calibrate the procedure in the first two groups. We use the Monte Carlo simulation to investigate the finite sample properties of these procedures for Weibull parameters and quantiles based on Type I censored data. The usual normal approximation methods are crude unless the expected number of failures is large (> 50 or 100), especially for one-sided confidence bounds. The likelihood ratio methods work much better and provide an adequate procedure down to 20 or 30 failures. With the bootstrap methods, limiting distributions are replaced by simulated sampling distributions, then the approximate confidence interval procedures for both one-sided and two-sided cases generally perform well for expected number of failures down to 10 or less.

Likelihood-based estimation for the random effect model with measurement error

Elizabeth Martha S. Paterno, Department of Statistics, Iowa State University

Random or mixed effect analysis for panel data is considered when some explanatory variables are measured with error. In some applications (e.g., economic analysis), the covariance between the random effect and the unobservable true explanatory variables is to be estimated, and contributes to the difficulty of the problem. Identification of model parameters is examined, and relatively unrestrictive sufficient conditions for identification are obtained. Estimation based on maximum normal likelihood is proposed. This method can be easily implemented using available computer packages that perform moment structure analysis. Compared to the only existing procedure based on instrumental variables, the new method is shown to be more efficient and to have much wider applicability. Standard error estimates and goodness-of-fit statistics obtained under the assumption of normal obsevations are also shown to be asymptotically valid for a broad class of non-normal observations. Simulation results demonstrating the efficiency and usefulness of the new procedure are presented.

Regression Model for Prediction of Erosion in the United States

Amy J. Meyer* and Jean Opsomer, Department of Statistics, Iowa State University

The National Resources Inventory (NRI) includes a measure of soil erosion. Every year a subset of the points included in the NRI are observed as part of an Erosion study. The Universal Soil Loss Equation is a product of six factors affecting water erosion. In the past the values of these factors have been determined by conservationists in the field. In the current 1996 study, these factors are not available. In order to compute a measure of water erosion for the 1996 data, amodel has been developed to predict the main factor based on the cover and management of the land. A basic linear regression model was estimated from 1995 data after performing a log transformation to stabilize the variance. The variables in the model include four years of land use and an indicator for the state. The model was further calibrated by performing a second regression of the observed values on the model predictions. Erosion changes from 1995 to 1996 were assessed by computing the model predictions for both years.

Statistics Session II

Predicting Nocturnal Sky Cover in Iowa

Vera Boulaevskaia, Department of Statistics, Iowa State University

Atmospheric cloud cover (sky cover) is a potentially important variable for predicting dew formation and duration. Dew duration is important to farmers because the activity of many crop diseases is affected by the duration of wetness periods. While daytime skycover can be estimated by using solar radiation, other methods have to be found for estimating nocturnal sky cover. This research attempts to identify such methods. The relationship of sky cover in the evening and morning to the sky cover during the intervening night hours was investigated using data for Des Moines, IA. The most frequent patterns were entirely clear and entirely cloudy nights. Sky cover values in the evening and the following morning were strong indicators the sky cover values during the intervening night. Average sky cover was regressed on the overnight air temperature change and average relative humidity for the night. Overnight average relative humidity was found to be a strong predictor of either completely clear or completely cloudy overnight sky cover patterns, but not of intermediate patterns.

Probability of Detection Modeling for Ultrasonic Testing

Pradipta Sarkar* (Center for Nondestructive Evaluation and Department of Statistics, Iowa State University), William Q. Meeker (Center for Nondestructive Evaluation and Department of Statistics, Iowa State University), R. Bruce Thompson (Center for Nondestructive Evaluation, Ames Laboratory of Science and Technology, Department of Materials Science and Department of Aerospace Engineering and Engineering Mechanics, Iowa State University), and Timothy A. Gray (Center for Nondestructive Evaluation and Department of Aerospace Engineering and Engineering Mechanics, Iowa State University).

The objective of this paper is to combine the physical model with the statistical model to develop a useful methodology for predicting probability of detection for ultrasonic testing. The methodology will be illustrated in the context of ultrasonic nondestructive

evaluation data on heat exchanger from nuclear power plants. Generalized deviations between the physical model prediction and actual data points are modeled using the method of maximum likelihood estimation for censored data. This estimated distribution will be used to obtain an estimate of the variability in the data and the probability of detection. Cautious use of the physical model allows prediction of the probability of detection for other inspection configurations.

Analyzing Ecological Trends with Multiple Natural Resource Databases

Junyuan Wang, Department of Statistics, Iowa State University

Wildlife population data are routinely collected by state and federal agencies. Federalagencies also collect data on landuse, natural resources and agricultural practices, such as those provided by the Agricultural Census and the National Resources Inventory (NRI). These databases can be used to investigate the relationships between ecological trends and natural resource policies. Our objective is to develop general approaches to analyze data from multiple natural resource databases, with particular emphasis on relating population dynamics to landscape characteristics.

Difficulties arise when combing data collected from different studies. We begin by establishing a spatial link between the two data sets by defining a common polygon for aggregation, such as counties. Next, we summarize time trends for variables in each database by polygons. The estimated statistical parameters are then used to model relationships in ecological trends and landuse patterns. This approach will be illustrated with Iowa Department of Natural Resources annual pheasant count data and Iowa data from the USDA National Resources Inventory (NRI).

Weak Convergence Results for the Diameter of a Random Point Set

Chris Najim, Department of Statistics, University of Iowa

Let n points be uniformly distributed on a two-dimensional region which contains a single axis of greatest width. Suppose that the boundary of the region behaves like the curve of a polynomial function in a neighborhood of each of the endpoints of this axis. We will call the diameter of the point set the largest distance between any two of the n randomly generated points. The limiting distribution of this diameter, suitable centered and rescaled, is found to be either that of a Weibull random variable or that of the sum of two Weibull random variables as n goes to infinity. The number of Weibull random variables involved, their parameters, and the amount of rescaling required all depend on the behavior of the boundary near the endpoints of the axis of greatest width.

Using Fenchel Duality to Find Constrained MLEs

Joy Jordan, Department of Statistics and Actuarial Science, University of Iowa

Lee, Robertson and Wright (1989) considered testing marginal homogeneity versus stochastic ordering in a two-factor experiment. The MLE of the mean vector under stochastic ordering was found. We will present an alternative way of finding the MLE, based on the Fenchel Duality Theorem. It will be shown that the solution to the dual (quadratic programming) problem is, in fact, an isotonic regression.

Statistics Session III

Is There Evenhandedness in the Mississippi Delta?

Heather J. Smith, Department of Statistics, Iowa State University

Sample surveys can provide information regarding response patterns of individuals. However, the patterns may arise from characteristics of the questionnaire. In particular, response patterns to two related questions can invoke a special pattern called the norm of even handedness. Several classic examples of this phenomenon will be discussed and graphical displays will be shown. In addition, two methods of testing for even handedness, t tests and repeated measures ANOVA, will be developed. The procedures will then be used to analyze responses to a surveydone in the Mississippi Delta in the summer of 1995. In the survey, responses were analyzed with respect to race and sex. The poll revealed some evidence of even handedness, particularly for the females and black males.

Estimating bivariate usual intake distributions

Juan Jose Goyeneche*, Alicia L. Carriquiry, and Wayne A. Fuller, Department of Statistics, Iowa State University

Ratios of usual intakes of dietary components such as percent of calories from fat or percent of calories from saturated fat are important indicators of dietary adequacy.

To estimate the proportion of the population with usual intakes of 30% or less calories from fat, for example, requires that we obtain an estimate of the joint distribution of usual fat and energy intakes. From a statistical point of view, the problem is challenging in that observed intakes for pairs of nutrients are: (i) often correlated; (ii) subject to measurement error, and (iii) not normally distributed.

We present a method for estimating the usual intake distribution for a pair of nutrients and for their ratio. We first transform observed intakes into approximate bivariate normality, and then we fit a bivariate measurement error model to the transformed vectors. A set of of representative usual intake and measurement error vectors are generated from the model, and backtransformed to the original space. Finally, the joint distribution for the pair of nutrients, and for their ratio is estimated.

On assessment of process capability in multivariate quality control

Syed Kirmani and Vani Sundaraiyer*, Department of Mathematics, University of Northern Iowa

A celebrated theorem of Anderson (Proc. Am. Math. Soc. 1955) on multivariate normal probabilities of centrally symmetric convex sets is used to motivate a criterion for multivariate process capability. A union-intersection test for process capability is derived. The test is in terms of the largest eigenvalue of a certain matrix. It is shown, through an example, how bootstrapping may be used to interpret the value of the test statistic.

Use of estimating funtions for estimating finite population parameters
Jae kwang Kim* and Wayne Fuller, Department of Statistics, Iowa State University

The theory of estimating functions was set forth in the seminal work of Godambe (1960), and research in the area has been active since then. The theory was designed to provide a framework for optimizing the score function in a parametric setting, and provides a unified framework for two of the principal methods in the theory of estimation, namely, least squares and maximum likelihood. In problems related to survey sampling, Godambe and Thompson (1986) have used unbiased estimating functions to estimate the parameters in superpopulations and in survey populations. Their approach, however, is somewhat restrictive in the sense that it requires independence in the superpopulation model. Here, we present some general results in the use of estimating functions in survey sampling settings. In finding optimal estimating functions we relax several assumptions about the superpopulation model, and thus are able to discard Godambe and Thompson's (1986) independence assumption at the superpopulation level. We also propose optimal designs under the model, where optimal here means that estimators achieve the lower bound of their expected variance. As an example, we derive optimal sampling strategies for sampling across time under a reasonable covariance structure.

Card Shuffling:A Computer-Graphics Approach
Karina Bauswell, Kevin Buesing*, Mike Custer, Jason Thompson, and Brent Willis, University of Northern Iowa

Given a deck of n cards,how many times must we shuffle to make it 'random'?. We discuss this question through computer animations with varying values of n and for various types of shuffling. The shuffling types include include riffling, normal, subpar, and perfect shuffling. Are seven shuffles enough? To find out, come and see our animation.

Statistics Session IV

Pseudo point generation for NRI data
Jens Eickhoff, Department of Statistics, Iowa State University

The National Resource Inventory (NRI) is a longitudinal survey aimed at assessing conditions and trends at 5-year intervals for soil, water, and related resources on nonfederal rural lands of the United States. The primary sample unit (PSU) is a land area within a county with a typical size of 160 acres. For each sample PSU, size data are collected for five different landuses. Within each PSU, detailed data are collected at 3 randomly selected points. Since PSU data may contain a pattern of change over the three years that is not reflected by the points, pseudo points are created so that changes on PSU level are reflected on the point level. The data for the pseudo points are imputed from real point data, usually within the vicinity of the PSU. While a previous procedure selected the donor randomly within a given region, a proposed improved procedure uses newly available spatial location information to select a donor point from the closest PSU. Comparisons between the old and new procedures indicate that the new procedure reduces misclassification errors.

A Comparison of Spatial Cumulative Distribution Function (SCDF) Predictors of a Spatial Process Sampled with Measurement Error

Jeremy Aldworth* and Noel Cressie, Department of Statistics, IowaState University

Consider a Gaussian spatial process, defined over a discretized region, to be contaminated with measurement error. Interest is in prediction of the spatial cumulative distribution function (SCDF) of the (measurement-error free) spatial process. Parametric, semi-parametric, and non-parametric predictors are compared. Design-based comparision criteria are used in a factorial-design computer simulation experiment. The factors include different sampling designs, levels of measurement error, presence or absence of trend, and size of prediction regions.

A Spatial Autoregressive Model in Precision Agriculture

Cong Chen* and Jay Breidt, Department of Statistics, Iowa State University

In precision agriculture, it is important to establish the relationship between crop yields and soil nutrients and to predict soil nutrient values at unsampled sites. In this presentation weintroduce a spatial autoregressive model to achieve both goals. The Gibbs sampler is used to obtain posterior distributions on all unknown quantities. The issue of convergence rate of the Gibbs sampler is addressed. Explicit bounds for the convergence rate of the Gibbs sampler are obtained. The methodology is applied to data from a corn field in Iowa.

Asymptotic Statistical Properties of Autoregressive Spectral Estimator for Random Processes with Mixed Spectrum

Soon Lau* and Peter J. Sherman, Department of Statistics, Iowa State University

The influence of a point spectrum on large sample statistics of the autoregressive spectral estimator is addressed. In particular, the asymptotic distributions of the AR coefficients, the innovations variance, and the spectral density estimator of a finite order AR(p) model to a mixed spectrum process are presented, as are asymptotic results as the order p tends to infinity. Numerical simulations are performed to verify the analytical results.

A Likelihood Based Estimator for the First Order Vector Autoregressive Process

Anindya Roy* and Wayne A. Fuller

A one-step approximation to the unconditional maximum likelihood estimator of the coefficient matrix for the first order vector autoregressive process is suggested. The one-step estimator generally has better finite sample behavior than the ordinary least squares estimator, particularly for processes with a root close to one. The finite sample properties of the one-step estimator are investigated via Monte Carlo simulations.

General Information

Registration: The registration desk and book display will be open from 12:00 noon to 7:30 on Friday in 404 Carver; and it will be open from 8:00 to 4:15 on Saturday in the lobby outside 101 Carver. The registration fee is $5.00 for regular members and free for student members. Maps of the campus and town will be available at the registration desk.

Directions and Parking: Follow Highway 30 (which has an exit off Interstate 35) to the Elwood Drive exit in Ames. Follow Elwood Drive north 1 mile to Lincoln Way. Turn left and follow Lincoln Way west 1/2 mile to Lynn Avenue. On Friday afternoon the easiest parking will be in the Memorial Union parking ramp on the northeast corner of that intersection (there will be an hourly charge). On Friday evening (after 5:30) or all day on Saturday you can also park in the Memorial Union parking ramp for a fee. Alternatively, you may park for free on Friday evening or all day Saturday by following Lynn Avenue one short block north, then drive east 1.5 blocks to a large parking lot (Lot 50) where you may park in the general staff parking area (but not in the 24 hour reserved parking section).

IMATYC Lunch and Business Meeting: The lunch will be held in the South Pine Room, located in the southwest corner adjacent to the Food Court in the Memorial Union. Various fast foods are available at the Food Court.

Accommodations:

Iowa State Memorial Union (on ISU campus)	(515)-292-1111
Holiday Inn Gateway Center at Elwood Drive exit from Hwy 30. Ames	(515)-292-8600
Ames Motor Lodge, 318 E. Lincoln Way, Ames	(515)-232-4315
Hampton Inn, 1400 S. Dayton Avenue (exit from Hwy 30), Ames	(515)-239-9999
Heartland Inn, Interstate 35 and New Hwy 30, Ames	(515)-233-6060
Ramada Inn, 1206 S. Duff Ave (exit from Hwy 30), Ames	(800)-228-2828
University Inn, 316 S. Duff Ave, Ames	(515)-232-0280

1997 Iowa Collegiate Mathematics Competition

Grinnell College is hosting the third annual Iowa Collegiate Mathematics Competition on Saturday, April 5. The format of the competition will be as in the past -- teams of 3 (undergraduate) students working on about 10 problems for 3 hours, submitting written solutions. The schedule for the day is as follows:

9:30 am	Registration, coffee and rolls.
10 am - 1 pm	Students compete.
1pm - 2:30 pm	Lunch, with talk on problem solving by Stan Wagon, Macalaster College

During the student competition, faculty will enjoy a demonstration/workshop of the Linear Algebra Modules Project (LAMP) by Gene Herman of Grinnell and also have time for some informal interaction.

If your school plans to participate and you have not yet registered your teams, please contact Emily Moore at mooree@math.grin.edu immediately.

STATS: Statistical Thinking with Active Teaching Strategies Workshops for Mathematicians Who Teach Statistics

Supported by the National Science Foundation, the Mathematical Association of America is conducting a series of faculty development workshops for mathematicians who teach courses in introductory statistics but have little formal training in the subject. Goals of the workshops are to help the faculty participants to:

- o teach statistical thinking with more data and concepts, less theory and fewer recipes
- o explore active learning alternatives to the lecture method in their teaching of statistics
- o make effective use of technology in their statistics courses
- o use authentic assessment practices in evaluating the work of their statistics students
- o discover a myriad of print and electronic resources for teaching
- o engender lasting collegial relationships among mathematicians who teach statistics

Each workshop will feature sessions led by two leading statistics educators. These sessions involve workshop participants actively in their own learning by presenting topics and activities that lend themselves to direct use with students. Week-long workshops also feature participants working on team projects of data collection and analysis.

Support from NSF covers room and board expenses for the week-long workshops, lunch for the one-day workshops, and a variety of workshop materials related to teaching statistics. There is no registration fee. Workshop participants or their institutions are expected to ocover travel costs, and participants must have e-mail accounts.

Cornell College is hosting a STATS workshop on Saturday, May 31. The application deadline is April 15. For more information and to receive application forms, please contact Jane Heckler, STATS Project Registrar, MAA, 1529 Eighteenth Street NW, Washington DC 20036-1385. phone 202-387-5200 FAX 202-265-2384 e-mail jheckler@maa.org.

You may also find information and apply electronically from the STATS home page at http://stats.dickinson.edu.

UNIVERSITY OF NORTHERN IOWA
CONFERENCE ON
TEACHING MATHEMATICS TO UNDERGRADUATES

Saturday, March 29, 1997

The Department of Mathematics, University of Northern Iowa, Cedar Falls, Iowa will host a one-day Conference on Teaching Mathematics to Undergraduates on Saturday, March 29, 1997. This conference is intended to provide a forum for mathematicians and mathematics educators to exchange ideas on the issues and challenges facing undergraduate mathematics instruction. It is expected that the conference will address issues such as use of technology and mathematical software, calculus reform, revamping the undergraduate mathematics curriculum, and novel and innovative ways of teaching mathematics to both majors and non-majors.

The conference will consist of invited as well as contributed papers. The keynote speakers will be Professors Keith Stroyan (Iowa), A. M. Fink (ISU), and Emily Moore (Grinnell). Contributed papers are sought on topics and issues mentioned above. Those wishing to present 20-25 minute papers are requested to send an abstract (limited to one paragraph) no later than Friday, March 14, 1997. Please send the abstracts, preferably by e-mail, to Professor Syed Kirmani, Department of Mathematics, University of Northern Iowa, Cedar Falls, IA 50614-0506, Phone: (319)273-2940, FAX (319)273-2546, kirmani@math.uni.edu. Notification of acceptance of the abstracts will be given by Monday,March 17,1997.

All persons interested in teaching mathematics to undergraduates are cordially invited to attend. There is no registration fee. However, those who expect to attend are requested to register by March 14. To register, please send your name and affiliation, preferably by e-mail, to Professor Kirmani. The conference will begin at 9:30 a.m. on Saturday, March 29, and the final session will end by 5:00 p.m. on the same day. The only social event will be a lunch (Chicken Monterey au Gratin, Parmesan Breadstick, Seasonal Fresh Fruit, Marble Cake, Beverage). The cost of the lunch, to be collected at the door, will be $7.50. The conference sessions will be held in Wright Hall on the UNI campus.