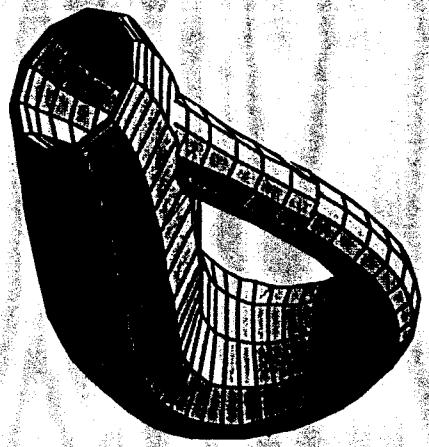
Department of Mathematics and Computer Science
Coe College
Cedar Rapids, IA 50219

Iowa Section Newsletter



SPRING 1996

Joint Spring Meetings
at
Cornell College
Friday and Saturday
April 26–27, 1996

A Note from the Program Chair, Jim Freeman

Cornell College is pleased to host the 1996 Annual Joint Meetings of the Iowa MAA, ASA, and IMATYC. With the help of several people in these organizations, we look forward to exciting, stimulating and productive meetings.

You will find that the program is quite full this year. You can choose between two MAA invited talks, one ASA invited talk, 15 minute student presentations, 25 minute faculty presentations, a hands-on computer tutorial or a presentation on preparing materials for the World Wide Web. There are 53 different talks planned and 5 different tracks on Saturday.

You will find directions to campus and information on parking, accommodations, and other items after the abstracts in this newsletter. A registration desk staffed by Cornell students will be open for essentially the entire meeting. If you have any questions during the meetings, please go to the registration desk.

If you are bringing students, please let me know in advance. If there are enough students planning to attend Friday evening, we will try to schedule a special event for students. In addition, winners of the student talks on Friday will be announced before the invited talk Friday night, as well as at the business meeting.

At the business meeting, changes to the by-laws will be proposed. For those interested in the current by-laws, a copy has been placed on the Iowa MAA WWW site, http://maa-ia.cornell-Iowa.edu/. Any changes to this program will also be available from that site. You may contact me by e-mail at freeman@Cornell-Iowa.edu or by phone at (319) 895-4393.

Looking forward to seeing you at Cornell on the 26th and 27th.

National Summer Meeting
Seattle, Washington, August 10–12, 1996

Governor's Report - Spring 1996

The Association's Board of Governors winter meeting was held in Orlando on January 9. This was hard on the heels of the worst storm to hit the east coast this past winter. As a result, the Washington staff of the Association missed the meeting and most of the business transacted was of a routine nature. Please see the February issue of FOCUS for a summary of the Association activities at the annual meetings.

Also in the February issue of Focus are an article and an editorial dealing with the demise of UME Trends as a separate publication. Section members should be aware of the various plans to fill the gap left by the passing of this newsletter.

Gerald Alexanderson, who has been the Secretary of the Association, will become its next president. Martha Siegel, until recently the editor of Mathematics Magazine, has been elected by the board to replace Professor Alexanderson as Secretary. Professor Siegel is one of the featured speakers at the Iowa Section meeting in April.

Alex Kleiner

Nomination for Chair Elect

The Iowa Section Nominations Committee (Luz DeAlba, James Peake and Ron Smith) has submitted the name of Stephen J. Willson, Professor of Mathematics at Iowa State University, for the position of Chair Elect.

Steve Willson received his bachelors degree with a major in mathematics from Harvard University in 1968. He earned his Ph.D. degree from the University of Michigan in 1973, writing a thesis in the algebraic topology of transformation groups under A.G. Wasserman. Steve has been at ISU since 1973 and served as Chair of the department from 1992 through 1995.

Much of Steve's research has dealt with various problems in which a map is applied iteratively to some geometric construct. Many of his papers, for example, deal with the long-term behavior of certain cellular automata in which enough regularity is assumed to permit the proof of theorems. He also has interests in game theory, fractals, knot theory, and fair division problems.

Professor Wilson devotes considerable energy to teaching, and he received an AMOCO Outstanding Teacher Award in 1983. He has helped to design a course in the mathematics of fractals for advanced undergraduates.

TREASURER'S REPORT

March 28, 1996

	Debits	Credits	Balance
Starting Balance (3-1-95)			$1,396.89
MAA Dues Rebate		$300.00	$1,696.89
1995 Spring Meeting			
Registrations (59 @ $5)		$295.00	$1,991.89
Book Sales		$217.00	$2,208.89
1995 Meeting Expenses(1)	$0.00		$2,208.89
1995 Spring Newsletter	$334.99		$1,873.90
1995 MAA Books	$217.00		$1,656.90
1995 Book Sale Commission(2)		$0.00	$1,656.90
1995 Info Call for Fall Newsletter	$11.20		$1,645.70
1995 Fall Newsletter	$253.09		$1,392.61
Additional Dues Rebate (one-time)(4)		$200.00	$1,592.61
Excess funds from Meeting at ISU(5)		$225.62	$1,818.23
Interest		$21.08	$1,839.31
Ending Balance (3-1-96)			$1,839.31

A couple of notes about the report:

1. UNI covered the expenses for the spring 1995 meeting so we did not have any expenses for that meeting.
2. We have yet to receive a commission check from the national office for 1995 book sale. I am still hopeful that we will.
3. We have not been billed for the Spring Call for Papers yet. By the meeting, that will appear on the report.
4. The national office sent an additional $200 to help for the difference in the new subventions (which is 2.5% of dues for the section). For some sections (like ours) this formula gives us less money. This is a one-time payment to get us over the adjustment period.
5. This is money that was leftover from the section meeting we had at Iowa State University several years ago.

Steve Nimmo

Amendments to By-Laws

The Committee for Updating the By-Laws proposes the following amendments to the current By-Laws of the Iowa Section of the MAA. This article serves as the notice required 15 days before the Section meeting for any amendments to the By-Laws. We will vote on these By-Law changes at our annual business meeting on April 27, 1996. A copy of the current By-Laws is available on the Internet (http://maa-ia.cornell-Iowa.edu/); paper copy available from Steve Nimmo, Secretary/Treasurer at Department of Mathematics, Morningside College, Sioux City, IA. If you have questions or comments about the proposed changes contact Emily Moore <mooree@math.grin.edu>.

These are the proposed amendments to the By-Laws:

A. Article II, Section 1b:
Change the reference to Article IV of the national MAA By-Laws to Article VI. (This may have been in error previously, or may have become out of date due to a change in the MAA By-Laws.)

B. To introduce gender-neutral language into the By-Laws:

1. Throughout the document:
Change Chairman to Chair, Chairman-Elect to Chair-Elect, etc.

2. Article III, Section 1:
Change "his successor" to "a successor".

3. Article III, Section 6a:
Change "He shall" to "The Chair shall".

4. Article III, Section 6c:
Avoid using "He shall" by describing the duties of the Secretary-Treasurer using one sentence with items separated by commas.

C. To bring the By-Laws in line with current practice:

1. Article V, Section 1.
This currently reads: "There shall be no dues or registration fees assessed the members of the Section, unless the dues and/or fees are approved by the members at a properly called meeting."

Proposed wording: "There shall be no dues assessed the members of the Section unless dues are approved by the members at a properly called meeting. There shall be a nominal registration fee assessed at the annual spring meeting."

Joint Meetings of the Iowa MAA, ASA, and IMATYC
Cornell College, Mount Vernon, Iowa
April 26 and 27, 1996

Friday, April 26

12:00 – 7:30	Registration and Book Exhibit	West Foyer/Science Library
1:30 – 3:00	Statistics Session I	West 118
1:30 – 3:05	Mathematics Student Papers I and II	West 213, 218
3:00 – 3:15	Break	West Foyer
3:15 – 4:30	Statistics Session II	West 118
	Mathematics Student Papers III	West 218
4:30 – 7:00	Films	West 118
5:00 – 7:00	Dinner on your own	
	Iowa ASA dinner and meeting reservations required	Hillcrest Country Club
7:30 – 8:30	MAA Keynote Lecture I: **Martha Siegel**, Towson State University *Probability as the Queen*	Armstrong Theatre
8:30 –10:00	Reception	Orange Carpet, Commons

Saturday, April 27

8:00 – 4:15	Registration and Book Exhibit	West Foyer/Science Library
8:30 – 8:35	Welcome: Dean Dennis Damon-Moore	Armstrong Theatre
8:35 – 9:35	ASA Keynote Lecture: **Joel Greenhouse**, Carnegie Mellon University *Jet Lag, Baseball, and Depression: Statistical Models for Biological Rhythm Data*	Armstrong Theatre
9:35 – 9:50	Break	Armstrong Lobby
9:50 –10:50	MAA Keynote Lecture II: **Martha Siegel** *Industrial Mathematics for Fun and Profit*	Armstrong Theatre
10:50 –11:30	Iowa MAA business meeting	Armstrong Theatre
11:00 – 1:00	Isolated Statisticians meeting	Harlan, Commons
11:00 – 1:00	Films	Science Library
11:30 – 1:00	Lunch (on your own)	
	IMATYC Lunch and Business Meeting	Magee, Commons
1:00 – 2:00	Mathematics Technical Session I reservations required (max 12)	Cole Library, Training Room First Level
1:00 – 2:30	Statistics Session III	West 100
	Math Contributed Papers I, II and III	West 118, 213, 218
2:30 – 2:45	Break	West Foyer
2:45 – 4:00	Statistics Session IV	West 100
2:45 – 4:15	Math Contributed Papers IV, V, and VI	West 118, 213, 218
	Mathematics Technical Session II	Law 206

Friday Afternoon Session

West 213: Mathematics Student Papers I: 1:30 – 3:05

1:30 1:45 Suzanne Michelle Shontz, University of Northern Iowa
Molecules and Their Symmetries: Determining the Hybridization of the Central Atom Using Point Graphs

1:50 –2:05 John Hamman, University of Northern Iowa
A Look at the Four-Vertex Theorem

2:10 –2:25 Terry Sargent, University of Iowa
On functions with intermediate value property that are not derivatives

2:30–2:45 Tom Oleson, University of Northern Iowa
What It Takes to Buy Commutativity with $(XY)^n = X^nY^n$

2:50–3:05 Alexander Samuel, University of Northern Iowa
Unsolvability of the Problem of Trisecting an Angle

West 218: Mathematics Student Papers II: 1:30 – 3:05

1:30 –1:45 Brian Olson, Luther College
Three Theorems on Nonstandard Dice

1:50 –2:05 Kartik C. Parija, Drake University
Examining the Inertia of Derogatory Matrices under the Stein Transformation

2:10 –2:25 Lee Vettleson, Drake University
Quantum Computations

2:30–2:45 Bao-jun Jiang, Grinnell College
On Right-Angle-Triangle Free Sets

2:50–3:05 Karen Ball, Grinnell College
On Packing Unequal Squares

West 118: Statistics Session I: 1:30 – 3:00

1:30 –1:45 D. L. Bruden and M. S. Kaiser, (student, ISU)
Effects of Aggregation in Bivariate Correlation

1:45 –2:00 K. W. Dodd, A. L. Carriquiry, and W. A. Fuller, (student, ISU)
Replicate Weighting Methods for Quantile Variance Estimation

2:00 –2:15 P. J. Abbitt, (student, ISU)
Sampling Approaches for Soil Survey Updates

2:15–2:30 H. M. Axelson, F. J. Breidt, and A. L. Carriquiry, (student, ISU)
Two-Phase Regression Estimation for Policy Analysis Using Computer Simulation Experiments

2:30–3:00 D. Cook, (faculty, ISU)
Through the Windshield in p-Dimensions

West 218: Mathematics Student Papers III: 3:15 – 4:30

3:15 –3:30 Goran Krilov, Drake University
3-D Invariants of Polyhedral Structures

3:35 –3:50 Adam Sales, Grinnell College
Packing an Infinite Sequence of Circles

3:55 –4:10 Sol Bobst, Drake University
On Characterization of Helices

4:15–4:30 Paula Calkins, Drake University
On Full Decomposition of Graphs

West 118: Statistics Session II: 3:15 – 4:15

3:15 –3:30 H-C. Huang, and N. A. C. Cressie. (student, ISU)
A Spatio-Temporal Kalman Filter

3:30 –3:45 A. Roy and W. A. Fuller. (student, ISU)
Estimator for the First Oder Vector Autoregressive Process

3:45 –4:15 G. Bril. (faculty, Luther College)
Tree Rings and Decorah Climate

Saturday Afternoon Session

West 213: Mathematics Contributed Papers I: 1:00 – 2:30

1:00 –1:30 Charles Ashbacher, Decisionmark
Smarandache Function

1:30 –2:00 Steve Nimmo, Morningside College
The Use of Toolbook in Math Seminar

2:00 –2:30 John Price, Maharishi University of Management *The Absolute Number as a Mathematical Theory and Technology of Everything*

West 218: Mathematics Contributed Papers II: 1:00 – 2:30

1:00 –1:30 Arnold Adelberg, Grinnell College
p-adic Analysis and Bernoulli Polynomials

1:30 –2:00 Charles Jepsen, Grinnell College
Dissecting a Polygon into Triangles of Equal Areas

2:00 –2:30 Alex Kleiner, Drake University
Summability of Unbounded Series

West 118: Mathematics Contributed Papers III: 1:00 – 2:30

1:00 1:30 Cathy Gorini, Maharishi University of Management
Discovering Non-Euclidean Geometries
1:30 2:00 Daniel Alexander, Drake University
Reform Real Analysis
2:00 –2:30 Ruth Berger, Luther College
Learning Abstract Algebra in a Computer Classroom

Cole Library, Training Room: Math Technical Session I: 1:00 – 2:30
This session is limited to the first 12 people who request this session. Reservations will be taken on a first come first serve basis at the registration desk.

1:00 –1:30 Al Hibbard, Central College
Accessing Mathematical Resources on the Internet

West 100: Statistics Session III: 1:00 – 2:30

1:00 –1:30 H. S. Stern. (faculty, ISU)
Who's Hot and Who's Not?
- Runs of Success and Failure in Sports
1:30 –1:45 N-J. Hsu, and F. J. Breidt. (student, ISU)
Bayesian Approach to Long-Memory Stochastic Volatility Models
1:45 –2:00 P. Sarkar, and W. Q. Meeker. (student, ISU)
Bayesian On-Line Abrupt Change Detection Algorithms with Process Monitoring Applications
2:00 –2:15 D. Nettleton. (student, U of I)
Interval Mapping of Quantitative Trait Loci through Order Restricted Inference
2:15 –2:30 M. Haubrich, and M. Schwab. (student, ISU)
An Interactive Method for Ranking Cities

West 213: Mathematics Contributed Papers IV: 2:45 – 4:15

2:45 –3:15 Elias S.W. Shiu, University of Iowa
Interest Rate Risk: A Calculus Solution
3:15 –3:45 John P. Lediaev, University of Iowa
Creating Math Movies on the TI-85 and the TI-92 to Enhance Calculus and Pre-Calculus Instruction
3:45 –4:15 Murphy Waggoner - Simpson College
Lies My Calculator Told Me (or Why I Still Need to Know Math Even Though I've Got a Graphing Calculator)

West 218: Mathematics Contributed Papers V: 2:45 – 4:15

2:45 –3:15 Luz M. DeAlba, Drake University
Superstable Matrices
3:15 –3:45 Stephen Willson, Iowa State
A New Envy-Free Allocation in the Fair Division Problem
3:45 –4:15 Milan Randić, Drake University
Higher Order Lucas Numbers

West 118: Mathematics Contributed Papers VI: 2:45 – 3:45

2:45 –3:15 Doug Swan, Morningside College
Phase Plot Labs in Ordinary Differential Equations
3:15 –3:45 Robin Pennington, Wartburg College
A Project-Oriented Differential Equations Course

Law 206: Mathematical Technical Session II: 2:45 – 4:15

2:45 –3:15 Al Hibbard, Central College
A First Look at Mathematica 3.0
3:15 –4:15 James Freeman, Cornell College
Creating Materials for the Web: Pros and Cons

West 100: Statistics Session IV: 2:45 – 4:00

2:45 –3:00 H. Shierholz. (student, ISU)
Sampling Approaches for Minnesota Fish Contamination and Ecology Studies
3:00 –3:30 R. V. Lenth. (faculty, U of I)
Experimental Design for Process Settings in Aircraft Manufacturing: A Case Study
3:30 –4:00 M. S. Kaiser. (faculty, ISU)
Underdispersed Binary Trials in Toxicity Tests

Friday Afternoon

Mathematics			Statistics	
	West 213	West 218		West 118
1:30–1:45	Shontz	Olson	1:30–1:45	Bruden
1:50–2:05	Hamman	Parija	1:45–2:00	Dodd
2:10–2:25	Sargent	Vettleson	2:00–2:15	Abbitt
2:30–2:45	Oleson	Jiang	2:15–2:30	Axelson
2:50–3:05	Samuel	Ball	2:30–3:00	Cook
3:15–3:30		Krilov	3:15–3:30	Huang
3:35–3:50		Sales	3:30–3:45	Roy
3:55–4:10		Bobst	3:45–4:15	Bril
4:15–4:30		Calkins		

Saturday Afternoon

Mathematics				Statistics	
	West 213	West 218	West 118		West 100
1:00–1:30	Ashbacher	Adelberg	Gorini	1:00–1:30	Stern
1:30–2:00	Nimmo	Jepsen	Alexander	1:30–1:45	Hsu
				1:45–2:00	Sarkar
2:00–2:30	Price	Kleiner	Berger	2:00–2:15	Nettleton
				2:15–2:30	Haubrich
2:45–3:15	Shiu	DeAlba	Swan	2:45–3:00	Shierholz
3:15–3:45	Lediaev	Willson	Pennington	3:00–3:30	Lenth
3:45–4:15	Waggoner	Randić		3:30–4:00	Kaiser

Mathematics Technical		
	Cole Library	Law 206
1:00–2:00	Hibbard	
2:45–3:15		Hibbard
3:15–4:15		Freeman

Keynote Lectures

Probability as the Queen
Martha Siegel, Towson State University

Exploration of classical and modern ideas in probability as gems of mathematics.

Industrial Mathematics for Fun and Profit
Martha Siegel, Towson State University

Preparing students and faculty for the challenge of applied mathematics.

Jet Lag, Baseball, and Depression:
Statistical Models for Biological Rhythm Data
Joel B. Greenhouse, Carnegie Mellon University

After jetting across several time zones, you may feel out of sorts, have low energy, sleep and eat at the wrong times, and maybe even feel a little depressed. It has been argued that this collection of symptomatology, commonly known as jet lag, is brought on by the sudden disruption of the synchronicity between your internal biological clock and the external environment. Recently, it has been suggested that such disruptions of the internal biological clock could have profound effects on the performance of shift-workers and baseball players. Similarly, many psychiatrists believe that disruptions in biological rhythms, like the ones that cause jet lag, are intimately related to the affective illness known as major endogenous depression. In this talk, I discuss the application of statistical methods to the study of biological rhythm data, and see how these methods contribute to the understanding of the biology of depression.

Mathematics Student Papers

Mathematics Student Papers I

Molecules and Their Symmetries: Determining the Hybridization of the Central Atom Using Point Graphs
Suzanne Michelle Shontz, University of Northern Iowa

Symmetries are evident everywhere in nature. Leaves are symmetrical; snowflakes are symmetrical, and crystals are symmetrical. Another very important example of symmetry in nature occurs in molecules.

Using symmetry operations such as rotations, inversions, and reflections, molecules can be transformed into molecules that are similar to or indistinguishable from the original molecule. It can be shown that the set of symmetry operations on a molecule forms a mathematical group with respect to composition.

Once a molecule's symmetry group, or point group, has been established, a character table for the symmetry group can be consulted. Using information

from the character table, calculations may be done that determine what symmetry properties the atomic orbitals have that constitute the hybridization of the central atom of the molecule. Finally, knowledge of chemical bonding theory allows us to decide which atomic orbitals make up the hybrid molecular orbital.

A Look at the Four-Vertex Theorem

John Hamman, University of Northern Iowa

The four-vertex theorem is a statement of differential geometry which states that all simple convex curves have at least four vertices. The traditional proof of this theorem relies on a proof by contradiction and is not at all geometrical in nature. I will discuss two different articles which not only give two distinct geometrical proofs but broaden the hypothesis to include Jordan curves which are curves that separate the plane into two disjoint, connected sets.

The presentation is based on two articles which appeared in the "American Mathematics Monthly." The first of these articles was written by Robert Osserman in which he finds a circumscribing circle about the curve (here the curve can be Jordan). By translating this circle until the curve touches the circle at a single point, the points of relative minimum curvature are found. The points of maximum curvature can then be found on the curve between the two minimum points. The second article, written by Serge Tabachnikov, uses the evolute curve which can be associated with each smooth curve plane. The singularities, usually cusps, that appear on the evolute are associated with the vertices on the original curve. Thus, showing the evolute has at least four cusps will guarantee that the original curve has four vertices.

Finally, a comparison of the different methods of proof and the pros and cons of each method will conclude the presentation.

On Functions with Intermediate Value Property that are not Derivatives

Terry Sargent, University of Iowa

Certain G functions by themselves and taken along with any of their powers will not always conform to the intermediate value theorem "by mapping intervals to intervals" and hence produce a derivative. We will prove this by finding these examples of G, i.e. Sin (1/X) and Cos (1/X) and by raising them to various powers. A generalized formula can be derived that will determine which G functions will produce a derivative.

What It Takes to Buy Commutativity with $(XY)^n = X^nY^n$

Tom Oleson, University of Northern Iowa

If a ring R is commutative, then it is easy to show that $(xy)^n = x^ny^n$ for all $x, y \in R$ and for some positive integer $n > 0$. However, the partial converse is of interest: if $(xy)^n = x^ny^n$ for all $x, y \in R$ and for some positive integer $n > 0$, must R be commutative? We consider several partial results including the following:

Theorem: Let R be a ring with a multiplicative identity element, and suppose R satisfies $(xy)^n = x^ny^n$ for three consecutive positive integers n. Then R is commutative.

Theorem: Let R be a ring with a multiplicative identity. Suppose that R satisfies $(xy)^n = x^ny^n$ for $n = k$, $k+1$, and that R contains no nonzero elements for which $k!x = 0$. Then R is commutative.

These theorems lead to the search for the minimal restrictions needed, along with $(xy)^n = x^ny^n$, to insure commutativity. Answers to this are provided using H. E. Bell's article "The Identity $(XY)^n = X^nY^n$: Does It Buy Commutativity?", appearing in the Mathematics Magazine, Volume 55, No. 3, May 1982.

Unsolvability of the Problem of Trisecting an Angle

Alexander Samuel, University of Northern Iowa

Among the geometric construction problems left unsolved by the ancient Greeks, three are particularly famous. One of these problems is to show that every angle can be trisected using only an unmarked straightedge and a compass.

Motivated by the definition of the quadratic extension of a field, we will try to find the values of 'a' for which we can construct a segment of length 'a'. Then with the aid of elementary trigonometric formulas, we derive a cubic equation whose roots are not constructible. Using this cubic equation, we discuss the unsolvability of the problem of trisecting any arbitrary angle. In particular, we will show that an angle of 60 degrees cannot be trisected.

Mathematics Student Papers II

Three Theorems on Nonstandard Dice

Brian Olson, Luther College

An undergraduate research paper detailing some mathematical solutions to the questions of different numberings on the faces of dice. Details the work of George Sichermann and Joseph Gallian on this subject.

Examining the Inertia of Derogatory Matrices under the Stein Transformation

Kartik C. Parija, Drake University

Let A be a square derogatory matrix of dimension n, such that all of its eigenvalues lie on the unit circle. Let π and υ be nonnegative integers, with $\pi + \upsilon = n$, and let π' and υ' be positive integers, with $\pi' + \upsilon' = n$. This project examines the existence of a Hermitian nonsingular square matrix K, with inertia $(\pi, \upsilon, 0)$, such that the matrix H produced by the Stein equation $H = K - AKA^*$, is a Hermitian nonsingular matrix with inertia $(\pi', \upsilon', 0)$. The investigation was initially carried out with $n = 3$ and these results are presented. The $n = 4$ case is being currently researched and any ensuing conclusions resulting from this study will be submitted. (Supported by a Drake University Undergraduate Research Grant 1996)

Quantum Computations

Lee Vettleson, Drake University

Theoretical computer scientists with their physics counterparts are working on sending information by quantum states. Bennett at IBM labs has been giving talks on algorithms using this method. These have an exponential efficiency over

their classical counterparts such as factoring large numbers, becoming a potential threat to cryptography schemes that depend on the difficulty of factoring. These quantum state transmissions also provide near-perfect security against undetected eavesdropping.

On Right-Angle-Triangle Free Sets

Bao-jun Jiang, Grinnell College

Erdös and Silverman posed the following problem in 1977: Find the largest integer $f(n)$ such that from every set of n points in the Euclidean plane one can select $f(n)$ points no three of which are the vertices of a right-angle triangle (RAT). It has been shown that $\sqrt{n} \leq f(n) \leq 2\sqrt{n}$ for any n. Further it is known that $f(5) = f(6) = f(7) = 3$ and $f(10) = 4$, and hence $3 \leq f(8) \leq 4$, $3 \leq f(9) \leq 4$. We prove that $f(9) = 4$.

On Packing Unequal Squares

Karen Ball, Grinnell College

We improve the best known bound on the smallest rectangle into which all the squares of side lengths $1/n$, $n = 2, 3, 4, \ldots$ can be packed. The question of whether a packing with an arbitrarily small excess area is possible remains unanswered.

Mathematics Student Papers III

3-D Invariants of Polyhedral Structures

Goran Krilov, Drake University

Graph theory has been successful in generating numerous invariants for molecular graphs that have been used in study of the structure-property relationship. However, some molecular properties are sensitive on details of 3-dimensional molecular structure, which graph theory is unable to characterize. We will consider novel structural invariants that have been recently introduced [1] which are based on averaging the interatomic separations in a molecule. In particular we consider several polyhedral forms for which novel structural invariants will be generated. Instead of using only separations between vertices of the polyhedra we will extend the approach by representing each structure with a large number of points. The computer program developed will be outlined and CPU times listed for few representative computations.

[1] M. Randić, Molecular Shape Profiles, J. Chem. Inf. Comput. Sci., **35**, 373-382 (1995).

Packing an Infinite Sequence of Circles

Adam Sales, Grinnell College

Given discs of radii $\frac{1}{n}(n = 1, 2, 3, \ldots)$, what is the smallest region of specified type (a rectangle, a quadrilateral, an arbitrary convex region) into which these discs can be packed? We show that the smallest rectangle that can accommodate all of these circles has dimensions 2 by $(\frac{2}{3}+\sqrt{2})$, an area of 5.8284271247, a surplus of 13%. The smallest quadrilateral that we were able to find inside which these discs can be packed has an area of 5.6411776667, a surplus of nearly 9%. Finally we discuss four different convex regions, the smallest with an area of 5.275973043, a surplus of 2.095%.

On Characterization of Helices

Sol Bobst, Drake University

Currently of considerable interest in chemistry and biology is the relationship between the function and the form of proteins. The double helix is the underlying structural element in modeling proteins. Helices of different form have been reported in the literature, the α-helix being the most common. We will outline a procedure for characterization of helices by considering D/D matrices in which elements are given as the ratio of geometrical distance and the graph theoretical distance[1]. The first eigenvalue of D/D matrices λ apparently is an index of the degree of folding of a curve in 2-dimensional or 3-dimensional space. We will report on the dependence of λ on the geometrical parameters that define helices.

[1] M. Randić, A. F. Kleiner and L. M. DeAlba, Distance/Distance Matrices, J. Chem. Inf. Comput. Sci., **34**, 277-286 (1994).

On Full Decomposition of Graphs

Paula Calkins, Drake University

There are many ways in which graphs can be decomposed into set of components. For example, the counts of paths of different length represent one such decomposition. We will consider a decomposition of graphs, called dissection and outlined some time ago, in which components are successively broken down into smaller components until all components are either isolated vertices or isolated edges [1]. Difficult questions to answer are: Can different graphs produce the same decomposition? Can one reconstruct a graph if the numbers of components is known. We will report on decomposition of all trees (acyclic graphs) having up to $n = 10$ vertices and on several families of cyclic graphs. No two graphs having the same decomposition have been so far found.

[1] M. Randić, On Dissection of Acyclic graphs, MATCH, **5**, 135-148 (1979).

Mathematics Contributed Papers

Mathematics Contributed Papers I

Smarandache Function

Charles Ashbacher, Decisionmark

The standard functions of number theory such as the Euler phi function were defined centuries ago and still lead to new and exciting consequences. In 1979, Florentin Smarandache, a Rumanian mathematician, defined a new function in number theory

$S(n) = m$, where m is the smallest integer such that n evenly divides $m!$

that is called the Smarandache function in his honor.

In this presentation, the function will be defined and some of the basic theorems and consequences will be discussed. The level of the material will be basic number theory and therefore suitable for undergraduates.

The Use of Toolbook in Math Seminar
Steve Nimmo, Morningside College

In this talk I will discuss our Math Seminar course that we require of all math majors and minors. The main focus of the talk will be how we incorporate the use of the authoring system "Toolbook" into the course for student presentations. Software presentations of past and present students will be shown.

The Absolute Number as a Mathematical Theory and Technology of Everything
John Price, Maharishi University of Management

For some years, physicists have been writing about "theories of everything." By definition, such theories must include the consciousness of the observer. This talk looks at possible requirements for the mathematics of such theories and concludes that we have to go beyond "object referral mathematics" and "intellect referral mathematics."

Mathematics Contributed Papers II

p-adic Analysis and Bernoulli Polynomials
Arnold Adelberg, Grinnell College

The *Bernoulli polynomials* $B_n^{(l)}(x)$ can be defined by

$$\sum_{n=0}^{\infty} B_n^{(l)}(x)\frac{t^n}{n!} = e^{xt}\left(\frac{t}{e^t-1}\right)^l.$$

Their constant coefficients $B_n^{(l)}(x)$, which are rational numbers if l is an integer, are called *Bernoulli numbers*. The Bernoulli numbers and polynomials have been studied extensively, for their intrinsic significance and for their relationship to Fermat's Last Theorem.

If p is a rational prime, we have proven some results on the powers of p that divide the numerators and denominators of the Bernoulli numbers if l is a p-adic integer. These lead to a complete description of the Newton polygons of certain Bernoulli polynomials, which in turn yields strong factorization results over the field of p-adic numbers.

All terms will be defined in this talk.

Dissecting a Polygon into Triangles of Equal Areas
Charles Jepsen, Grinnell College

Suppose a polygon is dissected into triangles of equal areas. What numbers of triangles are possible? We begin with a square and then note what is known for a regular n-gon with $n \geq 5$. We concentrate on dissections of trapezoids and observe that for many trapezoids the number of triangles is a multiple of a single integer. We exhibit an infinite collection of trapezoids for which this is not the case.

Summability of Unbounded Series
Alex Kleiner, Drake University

It is a classical result in summability theory that every regular, (sequence to sequence) matrix method of summability, A, that "sums" a divergent sequence also "sums" an unbounded sequence. It is also known that if A sums at least one series with terms that do not converge to zero, then it must sum at least one series with unbounded terms. It will be shown that this is result can not be extended to the class of all regular methods or even to those which sum a bounded divergent sequence. Counterexamples to several potential "consolation" theorems will be developed.

Mathematics Contributed Papers III

Discovering Non-Euclidean Geometries
Cathy Gorini, Maharishi University of Management

Mathematicians only accepted the existence of non-Euclidean geometries after consistent models had been shown to exist; we should not expect students to be very different. This paper describes many ways to have students explore concrete models of non-Euclidean geometry, including beach balls, the Lenart sphere, Geometer's Sketchpad, and KaleidoTile.

Reform Real Analysis
Daniel Alexander, Drake University

I taught a year-long real analysis course at Drake this past year that was somewhat out of the ordinary in two respects:

(A) The topics were all motivated by the history of analysis. In particular, the central problem was the development of Fourier series, and we explored how these strange (at least to an early 19th century mind) mathematical beasts forced mathematicians to take a much closer look at concepts they had long taken for granted (eg., the integral, continuity, and especially convergence issues regarding series of functions).

(B) Mathematica was used to explore many of the issues raised. For example, we rearranged the harmonic series and we looked graphically at the notion of uniform convergence.

The text I used was David Bressoud's "A Radical Approach to Real Analysis" and I more or less followed his approach.

Learning Abstract Algebra in a Computer Classroom
Ruth Berger, Luther College

This past Fall my Abstract Algebra class met in a computer classroom. Each week, the students spent one or two class periods working in groups on worksheets which I developed. These worksheets use ISETL and the program "Exploring Small Groups" to let students experiment with many examples. The students came up with conjectures before we proved the corresponding theorem. They developed a very good feeling for Abstract Algebra concepts and were able to give examples of groups with certain properties during tests where no computer use was allowed.

Interest Rate Risk: A Calculus Solution

Elias S.W. Shiu, University of Iowa

A problem faced by the insurance industry is that of interest rate fluctuations, which can cause billions of dollars of losses. To understand what interest rate risk is, consider a block of insurance business and its associated assets. The *asset cash flow* (or *investment cash flow*) in any future time period is defined as the investment income and capital maturities expected to occur in that time period. The *liability cash flow* (or *insurance cash flow*) in any future time period is defined as the sum of the policy claims, policy surrenders and expenses minus the premium income expected to occur in that time period. The *net cash flow* is defined as the difference between the asset cash flow and liability cash flow. A positive net cash flow means that the asset cash flow exceeds the liability cash flow, generating excess cash for reinvestment. Losses may occur, if interest rates are below the current level when the net cash flows are positive. On the other hand, negative net cash flows mean cash shortages for meeting liability obligations. At such times it would involve the liquidation of assets or borrowing. Losses may occur, if interest rates are above the current level when the net cash flows are negative. The purpose of this talk is to present a solution by applying elementary calculus.

Creating Math Movies on the TI-85 and the TI-92 to Enhance Calculus and Pre-Calculus Instruction

John P. Lediaev, University of Iowa

Some mathematical concepts can be visualized with the aid of a single graph or picture. Others, including many that are defined by a limit, can be more easily visualized by a carefully constructed sequence of images. Adding animation to such a sequence of images can create a more powerful catalyst for the imagination. For example, an animated rotation of a complicated graph of a function in 3 space helps the student to understand that function more quickly, an animated sequence of graphs of Taylor polynomial for a function f about a point makes concrete the idea of Taylor polynomials approximating $f(x)$, and animation can be used to visualize limits as dynamic processes.

The easy-to-use animation features on the new Texas Instrument's TI-92 graphing calculator makes math movies a viable tool for teaching and learning. This talk will present several fundamental calculus and pre-calculus concepts that can be visualized more effectively by adding animation to appropriate sequences of graphs or pictures.

Lies My Calculator Told Me (or Why I Still Need to Know Math Even Though I've Got a Graphing Calculator)

Murphy Waggoner, Simpson College

Although a graphing calculator is a useful tool for learning mathematics, students often do not realize that it is only a tool and cannot do the mathematics for them. To help students understand both the power and the limitations of the machine they hold in their hands, we must understand how the machine works.

In this talk there will be a brief introduction to the algorithms used by the TI-85 graphing calculator for integration, differentiation, finding roots, etc. Examples will be presented from college algebra and calculus for which the TI-85 does not give good results with an explanation of what went wrong in each case.

Superstable Matrices

Luz M. DeAlba, Drake University

An $n \times n$ matrix A is called *stable* if all of its eigenvalues have positive real part. An $n \times n$ matrix A is called *superstable* if every principal submatrix of A is stable. Superstable matrices arise in applications to economics. In this talk we will describe geometric and algebraic properties of superstable matrices; we will use the Routh-Hurwitz criterion to obtain characterizations of superstable matrices of sizes up to 7×7. Also included in this presentation will be a discussion of the relation among superstable matrices and other stability classes of matrices.

A New Envy-Free Allocation in the Fair Division Problem

Stephen J. Willson, Iowa State University

The problem of "fair division" is the problem of dividing goods among a number of people in a manner that is recognized as being "fair." Each person i tells his or her "weight" w(i,j) for item j so that all the weights for each person add up to, say, 100. An allocation x gives the fraction x(i,j) of item j to person i, and the valuation to player i is the sum over j of the terms x(i,j)w(i,j). The allocation x is "equitable" if all players receives the same valuation under the allocation. The allocation x is called "envy-free" if no player would prefer strictly the share that any other player received. An envy-free allocation x is called "efficient with respect to envy-freeness" if there is no other envy-free allocation y such that all players are at least as pleased with their allocation under y as they would be with their allocation under x and some player strictly prefers his or her allocation under y. We survey some principles for choosing a fair allocation. We then give a description of a new allocation we call the "nucleolus" of the fair division problem. The nucleolus is the best envy-free allocation under the criterion that, roughly, an allocation x is preferred to the allocation y if the person receiving least under x gets more than the person receiving least under y. This quantifies a principle of justice proposed by John Rawls. The nucleolus is an envy-free allocation which is efficient with respect to envy-freeness. The nucleolus is essentially unique.

Higher Order Lucas Numbers

Milan Randić, Drake University

We consider a generalization of the Lucas numbers: $1, 3, 4, 7, 11, 18, 29, 47, \ldots$ that was motivated by the occurrence of Lucas numbers as the count of all the matching cyclic graphs. The work parallels similar generalization of Fibonacci numbers that, among others, occur as the count of all matching in acyclic graphs. A relationship between the generalized Lucas numbers and the generalized Pascal triangle will be outlined that parallels similar relationship between the generalized Fibonacci numbers and Pascal triangle. Finally the possibility to generalize

Catalan numbers using Pascal triangle and generalized Pascal triangle as a source for generalization will be considered. Most of the work was carried in a collaboration with Professor O. Araujo and Professor D. Morales from the Universidad de Los Andes, Merida, Venezuela.

Mathematics Contributed Papers VI

Phase Plot Labs in Ordinary Differential Equations
Doug Swan, Morningside College

Students understand phase plots more clearly when they are involved in their creation. I will share ideas from three labs using Derive from the first half of this semester's course. These include: One dimensional phase plots or doomsday/extinction vs. stable populations, Time and phase plots for undriven springs, and Phase plots for spring systems using Runge-Kutta methods.

A Project-Oriented Differential Equations Course
Robin Pennington, Wartburg College

Reformed mathematics courses have been offered at the algebra and calculus level for a decade now, and the movement has begun traveling up into higher level courses. Differential Equations is particularly well-suited for reform because differential equation solvers incorporated into the computer mathematics packages shift the emphasis away from discussion of integration techniques. Freedom from laboring extensively over these techniques leaves more time for discussing the motivating applications, allowing for a focus on dynamical systems.

I taught such a reformed Differential Equations course in the Fall of 1995, relying entirely on projects to get across the content of the course. The course was structured so that projects accompanied a text and incorporated the types of equations and solution techniques described in the text. I will be discussing my structure and strategy for the course, indicating junctures at which it was possible to infuse the content with theoretical matters. Additionally I will be sharing some of the students' results and impressions as well as my thoughts on what worked well and how the course could be improved in the future.

Mathematics Technical Session I

Accessing Mathematical Resources on the Internet
Al Hibbard, Central College

This will be a hands-on session with the aim of familiarizing one with the use of various internet tools and access methods, specifically aiming at resources of use and interest to a mathematician. Conducted in a lab containing both Macintoshes and Windows-based PC's, we will look at how to use a web browser, as well as gopher and ftp tools. Although we will use the Mathematics Archives (archives.math.utk.edu) as our starting point, we will visit numerous other sites. (Space limited to 12 people. Please register for the session at the registration desk.)

Mathematics Technical Session II

A First Look at Mathematica 3.0
Al Hibbard, Central College

Wolfram Research, Inc. is currently in the first beta stage with their new version of Mathematica. Version 3.0 has many significant improvements and changes. We will look at some of these features of this new version and indicate how these changes enable Mathematica to be used more easily for courseware.

Creating Materials for the Web: Pros and Cons
James Freeman, Cornell College

For the last two years, I have been developing for the World Wide Web a hypertext version of the Cornell Catalogue that is tied to the list of courses taught during the year, a system for access to Legislative Information for the Iowa General Assembly, a site for the Iowa League of Women Voters, and other projects. WWW technology is a powerful tool for sharing information, but there are problems when that information has great amounts of mathematical notation.

This presentation will discuss how to effectively use WWW technology and will help people begin to develop their own WWW materials. When preparing material for WWW, it is important to remember what I call the Peterson-Hill Principle, namely "Just because you can do it does not mean you should do it."

Statistics Sessions

Statistics Session I

Effects of Aggregation in Bivariate Correlation
Dana L. Bruden and Mark S. Kaiser, Iowa State University

The ecological fallacy refers to incorrect inferences about the behaviour of individuals made from the analysis of group level data. The ecological fallacy may be manifested as Simpson's paradox which states that the examination of marginal distributions may not lead to the same conclusions as examination of conditional distributions. In general, the difference between results obtained from group level analyses and those from individual level analyses is termed the aggregation effect.

Aggregation of data is important within a sampling context. In environmental sampling, to assess the level of a potential contaminant, the cost of analyzing individual (grab) samples can be high. As a result, analyses are often conducted on composite samples instead. A composite sample is a collection of thoroughly mixed grab samples. Compositing is often done to obtain a less expensive estimate of an average. Attention on aggregation effects in this context has primarily focused on estimating population means and variances. The effect of aggregation on estimation of relations among variables has received less attention.

We investigate the effects of random and systematic grouping of observations on estimated quantities in a simple correlation model. Our results have implications for contaminant monitoring programs used to issue public fish consumption advisories in many states of the U.S.

Replicate Weighting Methods for Quantile Variance Estimation

Kevin W. Dodd, Alicia.L. Carriquiry, and Wayne A. Fuller,
Iowa State University

We discuss the problem of estimating quantiles and their standard errors, under complex survey design, when data are subject to measurement error. Consider the problem of assessing the percent of the population with usual dietary intake below a given level for a nutrient. Here, usual intakes are unobservable long-run averages of daily intakes, and we assume that daily intakes measure usual intakes with error. A method for estimating usual intake distributions and their quantiles was developed at Iowa State University. In this paper we consider the problem of estimating the standard error of the p-th quantile of a usual intake distribution when daily intake data are collected according to a complex survey design. We investigate the performance of replicate weighting methods for variance calculations via Monte Carlo simulation.

Sampling Approaches for Soil Survey Updates

Pamela J. Abbitt, Iowa State University

The National Cooperative Soil Survey (NCSS) is responsible for constructing soil maps detailing the location of soil series throughout the US. It is a cooperative program involving the USDA Natural Resources Conservation Service (NRCS) and a state agency. Reports are generated for each county that contain maps plus a description of the characteristics for each soil map unit within the county. These maps are periodically updated by the NRCS to provide current information on the range of values for particle composition, depth of horizons, and other related attributes. Soil scientists and other natural resource scientists have recently become interested in obtaining more detailed statistical descriptions of the distribution of soil map unit characteristics. This paper describes current research on the use of statistical sampling techniques to update these soil surveys.

Two-Phase Regression Estimation for Policy Analysis Using Computer Simulation Experiments

H. Martin Axelson, F. Jay Breidt, and Alicia L. Carriquiry
Iowa State University

In agricultural economic policy analyses, data of interest such as long-run averages of soil lost to erosion or chemicals leached to groundwater are not available due to high monitoring costs. Hence, computer simulation models are used to describe the corresponding physical processes of soil erosion and chemical movement in soils. These models are site-specific, as they depend on topography, soil properties, weather, management practices, etc. It is impractical to run a simulation model for all sites in a region of interest because input information is not available and computing resources are not adequate. Instead, the model is run for a subsample of the points drawn in the National Resources Inventory (NRI), a stratified two-stage area sample of the nonfederal lands in the United States. Researchers then typically fit a regression "metamodel" to the results of this computer simulation experiment, and finally the fitted metamodel is used on all NRI points to obtain estimates at regional levels (e.g., hydrologic regions, counties, etc.) We formulate this metamodel estimation problem in terms of two-phase regression estimation and develop a variance estimation strategy.

Through the Windshield in p-Dimensions

Dianne Cook, Iowa State University

Graphics for 1-, 2- and even 3-dimensional data are very familiar and often used tools for exploring and analysing data. But as a statistician how often have you found that you have data that comes with just 1, 2 or 3 variables? More often data comes with many more variables and plotting methods restricted to 3 dimensions are inadequate for our needs as analysts. We will discuss methods for looking at such high-dimensional data, how these tools can help to find inherently multivariate relationships, and open research problems for statistical graphics.

Statistics Session II

A Spatio-Temporal Kalman Filter

Hsin-Cheng Huang, and Noel A. C. Cressie, Iowa State University

Consider a spatio-temporal stochastic process $\{Z(s;t) : s \in D;\ t = 1, 2, \cdots\}$ and suppose it is of interest to predict $\{Z(s;t_0) : s \in D\}$ at some fixed time point t_0. Purely spatial methods use data $Z(s_1;t_0), \cdots, Z(s_n;t_0)$ to construct a spatial predictor (e.g., kriging). But, when data $\{Z(s_i;t) : i = 1, \cdots, n;\ t = 1, 2, \cdots, t_0\}$ are available, it is advantageous to treat the problem as one of spatio-temporal prediction. We introduce a spatio-temporal model and construct a Kalman-filter prediction algorithm for the model. A simple procedure for estimating the parameters in the model is also developed. The methodology is applied to the snow water equivalent data for the Animas River basin in southwest Colorado.

Estimator for the First Oder Vector Autoregressive Process

Anindya Roy, and Wayne A. Fuller, Iowa State University

Alternative estimators for the coefficient matrix of the first order vector autoregression under the possibility that the largest root of the matrix is a unit root are considered. One procedure is an extension to the vector case of an approximately median unbiased univariate procedure. Monte Carlo evidence shows the estimator has smaller mean square error than the ordinary least squares estimator when the largest root is in a neighborhood of one. Also the pivotal statistics are more nearly symmetrically distributed.

Tree Rings and Decorah Climate

Gordon Bril, Luther College

Three ring width indices are used to reconstruct Decorah temperature and precipitation for the years 1670-1893. Records of tree ring widths are available from nineteen locations in the state of Iowa. The modeling process provides a linear regression case study in the areas of variable selection, lagged variables, and prediction. Among the findings are that precipitation yields a better reconstruction than temperature and that it appears one has to go back over 300 years to find a year with more rainfall than 1993.

Who's Hot and Who's Not? - Runs of Success and Failure in Sports

Hal S. Stern, Iowa State University

Statisticians concern themselves with understanding the nature of variability. It is relatively simple to demonstrate that patterns, e.g., long runs of success, can and do occur in a sequence of independent identically distributed Bernoulli trials. The recent literature on shooting streaks in basketball and hitting streaks in baseball appears to demonstrate that what is observed in these sports can be explained by chance. Such articles ask whether chance is an adequate explanation of the data but do not ask whether chance is the best explanation for the data. The findings are controversial because they run counter to the experience of almost every athlete and fan. We consider evidence from a reanalysis of baseball hitting data and from computer simulations to assess the evidence concerning hitting streaks in baseball.

Bayesian Approach to Long-Memory Stochastic Volatility Models

Nan-Jung Hsu, and F. Jay Breidt, Iowa State University

Recently, Long-Memory Stochastic Volatility (LMSV) models have been introduced to describe the volatility in the stock market. The exact likelihood of the LMSV model involves an n-dimensional integration and therefore it is very difficult to evaluate. In this paper, a Bayesian approach based on the Gibbs sampling technique is used for inference on volatilities and hyperparameters. The performance of the algorithm is investigated using simulated and real data.

Bayesian On-Line Abrupt Change Detection Algorithms with Process Monitoring Applications

Pradipta Sarkar, and William Q. Meeker, Iowa State University

Many problems arising in process monitoring can be modeled with the aid of parametric models in which the parameters are subject to abrupt changes at unknown times. Many such change detection algorithms are available in the literature. Most of these are developed from frequentist point of view. This talk describes on-line change detection algorithms from a Bayesian point of view for the following three cases : (i) change of known magnitude, (ii) change of unknown magnitude but in a known set and (iii) several changes of unknown magnitude and trend. We develop a stopping rule, based on the cost structures, to decide when to adjust the process and when one should schedule inspections.

Interval Mapping of Quantitative Trait Loci through Order Restricted Inference

Daniel Nettleton, University of Iowa

Interval mapping of quantitative trait loci (QTLs) is an important technique in genetics introduced by Lander and Botstein (1989). This method is used to determine the position of gene pairs which have an impact on quantitative traits in experimental organisms. An order restricted likelihood ratio test is developed to be used in the context of interval mapping. Simulations indicate that this order

restricted test has greater power than the corresponding unrestricted test used by Carbonell, Gerig, Balansard, and Asins (1992). The null distribution of the test statistic is well approximated by a chi-bar-square distribution with mixing proportions that can be determined explicitly through a geometric argument. An order restricted version of the EM algorithm is used to obtain maximum likelihood estimates of relevant genetic parameters.

References

Carbonell, E. A., Gerig, T. M., Balansard, E., and Asins, M.J. (1992). Interval mapping in the analysis of nonadditive quantitative trait loci. *Biometrics* **48**, 305-315.

Lander, E.S. and Botstein, D. (1989). Mapping Mendelian factors underlying quantitative traits using RFLP linkage maps. *Genetics* **121**, 185-199.

An Interactive Method for Ranking Cities

Matthew Haubrich and Matthew Schwab, Iowa State University

The data given for the 1996 Undergraduate Data Analysis Contest included 24 variables on 77 cities. The data set was completed by estimating missing values for several cities. Factor analysis was employed to reduce the dimensionality of the data and expose some "underlying factors." These underlying factors are used in an interactive program that allows the user to find cities that most closely meet their overall preferences.

Sampling Approaches for Minnesota Fish Contamination and Ecology Studies

Heidi Shierholz, Iowa State University

Several Minnesota state agencies cooperate to collect data on mercury contamination in lakes. The data are used to construct fish consumption advisories and to study lake ecology. These agencies are interested in developing a unified, probability sampling approach for their lake studies. It is desirable to base the sample design in part on existing annual sampling efforts for fish management surveys. Administrative areas are also an important factor in obtaining geographic spread and facilitating management of the survey. In this paper, I will discuss approaches to constructing sample designs for such investigations.

Experimental Design for Process Settings in Aircraft Manufacturing: A Case Study

Russell V. Lenth, University of Iowa

This presentation is a result of a collaboration with an applied statistician at Boeing Commercial Airplanes Division. We discuss the design and analysis of an experiment to study process settings for drilling holes. The experiment is motivated by the need to change from a CFC lubricant to a new one. An incomplete-block factorial design was used, with test coupons as blocks. Several responses were measured, and several covariates are present. There are a number of interesting challenges in understanding the design and its restrictions on randomization, in exploring and analyzing the data, and in resolving what is the best setting for overall hole quality.

Underdispersed Binary Trials in Toxicity Tests
Mark S. Kaiser, Iowa State University

The problem of underdispersion arises when the variance among several sets of binary trials is less than that expected from repeated sampling from a binomial distribution. Although not as common as the problem of overdispersion, underdispersed binary trials can occur in repetition of short-term toxicity testing in which conditional independence of individual trials is a reasonable assumption. Lack of independence among individual binary trials has been used to develop contagious discrete distributions, but formal models leading to underdispersion among conditionally independent trials remain undeveloped. A formal model suitable for this situation is proposed, depending on nonindependence among random parameters for individual trials. A joint distribution for parameters in a set of binary trials is developed as a modified version of the Dirichlet. A variety of correlation structures may be produced in the resultant set of binary variables through the use of a parameter which compresses the support of this distribution. In the toxicity setting, this parameter represents the level of mortality caused by a given treatment, and estimation is investigated. While the use of this model can lead to dispersion patterns matching those seen in the toxicity data presented, the model holds serious implications for the standard concept that variability arises from nonuniformity among sampling units. That is, the model proposed is in direct conflict with the generally accepted theory of tolerance in quantal bioassay. Under this model, variability among sets of trials arises not from inherent differences among organisms, but rather from the physical and chemical behavior of the toxicant solution. Nonetheless, the model may be plausible for the example presented in which the individual organisms involved are known to have low genetic variability.

General Information

Registration: Will occur at the meeting. The registration desk and book display will be open from 12-7:30 on Friday and 8-4:15 on Saturday in the lobby of the West Science Building. The fee is $5.00 for regular members, free for student members. Maps of the campus and town will be available at the registration desk.

Directions and Parking: Follow U.S. 1 into Mt. Vernon (either north from I-80 or U.S. 30; or south from U.S. 151). At the stoplight at the top of the hill (only stoplight on 1 in town) turn west onto 1st St. Continue 5 blocks to 5th Ave. Turn left (south), and go up the hill. Just over the crest of the hill there is a 3-way stop at 3rd St. Turn right. This takes you into a parking lot which winds around West Science (the building directly in front of you right after you turn). You may park anywhere in this lot. If it is full, at the end of the lot is an alley leading downhill to another lot (next to the library). You may also park here. Our parking monitors have been instructed not to ticket these lots during the conference. If you do happen to get a ticket, please turn it in at the registration desk and it will be taken care of. On Friday, the Grant Wood Young Writer's Workshop is also using Cornell Facilities until 2pm. Until that time, parking in the lots may be difficult. You may also park along First Street and walk up the hill.

ASA Chapter Business Meeting: Will be held at the Hillcrest Country Club in Mt. Vernon on Friday evening. This meeting will follow a cash bar and dinner. Dinner reservations are necessary. If you are planning on attending the dinner please contact Ann Cannon by Wednesday, April 17 (phone: (319) 895-4461; email: acannon@cornell-iowa.edu) with your meal choice: Prime Rib, $12.95; Baked Breast of Chicken with Rosemary, $8.95; Vegetarian Lasagna, $6.95.

IMATYC Lunch and Business Meeting: Registration for lunch will occur at the the registration table.

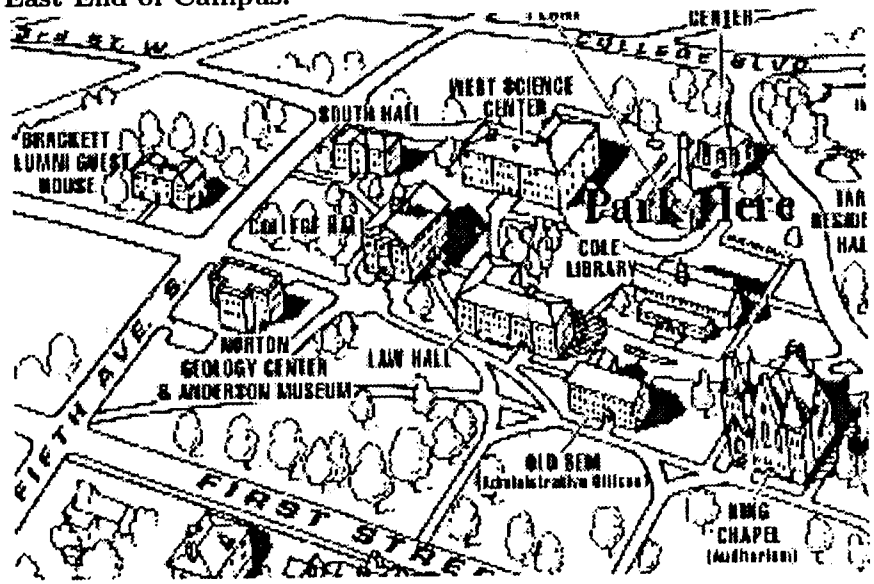
Accomodations:

Mt. Vernon Motel	(319) 895-8868	$30/45	Mt. Vernon
Engelbrecht Inn (Bed and Breakfast)	(319) 895-8895	call	Mt. Vernon
Exel Inn	(319) 366-2475	$33/48	Cedar Rapids
Super 8	(319) 363-1755	$41/47	Cedar Rapids
Sheraton Inn	(319) 366-8671	$78/88	Cedar Rapids

To get to the hotels in Cedar Rapids, go north on I-380 one exit past U.S. 30. Turn left from the exit ramp. All these hotels (and several others) are on this street.

Updated Information: The Iowa Section of the MAA has a WWW site which will have updated information about this conference. Campus Maps are available off this site. The URL is: http://maa-ia.cornell-iowa.edu/

East End of Campus:



News and Announcements

Charles Ashbacher <71603.522@compuserve.com>, an Iowa Section member from Cedar Rapids, is the author of a new book. An Introduction to the Smarandache Function was published in November by the Erhus University Press of Vail, Arizona. Charles is an employee of Decisionmark, 200 2nd Ave. SE, Cedar Rapids, IA 52401. Phone: (319) 365-5597

(Editor's note: If you have news that you would like to share with other members of the Iowa Section, please submit it for inclusion in the section newsletter.)

INDIVIDUALS HONORED WITH CERTIFICATES OF MERITORIOUS SERVICE

Five Certificates of Meritorious Service were presented by the MAA at the Orlando Meetings in January. This year's honorees are Professor Marvin L. Brubaker, Messiah College, Professor Robert Bumcrot, Hofstra University, Professor Sylvan Burgstahler, University of Minnesota, Duluth, Professor Donald W. Bushaw, Washington State University, and **Professor Donald V. Meyer, Central College.**

The Certificates of Meritorious Service are presented for service at the national level or for service to a Section of the Association. Professor Meyer was nominated by the Iowa Section. His citation reads in part: Professor Meyer received his B.A. degree from Central College in 1957, M.A. degree from the University of Iowa in 1959 and Ph.D. from the University of Iowa in 1962 in point set topology. In 1963 he joined the faculty at Central College and has remained there except for leaves at the University of Oklahoma, the University of Wisconsin, the State University of New York at Binghampton, the University of Georgia, and Iowa State University. While at Central College, Professor Meyer has served as chair of the Department of Mathematics and Computer Science for 18 years. In 1984 he was awarded the Outstanding Faculty Performance Award. In the last fifteen years Professor Meyer has served the Iowa Section in an exemplary fashion. He has served as Section Chair (1978-79), Governor (1983-86), and Newsletter Editor (1984-86,1991-95) for the Section.

Name Needed for Newsletter

Northern California has the *Mini-Focus*, while Ohio publishes the *Ohio Focus*. The Illinois Section uses the name *Greater Than Zero*. There is also *The Seaway Current*. Surely the members of the Iowa Section can think of a creative name for our section newsletter. Please send your suggestions to the editor or any member of the executive committee. Ideas for a distinctive logo are also welcome.

MAA/Department Liaisons

This winter the MAA has begun a new program of departmental liaisons at mathematics departments across the country. Departmental liaisons will provide a vital communication link between their departments and the MAA. As of mid February, 18 MAA Liaisons had been appointed in Iowa. If your department does not yet have a Liaison, contact Jane Heckler, Senior Assistant of Programs <jheckler@maa.org>.

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MAA Online
http://www.maa.org

Dear Colleagues,

I am pleased to announce that Ivars Peterson, prize winning author and columnist of Science News, is now writing "MathLand," a weekly MAA Online column on mathematics for the enjoyment of all MAA members and the millions and millions of others in WebLand who share our love of mathematics. Ivars joins Keith Devlin on MAA Online as our second mathematical columnist. Keith's popular column, "Devlin's Angle," is the target of a large number of electronic "hits." It's absolutely clear that both of these writers are big hits.

Don Albers <dalbers@maa.org>

Ohio Section 1996 Summer Short Course
Actuarial Mathematics

The MAA Ohio Section will hold its summer short course in Actuarial Mathematics June 3-5, 1996, on the campus of Marshall University in Huntington, West Virginia. The course will be conducted by Professor Matthew Carlton. Prof. Carlton holds a PhD in mathematics, and he is a Fellow of the Society of Actuaries. He is also a principal in American Benefit Corporation, an insurance consulting firm, where he has practiced for over two decades.

Topics will include an overview of the actuarial profession and the actuarial exams, employment prospects for new graduates, advancement opportunities, suggested courses for student advising, actuarial problems to apply in traditional mathematics courses, actuarial topics for seminars, the theory of interest, numerical analysis topics and mortality tables. Demonstrations will be in the area of pension mathematics, which is his specialty and which he feels is also the most interesting mathematically.

Lodging is available through local hotels and motels at competitive rates. Dormitory rooms, with communal bath, at very inexpensive rates, may become available for the nights of June 3-5. Course registration fee is $100, and the deadline for $50 deposit is May 3. Checks should be made payable to the Marshall University Research Corporation, and they should be marked "Actuarial Mathematics." Registrations may be sent to Actuarial Mathematics, Department of Mathematics, Marshall University, Huntington, West Virginia 25755-2560. For more information contact David Cusick at the above address. Telephone 304-696-3038. e-mail cusick@munxt01.mu.wvnet.edu. This announcement, and any updates, will be posted on the MAA Ohio Section Home Page.

1996 Summer Technology One Week Short Courses for College Faculty

The Ohio State University Short Course Program organized by Bert Waits and Frank Demana is offering week-long courses at many colleges throughout the United States. Each short course participant will learn "hands-on" how to use the new TI-92 hand-held symbolic algebra computer and/or the TI-82 or TI-85 graphing calculator to enhance the teaching and learning of college and university mathematics. Mathematics reform materials consistent with the calculus reform movement, MAA recommendations, and the AMATYC *Crossroads in Mathematics* will be the focus of appropriate short courses. Applications, problem solving, group learning, pedagogy, implementation issues, and testing issues will be featured in all short courses. The Calculator-Based Laboratory (CBL) system may be used to gather real data and connect mathematics with science.

Courses offered in the Midwest include:

ALGT	College algebra, trigonometry, and data analysis using the TI-82 and CBL with an introduction to the TI-92
PCALC	Precalulus and calculus topics using the TI-82 or TI-85 and CBL with an introduction to the TI-92
CAS-CALC	Calculus enhanced with computer symbolic algebra usint the TI-92 and CBL

Short Course	Dates	Location	State	Host	Information	Instructor
PCALC	June 10 - 14	Northern Illinois U.	IL	D. Porzio	(815) 753-6732	A. Stickney
CAS-CALC	June 17 - 20	Harper College	IL	A. Olsen	(708) 925-6405	J. Fiedler
ALGT	June 17 - 21	Central Michigan U.	MI	D. St. John	(517) 774-2554	B. Sultenfuss
PCALC	June 17 - 21	Indiana Inst. of Tech.	IN	T. Romary	(219) 422-5561	A. Stickney
CAS-CALC	June 24 - 28	U. of Wisc.-Oshkosh	WI	Ganapathy/Szydlik	(414) 424-7355	Hofmann
CAS-CALC	July 15 - 19	Grand Rapids CC.	MI	J. Chesla	(616) 771-4273	S. Thomas
ALGT	August 5 - 9	Johnson County CC.	KS	J. DiCostanzo	(913) 469-8500	Sultenfuss

For further information on dates and locations of all college sites, please contact Bert Waits and Frank Demana at Ohio State c/o Ed Laughbaum at (614)292-7223, or <elaughba@math.ohio-state.edu>, or Room 342 Math Tower, The Ohio State University, 231 West 18th Avenue, Columbus, OH 43210.

CRYPTOLOGY AND MATHEMATICS- A DYNAMIC PARTNERSHIP

Dates: July 8-12, 1996

Location: Allegheny College, Meadville, Pennsylvania

Principal Lecturer: Dr. Richard Shaker, retiree from NSA, investment advisor.

Abstract: Cryptology, the science of making and breaking codes, is an exciting subject in its own right, but this course will explore and emphasize the dramatic relationship between cryptology and mathematics. We will study several examples where fundamental mathematics (primarily algebra, number theory, and probability/ statistics) provides just what is needed to create or destroy encryption processes. Conversely, these cryptologic applications will help to focus mathematical research in new, dynamic areas. Some examples of the interaction between cryptology and mathematics will be drawn from "cryptologic history," (e.g., the work of the World War II codebreakers), but the bulk of the course will analyze current encryption schemes.

Dr. Shaker's undergraduate and graduate studies were at the University of Chicago; his Ph.D. was obtained under the direction of Professor Irving Kaplansky. Dr. Shaker recently completed a 26-year career at the National Security Agency, retiring as its Chief of Mathematical Research in January, 1995. He currently works to break the "stock market code" as an investment advisor.

The course will once again be held at Allegheny College. Course registration will be $150 and room and board will be $130 for a total of $280.

For further information and an application, contact:

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