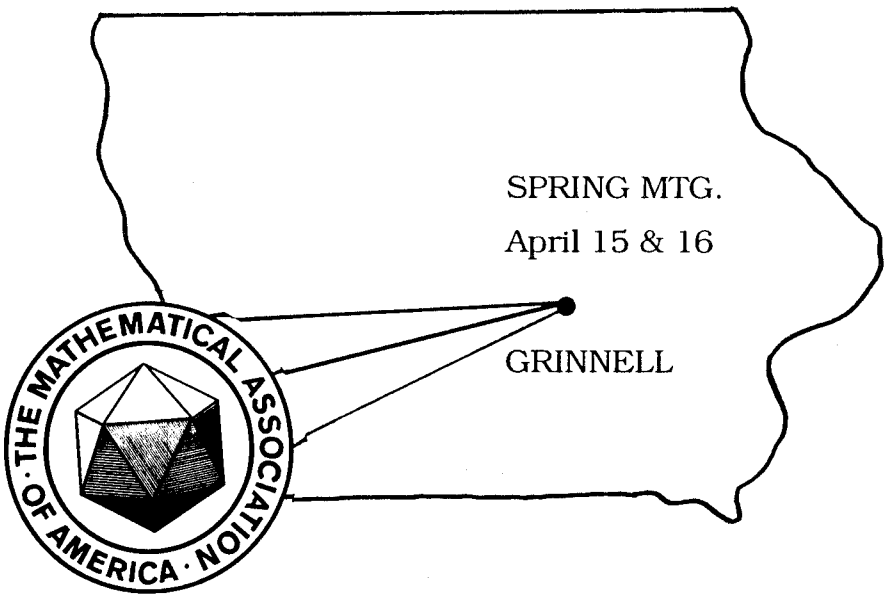
IOWA SECTION NEWSLETTER



SPRING 1994

IOWA SECTION **SECTION OFFICER LIST** **JUNE 1993**

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VOLUME X NO. 2 April 1994

SPRING SECTION MEETING
at
GRINNELL COLLEGE
Friday and Saturday
April 15-16, 1994

A Note from the Program Chair, Emily Moore

Grinnell College is pleased to host the 1994 Annual Joint Meetings of the Iowa MAA, ASA, and IMATYC. Thanks to the efforts of several people in these organizations, we look forward to an interesting program.

In this newsletter you will find a map of the Grinnell College campus. There will be several groups on campus, so parking may be tight. The most convenient parking will be along Park Street near ARH, and in the parking lot off 8th Street near Darby Gym. Parking stickers will not be required during our meetings.

If you have students who would like to bring sleeping bags and stay with our students in the dorms, please contact me as soon as possible. While there was not enough interest in a student modeling competition, we hope students will come and participate in the meetings. We are trying to arrange something especially for the students Friday evening.

NATIONAL SUMMER MEETING
MINNEAPOLIS, MINNESOTA, AUGUST 15-17, 1994

GOVERNOR'S REPORT
LYNN J. OLSON

I again had the privilege to represent the Iowa Section at the Board of Governors just prior to the joint meetings in Cincinnati.

The business meeting was again handled with amazing speed and efficiency. Don Kreider is a very effective leader and Gerald Alexanderson exhibits great skill as the Association Secretary. Gerald was reelected to that position. The financial status of the Association seems to be solid even though there was a $125,000 deficit for 1993. This deficit was due mainly to a short-fall in dues and subscriptions. It doesn't appear that this will be a continuing problem and in the last five years there was actually an accumulation of $50,000 in the general fund. To its credit the leadership has been able to halt what they termed as "administrative creep" and this has led to better controls on the budget.

The final draft of the "MAA Strategic Plan" was adopted. This document has been in the making for about three years. Its purpose is to serve as a guide to our committees, officers, and members and as a stimulus for discussion of the priorities of the MAA. My personal worries are that it may not be allowed to evolve but the leadership appears committed to not allowing it to become stagnant.

The most important issue brought up at the meetings was the need for financial support for the newly initiated "Math Horizons." This new publication is aimed at undergraduates interested in mathematics. The first two copies, one in January, 93 and the next in March, 94, were funded through grants. The idea is that it will be offered free to students and distributed through individual departments. Starting next year there will be four issues per year. Subscriptions are $100 per group of 20 and the intent is that departments will cover this cost. At a luncheon meeting several ideas for obtaining these funds were generated. I will share these at the meeting in Grinnell and if any of you have unique ideas in this regard please pass them on to me. The biggest problem is a time line. The Association needs to have 160,000 subscriptions by the end of June to continue the project. I will make a major push at the section meeting.

Finally, I would like to make two special notes. First I would like to emphasize the Math Fest in Minneapolis this next August. I guess the last one was highly successful. Secondly, the national office is in the process of installing a Gopher as part of their electronic services upgrading.

Hope to see you at Grinnell.

TREASURER'S REPORT
Steve Nimmo

	Debits	Credits	Balance
Starting Balance (4-1-93)			1243.47
MAA Dues Rebate (294 members)		444.00	1687.47
1992 Meeting Expense	150.90		1536.57
1993 Spring Meeting			
Registrations (61 @ $5)		305.00	1841.57
Lunches (46 @ $5)		230.00	2071.57
Vendor Registration		50.00	2121.57
Book Sales		396.85	2518.42
Lunch Expenses	254.40		2264.02
Reception	85.76		2178.26
1993 Meeting Expenses	39.40		2138.86
1992 Book Sale Commission		71.11	2209.97
1993 Spring Newsletter	304.09		1905.88
MAA Book	446.83		1459.03
1993 Book Sale Commission		57.70	1516.73
1993 Fall Newsletter	239.32		1277.41
1993 Spring Call for Papers	82.07		1195.34
Interest		13.11	1208.45

NOMINEES FOR CHAIR ELECT

The nominations committee consisting of A. M. Fink (ISU), Joel Haack (UNI), and Ron Smith (Graceland) is pleased to submit the following persons for the position of Chair-Elect: Greg Dotseth from the University of Northern Iowa, and Keith Stroyan from the University of Iowa. A brief biographical sketch of each of these candidates follows.

Gregory Dotseth is an Associate Professor of Mathematics at UNI. A member of the UNI Mathematices Department since 1966, he received his BA from Luther College, an MA from Western Washington University and PhD from Iowa State Universtiy. He has previously served as Chair of the Iowa Section of the MAA. Recent activities involve developing precalculus and mathematical modeling materials.

Keith Stroyan teaches mathematics at the University of Iowa in Iowa City. His teaching interests are broad - he has taught courses on 17 different topics from high school through graduate level. As a frequent member of his department's undergraduate committee, he has written a dozen new syllabi and helped select numerous texts. He has also written 6 undergraduate texts with software, most recently the "reformed" calculus book, "Calculus Using Mathematica," (Academic Press 1993).

In the last few years, Keith has given over 30 workshops and lectures on Iowa's new calculus curriculum, which uses Mathematica computing, but primarily emphasizes calculus as the language of science. Iowa calculus 1 & 2 students work projects and write term papers to answer questions such as, "Why did we eradicate polio by vaccination, but not measles?" The purpose of this curriculum is to show students that mathematics has important things to say about their lives.

Keith does research in the modern theory of infinitesimals with applications in complex variables, functional analysis, economics, and probability. He wrote two monographs, "Introduction to the Theory of Infinitesimals," and "Foundations of Infinitesimal Stochastic Analysis."

In his spare time, Keith raises and trains Labrador Retrievers, writes for several retriever magazines, edits the NAHRA Judges' Newsletter and is International Liaison for the North American Hunting Retriever Association.

Editorial Note: We, the Iowa Section Members, owe a special thank you to the members of the nominating committee for putting the slate together, and to Professors Dotseth and Stroyan for their willingness to serve. Many thanks!

Joint Meetings of the Iowa MAA, ASA, and IMATYC

Grinnell College, Grinnell, Iowa

April 15 and 16, 1994

Friday, April 15

1:00 - 4:00 pm	Registration	Forum North Foyer
1:30 - 4:00 pm	Student papers	Science 3204, 3311
4:00 pm	Registration, book exhibit	ARH 3rd floor
4:30 - 5:30 pm	**Patricia Rogers**, York University *Classroom Climate and Other Issues*	ARH 302
5:30 - 7:30 pm	Dinner on your own Iowa ASA dinner & meeting	Oak Room
7:30 - 8:30 pm	**James Hall**, Deere & Company *Neural Networks and Genetic Algorithms: Applications in Finance and Engineering*	ARH 302
8:30 - 10:30 pm	Informal Reception: sponsored by the Iowa and Iowa State Statistics Departments	Forum South Lounge

Saturday, April 16

8:00 am	Registration, book exhibit	ARH 3rd floor
9:00 - 10:00 am	**Johannes Ledolter**, University of Iowa *Evaluating the Impact of the 65 mph Maximum Speed Limit on Iowa Rural Interstates*	ARH 302
10:15 - 10:20 am	Welcome by President Pamela Ferguson	ARH 302
10:20 - 11:20 am	**Patricia Rogers** *You Couldn't Do That in My Class: Curriculum transformation and mathematics education*	ARH 302
11:20 - 11:50 am	Iowa MAA business meeting	ARH 302
11:50 - 1:15 pm	Lunch on your own IMATYC lunch & business meeting	Forum Coffee House
1:30 - 4:00 pm	Concurrent sessions	ARH 102, 120, 131, 224

Friday afternoon Sessions (Student papers)

Science 3204

1:30 - 1:55 Mary Bond, UNI
Marching to the Beat of a Different Manifold

2:00 2:25 Sarah A. McMullin and Theodore F. Smith
Dept. of Mechanical Engr., University of Iowa
Parallelization Techniques of Thermal Systems Numerical Model Codes on Workstation Clusters

2:30 2:55 Kevin John Haertzen, UNI
Graph Theory and the Classification of Surfaces

3:00 - 3:25 Steve Walk, UNI
The Suitability of the Usual Statement Calculus for a Particular Three-Valued Logic

Science 3341

1:30 - 1:55 Lawrence Pelo, NIACC
The Random-Grid Cryptosystem

2:00 2:25 Chris Mosbo, Luther College
Coin Flipping using Quadratic Residues

2:30 2:55 Vikram Subramaniam, Grinnell College
An Expert System to Place Incoming Students

3:00 3:25 Lowell Vaughn, Grinnell College
The Orders of Polyominoes

3:30 3:55 James Mills, Subhesh Pakrashi, and Vikram Subramaniam, Grinnell College
Makespans - Optimal Communication on a Computer Network

Saturday afternoon Concurrent Sessions

ARH 102

1:30 - 2:25 PANEL: *Teaching the History of Mathematics*
Michael Millar, Daniel Alexander, Alex Kleiner

2:30 - 2:55 Daniel S. Alexander, Drake University
Complex Dynamics from Schröder to Fatou and Julia

3:00 - 3:25 Alex F. Kleiner, Drake University
Summability of Unbounded Series

3:30 - 3:55 Joel Haack and Glenn Nelson, University of Northern Iowa
An MA program for Middle Grades Mathematics: Content Considerations

ARH 224

1:30 - 1:55 Catherine Gorini, Maharishi International University
Modular Arithmetic as a Microcosm of Mathematics

2:00 - 2:25 Paul Corazza, Maharishi International University
Using an Ancient Perspective to Understand Large Infinities

2:30 - 2:55 Reginald Laursen, Luther College
A "Look" at l'Hôpital's Rule

3:00 - 3:25 Doug Swan and Steve Nimmo, Morningside College
Success and Retention using Cooperative Learning in Calculus

3:30 3:55 Doug Swan, Morningside College
Teaching Integration by Parts

ARH 131

2:30 - 2:55 Elias S. Shiu
Dept. of Statistics and Actuarial Science, University of Iowa
Pricing the Russian Option

3:00 - 3:25 K. S. Chan
Dept. of Statistics and Actuarial Science, University of Iowa
Regression Analysis of Ordered Categorical Panel Data

3:30 - 3:55 Henry Walker, Grinnell College
A Revised Model Curriculum for a Liberal Arts Degree in Computer Science

ARH 120: Computer demonstrations

1:30 – 2:25 Deane Arganbright, Whitworth College, Spokane, WA
Creative Approaches to Mathematical Visualization and Applications via Spreadsheets

2:30 – 3:25 Keith Stroyan, University of Iowa
Calculus Using Mathematica

3:30 – 3:55 Russell V. Lenth
Dept. of Statistics and Actuarial Science, University of Iowa
Using XLISP-STAT for Teaching and Consulting

Friday afternoon

	Science 3204	Science 3341
1:30	Bond	Pelo
2:00	McMullin	Mosbo
2:30	Haertzen	Subramaniam
3:00	Walk	Vaughn
3:30		Mills

Saturday afternoon

	ARH 102	ARH 131	ARH 224	ARH 120
1:30	PANEL: History		Gorini	Arganbright
2:00			Corazza	
2:30	Alexander	Shiu	Laursen	Stroyan
3:00	Kleiner	Chan	Swan/Nimmo	
3:30	Haack/Nelson	Walker	Swan	Lenth

INVITED TALKS

Neural Networks and Genetic Algorithms: Applications in Finance and Engineering

James Hall, Deere & Company

Dr. Hall will discuss the application of neural networks and genetic algorithms in finance and engineering. He uses neural networks (biolgically motivated prediction algorithms) for portfolio selection and pension fund management. He is also investigating the application of genetic algorithms (biologically motived search and optimization methods) to engineering and finance.

Dr. James Hall is Manager, Active Equity Investment, Deere & Company. Dr. Hall received his Ph.D. in Mechanical Engineering from the University Of Illinois with thesis topic "A Neural Network Combine Controller." Dr. Hall is a frequent panalist at financial conferences and has been quoted in both Fortune and the Economist.

Evaluating the Impact of the 65 MPH Maximum Speed Limit on Iowa Rural Interstates

Johannes Ledolter, University of Iowa

This talk will discuss the impact of the May 1987 speed limit increase on rural interstates from 55 mph to 65 mph. Did the change in law result in a simple rise in the average driving speed? Did more drivers exceed the speed limit? Was there a spillover effect to the other (non-rural-interstate) systems? What ultimate effect did the change have on the number of fatal accidents and on the number of major injury accidents? This talk will use Iowa DOT data to answer these questions through a variety of statistical methods, including graphical, descriptive, and time series. The talk will be aimed at a general audience. Some discussion will go to the special methodological problems created by time series data with sparse counts.

Professor Ledolter earned his Ph.D. from the University of Wisconsin - Madison. He has been on the faculty at the University of Iowa since 1978 with a joint appointment in Statistics/Actuarial Science and Management Sciences. Professor Ledolter has authored 3 books and numerous papers primarily in the areas of times series, forecasting, and applied statistics. In recent years he has been a visiting professor at the Institute for Advanced Studies in Vienna and the Department of Civil Engineering at Princeton. In 1991 Professor Ledolter was elected to membership in the International Statistical Insitute and was also elected as a Fellow of the American Statistical Association.

You Couldn't Do That in My Class: Curriculum transformation and mathematics education

Patricia Rogers, York University

Have you ever been tempted to abandon lecturing in favour of more participatory teaching methods but thought you couldn't do it in your classroom? I was and did! Studies done with minority students in Berkeley, first generation university students in Potsdam, privileged students at Harvard, and feminist research on the gendered nature of communication in the classroom all point to explicit ways in which students' communication skills can be developed to improve student learning in mathematics. Such approaches entail a change in power relations and give voice to students normally silenced by traditional pedagogy. In my presentation, I will describe my attempts to create a learning environment that is true to the nature of mathematical enquiry and which fosters collaboration among students as well as their independence. I will share the joys, the challenges—and some of the frustrations—of teaching in this way.

Patricia Rogers is an Associate Professor of Mathematics and Education at York University, Canada, and does research in mathematics pedagogy and gender issues. She is well known for her work in advancing the issue of women and mathematics education. She has designed and mounted several interventions, notably the "Real Women Don't Do Math!" camps for grade 10 girls. She is currently promoting feminist teaching methods and instructional curriculum transformation in mathematics and has recently been honoured for her work by being appointed to the George Polya Lectureship of the Mathematical Association of America for 1992-94. As well, she was recognised in 1990 for excellence in teaching and commitment to the development of university teaching by the Society for Teaching and Learning in Higher Education by being awarded the 3M Teaching Fellowship. Her work transcends disciplinary and institutional boundaries as she has worked with teachers from kindergarten to graduate school and across disciplines through her work as Academic Director of the Centre for the Support of Teaching at York University. She has recently been appointed representative to the MAA of the Canadian Mathematics Society.

STUDENT PAPERS

Marching to the Beat of a Different Manifold

Mary Bond, UNI

If we view the surface of a drum as a plane domain, M, there exists an interesting relationship between the Laplacian of M and the range of frequencies produced by the drum. In particular, the range of eigenvalues of the Laplacian of M completely determine the frequencies created by the drum. It has been proven that this range of eigenvalues, called the spectrum of the drum, determines some geometrical properties such as the perimeter and the area of the drum. An example of spectrum computation will be presented.

In 1966, Mark Kac posed the interesting question "Can you hear the shape of a drum?" We might ask, "What other properties can be determined from the spectrum?" That is, "What can be determined about the drum merely by its sound?" Some valuable theorems have surfaced in the search for answers to these questions. For example:

> **Theorem:** Let ϕ be an almost inner automorphism of a nilpotent Lie group G. Let Γ be a discrete subgroup of G with $\Gamma\backslash G$ compact. Then the manifolds $\Gamma\backslash G$ and $\phi\,\Gamma\backslash G$ are isospectral.

The source of this theorem and its proof is an article by Carolyn Gordon, "When You Can't Hear the Shape of a Manifold," *Mathematical Intelligencer*, Vol. 11, #3. A brief overview of this proof will be presented.

Graph Theory and the Classification of Surfaces

Kevin John Haertzen, UNI

There is a well-known theorem in topology that any surface is homeomorphic to the connected sum of a sphere, m tori, n projective planes, and r Klein bottles, where m, n, and r are greater than or equal to zero. Any surface can be defined by a finite collection of triangles in some Euclidean space. The collection of all vertices and edges of these triangles forms a graph Σ. A new graph G_Σ can be formed, whose vertices are the barycenters of each of the triangles and from this, we can form a spanning tree T of G_Σ. We now define K_T to be the subgraph of Σ consisting of all the vertices of Σ and those edges of Σ not crossed by T. We then compute the cyclomatic number L of K_T. If $L = 0$, then K_T is a tree and Σ is homeomorphic to a sphere. If $L \neq 0$, then K_T is not a tree, so there must be a cycle γ on K_T on which to do surgery. Doing surgery on a cycle is the same as doing rudimentary surgery on a nonseparating simple closed curve on the original surface. This surgery represents the removal of a torus, a projective plane, or a Klein bottle.

The source for this proof of the theorem is Peter Andrews, "The classification of Surfaces." *Mathematical Monthly*, Nov. 1988. Constructive examples of Andrews' method of surface classification using techniques of simple graph theory will be presented.

on Workstation Clusters

Sarah A. McMullin and Theodore F. Smith
Dept. of Mechanical Engr., University of Iowa

Analysis of realistic mathematical models of thermal systems takes a significant amount of both computer and human time. Computation times for thermal system codes can easily exceed six hours. Mathematical models of thermal systems contain many functions, such as derivatives, whose evaluations are independent. Independent functions and subroutines make thermal system model codes ideal candidates for parallel processing. Subroutines can be divided and downloaded to other workstations to share the computational effort. Applications of the readily available software package Parallel Virtual Machine (PVM) and results of parallel codes using Bessel functions and array passing will be discussed.

Makespans: Optimal Communication in a Computer Network

James Mills, Subhesh Pakrashi, and Vikram Subramaniam, Grinnell College

The second problem in this years Mathematical Contest in Modeling deals with a network of computers. The problem is to schedule the transfer of files between the computers in an optimal way to minimize the total time it takes to complete all the transfers. These students will define the problem and will discuss their solution.

Coin Flipping using Quadratic Residues

Chris Mosbo, Luther College

Two alternative methods of flipping a coin over the phone are presented. One involves cryptography using Fermat's theorem. The other method involves the Legendre and Jacobi Symbols and the relationship of their values.

The Random-Grid Cryptosystem

Lawrence Pelo, NIACC

My paper will focus on cryptology and will consist of two parts. The first part will be to discuss a computer program (in Pascal) which will encipher and decipher text using the random grid cryptosystem which I have invented. The second part of the project will be a statistical analysis of the cryptosystem and its output, and a determination of its degree of security.

An Expert System to Place Incoming Students in Mathematics and Computer Science Classes

Vikram Subramaniam, Ivan Sykes, and Henry M. Walker, Grinnell College

A rule-based expert system was developed at Grinnell College to use standardized tests (SATs, ACTs, Achievement Tests, Advanced Placement scores) and high school transcripts to place incoming students in mathematics classes (Precalculus, Calculus I or II, Linear Algebra and Differential Equations). The system, based on about 70 rules, uses a previously developed backward chained inference engine, TMYCIN. It automates a process done previously by faculty, clarifies rules and informal practices, and allows letters, tailored to placement data and conclusions, to be sent to all incoming students and their advisors. The system was also extended easily to place students in computer science classes (Problem Solving and Computing, CS1, CS2). Results of the system compared favorably with placement made by faculty.

The Orders of Polyominoes

Lowell Vaughn, Grinnell College

Can a given polyomino tile a rectangle? If it can, what is the smallest number of pieces that can tile a rectangle (i.e., the *order* of the polyomino)? This talk will give the results of our attempts to discover the order and the odd-order of all n-ominoes where $n \leq 8$. Several new tilings (e.g., a 21-piece tiling using an L-pentomino, a 21-piece tiling using an L-hexomino, a 39-piece tiling for the sled heptomino and a 45-piece tiling for the house-shaped heptomino) are given. We show that a number of polyominoes (e.g., the L-octomino) have no finite odd-order. Finally, we prove two theorems about general classes of polyominoes: first, that the L-shaped n-ominoes where n is odd have finite odd-order; and second, that Y-shaped n-ominoes with $n \geq 9$ have no finite order.

The Suitability of the Usual Statement Calculus for a Particular Three-Valued Logic

Steve Walk, UNI

The purpose of the study was to find a suitable formal system for a particular system of three-valued logic. The system in question is similar to both the classical two-valued logic and to a modified version of Jan Lukasiewicz's three-valued logic, and the usual statement calculus is a suitable formal system for both of these. However, the logic considered in the study appeared originally not to have the usual statement calculus as a suitable formal system. This appearance was eventually done away with, and the usual statement calculus was found to be suitable for the logic after all.

The author's introductory material includes a review of two-valued logic and the usual statement calculus, as well as arguments that many-valued logics are a worthwhile area of study. After defining many-valued logics, introducing the particular logic to be studied, and discussing the difficulties involved, the author presents a proof that the usual statement calculus is a suitable formal system for the logic. Concluding remarks suggest interpretations for middle truth values and directions for future research.

CONTRIBUTED PAPERS

alphabetical by author

Complex Dynamics from Schröder to Fatou and Julia

Daniel S. Alexander, Drake University

The contemporary study of complex dynamics is based on works by G. Julia and P. Fatou which appeared around 1918. These works in turn grew out of a body of work regarding the iteration of complex functions which dates back to two papers published by E. Schröder in 1870-71. Schröder's name is linked to the study of iteration through the Schröder functional equation, but the historical significance of his work has been not fully appreciated.

The French mathematician G. Koenigs was the central figure in the study of iteration of complex functions in the late 1800's. Due in part to the influence of G. Darboux, he developed a unified and rigorous approach to the iteration of complex functions and influenced the subsequent development of the theory.

The work of Koenigs served as the point of departure for the studies of Fatou and Julia. Equally vital to their work was the incorporation into French mathematics of concepts from the set theory, as well P. Montel's theory of normal families. Where Koenigs' study was characterized by its focus on iteration in the neighborhood of a fixed point of a given function, Fatou and Julia were able to characterize iteration of a given rational function for arbitrary points in the plane.

Mathematics and the Ubiquitous Spreadsheet: Visualization, Conceptualization, and Applications

Deane Arganbright, Whitworth College

The popular electronic spreadsheet, usually thought of as a business tool, is also a natural and powerful tool for visualizing and conceptualizing a wide variety of mathematical ideas and algorithms. In particular, the spreadsheet's graphic capabilities can be exploited in diverse and creative ways within mathematics and applied fields. This talk provides visual mathematical illustrations from such diverse areas as probability and statistics, calculus, classical curves and tessellations, numerical analysis, operations research, and linear algebra. The talk also shows uses of the increasingly powerful built-in mathematical tools provided with spreadsheets, and illustrates how easy it is to use spreadsheet presentation capabilities, dialog boxes, hypercard-like effects, and even animation, in mathematical presentations and investigations.

Regression Analysis of Ordered Categorical Panel Data

K. S. Chan, University of Iowa

We propose a new regression model for analyzing ordered categorical panel data. Our approach is adapted from an approach initiated by Kalbfleisch and Lawless (1985) who assumed that the data is obtained from sampling a latent continuous-time discrete-state-space Markov process. For a continuous-time Markov process the transition intensity matrix determines the transition probabilities, and, in general, $K(K-1)$ intensity parameters are needed for specifying the transition mechanism. Here, K is the number of categories. Even for moderate K, the number of parameters becomes exceedingly large. For ordered categorical data, we make a further assumption that direct transitions are only allowed between adjacent (ordered) categories. This results in a tridiagonal transition matrix which has only $2(K-1)$ intensity parameters. It is assumed that after applying a link transformation (e.g. the log-transformation), the vector of intensity parameters is a linear function of the covariates whose coefficients are unknown and need to be estimated. The tridiagonal form of the intensity matrix results in a more parsimonious model. Also, the numerical computation of the likelihood function is straightforward for tridiagonal transition matrices. The intensities describe the rates of transitions between adjacent categories and hence have very natural interpretation. This approach will be illustrated with real data.

Using an Ancient Perspective to Understand Large Infinities

Paul Corazza, Maharishi International University

At the end of the last century, Georg Cantor developed a rigorous theory of mathematical infinity and also provided a conceptual framework by which the notion of the infinite could be grasped intuitively. His framework, however, has not turned out to be rich enough to account for the presence of the extraordinarily large infinities -known as large cardinals -that have emerged in the last quarter century. We discuss a generalization of Cantor's framework provided by a system of thought dating back thousands of years, which quite naturally accounts for these troublesome magnitudes.

Modular Arithmetic as a Microcosm of Mathematics

Catherine Gorini, Maharishi International University

In MIU's core course in mathematics taken by all first-year students, we want to introduce the full range of mathematics. In the unit on modular arithmetic, students can find patterns and make conjectures, prove theorems, and find applications - just in a few lessons.

An MA program for Middle Grades Mathematics-Content Considerations

Joel Haack and Glenn Nelson, University of Northern Iowa

The University of Northern Iowa has developed an MA program for teachers of middle grades (4-8) mathematics. Knowledge about mathematics, teaching mathematics, learning mathematics, and the mathematics curriculum is woven throughout the program; mathematics content is the primary emphasis in at least two of the courses. The program, its structure, and, in particular, the philosophy of these two courses will be discussed in this presentation on a "work in progress".

Summability of Unbounded Series

Alex F. Kleiner, Drake University

It is a classical result in summability theory that every regular, (sequence to sequence) matrix method of summability that "sums" a divergent sequence also "sums" an unbounded sequence. In this presentation we will consider the question of whether such a method must also sum a series whose terms form an unbounded sequence. After reviewing the basic ideas of matrix summability, we shall show that the answer is, in general, no. We shall further give additional conditions on the method which provide a yes answer.

A "Look" at l'Hôpital's Rule

Reginald Laursen, Luther College

Demonstration of a "discovery" computer laboratory assignment for Calculus 2 which views l'Hôpital's rule from a graphical perspective and attempts to connect that view with the analytical result.

Using XLISP-STAT for Teaching and Consulting

Russell V. Lenth, University of Iowa

Using XLISP-STAT we can demonstrate dynamic graphics, bootstrapping, and dialogs for power and sample size determination. These are some tools I have developed using XLISP-STAT for teaching and consulting.

PANEL: Teaching the History of Mathematics

Michael Millar, Daniel Alexander, Alex Kleiner

Anyone interested in the history of mathematics, teaching or thinking about teaching a course in this area is encouraged to attend and to come prepared with comments and/or questions. Anyone desiring further information should contact one of the organizers.

Pricing the Russian Option

Elias S. Shiu

Dept. of Statistics and Actuarial Science, University of Iowa

The owner of a Russian option on a stock receives the historical maximum value of the stock prices upon exercising the option. There is no fixed exercise date. We derive two (equivalent) pricing formulas by applying the optional sampling theorem.

Calculus Using Mathematica

Keith Stroyan

The University of Iowa offers a special new calculus course. In addition to developing students' basic skills and concepts, our course presents calculus as the 'language of science' and has students actively doing mathematics in laboratory-type projects. The dedicated lab associated with the course uses Mathematica computing for once weekly electronic homework as well as in the larger projects.

Our students develop skills and then learn why calculus is important by applying their skills to answer difficult questions of clear contemporary interest such as: (1) What is a sustainable harvest level for Sei Whales? (2) Why was polio eradicated by vaccination, but not measles? (3) Will a bungee diver smash into the bottom of the canyon? (4) How do you calculate the inverse of $y = x^x$ yourself? (5) What is the resonant frequency of an electrical circuit? Carefully selected scientific problems guide our curriculum and motivate the ideas of calculus for our students. Their answers to these large problems are presented in the form of 10 (or so) page term papers once or twice per semester.

Mathematica programs (called NoteBooks) play two main roles in our presentation of calculus. First we use the computer to illustrate and reinforce basic mathematical concepts. Second, up-to-date scientific computing helps us reduce technicalities and concentrate on the main ideas of calculus. Computing also allows us to deal with more realistic applications that are too "messy" to compute by hand.

Our course is accelerated in that we treat the main topics from roughly three semesters of traditional calculus. This is a rough comparison, because modern computing allows us to treat "advanced" topics like phase plane analysis of nonlinear differential equations. Engineering students who work the project on resonance are exempted from sophomore engineering differential equations.

Teaching Integration by Parts

Doug Swan, Morningside College

Two consecutive days from Calculus 2: The first leads students to discover the formula for integration by parts using Derive to illustrate several examples. The second day features a tabular method for repeated application of the rule. All 14 students integrated $\int x^3 \sin(2x)\,dx$ perfectly on the exam and 12 of 14 also integrated $\int \sin(4x)\cos(x)\,dx$ perfectly using the tabular method.

Success and Retention using Cooperative Learning in Calculus

Doug Swan and Steve Nimmo, Morningside College

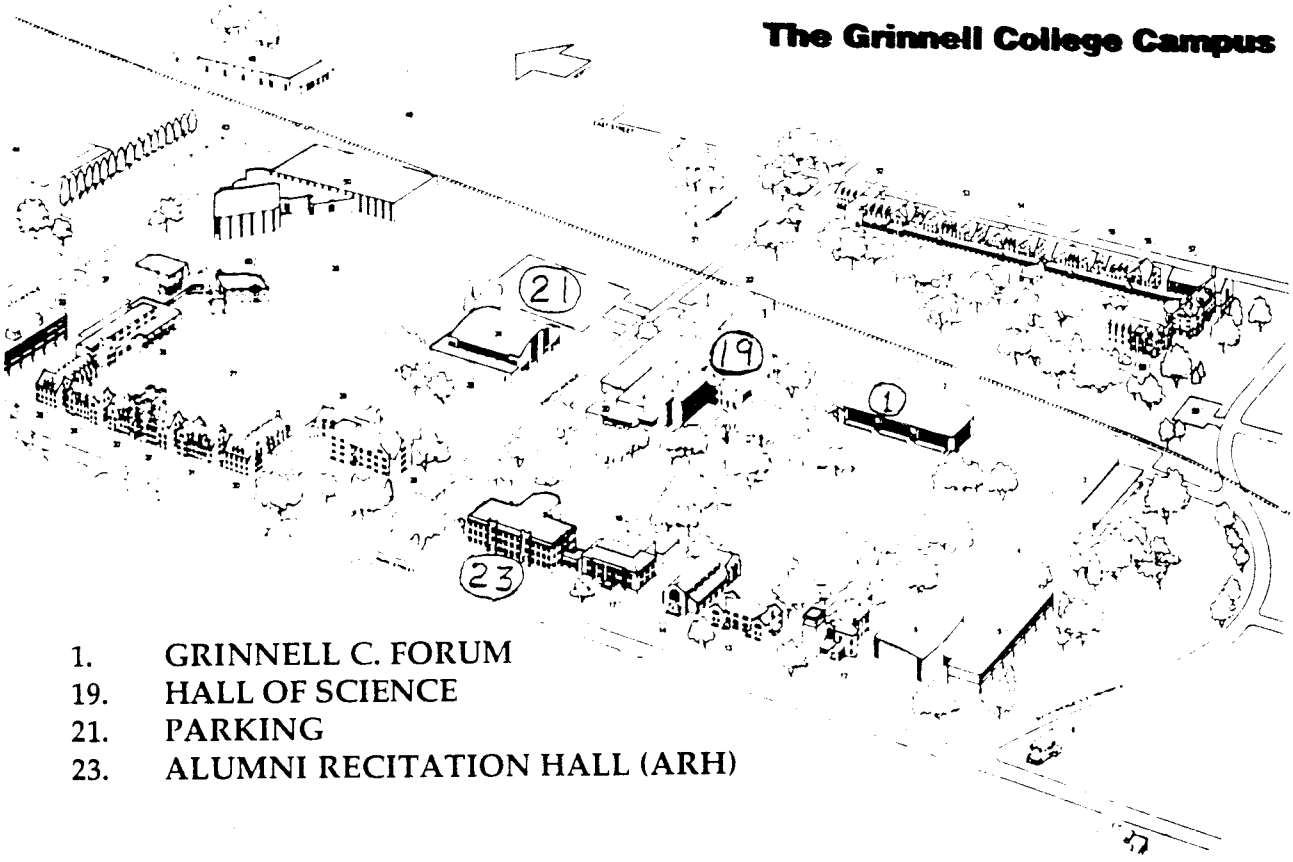
Data has been processed from the last six year's of calculus classes at Morningside College. During the first three, groups were used for some 10 labs a semester. During the last three, cooperative groups were used for all classes and half the tests. The data shows greater retention in calculus courses and differential equations and a modest improvement in grades. ACT scores and overall GPA's are analyzed.

A Revised Model Curriculum for a Liberal Arts Degree in Computer Science

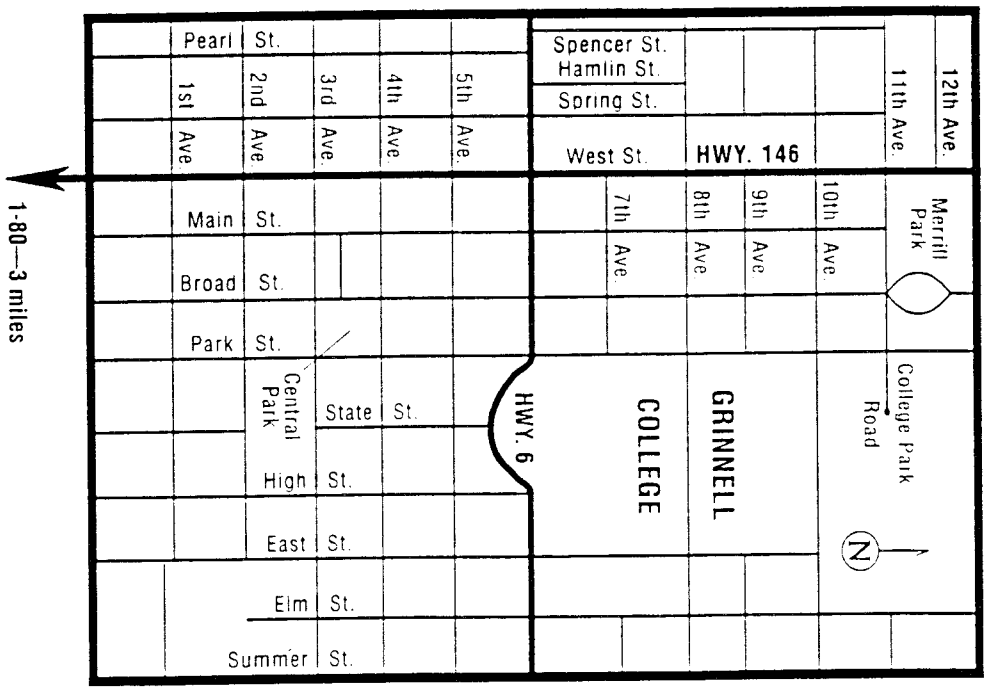
Henry Walker, Grinnell College

This talk outlines work in progress to update the 1986 recommendations for a high-quality B.A. degree program in computer science. Taking Curricula 1991 into account, it is hoped that this curriculum will provide a coherent model for colleges and universities of all sizes, where the goal is a strong computer science program in a liberal arts setting.

The Grinnell College Campus



1. GRINNELL C. FORUM
19. HALL OF SCIENCE
21. PARKING
23. ALUMNI RECITATION HALL (ARH)



Motels in the Grinnell Area

Carriage House	Days Inn	Motel Grinnell	Super 8 Motel
1133 Broad	515-236-6710	(Best Western)	515-236-7888
515-236-7520	800-325-2525	515-236-6116	800-800-8000
		800-252-9781	

The Carriage House is a B&B conveniently located 1 block from campus. They have a very limited number of rooms.

The three motels are all located just north of Interstate 80 at the Grinnell exit (#182), 3 miles south of Grinnell. We have been given a discount rate at each of these motels for Friday night. To get this rate, please identify yourself **at the desk** as a participant in the Mathematics Conference at Grinnell College. (People at the 800 numbers for Days Inn and Super 8 may not know about our discount rate.)

Restaurants in the Grinnell Area

	Fri pm	Sat am	Sat noon	Sun am
City Limits South Hwy 146 & I-80	√	√	√	√
Dairy Queen 702 2nd Avenue	√		√	
Godfather's Pizza † 800 4th Avenue	√		√	
Hardee's † 1019 West Street	√	√	√	√
JD's Restaurant † 922½ Main Street	√			
Jimbo's † 1027 4th Avenue	√			
Kelcy's Fine Foods † 812 6th Avenue	√			
Kentucky Fried Chicken 229 West Street				
Koffee Shoppe † 907 4th Avenue			√	

	Fri pm	Sat am	Sat noon	Sun am
The Last Egyptian † 915 Broad Street	√			
Longhorn † 1011 Main Street	√	√	√	√
Michael's † 720 5th Avenue	√			
The Oakroom R.R. #1	√			
Pagliai's Pizza † 816 5th Avenue	√			
Pizza Hut † 1033 Broad Street	√		√	
Subway † 1102 West Street	√		√	
Taco John's † 1020 West Street	√		√	
Forum Grill † Campus			√	

† denotes "within walking distance"

A Summer Workshop for High School and College

Teachers of Calculus

at Macalester College
July 11-16, 1994

This workshop will give attention to the goals of a modern course in calculus: questions related to the assessment of student work, changing methods of pedagogy, and the role of technology. The workshop will also give an overview of materials being developed in several major national projects.

Each participant will be given a set of the MAA's best selling five volume set. Developers of these materials will be on hand to demonstrate how these materials can be used in the classroom.

The workshop will begin with dinner on Monday evening, July 11 and end with lunch on Saturday, July 16. It is free to those who are selected, and a grant from the National Science Foundation will provide room and board for participants who are expected to stay on campus for the residential program.

Applications may be obtained by writing to:

Wayne Roberts
Mathematics/Computer Science Department
Macalester College
St. Paul, MN 55105
Phone: (612) 696-6337

Application

TENTH ANNUAL ALLEGHENY MOUNTAIN SECTION SUMMER SHORT COURSE

The course will be held June 13-17, 1994, and will be given by William Dunham, Truman Koehler Professor of Mathematics at Muhlenberg College. The following is a description of the course provided by the presenter.

Abstract: This five-day workshop examines a coleection of significant theorems from a 250 year span in the history of mathematics. We consider original work of Newton, the Bernouillis, Euler, Weierstrass, Cantor, and other major figures as they addressed questions form the realms of analysis, number theory, algebra, geometry, and set theory. The theorems--all of which have relevance to the undergraduate clasroom--are amplified by biographical information and placed in historical context, but our primary focus is on the genius of great mathematicians doing great mathematics.

Topics include:

- Newton's Method in its original form (1669)
- Some seventeenth century proofs of the divergence of the harmonic series (1647, 1689)
- Euler's evaluation of $\sum_{k=1}^{\infty} \frac{1}{k^2}$ and related series (1734)
- Euler's number theory, with emphasis on his discovery that $2^{2^5} + 1$ is not prime (1736)
- Euler's clever but flawed attempt to prove the fundamental theorem of algebra (1749)
- Wantzel's proof that angle trisection was impossible with the Euclidean tools (1837)
- Pathological functions of Dirichlet (1829), Riemann (1854), and Weierstrass (1872)
- Cantor's first proof of the non-denumerability of the continuum (1874)
- Volterra's proof that no real function can be continous precisely on the rationals (1881)
- Baire and his "category theorem" (1899)

The course will once again be held at Allegheny College. Course registration will be $120 and room and board will also be $120 for a total of $240.

For further information and an application, contact:

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