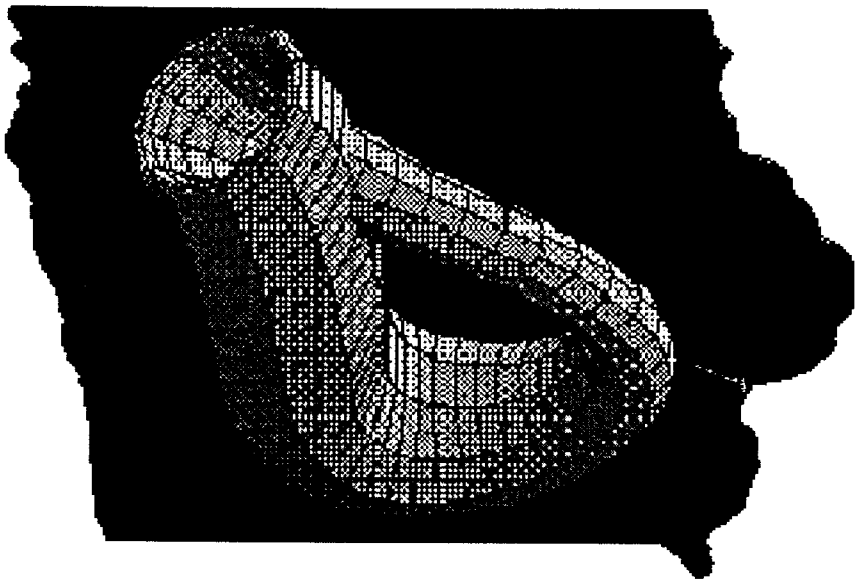
Iowa Section Newsletter



Spring 1998

Iowa Section -- Section Officer List

Chair:	Stephen J. Willson	
	Dept. of Mathematics	swillson@iastate.edu
	Iowa State University	Voice: 515-294-8142
	Ames, IA 5011-0001	FAX: 515-294-5454
Past-Chair:	Jim Freeman	
	Department of Mathematics	freeman@cornell-iowa.edu
	Cornell College	
	600 First Street West	Voice: 319-895-3493
	Mount Vernon, IA 52314-1098	FAX: 319-895-4492
Chair-Elect	Ruth Berger	
	Department of Mathematics	bergerr@luther.edu
	Luther College	
	700 College Drive	Voice: 319-387-1174
	Decorah, IA 52101-1043	FAX: 319-387-1088
Student Chapter Coord:	Catherine Gorini	
	Dept. of Mathematics	gorini@mum.edu
	Maharishi Univ. of Management	
	1000 North Fourth Street	Voice: 515-472-1107
	Fairfield, IA 52557	FAX: 515-472-1123
Newsletter Editor:	Cal Van Niewaal	
	Dept. of Mathematical Sciences	cvanniew@coe.edu
	Coe College	
	1220 First Avenue NE	Voice: 319-399-8642
	Cedar Rapids, IA 52402-5092	FAX: 319-399-8557
Public Info. Officer	R. B. Campbell	
	Department of Mathematics	
	Univ. of Northern Iowa	
	Cedar Falls, IA 50614-0506	
Secretary/Treasurer:	Steven Nimmo	
	Dept of Mathematical Sciences	sdn001@chief.morningside.edu
	Morningside College	Voice: 712-274-5466
	Sioux City, IA 51106	FAX: 712-274-5101
Governor:	Alex Kleiner	
	Dept. of Math and Comp Sci	Alexander.Kleiner@drake.edu
	Drake University	
	2507 University Ave	Voice: 515-271-3041
	Des Moines, IA 50311	FAX: 515-271-3977

VOLUME XIV No. 2 April 1998

Joint Meetings of the Iowa MAA, ASA, and IMATYC
Luther College, Decorah, Iowa
April 17 and 18, 1998

Friday, April 17

12:30 - 4:30	Registration and Book Exhibit	Olin 3rd Floor
1:50 - 3:05	Statistics Session I	Olin 112
1:30 - 3:05	Mathematics Student Papers I	Olin 102 & 108
3:10 - 3:25	Break	
3:30 - 4:45	Statistics Session II	Olin 112
3:30 - 4:05	Mathematics Student Papers II	Olin 101 & 108
4:10 - 5:50	Mathematics Faculty Discussion	Olin 101
	"What are your experiences or concerns with:Teaching Calculus with CD or Web"	
	"How is your major coursework structured so that students handle the transition from introductory courses to proof oriented courses?"	
5:30 - 7:30	Iowa ASA Dinner and Meeting ***RESERVATIONS REQUIRED***	Peace Dining Room
6:00 - 7:30	MAA Dinner ***RESERVATIONS REQUIRED*** (Dinner is free for MAA Student Speakers)	Peace Dining Room
7:45 - 8:45	MAA Keynote Lecture I: Jim Tattersall, Associate Secretary MAA *"The Cambridge Tripos 1498-1998"*	Olin 102
8:50 - 10:00	Reception	Hammarskjold Lounge LC Union

Saturday, April 18

8:00 - 3:30	Registration and Book Exhibit	Olin 1st Floor & Room 113
8:25 - 8:30	Welcome: President Baker	Olin 102
8:30 - 9:30	ASA Keynote Lecture: W. Michael O'Fallon, Chair, Department of Health Sciences Research, Mayo Clinic *"Attributable Risk Associated with Stroke Risk Factors"*	Olin 102
9:30 - 9:50	Break	
9:50 - 10:50	MAA Keynote Lecture II: Jim Tattersall, Associate Secretary MAA *"Nicomachus Rides Again"*	Olin 102
10:50 - 11:30	Iowa MAA business meeting	Olin 102
11:30 - 1:00	IMATYC Lunch and Business Meeting	Nansen Lounge, LC Union
11:30 - 1:00	Lunch on your own (Oneota Room in LC Union is open)	
1:00 - 2:05	Statistics Session III	Olin 112
1:00 - 3:25	Mathematics Contributed Papers I	Olin 101
1:00 - 3:25	Mathematics Contributed Papers II	Olin 107
1:00 - 3:25	Mathematics Contributed Papers III	Olin 108

Friday Afternoon Sessions

Mathematics Student Papers I

Olin 102

1:50 - 2:20 Chris Cochran, Kendra Marinaccio, Michael Raecker; Hawkeye CC
Calculus: Who Cares?

Olin 108

2:30 - 2:45 Travis Poole, Luther College
Comparing Various Numerical Methods of Approximating Solutions to Differential Equations

2:50 - 3:05 Katie Straub, Wartburg College
Would you play craps with different numbered dice?

Mathematics Student Papers II

Olin 108

3:30 - 3:45 Kalin Videv, Graceland College
How To Calculate $1/\pi$

3:50 - 4:05 Ben Steines, Luther College '97
A 'new' Distance

Olin 101

3:30 - 3:45 Anna Keyte, Iowa State University
A Mathematical Model of Tracheal Morphogenesis in Drosophila Melanogaster

3:50 - 4:05 Suzanne M. Shontz, University of Northern Iowa
Numerical Linear Algebra and Medical Imaging

Statistics Session I

Olin 112

1:50 - 2:05 Jeffrey D. Isaacson, Student, University of Iowa
Statistical Methods for Combining Temporally or Spatially Correlated Data from Multiple Measurement Systems

2:10 - 2:25 YoonDong Lee, Student, Iowa State University
Bootstrap Based Generalized Least Square Estimators of Spatial Variogram Parameters

2:30 - 2:45 John Castelloe, Student, University of Iowa
Anisotropy in Spatial Point Patterns

2:50 - 3:05 Juan J. Goyeneche, Student, Iowa State University
Distribution function estimation

Statistics Session II

Olin 112

3:30 - 3:45 Kevin Wright, Student, Iowa State University
Automatically verified critical points of a Bivariate F distribution

3:50 - 4:05 Kai Wang, Student, University of Iowa
Combining results in linkage study: an empirical Bayes approach

4:10 - 4:25 Jong Sung Kim, Student, University of Iowa
Proportional Hazards Model with Partly Interval-Censored Data

4:30 - 4:45 Sandip Sinharay, Student, Iowa State University
Sampling of Drainage Areas in a Watershed Health Assessment Study

Saturday Afternoon Sessions

Statistics Session III

Olin 112

1:00 - 1:30 Gavin Cross, Assistant Professor, Coe College
Teaching Off the Web: An Internet-based Introductory Statistics Course

1:35 - 1:50 Matthew M. Menzel, Student, Coe College
A Queuing Theory Simulation using the Java Random Number Generator

1:55 - 2:10 John Gabrosek, Student, Iowa State University
Spatio-Temporal Prediction of Level 3 Data for NASA's Earth Observing System

Mathematics Contributed Papers I

Olin 101

1:00 - 1:25 Daniel Willis, Loras College
How does the TI-85 find the zeroes of a polynomial?

1:30 - 2:55 Doug Swan, Morningside College
A precalculus writing and modeling project

2:00 - 2:25 Bernadette Baker, Drake University
The Development of Students' Calculus Graphing Schema

2:30 - 2:55 Samir H. El-Khabiry, Iowa State University
Learning Calculus on the Internet and CD

3:00 - 3:25 A.M. Fink, Iowa State University
Inequalities: What did the ancients know; who cares, and what's the big deal?

Mathematics Contributed Papers II

Olin 107

1:00 - 1:25 Joel Haack, University of Northern Iowa
The maximal order of an element in the symmetric group on n letters

1:30 - 1:55 Sean Bradley, Clarke College
Not Quite Golden Sections and Fibonacci Like Sequences

2:00 - 2:25 Marc Chamberland, Grinnell College
Families of Solutions of a Cubic Diophantine Equation

2:30 - 2:55 Tom Misseldine,Upper Iowa University
The Dirichlet Problem on an Annulus

3:00 - 3:25 Charles Ashbacher, Hamilton College
Pseudo-Smarandache Function

Mathematics Contributed Papers III

Olin 108

1:00 - 1:25 Ronald K. Smith, Graceland College
Tuition Discounting

1:30 - 1:55 Alan Macdonald, Luther College
Divergence and the Divergence Theorem

2:00 - 2:25 Kenneth R. Driessel, Iowa State University
On Measuring the Coefficient of Friction Between Skis and Snow

2:30 - 2:55 Wolfgang Kliemann, Iowa State University
Capsizing a Ship in Rough Sea

3:00 - 3:25 Stephen J. Willson, Iowa State University
Studies of some non-zero-sum matrix games using a theory of moves

Friday Afternoon:

	Olin #102	Olin # 101	Olin # 108			Olin # 112
1:50-2:20	Cochran, Marinaccio, Raecker				1:50-2:05 2:10-2:25	Isaacson Lee
2:30-2:45			Poole		2:30-2:45	Castelloe
2:50-3:05			Sraub		2:50-3:05	Goyeneche
Break					Break	
3:30-3:45		Keyte	Videv		3:30-3:45	Wright
3:50-4:05		Shontz	Steines		3:50-4:05	Wang
					4:10-4:25	Kim
					4:30-4:45	Sinharay

Saturday Afternoon:

	Olin # 101	Olin # 107	Olin # 108	Olin # 113		Olin # 112
1:00-1:25	Willis	Haack	Smith	Computer	1:00-1:25	Cross
1:30-1:55	Swan	Bradley	Macdonald	Classroom	1:30-1:45 1:50-2:05	Menzel Gabrosek
2:00-2:25	Baker	Chamberland	Driessel	Open		
2:30-2:55	El-Khabiry	Misseldine	Kliemann			
3:00-3:25	Fink	Ashbacher	Willson			

Abstracts for the Papers

Keynote Lectures:

Attributable Risk Associated With Stroke Risk Factors

W. Michael O'Fallon
Chair, Department of Health Sciences Research, Mayo Clinic

The deceptively simple concept of attributable risk (AR) was introduced in 1953 but has not been widely used for a number of reasons. Primarily, the limitations were statistical, as the variances of AR estimates were difficult to obtain, and extensions to multiple risk factors and covariates were nearly intractable.

Recent extensions of the concept of AR have permitted the development of multivariate models of AR, which allow one to take into account the confounding among individual risk factors. We have extended the use of resampling methods such as bootstrapping and jackknifing to matched case-control studies, permitting estimates of the variances of these complex multivariate AR estimates.

A recently published matched case-control study of stroke risk factors involving 931 incident cases of ischemic stroke occurring in residents of Rochester, Minnesota, provided a perfect vehicle for the application of these new techniques. Eleven stroke risk factors were assessed in this study, and seven of them [hypertension (HTN), TIA, ischemic heart disease (IHD), smoking (SMK), atrial fibrillation (AF), diabetes mellitus (DM) and mitral valve disease (MVD)] retained independent significance in a multivariable logistic regression model. Within the multivariable model, the odds ratio estimates for these seven ranged from 5.2 for TIA to 1.8 for HTN with corresponding AR estimates of 13.9% (11.1% - 16.7%) and 32.5% (21.3% - 43.6%).

The dramatic difference between the odds ratios and the AR estimates emphasizes the role of the prevalence of the risk factor on the AR estimates. Thus, although HTN had an odds ratio of only 1.8, 74% of all cases had HTN hence an AR of over 30%; only 17% of cases had a history of TIA and, thus, the odds ratio of 5.2 translated into an AR of only 13.9%.

If the seven AR estimates corresponding to the risk factors in the multivariate model were simply summed, the total was 88%. In contrast, the multivariate estimate of the risk attributable to this collection of seven risk factors was 61.4% (54.1% - 68.7%).

These analyses demonstrate the utility of the multivariable models of AR and the necessity of these models since, for most diseases, risk factors are interrelated, and attributable risk is truly a multivariable concept.

The Cambridge Tripos 1498-1998
Jim Tattersall, Associate Secretary of the MAA

A brief history of the Cambridge Tripos, which evolved into the Cambridge Mathematical Tripos, is offered. Many mathematicians such as Barrow, Newton, Waring, Stokes, Cayley, Sylvester, Thompson, Maxwell, Littlewood, and Hardy sat for the Tripos. It was felt by many, in the eighteenth century, that mathematics provided the best training for a rational mind. As a consequence, it became necessary to pass the Mathematical Tripos in order to obtain an honor degree from Cambridge. By the mid-nineteenth century, the Tripos had become the most formidable mathematical examination in Europe. In the late nineteenth century women began taking the Tripos.

Nicomachus Rides Again
Jim Tattersall, Associate Secretary of the MAA

The first century text Introduction to Arithmetic by Nicomachus of Gerasa was one the few sources of knowledge of formal Greek arithmetic in the Middle Ages. The book is philosophical in nature, contains few original results, and no formal proofs. Perhaps that is why it served as a text in medieval universities for almost 500 years. The book contains several properties of numbers that are as intriguing today as they were more than two thousand years ago. We generalize these properties and generate some challenging problems.

Mathematics Student Papers:

Calculus: Who Cares?
Chris Cochran, Kendra Marinaccio, Michael Raecker,
Hawkeye Community College

A brief accounting of the social, political and economic conditions in existence during the development of calculus. Some of the social, political and economic ramifications that the development of calculus has had on society in the past and present.

Comparing Various Numerical Methods of Approximating Solutions to Differential Equations
Travis Poole, Luther College

Various numerical methods (standard and hypothesized) of approximating solutions to differential equations were investigated and compared based on the increase in accuracy due to an increase in the number of divisions relative to the increase in computation required by the increase in the number of divisions.

Would you play craps with different numbered dice?

Katie Straub, Wartburg College

The answer is YES if they are Sicherman dice which means that they have normal six sided dice probabilities. I will demonstrate that there is just one way for the standard six sided dice to be renumbered. It will then be shown that other shapes and sizes of dice can be renumbered maintaining their original probabilities. The main objective is to show that an odd-numbered even-sided pair of dice can be renumbered. This process is done through the factoring of polynomials. I will demonstrate that each term of the polynominal can be used to define the number of sides and the side's value.

How To Calculate $1/\pi$

Kalin Videv, Graceland College

Over the years a number of algorithms have been developed for calculating $1/\pi$. Traditional methods include approaches taken from geometry and calculus. More recently, methods based on base representation of numbers have been developed. We will briefly overview traditional methods and take a closer look at the "Spigot Algorithm."

A 'new' Distance

Ben Steines, Luther College '97

An exploration of an unusual definition of distance and its effect on geometric figures.

A Mathematical Model of Tracheal Morphogenesis in Drosophila Melanogaster

Anna Keyte, Iowa State University

Drosophila melanogaster utilizes a series of tracheal trees (invaginations of the epidermis) for air intake. The tracheal system passively draws air from outside the fly into spiracles (openings of the fly's epidermis) and through the branchings of the tracheal tree into individual cells. The aggregate cross sections of the branches at any branching level are maintained throughout the tree. Using branching data collected from a large number of flies, a mathematical model that predicts the quantitative branching pattern of the tracheal tree can be constructed. This model is based on branching processes in random environment, whose parameters (splitting probabilities) are estimated from the data via maximum likelihood methods.

Numerical Linear Algebra and Medical Imaging

Suzanne M. Shontz, University of Northern Iowa

Because of the significant increase in the number of cancer cases in the United States, the importance of medical imaging in disease detection and prevention has increased. This medical imaging process can be modeled with a linear system of equations, Ax=b, where A is the transformation matrix representing the detector geometry, x is the unknown solution or actual medical image, and b is the projection data taken by the camera. The system of equations may then be solved by either direct or iterative numerical linear algebra methods. This research investigates the reproduction of medical images using the Conjugate Gradient (CG) Algorithm and the Least Squares (LSQR) Algorithm, two indirect, iterative algorithms. It was done at the University of Kentucky as part of the 1997 National Science Foundation's Research Experiences for Undergraduates Program in Mathematics and Engineering.

Mathematics Contributed Papers I (Olin 101):

How does the TI-85 find the zeroes of a polynomial?

Daniel Willis, Loras College willis@loras.edu

The speaker will discuss the inner workings of the POLY routine on the TI-85/TI-86. Essentially what the calculator does is use the QR method to find the eigenvalues of a related matrix (the "companion" matrix). The speaker will explain how the method works, and illustrate the method with examples. He will also make some general remarks about locating the zeroes of an arbitrary polynomial.

A precalculus writing and modeling project

Doug Swan, Morningside College das001@alpha.morningside.edu

This spring semester I assigned a population-modeling project based on data from The US Census Bureau web page. Each pair of students shared data for four nations, but they wrote up separate reports. Their analysis was done on an MSWorks spreadsheet using only simple functions. The lab and two sample student projects will be shared. Their reports had three parts. Part I required them to explain (1) the mathematics of selecting the best country for an exponential model, (2) building the model, (3) testing the model and (4) using it for predicting the population in 2020. Part II was base on interpretation of the application. They had to give at least two social, political or economic factors that impact on whether an exponential model is appropriate. To do this they compared the nation whose population growth was best modeled with an exponential function to the one that was least appropriate for an exponential model. Part III asked them to hypothesize what other facts would help one construct a better model for predicting future populations.

The Development of Students' Calculus Graphing Schema

Bernadette Baker, Drake University **bernadette.baker@drake.edu**

Analysis of 41 interviews of students working on a non-routine calculus problem were used to examine the level of development of their calculus graphing schema, based on the triad levels (intra, inter, trans) of Piaget and Garcia. Particular difficulties of the students and their pedagogical implications will be shared.

Learning Calculus on the Internet and CD

Samir H. El-Khabiry, Iowa State University **khabiry@iastate.edu**

We are developing a complete calculus curriculum consisting of three one-semester-web-based calculus courses in English and Arabic. This is a collaborative project between IITAP, Department of Mathematics at ISU, Suez Canal University, Egypt, and UNESCO. The web, together with the computer, brings new speed and functionality to data processing and information passing, which facilitates the creation of new knowledge. Production of Calculus courses on the Internet allows using technology to enhance the learning of calculus. Having these tools to assist in student learning, the lecturer is then free to use in-class lecture time to focus on theoretical and difficult concepts. The courses will also be produced on CD to provide the same learning approach whenever the Internet is not available or difficult to use. A learning module replaces the conventional lecture. The Internet allows the instructor to have much longer than the conventional 50-minute lecture by redefining the concept of in-class lecture by adding web-based pre-lecture and post-lecture activities. The project is intended to develop all ingredients of the teaching process including the learning module, tutorials, homework and quizzes. Mathematics is supported by interactive Java graphics. Courses will be linked to Mathematica software, which may be used at the option of the instructor. Currently we are developing the first two courses. Each course has a homepage; http://www.public.iastate.edu/~khabiry/Calculus/math165/index.html and .../math166/... . Each course homepage contains course information, course policies, course objective, course syllabus, assignments, solutions and grades of quizzes and tests, related homepages, links to outside resources, and list of students with their e-mail addresses. Partial trial of homepages of the first two courses is underway by using actual web-based lectures and feedback to students of tests solutions and grades on the Internet. Students interact with each other and this enhances cooperative learning. Instructors can update their material and include new examples and applications supported with graphics. Availability of these courses on the Internet can be also utilized in distance education. We emphasize that learning calculus interactively on the Internet will be more attractive and efficient for students.

Inequalities: What did the ancients know; who cares, and what's the big deal?
A.M. Fink, Iowa State University fink@math.iastate.edu

The index of an arbitrary history of mathematics book does not contain the word 'inequality'. Today there are two journals whose title is a slight variation on 'Journal of Inequalities'. What happened in between to make inequalities be a subject of research? Tune in to find out.

Mathematics Contributed Papers II (Olin 107)

The maximal order of an element in the symmetric group on n letters
Joel Haack, University of Northern Iowa haack@math.uni.edu

This expository talk will present known results regarding this problem as found in the work of Edmund Landau and Jean-Louis Nicolas. Information on this topic from other members of the session will be welcome!

Not Quite Golden Sections and Fibonacci Like Sequences
Sean Bradley, Clarke College sbradley@keller.clarke.edu

The simple yet surprising connection between Fibonacci's famous sequence and the Golden Ratio of yore is but the tip of an iceberg: there is an infinite family of geometrically defined, nearly golden ratios, and a corresponding collection of Fibonacci-like sequences, which preserve the well-known relationship. What's more, these sequences, as delightful as Fibonacci's, satisfy many of the elegant identities which we find so attractive.

Families of Solutions of a Cubic Diophantine Equation
Marc Chamberland, Grinnell College chamberl@math.grin.edu

Various families of solutions to the Diophantine equation $a^3 + b^3 + c^3 = d^3$ are categorized, with new results and connections obtained.This includes results dueto Ramanujan and an amateur Canadian mathematician of Indian origin.

The Dirichlet Problem on an Annulus
Tom Misseldine, Upper Iowa University MisseldineT@uiu.edu

An elementary method for solving the Dirichlet problem on an annulus. The solution is the limit of a uniformly Cauchy sequence of approximations.

Pseudo-Smarandache Function
Charles Ashbacher, Hamilton College 71603.522@compuserve.com

The Pseudo-Smarandache function has a simple definition: Given any integer $n > 0$, the value of the Pseudo-Smarandache function Z(n) is the smallest integer m such that n evenly divides the sum $1 + 2 + 3 + \ldots + m$. In this presentation several problems concerning this function will be presented and solved. Some will involve the standard number theory functions such as Euler's phi function and the sum of divisors function.

Mathematics Contributed Papers III (Olin 108):

Tuition Discounting

Ronald K. Smith, Graceland College rsmith@graceland.edu

The practice of tuition discounting--giving financial aid to offset the cost of tuition--is the norm among institutions of higher education today. We build a mathematical model and consider 5 strategies for determining how much financial aid to offer students. We describe the "best" strategy and use elementary calculus to calculate the amount.

Divergence and the Divergence Theorem

Alan Macdonald, Luther College macdonal@luther.edu

The *integral* definition of the divergence gives it a clear geometric/physical meaning. The definition allows a heuristic demonstration of the divergence theorem which shows the *reason* for the theorem. The definition and demonstration are more popular among physicists than mathematicians. Using a generalized Riemann integral, we make the demonstration rigorous under very general conditions. The proof extends to a general Stokes' theorem on manifolds.

On Measuring the Coefficient of Friction Between Skis and Snow

Kenneth R. Driessel, Iowa State University driessel@iastate.edu
(This is joint work with Emily Burke and Irvin Hentzel.)

I shall describe a simple experiment which we used to measure the coefficient of friction between a ski and snow. We used the standard model of sliding friction: The frictional force is directly proportional to the normal force. The coefficient of proportionality μ is called the `coefficient of friction'.

Consider a skier sliding down a slope. We model the skier as a particle with mass m. We assume that the particle remains in a fixed vertical plane. We assume that the only forces acting on the particle are friction and gravity. (We ignore air drag.) Then Newton's laws lead to the differential equation $m\, s'' = m\, F(s)$ where s is the distance traveled down the slope, $F(s) := g(\cos A(s) - \mu \sin A(s))$, g is the acceleration of gravity and A(s) is the angle of the slope. We compute the work done moving between two points on the slope. We find that the work equals $g(h - \mu d)$ where h is the elevation change and d is the horizontal distance traveled. This work determines the change in (the square of) the speeds at the two points.

Our mathematical analysis enabled us to design and perform the following simple experiment to determine μ. We used surveying equipment to measure the elevation change and horizontal distance between two points on a slope on a cross-country ski trail. We had a skier coast down the slope between these two points. We measured the skier's speeds at the two points. From these measurements we computed μ.

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

Capsizing a Ship in Rough Sea

Wolfgang Kliemann, Iowa State University kliemann@iastate.edu

Dynamic reliability theory connects the areas of dynamical systems and statistical reliability through the analysis of differential equations subjected to random perturbations. The mathematical tools for this analysis include global theory of diffusion processes, stochastic flows, multiplicative ergodic theory, and stochastic bifurcations. These tools are used for the study of failure probabilities, failure times, and failure location in systems exhibiting sudden collapse or degradation, e.g., via aging. The resulting probability distributions are obtained using numerical techniques for stochastic differential equations and are compared to the standard failure distributions in statistics, such as the Weibull and the lognormal families. The example of a ship capsizing in rough sea is used to illustrate the concepts and results.

Studies of some non-zero-sum matrix games using a theory of moves

Stephen J. Willson, Iowa State University swillson@iastate.edu

Consider a two-person game matrix which is not necessarily zero-sum. One player has the choice of the row, while the other player has the choice of the column. The payoffs to both players depend on both the row and the column selected. Instead of having both players simultaneously announce their strategies, assume that they announce strategies alternately until they both agree to end the game or until the time runs out. We study the possible final outcomes for rational players under various hypotheses.

Statistics Papers (Olin 112):

Statistical Methods for Combining Temporally or Spatially Correlated Data from Multiple Measurement Systems

Jeffrey Dean Isaacson and Dale Zimmerman, University of Iowa

Methods are developed for combining data from multiple measurement devices in the case where successive measurements are not independent, and the numbers of measurements from the two devices are not the same. The dependence in the measurements is due to the temporal or spatial correlation in the phenomenon being measured. The numbers of measurements from each device differ because one of the devices has been on-line longer than the other.

The newer device is considered better based on some criteria such as cost or reliability so the goal is to eventually stop using the old device. In many cases the data from the new device should not simply be considered an extension of the old device. Therefore, the proposed solution is to back-predict the unobserved measurements from the new device. The result will be an estimate of the hypothetical data from the new device had it gone on-line the same time as the old device.

Two methods are proposed for back-predicting the unobserved measurements from the new device. The first one is a frequentist approach which uses the EM Algorithm to estimate the unobserved observations. The second approach is a Bayesian approach, and it uses MCMC methods for computing the back-predictions.

Along with combining the data sets, methods are developed for comparing the measurement systems and deciding when to discontinue the old device. The measurement systems are compared by testing whether the biases and variances of the systems are the same, and calculations similar to those used in a power analysis are used to decide how long the systems should be on-line together.

Bootstrap Based Generalized Least Square Estimators of Spatial Variogram Parameters

YoonDong Lee and Soumendra Nath Lahiri, Iowa State University

GLS method is often recommended as a method to estimate the model parameters of spatial variogram models. In spite of statistical efficiency of GLS, its computational inefficiency makes the method difficult to use. The GLS method requires most of the computational effort to evaluate the covariance matrix iteratively in each minimizing step of the GLS. To improve upon this drawback, we develop a bootstrap based GLS method (BGLS) for estimating variogram parameters, which is efficient, both statistically and computationally. We prove the consistency and asymptotic normality of BGLS estimators of the variogram model parameters. To evaluate bootstrap based covariance matrix we used block bootstrap method for stationary processes in spatial situation. We also considered optimal block size problems and increasing block bootstrap for starshaped sampling region. Finite sample comparison of BGLS, GLS and OLS is given by a simulation study. The more difficult and the more unstable are the minimizing steps in GLS, the more attractive is the BGLS method.

Anisotropy in Spatial Point Patterns

John Castelloe, University of Iowa

In the analysis of spatial point patterns, it is generally assumed that the underlying spatial point process is isotropic, i.e., that all characteristics are invariant with respect to rotation. However, this is known in many applications not to be the case. For example, the distribution of plant seedling locations often exhibits directional asymmetry, or anisotropy, due to factors such as prevailing wind direction and systematic migratory behavior of seed carriers. Several spatial point process models are developed to describe different types of anisotropy. In addition, methods for testing for anisotropy and estimating the nature and extent of anisotropy are discussed.

Distribution function estimation
Juan Jose Goyenech, Iowa State University

The properties of the sample mean and alternative estimators of the cumulative distribution function are studied under several sampling designs. The performance of alternative estimators at different points on the distribution function is evaluated under different designs.

Automatically verified critical points of a Bivariate F distribution
Kevin Wright, Iowa State University

Self-validated computations using interval arithmetic produce results with a guaranteed error bound. This article presents methods for self-validated computation of probabilities and percentile points of f bivariate F distribution. For the computation of critical points (c, d) in $P(X \leq c, Y \leq d) = 1 - a$, we consider the case when $c = d$. A combination of interval bracket-secant and bisection algorithms is used for finding enclosures of the percentile points of the distribution.

Combining results in linkage study: an empirical Bayes approach
Kai Wang, The University of Iowa
(Advisors: Dr. Jian Huang and Dr. Veronica Vieland.)

I am developing an empirical Bayes approach to pool result from original study with result from follow-up study whose purpose is replication of positive finding, in the presence of disease locus heterogeneity. A rescaled Beta distribution is used as prior for recombination fraction θ in the original study, with one parameter fixed and the other one determined by the original study. The posterior from the original study is then used as prior in the follow-up study. The posterior distribution after the follow-up study contains information on linkage from both studies, from which point and interval estimator of recombination fraction can be obtained.

Using simulations, the performance of this approach is compared with the usual procedure of carrying out a single test in pooled data. It is found that when applied to phase-known double backcross data with small family size (2 or 5), sibpair data or general pedigree data, this method provides better estimation of θ than does the admixture test [Ott, 1983] using the pooled data, when the proportion of linked families in the follow-up study is lower. Bayes factor is used as a measure of strength of linkage.

The probability of false positive is investigated. It is argued that, for the commonly used admixture test, the criterion used to declare significance in follow-up study should not be as stringent as the one used in original study. Sensitivity analysis shows this approach is robust to the value of the fixed parameter chosen in the initial prior. This approach provides another promising method in searching of disease gene in complex disorders.

Proportional Hazards Model with Partly Interval-Censored Data

Jong Sung Kim, University of Iowa

The maximum likelihood estimator (MLE) for the proportional hazards model with partly interval-censored data is studied. Under appropiate regularity conditions, it is shown that the MLEs for the cumulative hazard function and the regression parameter are consistent and the MLE for the regression parameter is asymptotically normal. Estimation of the asymptotic variance-covariance matrix for the MLE of the regression parameter is also considered. The inverse of the profile information matrix near the MLE of the regression parameter is used to estimate the variance-covariance matrix.

Sampling of Drainage Areas in a Watershed Health Assessment Study

Sandip Sinharay and Jean Opsomer, Iowa State University

The study is conducted by the Watershed Sciences and Soil Sciences Institutes of the U.S. Natural Resources Conservation Service in collaboration with the Survey Section of the ISU Statistics Department. It focuses on two watersheds - one each in North and South Carolina. The objective of the study is to field test the Index of Biotic Integrity (IBI), a measure of environmental health. Drainage areas of size 2000-4000 acres were considered for taking IBI measurements and collecting data on other factors potentially affecting the IBI. In order to draw the sample of drainage areas, an exhaustive frame of 255 drainage areas had to be constructed for both watersheds using GIS and the drainage areas were spatially stratified. A sample of 92 drainages was drawn from the frame in 3 phases. After completion of the field measurements, the sampling weights for the drainage areas were computed from the sampling design and were corrected to account for the presence of ineligible and inaccessible drainage areas in the frame.

Teaching Off the Web: An Internet-based Introductory Statistics Course

Gavin Cross, Coe College

At small colleges statistics is often taught by faculty from a variety of fields. This talk will explore an Internet based text/computing package used at Coe College. This package can be used by statisticians and non-statisticians as an aid in the teaching of basic statistical concepts. The design of the pages and the use of JavaScript will be discussed.

A Queuing Theory Simulation using the Java Random Number Generator
Matthew M. Menzel, Coe College

This paper reports on and examines a senior project in queuing theory. As an application of queuing theory, the topic of cafeteria engineering was explored. The primary component of the project was a Java applet which has been posted on the web. The aforementioned applet uses Java's random number generator to allow a user to simulate how the manner of food distribution in a cafeteria affects the efficiency of the system. This applet was then used to analyze the cafeteria queuing system.

Spatio-Temporal Prediction of Level 3 Data for NASA's Earth Observing System
John Gabrosek, Noel Cressie, Hsin-Cheng Huang, Iowa State University

The first Earth Observing System (EOS) satellites will launch in 1998 and will generate massive amounts of atmospheric data in both space and time. We explore the statistical issues relating to (optimal) processing of the resulting Level 2 data. We consider an approach to constructing Level 3 data products from Level 2 data that uses the spatio-temporal dependence of the data. We discuss the impact of global-grid-system choice and of spatial resolution on the error characteristics of the Level 3 data product. Data from the Total Ozone Mapping Spectrometer (TOMS) will be used for illustration.

General Information

Updated Information: Check the Iowa MAA WWW site for last minute changes and announcements.

http://maa-ia.cornell-iowa.edu

Registration: Will occur at the meeting. The registration desk and book display will be open 12:30-4:30 Friday (Olin, 3rd floor) and 8:00-3:30 Saturday (Olin, 1st floor). The fee is $5 for regular members, free for students. Dinner tickets ($6) are also available at registration, but we need to know an estimated number of participants by April 13 (see below).

Directions and Parking: Go north on highway 52 passed the highway 9 intersection. About two miles further you will see the Luther College turn off. Turn right, follow College Drive until you see the Decorah Municipal Swimming Pool on your right; park there. The new Olin Building is the red brick building right in front of you. (Saturday you may be able to park closer.)

If you want to stop at the hotels first: Going north on Highway 52, turn right (east) onto Highway 9 to get to the hotels. They are all on Highway 9, Villager Lodge and Country Inn are almost right at the intersection of 52 and 9; Heartland Inn and Super 8 are about one mile east on Highway 9 (past Walmart).

Friday Dinner: There will be a dinner on Friday evening for all meeting participants. It will take place in the Peace dining room of the Luther College Union. The menu is a buffet featuring Chicken ala King w. Pattie Shells (with regular and vegetarian toppings), Chili, Salad bar, fruit and desert. The cost is $6 per person **(free for MAA student speakers). Advance reservation is required.** Please let the Math Department secretary Jeri Laursen (laurseje@luther.edu or 319-387 1340) know by April 13 that you plan to attend. We need an estimated number of participants! Tickets can then be picked up at time of registration.

ASA Chapter Business Meeting: see Friday dinner above.

IMATYC Lunch and Business meeting (Saturday): Registration for lunch will occur at the registration table, but please let Caroline Goodman (goodmcar@niacc.cc.ia.us) know that you plan to attend so we can have an estimated number of participants. (cost:$5; menu: Turkey Croissant Sandwiches with chips, fruit and desert)

Accommodations: Prices listed are for a single room.

Villager Lodge, $37.95 Phone: 319-3824241 or 800-632-5980

Country Inn, $46.80 (includes 10% Luther College discount)
Phone: 319-382-9646 or 800-456-4000

Super 8, $36.88 Phone: 319-382-8771 or 800-800-8000

Heartland Inn, $51.00 (Luther College discount might be given)
Phone: 319-382-2269 or 800-334-3277

Free Accommodations for Students: The Luther College Math Club will be putting up students in their dorm rooms on Friday night. Students will need to bring a sleeping bag and will probably have to sleep on the floor in the dorm room. If you are interested, please contact the LC Math Club president Kari Rabe (rabekari@luther.edu).

Questions?

Contact Ruth Berger (Iowa MAA chair-elect) at bergerr@luther.edu

Iowa Section MAA -- Governor's Report

The Association's Board of Governors has approved a motion that strongly encourages mathematics departments to involve themselves in intervention projects that reach out to under represented groups. See page 4 of the January Focus for a statement of the motion.

The January issue of Focus also contained the news that Project NExT has been funded for another three years. This new grant includes a component for NExT-like programs run by sections.

Keep in mind the upcoming Mathfest in Toronto, July 16-18. Details can found on the Association's web site. Last summer's successful meeting, in Atlanta, will be the model for future Mathfests.

One highlight of the Board of Governors' meeting in Baltimore was the burning of the mortgage on the Association headquarters.

Since my term as governor ends in July 1, this is my final report to the section. I thank the membership for the opportunity to serve the section.

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

Alex Kleiner
Drake University

New Iowa Section Governor Elected

Congratulations to our new Section Governor, Elgin Johnston. Elgin will begin his three year term this summer. And thanks to Alex Kleiner for his able service as governor of the Iowa Section for the past three years.

Iowa Section -- Nominating Committee Report

The Iowa Section Nominating Committee (Greg Dotseth, Ed Hill and Alex Kleiner) has submitted the following nominations for Chair-Elect. The election will be held at the business meeting in Decorah on Saturday, April 18.

David Manderscheid -- University of Iowa
David Oakland -- Drake University

David Manderscheid received his B.S. from Michigan State University in 1976 and his Ph.D. from Yale University in 1981. His research interests are in the areas of representation theory and number theory. He joined the University of Iowa Faculty in 1987 after teaching at the University of Utah and holding an NSF Postdoctoral Fellowship. He has also held visiting positions at The Institute for Advanced Study and MSRI. Currently he is Associate Chair and Director of Graduate Studies for the Mathematics Department. At Iowa he has won the Collegiate Teaching Award and the Panhellenic Council Commendation for Good Teaching. He has also served as chair of the Mathematics Department's Evaluation of Teaching Effectiveness Committee. He currently serves on the University of Iowa Council on Teaching, a group which determines winners of teaching awards at the University and advises The Office of the Provost on issues related to teaching. In addition he serves on the College of Liberal Arts Faculty Assembly and the University Faculty Senate. He has also served as a University of Iowa Homecoming Parade Judge.

David Oakland, Associate Professor of Mathematics and Computer Science at Drake University since 1981, received his B.S. (1966) in mathematics from South Dakota State University and his Ph.D. (1970) in mathematics from Iowa State University. He taught mathematics at Dakota Wesleyan University from 1971-79 and (part-time) at ISU from 79-81 while taking additional course work in computer science. Scholarly interests include the foundations of mathematics and computer science, programming languages, and topics in graph theory. He served as department chair at DWU (1972-79) and at Drake (1990-97) and was secretary-treasurer of the Iowa Section from 1987-1993.

MAA Online

Have you visited MAA Online lately? The home page (at www.maa.org) continues to grow and inprove, providing MAA members with an ever increasing level of access to information about programs, publications, meetings, student activities, and a host of other topics.

Mathfest 98
Toronto, July 16 - 18