Discrete Centered Laplacian
Richard I. Avery
Dakota State University

A discussion of a strategy involving iteration to find a solution of

$$\Delta_x \nabla_x u(x,y) + \Delta_y \nabla_y u(x,y) = \begin{cases} 1 & \text{if x=y=0} \\ 0 & \text{otherwise} \end{cases} .$$

Connections Between Mathematics and Biology
Carl Cowen
Purdue University

Dr. Rita Colwell, a research microbiologist and current Director of the National Science Foundation, regards the mathematical sciences as the backbone for US Scientific and Engineering research. Many scholars see the next few decades as a time of intensive progress in the biological sciences. Dr. Colwell sees mathematics as being an integral part of the progress in biology, not a traditional view, but a forward looking one.

In this talk, Carl Cowen will outline some of the research areas in the emerging collaborations between mathematical and biological scientists. In addition, Cowen, who began his study of the mathematics of neuroscience last year at the Mathematical Biosciences Institute at Ohio State University, and who is this year beginning research with Professor Christie Sahley in Purdue's Biology Department, will illustrate the connection between mathematics and neuroscience with a discussion of the Pulfrich phenomenon, an experiment that helps illuminate how the brain processes visual images. There are few mathematical or biological prerequisites for this discussion.

The Maxima Computer Algebra Project
Barton Willis
University of Nebraska at Kearney

This past year, the Maxima (aka Macsyma) computer algebra system celebrated its fortieth birthday. Although Maxima's children (SMP, Derive, and Maple) and grandchildren (Mathematica) are better-known, Maxima is still being used and is steadily being improved. I'll give a brief history of Maxima, describe the efforts to keep it alive and free, and show some of its best features.

Non-Unique Decomposition of Modules over Local Rings
Nicholas Baeth
University of Nebraska—Lincoln

Let R be a local ring and let C be a set of modules over R. Assume C is closed under direct summands and direct sums. One can then consider the semigroup S whose elements are objects in C and whose operation is direct sum. For complete local rings, the factorization of any element in S into irreducible elements is unique up to order of the factors. For non-complete local rings factorization is not necessarily unique, and elements of S can have arbitrarily many distinct factorizations. In this talk I will present what happens in the case of non-complete local rings whose completions are associated to certain Dynkin diagrams.

Viewing Green's Functions
Mark Sand
Dana College

Creating a Green's Function and using it in integration is a common method for solving a differential equation. But what does the graph of a Green's Function look like? What can be learned by considering a variety of graphs? These and other questions will be explored.

Calculators Cannot Solve All Problems or All Problems Correctly
Vincent Lempke
Central Community College—Columbus Campus

Most students believe that computer algebra systems (CAS) like the TI–89 can manipulate all algebra or calculus problems. This is is a look at the operations that they cannot perform or perform incorrectly. Emphasis will be on the TI—89 with some attention to the TI—92 and TI—85.

Financing the Penney-Ante Game
Michael J. Gerdes (Student) and Steven R. Dunbar
University of Nebraska—Lincoln

In the game of Penney-Ante (invented by Walter Penney in 1975) two players choose a pattern of heads and tails of a certain length and flip a coin until one of the two chosen series appears. In an apparent paradox, it

is always possible for the second player to choose a sequence with greater odds of occurring first regardless of the sequence chosen by the first player. Financing a bet on this game is the same as valuing a new form of exotic "financial derivative." We'll show how to finance the bet, and explore the financial consequences of holding such a derivative.

The MAA/PMET Workshop
Jim Lewis
University of Nebraska—Lincoln

Inverse problems: What's the problem
Tom Shores
University of Nebraska—Lincoln

Exponential Functions on Time Scales
Jake Weiss
University of Nebraska—Lincoln

In this talk, we will define the generalized exponential function for a time scale. We will examine some properties of the generalized exponential function and also some differences between it and the usual exponential function.

Special Points in Shimura Curves
Montserrat Alsina
University of Nebraska—Lincoln (visiting)

Shimura curves have relevance in main results in Number Theory together with modular curves. But comparing with those, few explicit things in Shimura curves are known. We show some explicit fundamental domains and give a definition to characterize special points on them, related with non-integer binary quadratic forms.

Cracking the Neural Code
Bo Deng, University of Nebraska—Lincoln

Are there universal laws that govern neural communications? What would be the optimal neural codes? Why do we have a base 10 number system? Speak with 4–5 vowels? Find rectangle of golden-ratio most pleasant? What would be the mathematics of neural communication like? In this talk we will try to answer these questions in the context of a circuit model for bursting-spiking neurons and from a perspective of dynamical system point of view

Membership in Professional Organizations of Nebraska/SE South Dakota Section of MAA
Tami Worner
Wayne State College

A summary of information collected from colleges and universities in the Nebraska/SE South Dakota Section of the MAA regarding activity in professional organizations. Time will be given for discussion.

Mixing of Random Walks on Graphs
Pari Ford
University of Nebraska—Lincoln

A cone of linear transformations with Hermitian-like properties
Muriel Skoug
Nebraska Wesleyan University

A Random Boolean Network Model which Exhibits Deterministic Chaos
Dora Matache and Jack Heidel
University of Nebraska at Omaha

We consider a simple Boolean network with N nodes, each node's state at time t being determined by a certain number of parent nodes, which may vary from one node to another. We make use of the same Boolean rule for all nodes. The rule generalizes rule 126 for elementary cellular automata. We provide a formula for the probability of finding a node in state 1 at a time t and use simulation methods to generate consecutive states of the network for both the real system and the model. The results match well. We study the dynamics of the model through sensitivity of the orbits to initial values, bifurcation diagrams, and fixed point analysis. We show that the route to chaos is due to a cascade of period-doubling bifurcations which turn into reversed (period - halving) bifurcations for certain combinations of parameter values.

Math Night, a Community Event
Kristie Pfabe
Nebraska Wesleyan University

On February 24, 2004, the Nebraska Wesleyan University Math Club hosted "Math Night" at Elliott Elementary School in Lincoln, Nebraska. Over 400 students and parents attended. In this talk, I'll discuss the activities that we prepared for Math Night, the planning process and the outcome.

It acts like the ACT!
Jennifer Choutka
Nebraska Wesleyan University

It is a common perception that boys tend to do better than girls in the subjects of math and science and that girls tend to do better in the subjects of English and writing. ACT statistics support this theory. We will look at a Mathematica program that uses statistics from 2001 ACT scores to simulate a probable set of results for one hundred students. We will examine conclusions that can be drawn from this data.

Faster Fast Food
Chad Katzberg
Nebraska Wesleyan University

Almost everyone has had to wait at a fast food restaurant and wondered, "What is so fast about this?" This model attempts to explain how two factors—line length and the time required to fill an order—cause customers to wait. Then it gives suggestions of how restaurants might reduce waiting time for customers.

To Hit of Not to Hit, a Black Jack Analysis
Brad Randazzo
Nebraska Wesleyan University

Shakespeare had the question wrong. "To be or not to be?" is not the question. The question is, "to hit or not to hit?" The analysis for this presentation is based on a computer generated simulation that uses a Monte Carlo method to simulate a game of Black Jack. The factors taken into consideration are the style of play a player possesses, and the cards in both the player's and dealer's hand. Conclusions from the simulated games can be drawn from the win-loss results.