78th Annual Meeting of MAA/Wisconsin Section

April 16 – 17, 2010

University of Wisconsin – Oshkosh

Wi-Fi Instructions for our Guests

Connection Instructions:

1. Turn on the Wi-Fi, Wireless, or WLAN adapter on your laptop or other mobile device.
2. Connect to the network named WOOSH.
3. Open any web browser. You'll land at a splash login page: http://netauth2.uwosh.edu. Accept/Allow any security warnings that pop up in the browser.
4. Enter the following guest account details:
    a. Username: *uwo_reeve*
    b. Password: *reeveguest*

For our students' privacy and protection, certain traffic is restricted when you are logged into WOOSH as a guest. Please try a wired LAN kiosk in the Reeve Union concourse if you need to access a resource restricted by WOOSH.

"*" Denotes events appropriate for students

Swart means Swart Hall, Reeve means Reeve Memorial Union, and Halsey means Halsey Science Center

12:30 – 5:00	Registration	202 Reeve
12:30 – 5:00	MAA Book Sale	202 Reeve
12:30 – 4:00	Student Lounge	220 Reeve

1:00-1:25 Nicholas Peeters, Tyler Erdmann, Nicholas Bloedow (UW-Oshkosh students sponsored by Steve Winters)* 201 Reeve

Optimizing Pitcher and Batter Strategies using Game Theory and Conditional Probability

We will talk about the optimal strategies for a pitcher and a batter during each count of a baseball game.

1:00-1:25 Alex Momich and Carlos Soto (Ripon College students sponsored by Tim Hess)* 213 Reeve

Multivariate Nonparametric Neuroimaging

This research project assesses brain activity by using statistical significance in the form of multivariate nonparametric analysis. The analysis incorporated different types of neuroimaging techniques, which made the analysis multivariate. This type of analysis was used to model Alzheimer's disease and its correlation with factors such as age and the number of years of education the person has had. In order to perform the test on our model, we calculate the skewness and kurtosis of the data to have parameters which we could then simulate with. The simulations then tested the overall power of the approach. Eventually, it is shown that our model is more powerful by comparing its power under our non-parametric approach to the power under the traditional form of this analysis, which is parametric. This was done in collaboration with UW-Madison which used their facilities to gather the data which was used in this

research project. All of the analysis was done using the statistical software R in which code was written to do the analysis.

1:00-1:50 Robert Allen (UW-LaCrosse)* 214 Reeve

Isometries on the Bloch Space

Let X be a Banach space. The problem of characterizing the isometries from X to X, that is the linear operators on X which preserve the norm, is open for most spaces. In this talk, I will discuss what is known of the isometries when X is taken to be a classical space, and in particular, when X is the Bloch space. Also, I will discuss current research in the characterization of isometries amongst specific types of operators.

1:00-1:50 Mike Simmers (UW-Stevens Point)* 215 Reeve

Teaching Students how to Study Mathematics: The Conceptual Construction of Quizzes and Study Guides

Studying mathematics is different than other subjects. It requires continual study---not occasional cramming. This talk will focus on creating quizzes and/or study guides relevant to content areas of geometry, algebra, pre-calc, and calc. The talk will focus on developing aspects of what is really important, somewhat important, and nice to know regarding content. Often students study math for many hours concentrating on the wrong things, doing problems without a purpose. We need to get students studying smarter not harder, becoming more efficient and productive with their study habits.

1:30-1:55 Robert Kreczner (UW-Stevens Point)* 201 Reeve

Counting Right Triangles

The talk will deal with a seemingly very elementary question about the number of non-congruent right triangles with a given hypotenuse. However, to find a solution to this innocent problem, I realized, leads to many nontrivial challenges in Number Theory. Besides learning the answer, I will share with you my insight and how this problem affected my teaching of Elementary Number Theory.

1:30-1:55 Josh Frinak (UW-Eau Claire student sponsored by Dr. Michael Penkava)* 213 Reeve

Classification of Z_2-graded Associative Algebras

Wedderburn's Theorem states that a simple finite dimensional algebra is a tensor product of a matrix algebra and a division algebra. Wedderburn also classified the division algebras over C and R. We extend these results to the Z_2-graded case. Our main new result is the classification of Z_2-graded division algebras over C and R. In addition to the usual division algebras, we obtain a new type of division algebra which means that the classification of Z_2-graded algebras has some feature which is not just a straight forward extension of the classical results.

2:00-2:25 Linda Osterloh and Rebecca Schwoerer (UW-Oshkosh students sponsored by Steven Winters)* 201 Reeve

A Graph Theory Approach to Solving Instant Insanity and Other Variations

Instant Insanity is a game consisting of four cubes with four different colors and each block is colored differently. The goal of the game is to stack the blocks in such a way that there are four different colors per row on each side, for example, red, blue, white and green for one side. Each stacked side will have all four colors with a different orientation on each side. One mathematical approach to solving Instant Insanity is to use graph theory. A graph can be constructed from the blocks and subgraphs can be taken in order to develop a solution to Instant Insanity. There are other variations to this game that will be looked at as well.

2:00-2:25 Mark Snavely (Carthage College)* 213 Reeve

A Real-Life Variation on the Birthday Problem

Most students of probability have seen the birthday problem: if there are n people in a room, what is the probability that at least two of them share a birthday? This fall, one of my students asked a similar question from his own life experience. This innocent question led to

a class project for my probability class. What was the question? Come to the talk to find out!

2:00-2:25 Wayne Johnson (Beloit College student sponsored by Benjamin Newton) * 214 Reeve

Classification of Finite Local Rings with Zero-Divisor Graphs of Crosscap 2

I will introduce the necessary background from commutative ring theory, manifolds, and graph theory to discuss the crosscap of a zero-divisor graph of a ring. I will then classify all finite local rings whose zero-divisor graphs are of crosscap 2 and begin the classification for finite non-local rings.

2:00-2:50 Bob Hoar and Jennifer Kosiak (UW-La Crosse) 215 Reeve

Building Digital Learning Objects to Enhance Student Learning

In this session, participants will explore a collection of digital Learning Objects that can support student learning in general education courses such as College Algebra, Statistics, and Calculus. Each Learning Object focuses on a mathematical question and includes a video podcast, supplementary self-check problems, and text-based tutorials for students to use. Participants will learn how to construct a Learning Object using free technologies and a user-friendly template available from the UW System funded Institute for Innovation in Undergraduate Research and Learning (IIURL) at UW-La Crosse.

2:00-2:25 Panel Discussion (Ed Clemens, UW-Oshkosh, organizer)* 221 Reeve

Developmental mathematics and retention

A panel of tutors discusses the UW-Oshkosh developmental math program and its positive impact upon student retention.

2:30-2:55 Steven Post (Edgewood College)* 201 Reeve

Evaluating some not-as-standard real integrals using complex contour integration.

In an introductory course on complex analysis students typically encounter some standard real integrals which are most easily evaluated using complex contour integrals. In this expository talk I will discuss some beautiful not-as-standard real integrals which can be evaluated using contour integration. Some knowledge of complex analysis will be useful, but I hope to make the material accessible to those without it.

2:30-2:55 Emily Schiavone (Carthage College student sponsored by Mark Snavely)* 213 Reeve

Converse of Sarkovskii's Theorem

Sarkovskii's theorem tells us that a function with a point of prime period 3 contains all other periodicities and that a function with a point of period 5 contains all periodicities except a point of prime period three. Conversely, we will study graphs of functions containing at least one point of prime period 5, but no point of prime period 3. We will then look to expand our investigation to a general solution of the converse of Sarkovskii's theorem.

2:30-2:55 Bruce O'Neill (Milwaukee School of Engineering)* 214 Reeve

Polygonal Numbers, centered and otherwise

This talk is for anyone who has ever put six pennies around (and tangent to) a single penny, and wondered what the formulas for additional rings surrounding these coins would be.

2:30-2:55 John Frohliger (St. Norbert College)* 221 Reeve

St. Norbert College's Natural Science PRIDE Program

St. Norbert College has an NSF-funded scholarship program designed to recruit and retain students majoring in mathematics and computer science. This presentation will describe the program and discuss its challenges and benefits for students and faculty alike.

3:00-3:50 Alexander Basyrov and Mingshen Wu (UW-Stout)* 201 Reeve

Teaching Calculus with Multimedia, WeBWorK and Desire2Learn

This talk focuses on the results of our Fall 2009 project in Calculus I. Numerous multimedia clips were developed and hosted on

Desire2Learn course management system as a supplement to in-class discussions. WeBWorK, an open source assessment system, was used to deliver and automatically grade homework assignments. In particular, we will discuss technical aspects of the development of video clips, what seems to work best, and the challenges we have faced.

3:00-3:50 Susan Harrison (UW-Eau Claire)* 213 Reeve

Lessons Learned: The Barriers, Burdens, and Benefits of Designing Flexibility into Remedial Courses

Over the past two years, flexibility has been designed into the remedial mathematics course sequence at UW-Eau Claire. Students have been given the flexibility to work as quickly through the material as they desire or to expand the time taken to complete the material. Those needing the full eight-credit remedial sequence were able to complete the sequence in five months rather than using two full semesters. Providing such flexibility, however, has had its consequences. During this presentation, lessons learned and survey results will be shared as some of the barriers encountered, the burdens faced, and benefits realized by both students and instructors are described.

3:00-3:25 Benjamin Newton (Beloit College)* 214 Reeve

Meet the Cyclotomics

The cyclotomic polynomials can be easily defined in terms of basic high school algebra, but an investigation of their properties quickly leads to some deep and very beautiful mathematics. In this talk we will take a brief tour of the cyclotomic polynomials. We will discuss where they come from, describe some of their connections to various branches of math, and get a sense of some of the quirky and appealing features they possess.

3:00-3:25 Mu-Ling Chang (UW-Platteville) 215 Reeve

Monogenity of the Rings of Integers of Some Fields

Let K be an algebraic number field, and O_K be the ring of algebraic integers of K. We say that O_K is monogenic if there exists t in O_K such that O_K=Z[t]. Mathematicians used to think that all these rings were monogenic, which is not true. In this talk, I will provide several examples of monogenic and non-monogenic rings of algebraic integers.

3:00-3:50 Melissa Bingham (UW-LaCrosse)* 221 Reeve

Statistics for 3-Dimensional Orientation

Motivated by a materials science problem, a new, useful class of distributions on orientations in three dimensions is developed. Statistical inference for this class of distributions is discussed and application is made to the motivating problem.

3:30 – 3:55 John Voynovich (Carthage College student sponsored by Mark Snavely)* 214 Reeve

Order Within March Madness

The NCAA Division I basketball tournament is the second largest sporting event in the US every year. Much of this popularity comes from fan's attempts to predict the outcome of the tournament in pools. There are many ways to pick a bracket. A good number of these ways involve math in some way. This study uses probability and 10 different quantitative pieces of data from each team to find the best way of picking the bracket.

3:30-3:55 Simei Tong (UW –Eau Claire)* 215 Reeve

Classifying Completed Subspaces of L_p (p>2) by Alspach Norm

Understanding of complemented subspaces of L_p has been an interesting topic in Banach space theory since 1960's. 1979 it was proved that there are uncountablely many complemented subspaces of L_p up to isomorphism. By introducing Alspach Norm we are able to classify some complemented subspaces of L_p. This talk is a result of REU project(summer 2009) at UWEC and is dedicated to Professor Alspach's 60th Birthday.

4:00-4:50 Invited Lecture* 307 Reeve

Leah J Welty (Northwestern University Feinberg School of Medicine)

Bayesian Distributed Lag Models: Estimating the Effects of Particulate Matter Air Pollution on Daily Mortality

A distributed lag model (DLM) is a regression model that includes lagged exposure variables as covariates; its corresponding distributed lag (DL) function describes the relationship between the lag and the coefficient of the lagged exposure variable. DLMs have recently been used in environmental epidemiology for quantifying the cumulative effects of weather and air pollution on mortality and morbidity. Standard methods for formulating DLMs include unconstrained, polynomial, and penalized spline DLMs. These methods may fail to take full advantage of prior information about the shape of the DL function for environmental exposures, or for any other exposure with effects that are believed to smoothly approach zero as lag increases, and are therefore at risk of producing sub-optimal estimates.

We propose a Bayesian DLM (BDLM) that incorporates prior knowledge about the shape of the DL function and also allows the degree of smoothness of the DL function to be estimated from the data. In a simulation study, we compare our Bayesian approach with alternative methods that use unconstrained, polynomial and penalized spline DLMs. We also show that BDLMs encompass penalized spline DLMs: under certain assumptions, imposing a prior on the DL coefficients is analogous to smoothing the DL coefficients with a penalty specified by the prior. We apply our BDLM to data from the National Morbidity, Mortality, and Air Pollution Study (NMMAPS) to estimate the short term health effects of particulate matter air pollution on mortality from 1987--2000 for Chicago, Illinois.

5:00-6:30	Reception*	227 B2C Reeve
5:30-6:30	Face Off*	227 AB1 Reeve

Jeopardy-style math game show for students, organized by Ken Price (*pricek@uwosh.edu*) and Steve Szydlik (*szydliks@uwosh.edu*)

6:30-7:45	Banquet*	227 B2C Reeve
8:00-8:50	Invited Lecture*	227 B2C Reeve

Betty Mayfield (Hood College)

Women and Mathematics in the Time of Euler

In the past couple of years, we have celebrated Everything Euler – his life, his work, his legacy. This talk, which grew out of a summer research project with undergraduate students, examines some female contemporaries of Euler, some famous, some not so famous. We will

also look at mathematics that was written both by and for women in the time of Euler.

Saturday April 17

8:00 – 11:00	Registration/ Book Sale	Tutor Lab Swart
8:00-11:00	Student Lounge	240 Swart
8:00-8:55	Business Meeting	217 Swart

9:00-9:25 Kirthi Premadasa (UW-Marathon County)* 3 Swart

Wikis for the Math class. The DO's and DON'Ts

Wikis can be excellent collaborative tools for students in math. However the project should be selected carefully to bring out the collaborative spirit in the students in an optimal manner. In this presentation we will describe the outcomes of two Math wiki projects of different nature that were carried out last year. We plan to guide the audience through a step by step "live" process on how a wiki is created as well as give samples of wiki projects that could work and others which might not produce the expected outcomes. We will all discuss some common constraints that students face while doing a Math wiki and provide possible solutions.

9:00-9:25 Laura Schmidt (UW-Stout)* 4 Swart

Closing the gap between learners' and instructors' expectations

What happens when you hand out expectations for yourself and your class? Do clear expectations encourage better motivation? What motivates the students in class? This talk will discuss some initial results of a multidisciplinary project on expectations.

9:00-9:25 Alexander Lavrentiev (UW-Fox Valley) 13 Swart

Multi-parameter Semigroups and the Hille-Yosida Theorem

I will talk about multi-parameter semigroups of two types and resolvent operators associated with such semigroups. I will introduce a version of the Hille-Yosida theorem in terms of resolvent operators.

9:00-9:25 Michael Parhem, Ray Parent, Aaron Koopin 14 Swart
(UW-Whitewater students sponsored by Geetha Samaranayake)*

A College Lesson Study in Calculus

A general description of Lesson Study will be provided for those who are not familiar with this activity. The topic of our Lesson Study was integration by substitution in Calculus. We decided on this topic because of our past experiences and the understanding that some students struggle with the topic. The lesson we developed, taught, and revised used traditional and modern settings which focused on the introduction of the acronym SHAFTS to assist students in recognizing and applying the steps in integration by substitution problems. Results of our study as well as observations of the process of Lesson Study and difficulties we encountered will be addressed.

9:00-9:25 Kallie Malis and Leah Wetzel (UW-Stout 102 Swart
students sponsored by Seth Dutter)*

Exploring Envelopes

This presentation will discuss undergraduate research done in the area of envelopes, families of curves that form interesting mathematical relationships. The presentation will also explore several potential theorems involving envelopes and their properties.

9:00-9:25 Ryan Yohnk (UW-Eau Claire student 126 Swart
sponsored by Simei Tong)*

Optimal Evacuation for the City of Eau Claire

Natural disasters and other related emergencies are of major concern for communities. It is crucial for the city to evacuate its citizens from danger, in the event of an emergency. Therefore, we have create a mathematical model based on Operations Research Theory and Graph Theory that can construct an evacuation plan to perform the optimal evacuation of a variety of emergency situations. We designed a program using the Java programming language that dynamically implements Dijkstra's algorithm and the Simplex Method to efficiently calculate the optimal solution of evacuation with minimal user interface. Specifically, the Emergency

Management Officer of the City of Eau Claire will be able to implement this software during times of emergency in the most efficient way.

9:00-9:25 Barb Bennie (UW-LaCrosse)* 127 Swart

A "testimator" for estimating the mean of skewed populations

The Student's t confidence interval for estimating population means is reliable when working with symmetric populations and/or large sample sizes. However, when restricted to relatively small sample sizes, the t confidence interval is not a good choice for estimating the mean of skewed populations. We consider some existing alternatives to the Student's t confidence interval and propose a new "testimator" that out performs existing methods.

9:30 – 9:55 Tristan Williams (UW-Eau Claire student sponsored by Manda Riehl)* 3 Swart

Avoiding Paired Colored Patterns of Length Three

We study pattern avoidance in colored permutations (S_n \wr C_r) using the pattern matching condition developed by Mansour. We prove results in the enumeration of avoidance classes of two patterns in S_3 \wr C_2 and present bijections to other previously studied objects. Specifically we have enumerated the avoidance of uni-colored patterns of length k in S_n \wr C_r. I will present a proof of our enumeration method and a bijection from the avoidance class in S_n \wr C_r of paired uni-colored patterns of length 3 to symmetric permutations of length 2n avoiding a decreasing string of length 5, studied by Egge.

9:30 – 9:55 Ted Wendt (UW-LaCrosse)* 4 Swart

The Wisconsin Mathematical Modeling Challenge

On October 10th, 2009, the UW-La Crosse math department hosted the first annual Wisconsin Mathematical Modeling Challenge (WMMC). This new regional math contest gave undergraduate students the opportunity to apply the skills they learned in their math classes to real world problems.

In this talk, I will discuss the value of math modeling contests in general, the goals of the WMMC, and several plans for expanding future participation to include more Wisconsin schools.

9:30 – 9:55 Amanda Welter (UW-LaCrosse student sponsored by Barbara Bennie)* 14 Swart

Stochastic Music

Stochastic music was pioneered by Iannis Xenakis, a Greek composer, theorist, and architect. In stochastic music, stochastic processes- processes that evolve over time based on probabilities- can be used to generate different musical elements, such as frequency, duration, and intensity. This talk explores Xenakis' use of probability and other mathematical theories in his compositions.

9:30-9:55 Tony Thomas (UW-Platteville)* 101 Swart

Rational Imaginary Roots of Polynomials

The Rational Root Theorem tells us where to look for rational roots of polynomials. In this talk we will discuss where to look for rational imaginary roots, i.e., imaginary roots whose real and imaginary parts are rational numbers. The only prerequisite for this talk is a background in algebra that includes finding roots of polynomials.

9:30 – 9:55 Jayanthi Ganapathy (UW-Oshkosh)* 102 Swart

A user-friendly comparison test

A not so commonly known version of the comparison test that is not restricted only to positive term series will be introduced and proved. The focus of the talk will be on one or two examples of infinite series for which commonly known tests fail but this new version of comparison test applies. This talk is easily accessible to all those undergraduates who have studied infinite series.

9:30 -9:55 William T. Mickelson (UW-Whitewater)* 126 Swart

Modeling Statistical Test Performance: The Case of the Robust Rank-Order Test

The traditional way of examining statistical test performance is to conduct Monte Carlo simulation to estimate Type I Error Rates and Power under a set of strategically selected population characteristics. Following this tradition, this research utilizes Monte Carlo

simulation to examine the Type I Error Rate and Power performance of the Fligner-Policello Robust Rank Order (RRO) Test (Fligner & Policello, 1981) and the traditional Student's T-test for comparative purposes. The RRO test is a modified version of the Mann-Whitney-Wilcoxon test designed to maintain both the nominal Type-I error rate and statistical power under generalized Behrens-Fisher conditions of unequal variances and non-normal distributions (Behrens, 1929; Fisher, 1939; Scheffe, 1970; Zumbo & Coulombe, 1997). This research deviates from the traditional presentation and analysis of results by considering the simulation estimates to be data points from a response surface that can be summarized and modeled using regression. The advantages of the approach presented in this paper include: a) regression models explicitly take into account sampling variability and replace cumbersome tables of results; b) permit graphical visualization of the response surface; c) allow a greater range of population conditions to be evaluated; and e) increase the opportunity for simulation results to be made more consistent with, and accessible to, researcher practice. Models of the Type I Error Rate and Power for the RRO and Student's T-test will be presented as illustrative cases with recommendations for researcher practice.

9:30 – 9:55 Kristin Thyrion, Elizabeth Quandt, Emma Nametz (UW-Oshkosh students sponsored by Steven Winters)* 127 Swart

Variation on Knight's Tour

We will be explaining and showing tours on various size boards along with the possible placement of an open square while still completing a tour. We are exploring the possibilities of extending our results to larger boards.

10:00-10:25 Kylie Ainslie (Ripon College student sponsored by Tim Hess)* 3 Swart

The Exact Distribution of the Clustered Wilcoxon Test

The standard Wilcoxon Rank Sum Test is commonly used in the comparison of populations under the assumption of independence of the data points; however, in some populations independence cannot be assumed. For example measures collected from the left and right eyes of visual implant patients would likely have positive correlation. In populations where independence cannot be assumed a

clustered Wilcoxon Rank Sum Test has been proposed and large sample theory developed.

In this talk we will present an implementation to write out the exact distribution of the cluster Wilcoxon test using the R statistical computing environment. A comparison of the exact distribution to the large sample approximations will be presented to assess when the large sample theory may be appropriate. Simulations will also be presented to assess the negative impact correlation has on the type I error rates for the independent Wilcoxon procedure and demonstrate the cluster procedure's ability to maintain nominal error rates.

10:00-10:25 Susan Hollingsworth (Edgewood College) 13 Swart

De Colores: a selection of coloring problems

The most well-known of coloring problems is the four-color problem, but there are many other interesting problems of this kind that are equally engaging. We will look at a selection together.

10:00-10:25 Joey Powers and John Nehls 14 Swart

(UW-LaCrosse students sponsored by Theodore Wendt)*

No Sting in Your Swing

Imagine you are a professional baseball player in a major league game, and you are up to bat. As the pitch comes in, you wind up and take a full swing at the ball, crushing it out of the park. As you round the bases, you realize you hardly even felt the ball collide with the bat. All you felt was a seemingly momentary increase in the weight of the bat. How can this be? You hit the ball as hard as you can, and yet you didn't even feel it? Our model describes this phenomenon as hitting the "sweet spot" of the bat. When the batter hits the ball at the sweet spot, the ball exerts most of its energy into rotating the bat in the opposite direction of the swing at the same pivot point that the batter is swinging the bat about. If the ball misses the sweet spot, a high portion of the energy the batter is putting into the rotation is absorbed in counteracting the shock of the ball trying to rotate the bat about a different pivot point. Thus, at the sweet spot, the ball leaves the bat with the maximum amount of energy.

10:00-10:25 Christopher Frayer (UW-Platteville)* 101 Swart

The Most Marvelous Theorem in Mathematics

One of my all-time favorite mathematical results is something called Marden's Theorem. Marden's Theorem states that if p(z) is a third degree polynomial with complex coefficients, whose roots z1, z2, and z3 are non-collinear points in the complex plane and T is the triangle with vertices at z1, z2, and z3, then there is a unique ellipse inscribed in T and tangent to the sides at their midpoints. The foci of this ellipse are the roots of p'(z). We will discuss the proof of this result as well as the generalization to fourth degree polynomials. This is an excellent talk for students and faculty alike, there will be plenty of pictures and intuition.

10:00-10:25 Mark Bauer (UW-Eau Claire student sponsored by Simei Tong)* 127 Swart

Optimizing the Evacuation of Hospitals Phase II

In Phase I of our project, we developed a successful evacuation model for Luther Midelfort Hospital of Eau Claire, WI. It saved 23% of total evacuation time in comparison to a logical method of evacuation. In Phase II, we have expanded our model to another major U.S. hospital. We dealt with 13 departments on four floors with 12 elevators; as well as 7 stairwells. Our model can now handle different scenarios of evacuation such as: the use of only elevators, no elevators at all, and horizontal evacuation between buildings. We performed sensitivity analysis on our solution to see how it varies with changing constraints.

10:00-10:50 Panel (Kirthi Premadasa, UW-Marathon County, organizer) 217 Swart

SO TELL me how to conduct mathematical research on classroom learning or teaching practices: A panel discussion on conducting SoTL research projects

10:30-10:55 Dale Buske (St. Cloud State University)* 3 Swart

On the Vector Triple Product

One of the fundamental properties of the vector triple product says that a x (b x c) = (a.c)b - (a.b)c. Through this identity, this talk aims to provide a better geometric understanding of the triple product.

10:30-10:55 Christopher Schafhauser (UW-Platteville student sponsored by Chris Frayer)* 13 Swart

Maximizing the Lp Norm of Monic Polynomials

The presentation is a generalization of a recent paper on finding the "largest" polynomial with roots on a given interval, in the sense that one polynomial is bigger than the other if its maximum deviation from the x-axis is larger. This presentation defines one polynomial to be larger than another if it has a larger Lp norm. I will show the Bernstein polynomials maximize the Lp norm for all p greater than or equal to 1.

10:30-10:55 Liem Nguyen, Krista Newell 14 Swart
(UW-Oshkosh students sponsored by Kandasamy Muthuvel)*
Symmetrically continuous functions
A real-valued function f is symmetrically continuous at x in R if $f(x+h)-f(x-h)$ approaches 0 as h approaches 0. Every continuous function is symmetrically continuous. The converse is not true. For example, the characteristic function of R \ Z is symmetrically continuous at every point of R, but discontinuous at every point of Z. However, for any symmetrically continuous function f the set of points where f is discontinuous cannot be large in the sense of category. We analyze the set of points at which a function f is symmetrically continuous but not continuous.

10:30-10:55 Josh McHugh and Noah Williams 101 Swart
(UW-Eau Claire students sponsored by Manda Riehl)*
Distinct Minimal Sequences in Genome Arrangements using the Double-Cut-and-Join Model
How closely related are the genomes of different species or individuals within a species, and how can one genome be mutated into another? The double-cut-and-join (DCJ) method models the way mutations can occur. For this project, we explored this model to find patterns between signed and unsigned genomes and to calculate the number of DCJ operations required to turn one genome into another.

Using Python, we developed a computer program which takes an unsigned genome as input and outputs the new genomes acquired after a desired number of DCJ operations are performed. Using this program, we found sequences of numbers relating the length of the genome, the number of DCJ operations performed, and the number of genomes created. We found an exponential generating function for the number of genomes which are distance n away from a genome of length n. We generalized this function to apply to any

number of pairs of external vertices and proved its validity by comparing it to a formula we found directly using counting methods.

Furthermore, we are exploring the relationship between genomes which are maximally distant, and we will use clique software to generate conjectures about the graphs for genomes of length n.

10:30-10:55 Ali Khalili, Cody Hunt, Hoang Vo 127 Swart
(UW-LaCrosse students sponsored by Theodore Wendt)*

The Bat, the Ball, and the Spot that is Oh So Sweet!

Every baseball player knows that there is a mystical sweet spot on the bat that delivers not only maximum power to the ball, but may also reduce the painful sensation know as sting. Research is almost always being done on the sweet spot, and its exact location is yet to be found. A greater understanding of the sweet spot could help improve the baseball experience for fans and players.

During the presentation we will try to adopt the best definitions of the sweet spot and analyze how changing different parameters, such as the material of the bat and corking of the bat, affect its location. Different ball-bat interactions are examined and varying models, from ideal mechanics situations to the effects of vibrations, are incorporated to accomplish our objectives.

We defined the sweet spot to be the range on the bat that transfers the most energy to the ball after collision, as well as minimizes the discomfort of the batter. Using an ideal mechanics model with common wood bat measurements, we found that the most efficient spot on the bat is at approximately 91% of the bat's length from the knob. Analyzing the effects of vibrations in different materials, we see that sound travels too slowly in wood and corked bats to enhance energy transfer to the ball, while hollow aluminum bats provide a trampoline effect which, in turn, enhance performance.

11:00-11:30 Reception* outside 109 Halsey

11:30-12:30 Invited Address* 109 Halsey

Jennifer Szydlik (UW-Oshkosh)

Teaching to Inspire Mathematical Thinking

Our community, the *mathematical* community, holds a set of values, mathematical tools, and distinctions about language that support us in learning new mathematics and in solving problems. We value precise definitions of objects, elegant arguments, and shared

notations. We use logic, create examples, non examples, and counterexamples, consider extreme or trivial cases, and make models for problems. We distinguish necessary from sufficient conditions, pay close attention to quantifiers, and are sticklers for language. This is our culture. I advocate for making this culture transparent to our students both in the ways we speak about mathematics and in the ways we do mathematics with them in class. In this presentation I will talk about how we might do both, and I will provide samples of problems and activities that inspire mathematical thinking.

12:30-3:30 Wisconsin Section NExT Meeting
306 Reeve