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CAROLINAS MATHEMATICS UNDERGRADUATE RESEARCH CONFERENCE ABSTRACTS

JOHN HARRIS, EDITOR

Abstract. On Friday, March 24, 2006, Furman University hosted the Carolinas Mathematics Undergraduate Research Conference. The conference was supported by the Mathematical Association of America (NSF Grant DMS-0241090). These are the abstracts for the eight undergraduate talks given on that day.

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Conference Schedule

10:00-10:30	Refreshments
10:30-11:30	Welcome and Plenary Address: Peter Winkler: Geometry and the Intuition
11:30-1:00	Lunch
1:00-1:15	Daniel Lamb: Graph Theoretic Models of Glucosyltransferases
1:20 - 1:35	Kathryn Pedings: Universality of Rank 6 Plucker Relations and GCP Maps
1:40 - 1:55	Nicholas Cain: Sequence Motif Recognition Using Artificial Neural Networks
2:00 - 2:10	Coffee break
2:15 - 2:30	Jennifer Aust: The Braid Index and Number of Seifert Circles for a Link
2:35 - 2:50	Hannah Davis: The Loss Function
2:55 - 3:10	Caroline Turnage: *Je le vois, mais je ne le crois pas*: Attempting to Understand Infinity
3:15 - 3:25	Coffee break
3:30 - 3:45	Stephani Garrett: Functional Music
3:50 - 4:05	Tracy Holt: Domination Cover Pebbling Numbers of Certain Graphs

Graph Theoretic Models of Glucosyltransferases

Daniel Lamb

East Tennessee State University

Abstract. In this work we use graph theory to model thirteen enzymes known as UDP binding glucosyltransferases. These enzymes transfer a sugar molecule in the biosynthesis of flavonoids. Flavonoids are currently of interest due to their anti-oxidant and anti-cancerous properties. Given these enzymes, it is known that they form two distinct functional classes. At this time, there is no known method for determining the functional classification of the enzyme other than time consuming laboratory methods. Using graphs, we quantify each enzyme with a unique numerical signature with the goal of classifying each enzyme.

Universality of Rank 6 Plucker Relations and GCP Maps

Kathryn Pedings

College of Charleston

Abstract. The Plucker relations define a projective embedding of the Grassmann variety $Gr(k, n)$. We give another set of equations, which defines the same embedding, and whose elements all have rank 6 and are in fact obtained by pulling back the unique Plucker relation on wedgespace(2,4). This is achieved through the construction of a finite set of linear maps wedgespace(k,n) to wedgespace(2,4) which preserve the decomposability of an element, such that for any indecomposable ω in wedgespace(k,n), there exists a linear map in this set preserving the indecomposability of ω. We also give a $(k+2)$-parameter family of linear maps having the same properties.

Sequence Motif Recognition Using Artificial Neural Networks

Nicholas Cain

Davidson College

Abstract. Many techniques in sequence motif recognition, such as MEME, rely on statistical analysis of biological information to identify conserved regions. Such techniques rely solely on primary structure information, and do not consider the more complicated molecular dynamics at work in a biological system. Often molecular secondary structure is essential in the facilitation of the motif's biological function. An algorithm that utilizes artificial neural networks to identify degenerate, conserved regions in mRNA molecules has therefore been developed, which exploits estimation of the molecules secondary structure using MFOLD. A committee machine architecture is used, implemented in parallel with grid computing techniques. This algorithm successfully identifies a seven base-pair motif in mRNA strands known to locomote to the forming bud-tip during mitosis in S. cerevisiae, where the importance of secondary structure in motif function has been established.

The Braid Index and Number of Seifert Circles for a Link

Jennifer Aust

Wofford College

Abstract. This talk will focus on Seifert circles, braids, and their relationship, with a discussion of bunching operations. Discussion will lead to a proof that the braid index for a link equals the minimum number of Seifert circles.

The Loss Function

Hannah Davis

Catawba College

Abstract. Through an internship, in dimensional control at Northrop Grumman Newport News, questions of how to measure quality arose. When fabricating goods, the need for measuring quality becomes an important issue. This leads us to examine the quality of a specific manufactured good, in this case a Coast Guard strut arm, in order to gain a numerical value for quality to improve customer satisfaction.

Je le vois, mais je ne le crois pas: Attempting to Understand Infinity

Caroline Turnage

Wofford College

Abstract. This presentation will pertain to the work of Georg Cantor involving his proofs on the different cardinalities and properties of infinity. The talk will also present an overview of the current work on the Continuum Hypothesis in order to show the problem's relevance to aspiring and established mathematicians alike.

Functional Music

Stephani Garrett

Catawba College

Abstract. We will explore a connection between mathematics and music. Using a computer program we will analyze sine and exponential functions creating small musical motives. And similarly, we will analyze fractals using a Julia Set for musical motives in consecutive intervals.

Domination Cover Pebbling Numbers of Certain Graphs

Tracy Holt

East Tennessee State University

Abstract. We consider the domination cover pebbling for the Petersen graph, the Heawood graph, and hypercubes. We start by defining the notions of pebbling and cover pebbling of a graph, and how those ideas lead to domination cover pebbling. We lead into the results of research for domination cover pebbling of the graphs mentioned.