Abstracts
Honors and Senior Seminar
Spring 2008 Simpson College
Mathematics Department

***Nim Games* by Shane Akers**

This talk will introduce the audience to *n*-pile Nim Games which is an example of a combinatorial game. A strategy will be introduced that when implemented guarantees a win for the player incorporating the strategy.

***Lorenz Curves, Gini Coefficients, and Poverty Redistribution* by Jonna L. Anderson, Honors Thesis**

Alleviating poverty is one of the major areas of study in both economics and mathematics today. This paper is concerned with examining the endowment portion of poverty and the methods incorporated to reduce inequality. Using Lorenz curves and the Gini coefficient we will show that the redistribution of income within a population is an effective method for reducing inequality. Finally, we will examine the possibilities for creating a simple poverty model dividing the population into a rich and a poor layer based on the Gini coefficient of the system. Provided there is enough incentive, "rich" individuals would then relinquish a certain percentage of their income to the redistribution process. Through numerous tests of this model we would hope to find that the Gini coefficient of the redistribution is significantly reduced indicating an effective reduction in inequality.

***Battle of the Monkeys* by Nick Bruhn**

In this poster presentation I will be discussing important concepts found in game theory related to two person games. I will model a situation between two monkeys competing for food. I will demonstrate the solution to the game, the importance of who goes first in a sequential game and the outcomes when they act simultaneously. I also will demonstrate a two-person poker game and the best response strategies for each player.

***Surjective L(3,2,1) Labeling* by Jessica Fletcher**

$L(3,2,1)$ labeling is a method that can be used to label the vertices of a graph. This talk will introduce $L(3,2,1)$ labeling and surjective $L(3,2,1)$ labeling. Families of graphs that can and cannot be labeled using surjective labeling will also be discussed.

***Bargaining Games* by Ashley Hopp**

During a workers strike, it is important to understand the process that is behind the bargaining situation. In this poster, I will model the process behind bargaining games to gain insight on the strategies and thought processes behind the offers. I will introduce a two stage game that will illustrate the strategy choices of the participants and incorporates the idea of money loss due to time. This model will also illustrate the role that an arbitrator can play in determining the outcomes of the game.

***Instant Insanity* by Kelly Lindblom**

Solving the Instant Insanity puzzle using trial and error is time consuming and difficult. This poster will illustrate how to simplify this process using basic graph theory techniques. We will show situations where the puzzle has solutions and situations where no solution exists.

***Ceva's Theorem—The beginning step to triangle centers* by Ryan McDonough**

Throughout high school geometry you discuss triangles and the many applications they are used for. However, very seldom do you hear about Ceva's Theorem. Using Geometer's Sketchpad we will prove the theorem and discuss how it is the foundation for more than 3,000 proven triangle centers. We will also look at applying parts of Ceva's Theorem to figures beyond the triangle.

***Convex Hull: Three different algorithms* by Tania Quiroz**

School district borders and pattern recognition are examples of the convex hull applications. There exists many different algorithms to find the convex hull; however, three of the most popular approaches will be presented (Graham's algorithm, Quick Hull, and Jarvis' march). A comparison between the three will be also discussed.

***Using 2- and 3-String Rational Tangles to Model the DNA-Enzyme Complex* by Tracy Robson, Honors Thesis**

The intersection between the study of biology and mathematics has allowed us to research genetics and its relation to the mathematical area of knot theory. Knots, links, and tangles closely resemble knotting that takes place in deoxyribonucleic acid (DNA). DNA is the genetic code for life and codes for proteins that keep bodies alive and functioning. For this reason, the study of knot theory and genetics has allowed us great insight into several enzymes that manipulate DNA in the body, including Mu transposase and XER recombinase. Knot theory allows us the ability to imagine abstractly removing DNA tangles from their greater context of DNA, manipulating them, and returning them to the DNA, a freedom that biologically experimenting with DNA does not offer. This paper outlines some background information, then goes in-depth into the use of 2- and 3-string rational tangles and their use in modeling genetics.

***The Deal with "Deal or No Deal"* by Casie Schmitt**

Monte Carlo simulation uses pseudorandom numbers to simulate the solutions of different mathematical problems. This poster presentation will demonstrate how such methods can be used to simulate the popular game show "Deal or No Deal." Using the contestant's expected value, one can determine the ideal offer from the banker. Also, one can determine when the contestant should take the deal or keep on playing. By creating a simple algorithm, one can create his or her own game of "Deal or No Deal."

***Bezier Curves* by Samantha Tunell**

In my presentation I will discuss Bernstein polynomials and Bezier curves. I will show two different ways to construct Bezier curves, including the de Casteljau algorithm. Also, I will discuss some important properties of Bernstein polynomials and Bezier curve. Lastly, I will share some of the applications of Bezier curves, such as graphic design and font design.

***Tessellations in Euclidean and Hyperbolic Geometry* by Vu Vo**

This poster will show the differences between tessellations in the Euclidean plane and tessellations in the Poincaré Disk. We will understand the definition of a tessellation, as well as creating our own. We will be able to understand tessellations, not only in Euclidian plane but in a hyperbolic plane. There are many tessellations in both planes, but we will only focus on tessellations that use regular polygons in the Poincaré Disk.

***An Introduction to Barycentric Coordinates* by Maria Y. Wadle**

Computer graphics in movies and video games are vehicles for creative expression in the digital reality that encompasses much of what passes for entertainment in our culture. At the heart of many graphic modeling programs is a local coordinate structure with Barycentric coordinates, which utilize triangular reference points instead of rectilinear coordinates. During this current semester, I am researching the underpinnings of Barycentric coordinates, and composing a presentation of this coordinate system in a way that is accessible to high school students. Utilizing Geometer's Sketchpad, the concepts of parametric equations, affine combinations of points, and Barycentric coordinates are investigated.