Mathematics & Statistics Colloquium

When: Wednesday, October 22, 2:00 pm - 2:50 pm

Where: Lee Drain Building 400

Simplified Pseudo-Kauffman Polynomial

Sarah Renfro

In mathematics, a knot is an embedding of a circle in 3-dimensional Euclidean space. However, the study of knots is primarily based on 2-dimensional representations of knots, called knot diagrams. Two knot diagrams are equivalent if and only if they are related by a finite sequence of Reidemeister moves. Pseudoknot diagrams, conventionally called pseudodiagrams, are generalizations of knot diagrams where, at a crossing, the over and under strands may be undetermined. Crossings where the over strand is unknown are called precrossings. Two pseudoknot diagrams are said be equivalent if and only if they are related by a finite sequence of Reidemeister moves and pseudo-Reidemeister moves. Equivalent pseudoknot diagrams are said to be diagrams of the same pseudoknot. A pseudoknot is said to be pure if there exists a diagram of the pseudoknot with only precrossings. In my presentation, I will introduce an invariant for pure pseudoknots inspired by the Kauffman Polynomial and characterize the polynomial for families of pure pseudoknots.

This research was done during the REU program at the University of Wisconsin-Stout under the guidance of Dr. Jeff Boerner.

Counting Real Roots of Random Polynomials

Joseph Cleveland

Though solving high degree univariate random polynomials and determining the precise real roots out of all the roots are some of the most important problems in mathematics, science and engineering, it has remained a highly challenging problem in computational mathematics. We combine an efficient multi-precision implementation for solving of high degree random polynomials with two of the certification methods, namely Smale's alpha-theorem and Gerschgorin theorem, which can certify if a given numerical root in the quadratic convergence region of a nearby exact solution. With this combination, we obtain the certified counting of the number of real roots as well as the certified real roots of the random polynomials. We quantify the difference between the two certification procedures and list the salient features of both the procedures. Then, after benchmarking with the random polynomials with the coefficients drawn from the Gaussian distribution, we obtain novel results for the Cauchy distribution case.

This research was done during the REU program at North Carolina State University under the guidance of Dr. Dhagash Mehta.