Math Monday

October 27, 3:10pm
109 Hayes Hall

Brownian Motion in the Complex Plane

Lila Greco ('15)

Abstract: This project explores Brownian motion, a model of random motion, in the plane. Given a domain in the complex plane and a basepoint in the domain, start a Brownian traveler at that basepoint. The h-function of the domain gives us information about where the Brownian traveler first hits the boundary of the domain. After defining the h-function of a domain, we present several examples of domains and their corresponding h-functions. We also explore properties of these functions as well as the relationship between the geometries of domains and their h-functions. Finally, we end with results about the convergence of h-functions.

Constructing New Linear Codes with Record Breaking Parameters

Nick Connolly ('15)

Abstract: Coding theory is the branch of mathematics interested in the reliable transfer of information. Error correcting codes are designed to detect and correct errors that occur during the transmission of a message due to noise. Linear codes have the mathematical structure of a vector space over a finite field. Every linear code has three fundamental parameters which determine its quality: length, dimension, and minimum distance. A code's minimum distance determines its error correcting capacity. For a given length and dimension, there exists an upper bound on the value of the minimum distance of a code; the best known linear codes are those with a minimum distance as close as possible to this bound. In this project, we attempt to construct new linear codes with larger minimum distances than the previously best known codes by exploiting the algebraic structures of constacyclic and quasi-twisted codes. For a given length and finite field, we exhaustively construct all constacyclic codes and record those codes with the highest minimum distance for a given length and dimension. We then use those best constacyclic codes to construct 1-generator quasi-twisted codes. Finally, we compare the minimum distance of these quasi-twisted codes against the best known linear codes with the goal of discovering new linear codes with better parameters. We have been able to find 96 new codes with this method which have been added to the online database of best known linear codes.