CUSP Summer Enhancement Fellowship abstracts 2014/10/8

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Scholar: C.P.Davis Scholar, Fu Memorial Scholar

Title of summer position: undergraduate researcher

Summary:

Exploring the New Ways to Construct Reinhardt Polygons

This summer I participated in the Summer@ICERM undergraduate research program at ICERM(Institute for Computational and Experimental Research in Mathematics) at Brown University, Providence.

Throughout the first week, we were introduced to the different topics we could choose from ---- periods of rational polygons, baker sequences, visualizing harmonic analysis, Reinhardt polygons, Dedekind sums and pisot numbers. I chose the research topic of Reinhardt polygons and spent my summer with Professor Mossinghoff and my teammates, Molly and Robert on the topic.

A Reinhardt polygon is a convex polygon which is the optimal solution to three unique problems: fixing diameter and maximizing perimeter, fixing diameter and maximizing width, and fixing perimeter and maximizing width. There has been previous work to enumerate and categorize these polygons whose sides have two prime divisors. I mainly focused on extending the construction of Reinhardt polygons with n=r\*p\*q(p,q prime numbers, r>=2) format into the construction of polygons with n = r\*p\*q\*l (l also a prime number)format. And then I programmed to test our model and visualized the polygons constructed.

. In the final presentation, we made extensions of previous techniques to polygons with three or more prime divisors. We first discussed the extensions of a previous construction to find all polygons of the form n = pqr to polygons of the form n = pqlr, where p, q, and l are primes and r is an integer greater than or equal to 2. We also discussed relevant theoretical bounds on the number of polygons of the form n = pqlr for a given n. In addition, we introduced a new method that can be used to produce all Reinhardt 105­gons.

Keywords: Reinhardt Polygons, Construction, Discrete Geometry, Computational Mathematics, ICERM

Budget Summer:

Housing: 1960

Meals: 1500 (estimated)

Transport: 200(amtrak)

Other: 200(estimated)