CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
S1605

Project Title
An Analysis of the Primitive Cycles Existence Conjecture

Abstract

Objectives/Goals
The objective of this project is to make progress toward the proof of the Primitive Cycles Existence Conjecture. Also, the project intends to present an analysis of total stopping time graphs for 3x+d and an application of the 3x+d function to cryptography.

Methods/Materials
The number of iterations k takes before the kth iteration is equal to the k+nth iteration for any n for any k, i.e. total stopping times of the 3x+d function, were analyzed using a Java program to find stopping times for 1 to 9999 for d = 1,5,7,11,13,17 and plotted it.

Results
The first theorem details conditions for a number divisible by a number of a certain form that is necessary for it to be a primitive cycle, and the second theorem builds on the first theorem to determine under what conditions a possible cycle can exist. These cycles are a subset of all cycles for all d.

Conclusions/Discussion
The resulting graph demonstrated a logarithmic relationship between the number and the stopping time. Also for further research, these theorems may be generalized to assist in proving the Primitive Cycles Existence Conjecture.

Summary Statement
This project conducts an analysis of the Primitive Cycles Existence Conjecture concerning a generalization of the 3x+1 problem to 3x+d.

Help Received
Mother looked over report and abstract; Father helped with poster formatting and also looked over report; Dr. Haxell critiqued theorems.