

Distance in the Graph Model of a Sudoku Grid

Julia Beilke, Marquette University
Dr. Kim Factor, Marquette University

Introduction

Given a 9x9 Sudoku grid and the positions of k of a specific digit to be filled in, we would like to minimize distance in the path from a starting point on the grid through each of the k squares. We have examined and classified configurations of $k = 2, 3, 4, \dots, 9$ filled in squares and described heuristic techniques for finding the shortest path for various classifications of configurations. We have also made observations about the similarities that exist among all possible arrangements of $k = 9$ squares.

Significance

This is a version of the Traveling Salesman Problem (TSP) in which we use the constraints of the Sudoku Grid to limit the number of possible configurations of squares.

Student Involvement

This was an REU summer research project funded by a National Science Foundation REU site grant, #ACI-1461264, 'Computation Across the Disciplines', at Marquette University, and was intended to be an open-ended research question guided by Dr. Kim Factor. Along with Dr. Factor and another REU student, I defined a graphical model to represent the Sudoku boards so that we could use a graph theory approach to work on the problem. I created a computer program to generate all possible boards of a given size and make observations about these boards to direct my research. With the assistance of the program, I made several observations about boards with 9 filled in squares that led to further research questions, which are discussed in both my poster and research paper.

References

Eugene L. Lawler, *The Traveling Salesman Problem: A Guided Tour of Combinatorial Optimization*. 1985.