

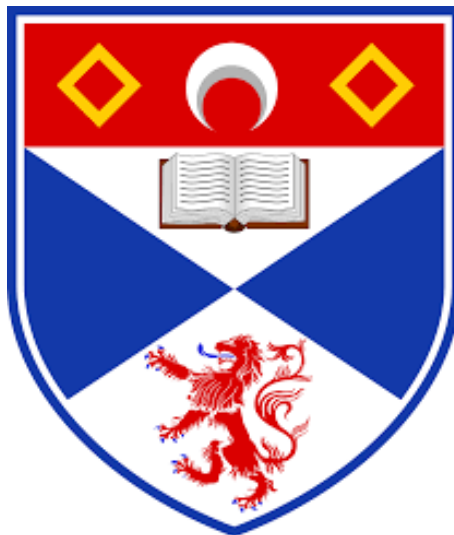
From Scramble to Solution

Developing an Optimal Solver for
a Rubik's Cube Variant

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Abstract

The Rubik's Cube is the most well-known combination puzzle of all time, and has led to the creation of numerous variants of the puzzle. One such puzzle is the Kilominx, a 2x2 dodecahedron-shaped puzzle with 12 faces and 20 cubies (individual cube elements of the puzzle). While the Rubik's Cube has been widely researched, leading to the creation of an optimal solver for the cube, the Kilominx has not been as widely studied.

This report describes the work that was accomplished to create an optimal solver for the Kilominx, guaranteeing a solution in as few moves as possible. The state of the Kilominx is represented as an array of cubies, each with an index and orientation. The solver uses an iterative-deepening A* (IDA*) algorithm to explore the search tree, using a number of pattern databases - large lookup tables which contain the number of moves needed to solve different subsets of cubies - as a lower-bound heuristic. In order to index into the pattern databases, a Lehmer code is computed for the state of the Kilominx, which can then be used to calculate the state's sequential index.

The solver performs very well up to a depth of 11, finding solutions in a matter of seconds. However, as solutions require longer sequences of moves to solve, the solver takes exponentially more time to find the optimal solution.

Declaration

I declare that the material submitted for assessment is my own work except where credit is explicitly given to others by citation or acknowledgement. This work was performed during the current academic year except where otherwise stated.

The main text of this project report is [insert word count] words long, including project specification and plan.

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Chapter 1

Introduction

1.1 Introduction

Introduction

Chapter 2

Context Survey

2.1 Context Survey

Context Survey

Chapter 3

Requirements Specification

3.1 Requirements

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Chapter 4

Design

4.1 Design

Design

Chapter 5

Implementation

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Evaluation and Critical Appraisal

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Conclusions

7.1 Conclusions

Conclusions

Appendix A

Testing Summary

Appendix B

User Manual