



GRP_11: Mastermind

Jaedyn Okabe (20275262)

Daniel Dinari (20288573)

Jake Nagel (20287407)

Ryan Pleava (20279636)

Course Modelling Project

CISC204

Logic for Computing Science

October 28, 2022

Abstract

The goal of the project is to be able to assess whether or not a game of mastermind can have a guaranteed win. The scope only includes the final guess of the game, the first 11 guesses have already been made and are used to determine the goal state. Based on a game of 4 pegs per guess with 6 colour options. The feedback pegs will only inform players if a peg is in the correct position or exists somewhere else in the row (are NOT related to the specific peg in a position but generically to the row).

Propositions

- $P_{i,j} \Rightarrow$ A purple peg is in row i, column j
 - This rule follows for all the different colours
 - T= teal, Y = yellow, O = orange, G = green, P = purple, and R = red
- $W_{i,k} \Rightarrow$ One correct colour in row i (a white peg)
- $B_{i,k} \Rightarrow$ One correct colour and position in row i (a black peg)
- $E_{i,k} \Rightarrow$ One incorrect colour (an empty peg)

Constraints

$$P_{i,j} \longrightarrow (\neg T_{i,j} \wedge \neg Y_{i,j} \wedge \neg O_{i,j} \wedge \neg G_{i,j} \wedge \neg R_{i,j})$$

$$W_{i,k} \longrightarrow (\neg B_{i,k} \wedge \neg E_{i,k})$$

$$B_{i,k} \longrightarrow (\neg W_{i,k} \wedge \neg E_{i,k})$$

Model Exploration

We spent a lot of time trying to determine how to build the board without making them too complex. Whether to include the feedback pegs in with the guess rows or as a separate object. We also realized that we would need to introduce a new proposition which handled no feedback peg (a null value). Furthermore, we are experimenting in how to logically link the feedback peg propositions to the colour peg one, and are thinking we will need to define a new set of propositions for the answer and its positional elements. We are exploring simplifications of the model as we continue to develop our understanding of it, such as making the index of the black peg the same as the index of the correct guess.

Temporary Jape Theorems

$$B_{i,k} \longrightarrow (T_{i,j} \vee Y_{i,j} \vee O_{i,j} \vee G_{i,j} \vee R_{i,j}),$$
$$(P_{1,2} \wedge \neg(R_{1,2} \vee G_{1,2} \vee Y_{1,2} \vee T_{1,2}) \wedge B_{1,2}) \rightarrow P_{12,2}$$