Logic-Based Encodings for Ricochet Robots



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What is 'Ricochet Robots'?

- Board game
- Created by Alex Randolph in 1999
- Content of the game:
 - ► Board, 16 x 16, with some barriers
 - 4 robots of different colors
 - A goal position for a given robot







There are even mobile versions of the game!

Rules of the Game

- Only one robot can move at a time
- A robot can only move horizontally or vertically
- Once a robot starts moving, it only stops when it reaches a barrier or another robot
- ► Goal: Put the correspondent robot in the goal position

Our Goal

- Find one optimal solution
- ► An optimal solution is a solution with the least amount of moves possible

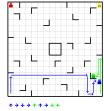
Example







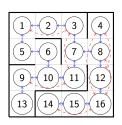




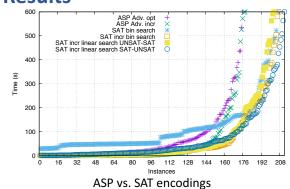
Can you find other solutions?

Model of the problem

- Board represented as a graph
- Each position is a vertex
- Adjacent positions with no barriers are connected by an edge
- An extended edge is added between a position and each other position in the same row or column iff there are no barriers between them



Results



Encodings

- Answer Set Programming (ASP) encodings already existed
- New Boolean encoding developed
 - Used with a Satisfiability (SAT) solver and a Satisfiability Modulo Theories (SMT) solver
- Constraint Programming (CP) approach developed
- Iterative approaches with incremental and non incremental implementations

* https://play.google.com/store/apps/details?id=shifty.ricochet.robots

Conclusion

- New logic-based encodings proposed
- ► Boolean encodings solved a larger set of instances than previously published ASP encodings

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