

UNIVERSITY OF THE WITWATERSRAND

COMS3005: ADVANCED ANALYSIS OF ALGORITHMS

Peg Solitaire Backtracking Assignment

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1 Introduction

The purpose of the assignment is to implement and analyse a version of the Peg Solitaire game and the backtracking algorithm (to play the game).

2 Background

The backtracking algorithm is similar to a brute force approach to finding solutions to problems but is more systematic. It attempts to follow a logical series of decisions in solving these problems and when a block state occurs the algorithm 'backtracks' to previous decisions and chooses different paths until a terminal (complete) state is reached. The full set of solutions to a problem can be found by continuing to run the algorithm until all paths have been searched but that is not always necessary.

2.1 Recursive Algorithm

```
FINDSOLUTION(start, final, path)
1  if start.numPegs ≤ final.numPegs
2      return (start = final)
3  else
4      for each jump  $J \in [0, n) \times [0, m) \times \{\text{NORTH, EAST, SOUTH, WEST}\}$ 
5          if  $J$  is a legal jump for start
6              start.makeMove( $J$ )
7              path.push( $J$ )
8              found = FINDSOLUTION(start, final, path)
9              if found
10                 return TRUE
11             else
12                 start.makeReverseMove( $J$ )
13                 path.pop()
14     return FALSE
```

Figure 1: Recursive Algorithm [1]

- 3 Implementation
- 4 Theoretical Analysis
- 5 Results
- 6 Empirical Analysis
- 7 Conclusion
- 8 Group Member Contribution

Acknowledgements

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All drawn diagrams were drawn using <http://draw.io/> and charts were made with Libre Office. All the programming was done in python using NumPy and OpenCV libraries.

References

- [1] "Charles E. Leiserson". Lab 5: Backtracking search. <http://courses.csail.mit.edu/6.884/spring10/labs/lab5.pdf>, 2010.