Functional Programming: Assignment 1

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Important Notices

Variations of *generateSuccessorStates*

- 2 variations of *generateSuccessorStates* were created:
  - *generateSuccessorStates*
  - *generateOptimisedSuccessorStates*
- *generateSuccessorStates* produces the values expected by the auto-marker and the provided unit tests.
- *generateOptimisedSuccessorStates* implements the optimisation mentioned in Question 4 whereby rotations that undo the last move are ignored.

Variations of *genStates*

- 3 variations of *genStates* were created:
  - *genStates*
  - *genStatesOptimised*
  - *genStatesOptimisedTailRecursive*
- *genStates* is a regular tail recursive implementation and produces the values expected by the auto-marker and the provided unit tests.
- *genStatesOptimised* was written in a completely different way as I was not happy with the performance of *genStates*. In order to obtain this improvement in completion time a non-tail recursive approach was taken. Some memory efficiency was sacrificed to get a major improvement in completion time (see theoretical questions pdf for more). Secondly, it makes use of *generateOptimisedSuccessorStates* to further speed up completion time and reduce memory usage.
- *genStatesOptimisedTailRecursive* is *genStates* that uses *generateOptimisedSuccessorStates* instead of *generateSuccessorStates*.

Variations of *solveCube*

- 3 variations of *solveCube* were created:
  - *solveCube*
  - *solveCubeSafe*

    - *solveCubeSlow*
- *solveCube* makes use of *genStatesOptimised* to provide the fastest completion time
- *solveCubeSafe* makes use of *genStatesOptimisedTailRecursive* to provide decent performance as well as a tail recursive approach
- *solveCubeSlow* makes use of genStates and is very slow for n>=7

Trace of functions

All the main functions include a trace to show that the function is tail recursive. Please note that *genStatesOptimised* is **not** tail recursive by design. The trace output is located in the *trace_output* folder.

Theoretical Questions

The theoretical questions are answered in *Theortical_Questions.pdf*. It also includes some additional comparisons and analysis based on the questions provided.

Files provided

- assignment3.scm
- Theoretical_Questions.pdf
- Readme.md
- Readme.pdf
- Theoretical_Questions.tex
- trace_output
    - rotate.out
    - generateSuccessor.out
    - generateOptimisedSuccessor.out
    - genStates.out
    - genStatesOptimised.out
    - genStatesOptimisedTailRecursive.out
    - solveCube.out
    - solveCubeSafe.out
    - solveCubeSlow.out
- memory_usage.jpg
- mem_usage2.jpg
- mem_usage3.jpg
- theory_data.dat
- theory_data_optimised.dat
- theory_data.xlsx
- .gitignore