Solving Solitaire game with AI

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The problem

- The solitaire problem I have decided to tackle is Sudoku.
- The method I have chosen to solve Sudoku is Evolutionary algorithms(EA).
- For the problem I needed to have, some form of encoding for the puzzle, a fitness function, mutation and a way to handle constraints.

Aims of the project

- Take a Sudoku puzzle of different sizes as an input i.e. 4x4 or 9x9.
- Use EA with repair method to handle constraints violations.
- Use multi-objective EA without a repair method to generate a solution if there is one.
- Compare EA with repair method to multi objective EA.

Encoding/Search space

- Encoding for the algorithm will be represented using a integer encoding of 0-n, where n is the size of the puzzle.

- This is stored in a n x n array, along with a second array which stores the initial positions of the puzzle.

Fitness function

- The fitness function used will evaluate the will evaluate the number of filled spaces within the puzzle.

- To deal with how simple the fitness function is here, the program will also use constraint handling.

Constraint handling

- For the handling of constraints uses a repair method.
- There will be 3 constraints, which are the same number being in a grid, row or column.
- The repair finds all the constraint violations and removes the highest conflicting square which is not in the initial population.

Mutation

Mutation will be dealt with two steps:

- If there is an empty space, it will mutate a random empty space.

- Otherwise randomly change a space on the puzzle that is not an initialized value.

Multi-objective

- Will be a similar program that uses multi-objective evolutionary algorithms, and no repair method.

- Will have two objectives, number of spaces filled and the number of constraint violations.

Comparison

The methods will be compared on:

- Runtime
- Number of puzzles failed

And compare them for different:

- Puzzle sizes
- Puzzle difficulty.

Current state of project

- Can currently solve 4x4 and 9x9 sudoku puzzles using the repair method.

- One component needed for the multi-objective version of the EA.

Stretch goals for the project

- Have repair based method working up to 16x16 sudoku.
- Have multi-objective method working up to 16x16 sudoku.
- Have a small GUI for inputting grid values and outputting the result.