Artificial Intelligence

Lab3 Report

CSP to solve Sudoku

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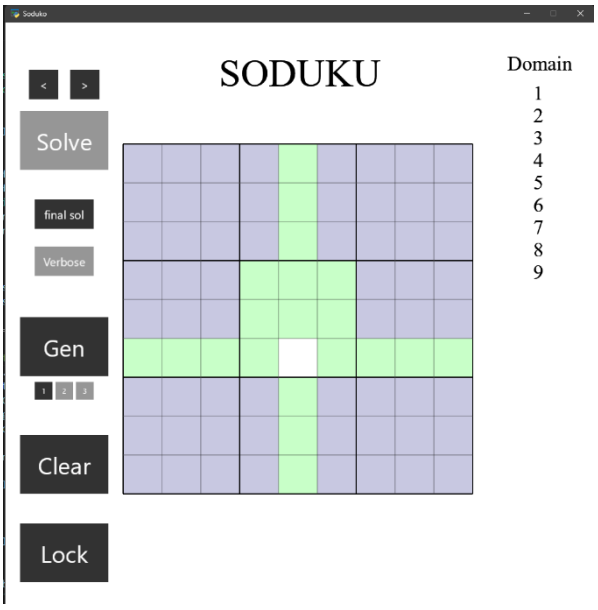
1 Game Description

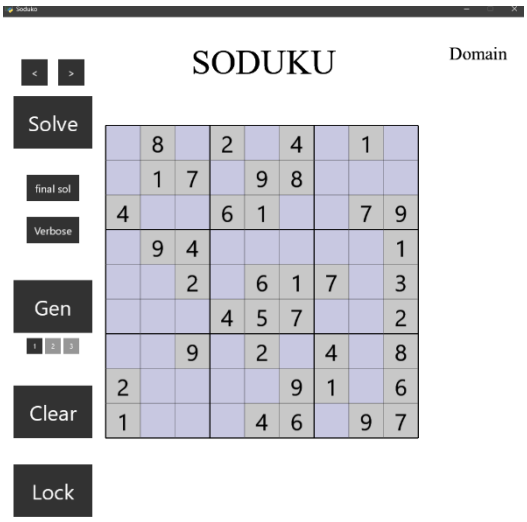
Sudoku is a logic-based number-placement game that challenges players to fill a 9x9 grid withdigits from 1 to 9. The objective is to complete the grid in such a way that each row, eachcolumn, and each of the nine 3x3 subgrids (also known as regions or boxes) contains all of thedigits from 1 to 9 without repetition.

2- Sample runs :

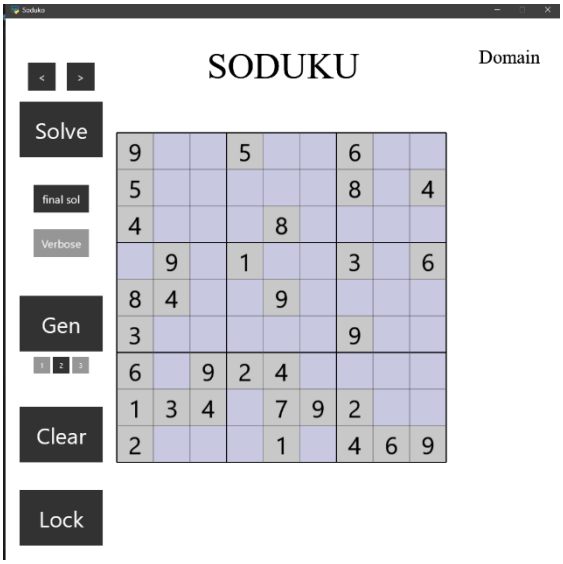
- <u>Before generation :</u>
  We can generate sudoku board with different difficulties , clear , lock and solve buttons , step by step solving .
  . make user fill board and check if input correct or violate constraints for each number.



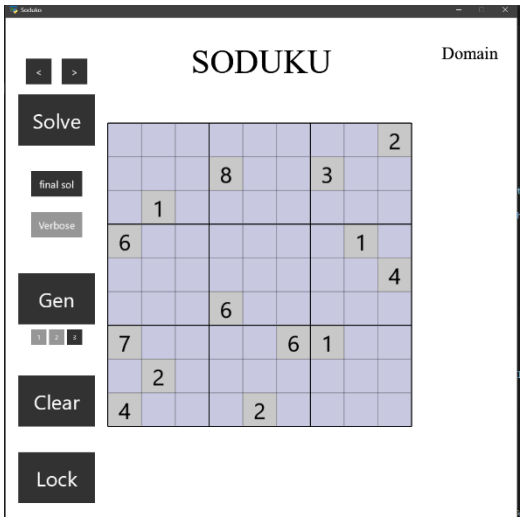
a- **Easy :**



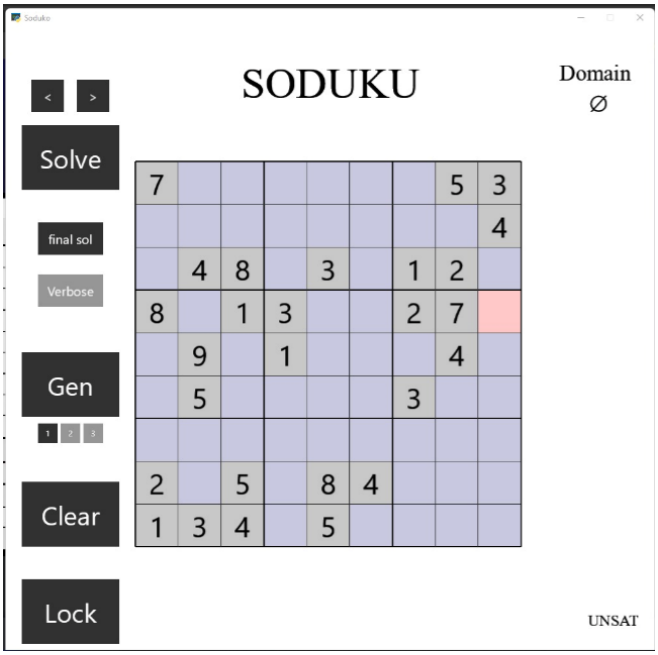
b-**Medium**



c- **Hard**



d-**Unsolvable** :



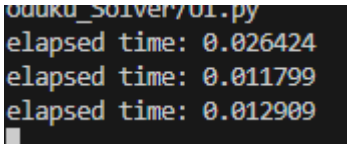
Comparison between difficulties :

- The initial puzzle generated for Easy difficulty tends to have a higher number of prefilled cells compared to higher difficulty levels.
- The puzzles are designed to be relatively straightforward, with more obvious patterns and fewer empty cells to fill.

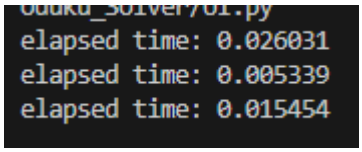
Easy : 38 out of 81 initial hints.
Medium : 32 out of 81 initial hints.
Hard : 14 out of 81 initial hints.

- **<u>Time comparison :</u>**

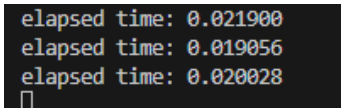
Easy :



Medium :



Hard :



3- Data structure , algorithms and assumption used:

GridVariable Class:
Data Structure: Each cell in the Sudoku grid is represented by an instance of the GridVariable class, which encapsulates attributes such as position, domain (possible values), current value, and read-only status.

Algorithms:

Methods in this class implement algorithms for updating domain, locking variables, resetting variables, and finding inconsistencies.

Board Class:

Data Structure: The Sudoku grid itself is represented as a 9x9 grid of GridVariable objects.

Algorithms:

This class implements various algorithms for solving Sudoku puzzles, including backtracking, enforcing consistency, finding unsatisfiable variables, applying constraints, and generating Sudoku puzzles.