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 :**

* Before generation :

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 screenshot of a game

Description automatically generated

1. A screenshot of a computer game

   Description automatically generated **Easy :**

A screenshot of a game

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b**-Medium**

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c- **Hard**

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d-**Unsolvable**  :

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**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.

* **A screen shot of a computer

  Description automatically generatedTime comparison :**

Easy :

A screenshot of a computer screen

Description automatically generatedMedium :

A screenshot of a computer screen

Description automatically generatedHard :

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.