Coursework1 Report

F29AI - Artificial Intelligence

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Abstract

This report involves the solutions to the tasks outlined in Coursework 1 for the *F29AI - Artificial Intelligence course*. The main objective of the coursework is to search algorithms and automated planning using $PDDL$.

1 Introduction

2 Procedure

2.1 Part 1 - Solving and Analyzing Sudoku with Search Algorithms

2.1.1 Part 1A

Solution:
A CSP(constraint satisfaction problem) should involves the following three components: Variables, Domains and Constraints. Therefore, we can define the Sudoku problem as follows:

$$\text{Sudoku} = \langle V, D, C \rangle$$

where

V	$= \{V_{i,j} \mid i, j \in \{1, 2, \ldots, 9\}\},$	variables representing each cell in the 9×9 grid;
D	$= \{D_{i,j} = \{1, 2, \ldots, 9\} \mid i, j \in \{1, 2, \ldots, 9\}\},$	domains of possible values for each cell;
C	$= \{C_k \mid k \in \{1, 2, \ldots, 27\}\},$	constraints enforcing unique values per row, column, and 3×3 box.

Time Complexity Analysis:

- Brute-force Search Algorithm:
  For each of the k spaces, there are 9 possible choices of numbers. This results in a total of $9 \times 9 \times \ldots \times 9$ (k times) combinations. Therefore, the time complexity of the brute-force search algorithm is $O(9^k)$. When the worst-case scenario occurs, the algorithm needs to explore all possible combinations, leading to the $O(9^{81})$ time complexity.

- Backtracking Search Algorithm:

2.1.2 Part 1B

2.2 Part 2 - Automated Planning

2.2.1 Part 2A: Modelling the Domain

2.2.2 Part 2B: Modelling the Problems

2.2.3 Part 2C: Extension

3 Reflection and Analysis

4 Conclusion