KTU Software Engineering Department

SE2009 Discrete Mathematics
Homework – 1

Project Title:
Sudoku Solvability through Satisfiability (SAT) Encoding

Overview:
In this project, you will design and implement a program that determines whether a given Sudoku puzzle is solvable by encoding it as a satisfiability (SAT) problem. If the puzzle is solvable, your program must also find all possible solutions and visualize them as Sudoku grid images.

Project Steps:
Input: The program must accept an image of a Sudoku puzzle as input and convert it to a 9×9 matrix using an external API. For this project, you must use an API (ChatGPT API, Gemini API, etc.) for digit detection/OCR and optional grid parsing.

Conversion to Logical Representation:
Convert the Sudoku grid from the image into a 9×9 matrix form and encode it as a SAT problem using propositional logic. Each cell (i, j) should be represented by propositions of the form p(i, j, n), where n ∈ {1,…,9}. Constraints must ensure that: Each row, column, and 3×3 block contains each number exactly once, and each cell contains exactly one number.

Satisfiability Solving: Use a SAT solver or your own algorithm to determine if the puzzle is satisfiable (i.e., has a solution). If solvable, find all valid solutions.
Output: Display the solution(s) as Sudoku grid images. The program must include a graphical user interface (GUI). You may use any programming language and tools of your choice.

Presentation:
Work in groups of 2–3 students. Each group will present their project to the class, demonstrating the interface and explaining their encoding and solving approach.

Deliverables:
• Source code
• Executable demo (with GUI)
• Project report (briefly explaining encoding, algorithms, and results)
• Presentation slides

Evaluation:
• Correctness and functionality (40%)
• Logical encoding and SAT solving implementation (25%)
• Interface design and usability (20%)
• Presentation and documentation (15%)

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