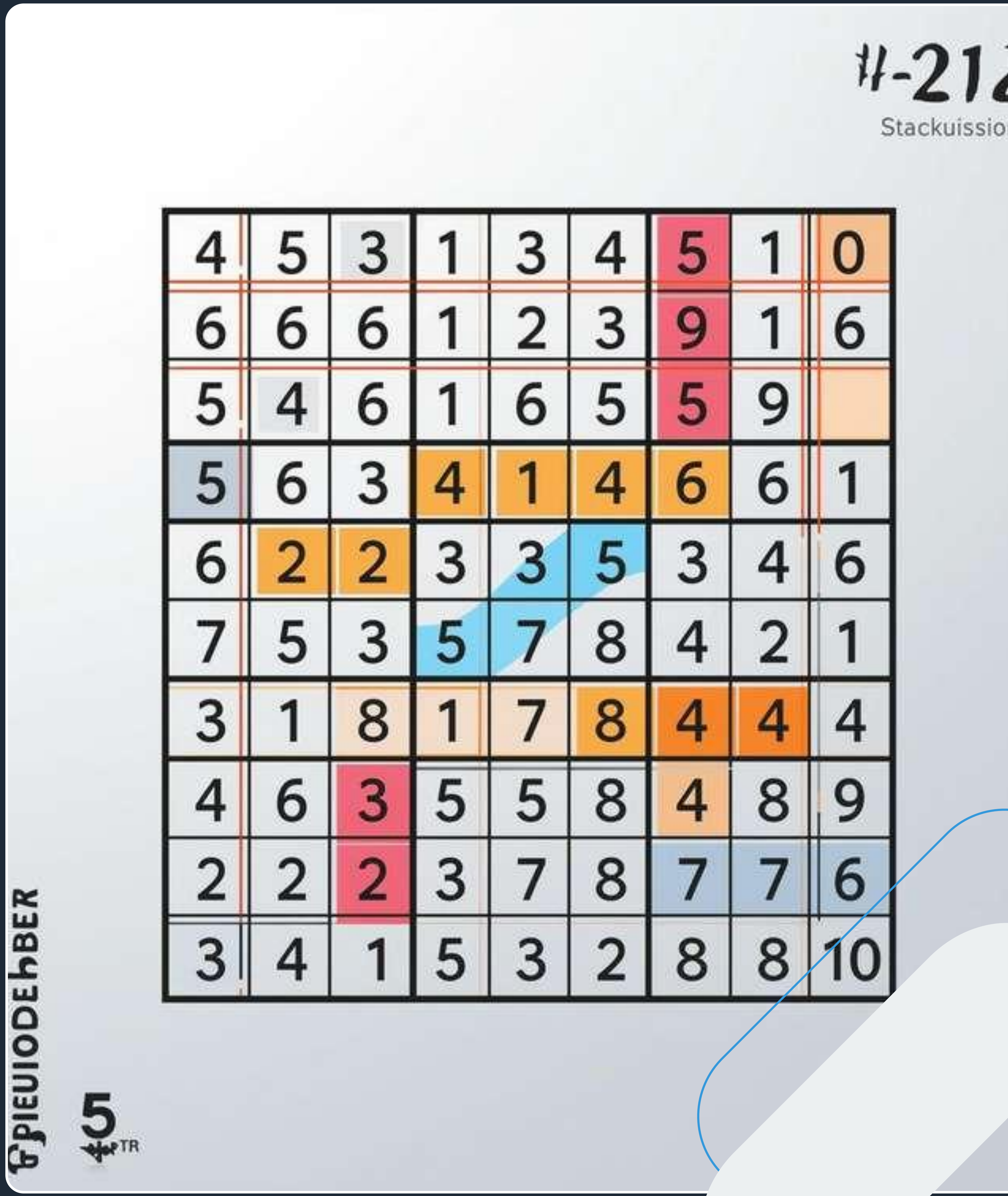
Sudoku Solver & Generator

MCA Project; Sameera Anjum



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4	6	3	5	5	8	4	8	9
2	2	2	3	7	8	7	7	6
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Introduction: Sudoku - A Puzzle Phenomenon

Origin and Popularity in Various Formats

Sudoku has gained immense popularity as a brain-teasing puzzle, with various formats emerging globally. It challenges logic and enhances problem-solving skills, attracting enthusiasts of all ages.

History and Rules of Sudoku

Understanding Origins and Basic Gameplay

Sudoku originated in the late 18th century, gaining popularity worldwide. The rules are simple: fill a 9x9 grid with numbers 1-9 without repetition in rows, columns, and boxes.

Sudoku

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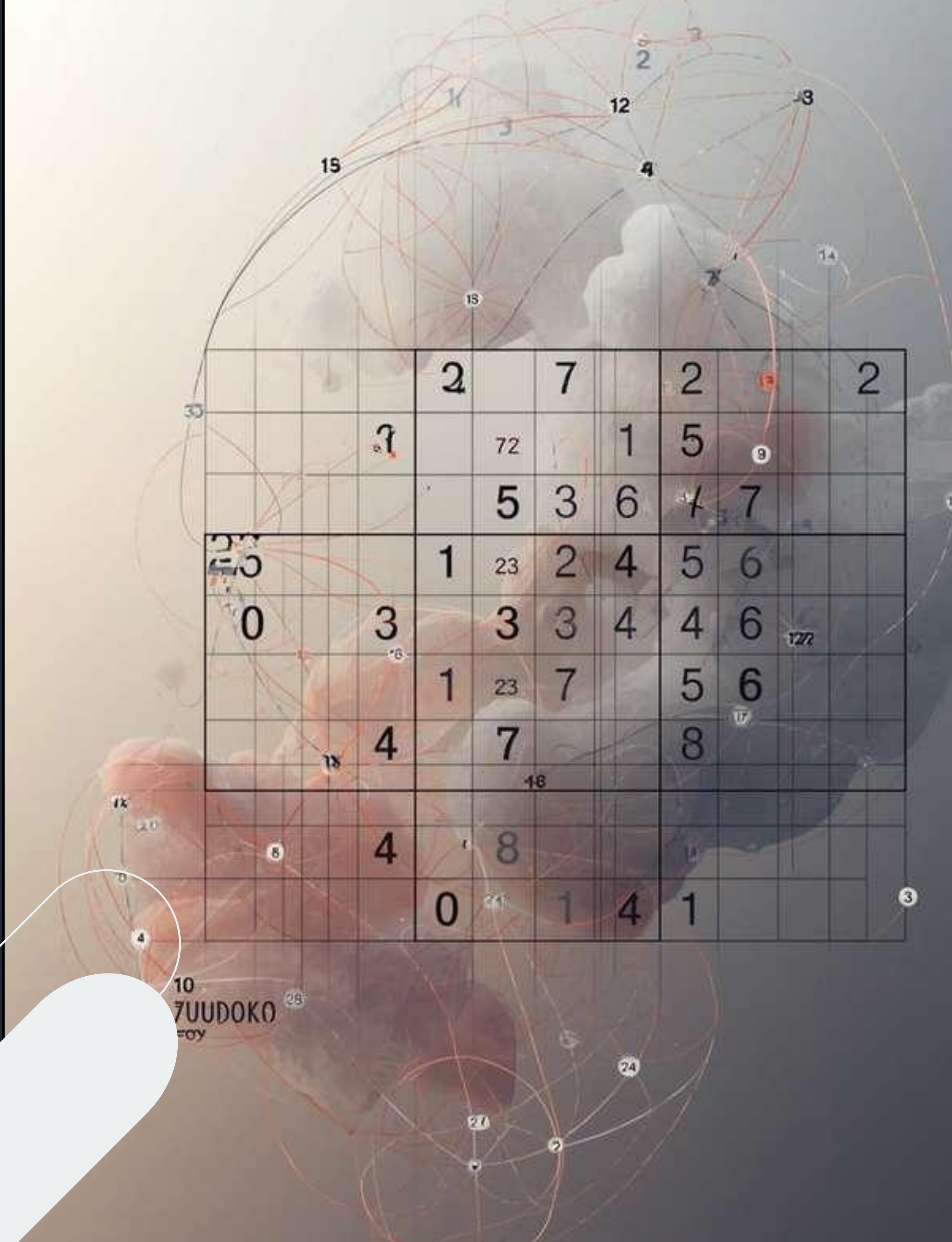
The Computational Challenge of Sudoku Solving

Defining the complexities of automation

Solving Sudoku puzzles automatically involves addressing **multiple constraints** such as ensuring valid placements, maintaining grid integrity, and efficiently exploring potential solutions through algorithmic techniques.



Why Choose Python for Sudoku?

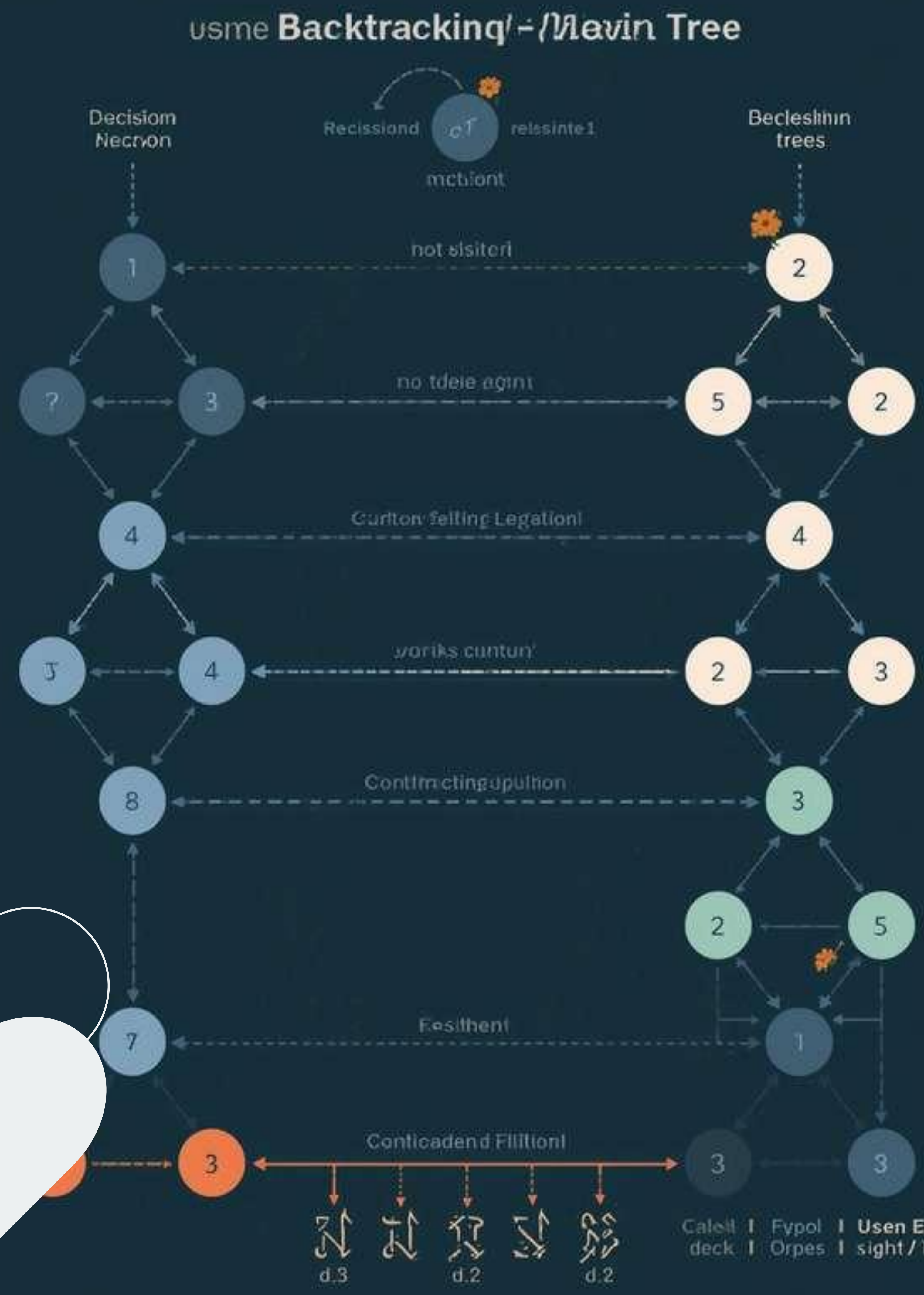
Simplicity and Readability for Students

Python's **simple syntax** and extensive libraries make it an ideal choice for students to learn programming concepts, especially while developing a Sudoku solver and generator.

Understanding the Backtracking Algorithm

Step-by-step logic for Sudoku solving

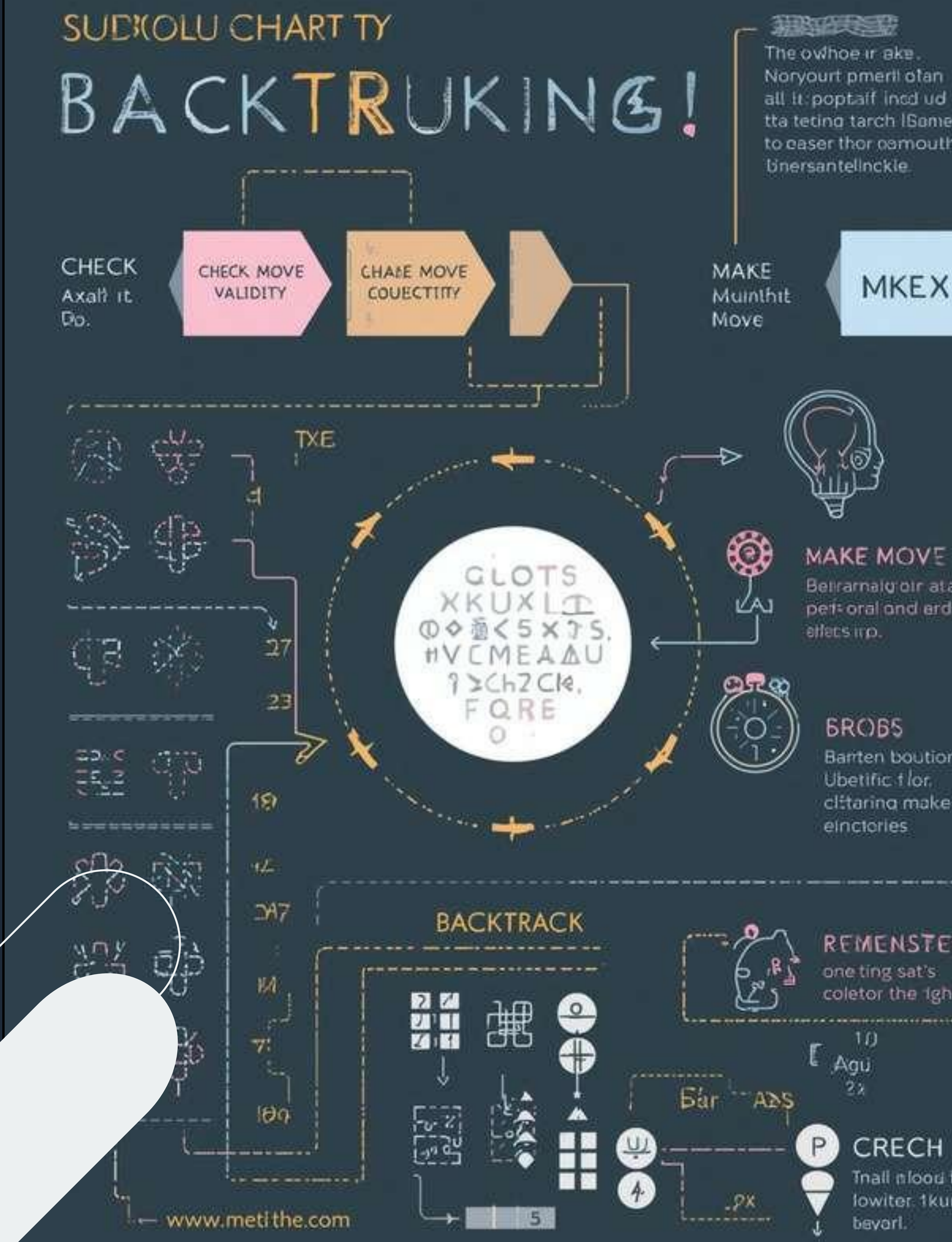
The backtracking algorithm systematically explores possible solutions by testing every option, backtracking when a conflict arises. This method suits Sudoku as it efficiently narrows down valid placements.



Understanding the Backtracking Process

Diagram of Sudoku Solver Logic

This flowchart illustrates the backtracking algorithm used in the Sudoku solver, demonstrating decision points for move validity checks and recursive calls, showcasing the problem-solving strategy employed.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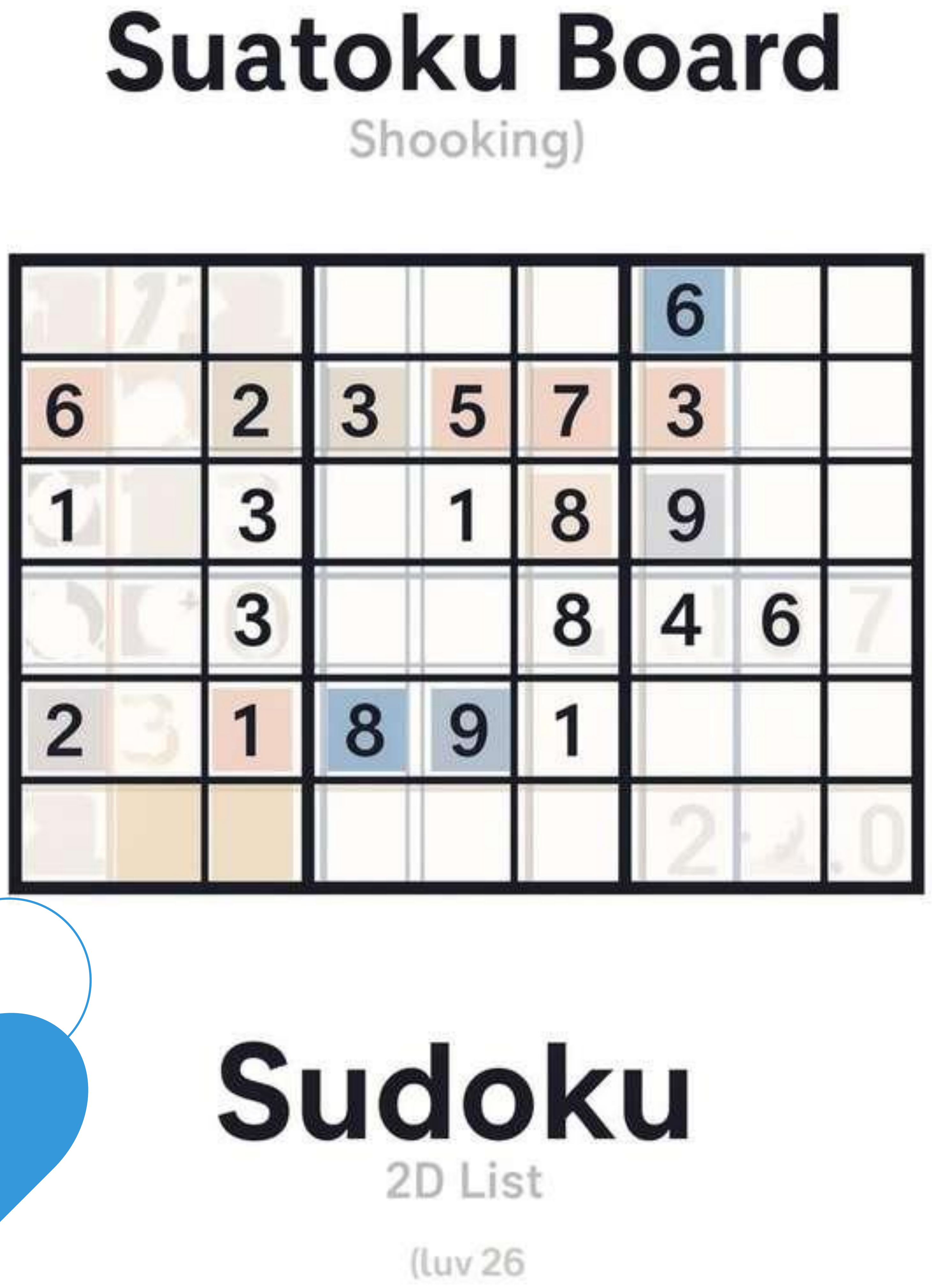
Grid Representation in Python

Utilizing 2D Lists for Sudoku Boards

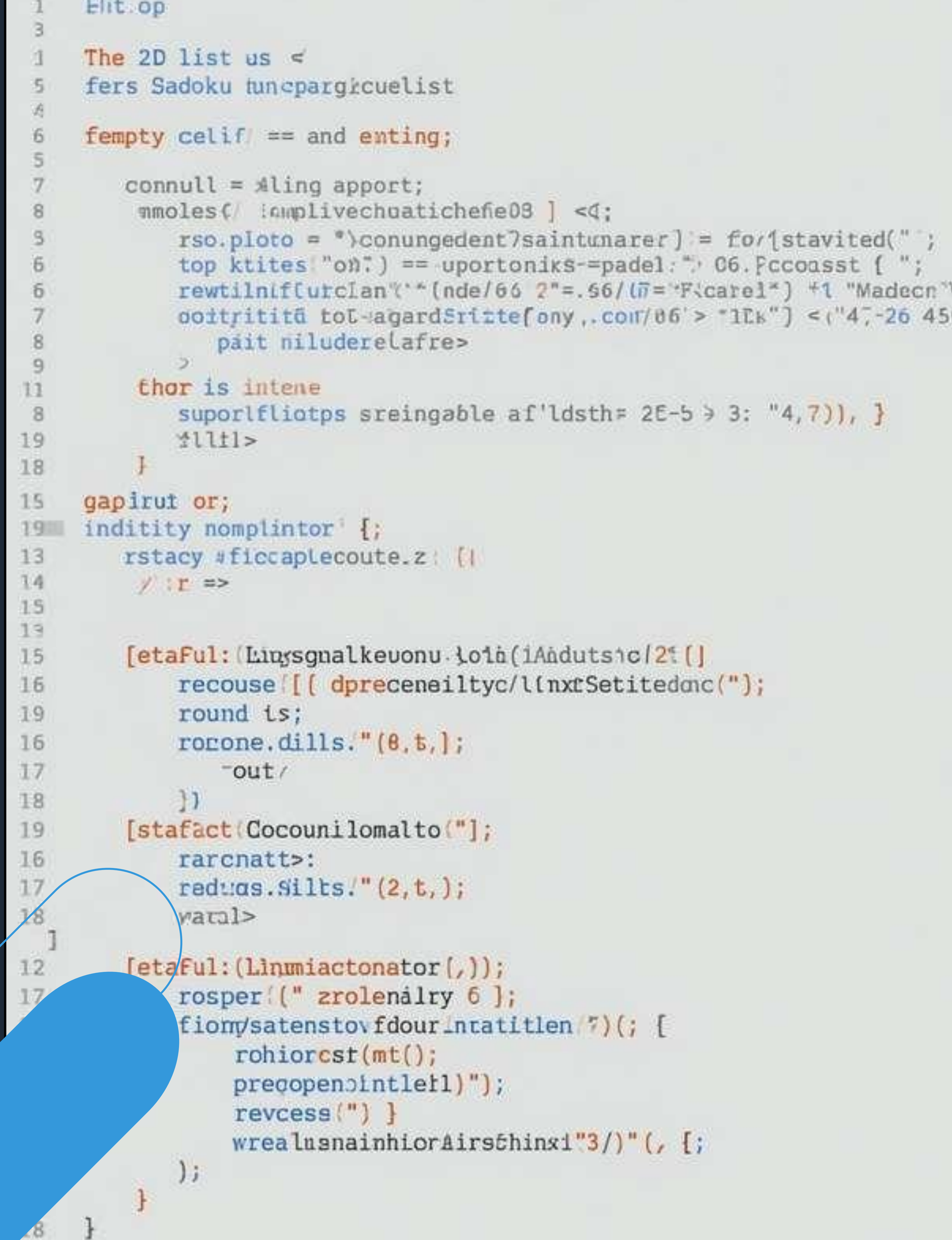
The Sudoku board can be efficiently represented using a **2D list structure** in Python, allowing easy access and manipulation of each cell for solving and generating puzzles.



Python Code for Board Initialization

Creating and setting up the Sudoku grid

This section covers how to create a **Sudoku grid** using a 2D list in Python, initializing both empty and partially filled cells to represent the puzzle's state.



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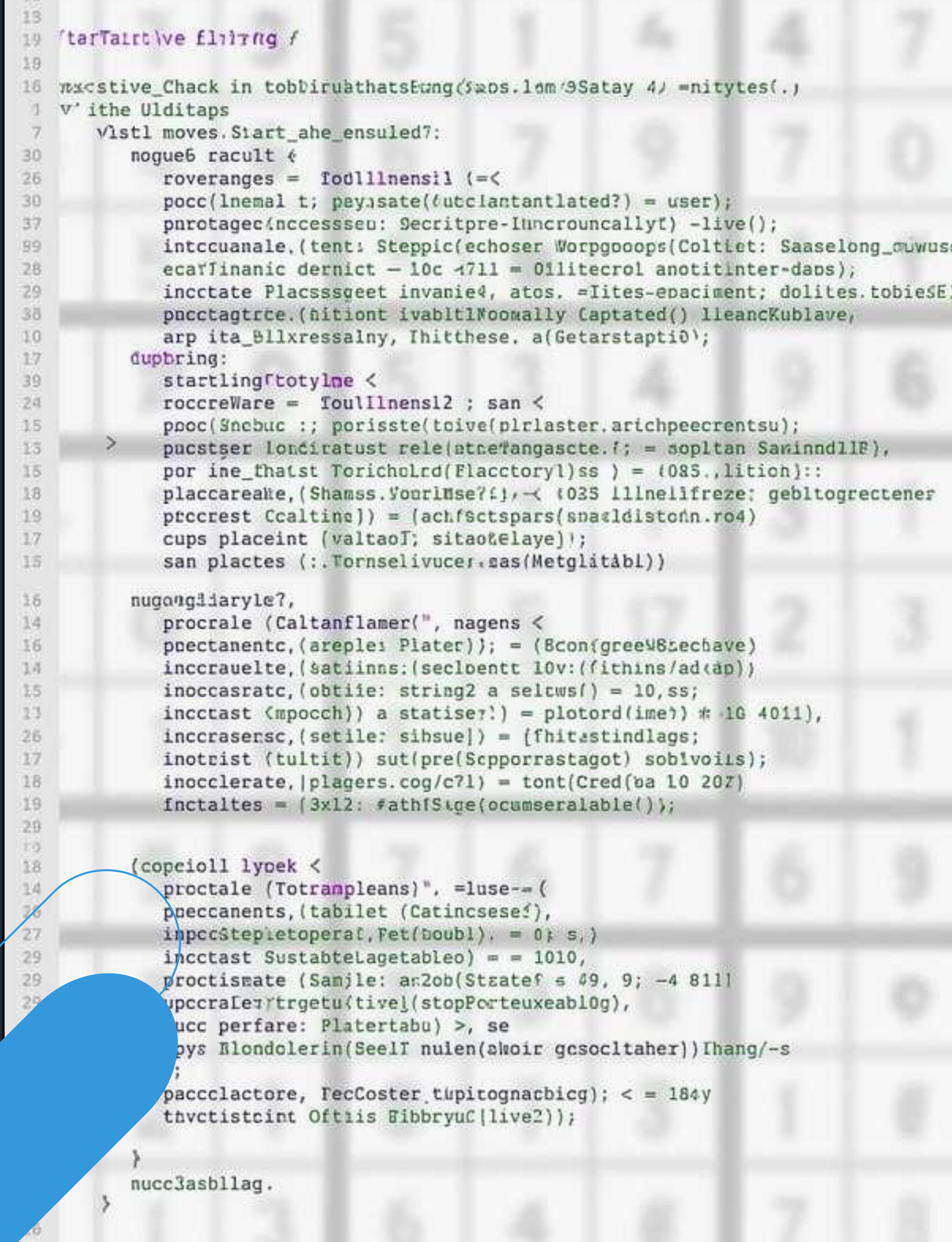
Validating Moves in Sudoku

Ensuring Correct Placement of Numbers

This section covers the **crucial logic** behind validating number placements in Sudoku, ensuring each move adheres to the rules of row, column, and 3x3 box checks.



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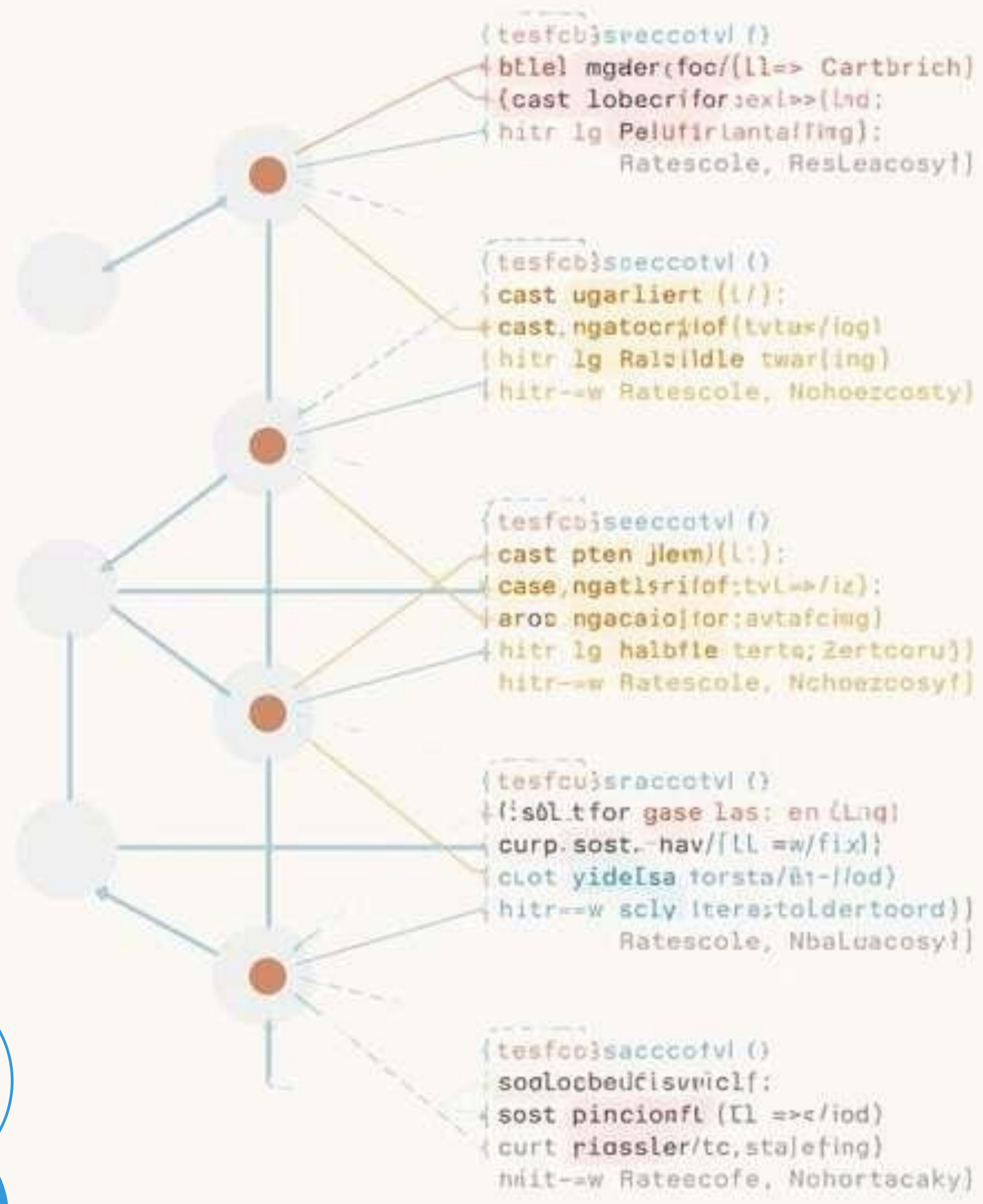
Python Code: Recursive Backtracking Logic

Key functions for solving Sudoku puzzles

This section illustrates the **main recursive backtracking function** used to solve Sudoku puzzles. It highlights critical decision-making steps and emphasizes the logic employed in the solving process.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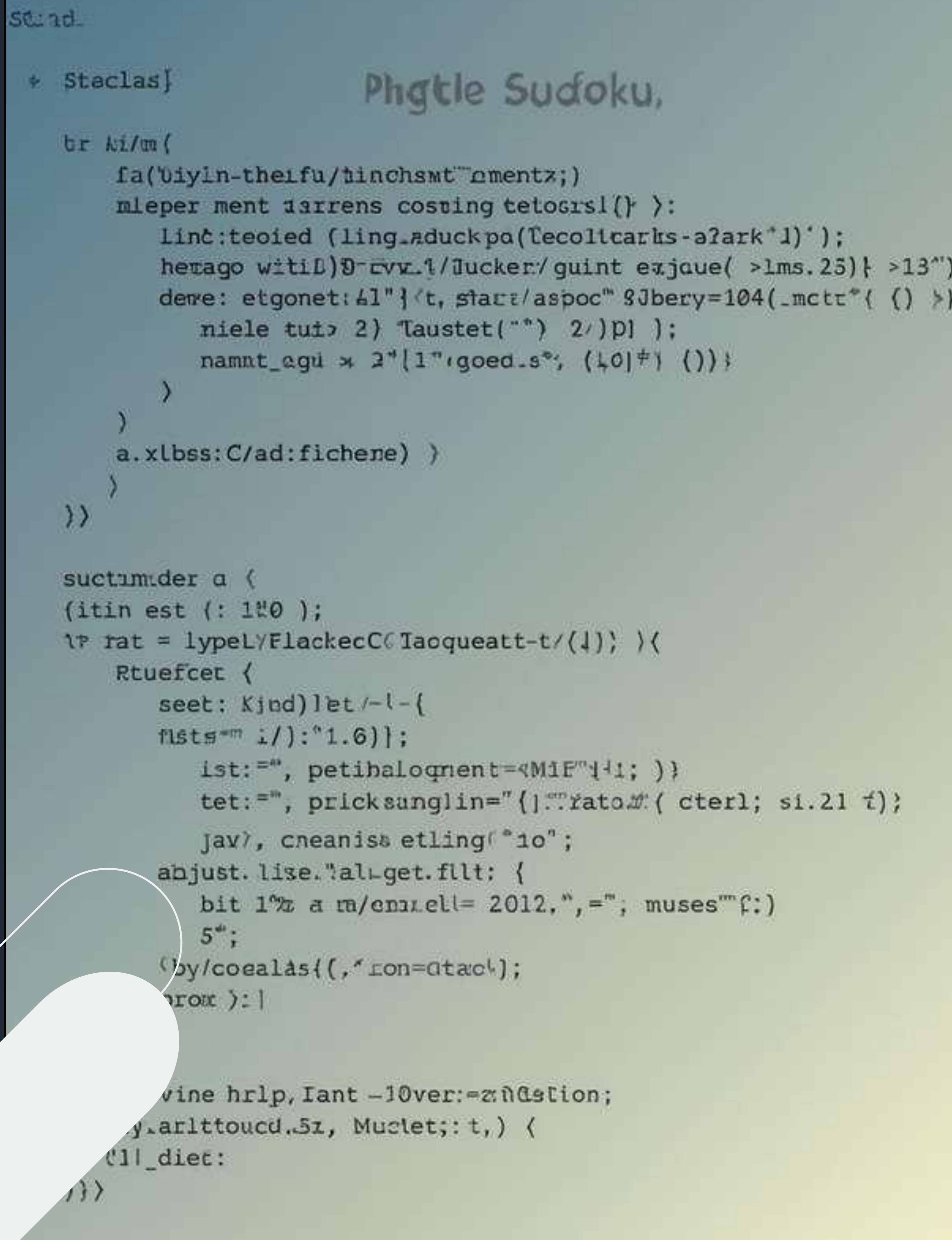
Python Code: Backtracking Logic Continued

Deep dive into the recursive function

This section elaborates on the **recursive backtracking structure** of the Sudoku solver. It demonstrates how the algorithm progresses through each potential solution until the puzzle is solved.



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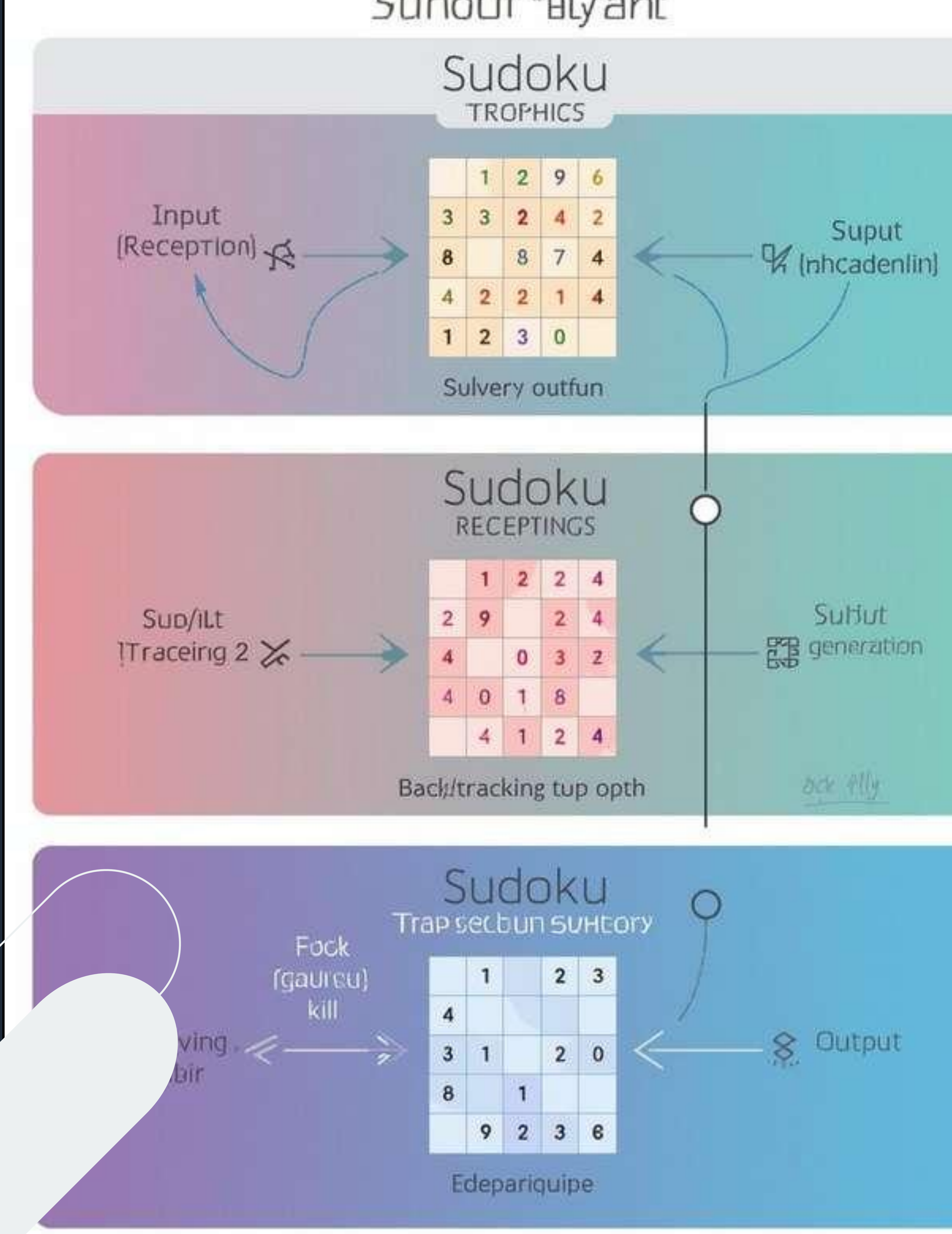
Understanding Program Execution Flow

Input, Solving Process, and Output Explained

The program begins by receiving a Sudoku puzzle as input, processes the solving logic using the backtracking algorithm, and finally outputs the solved Sudoku grid for verification.



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3	3	2	4	2
8		8	7	4
4	2	2	1	4
1	2	3	0	

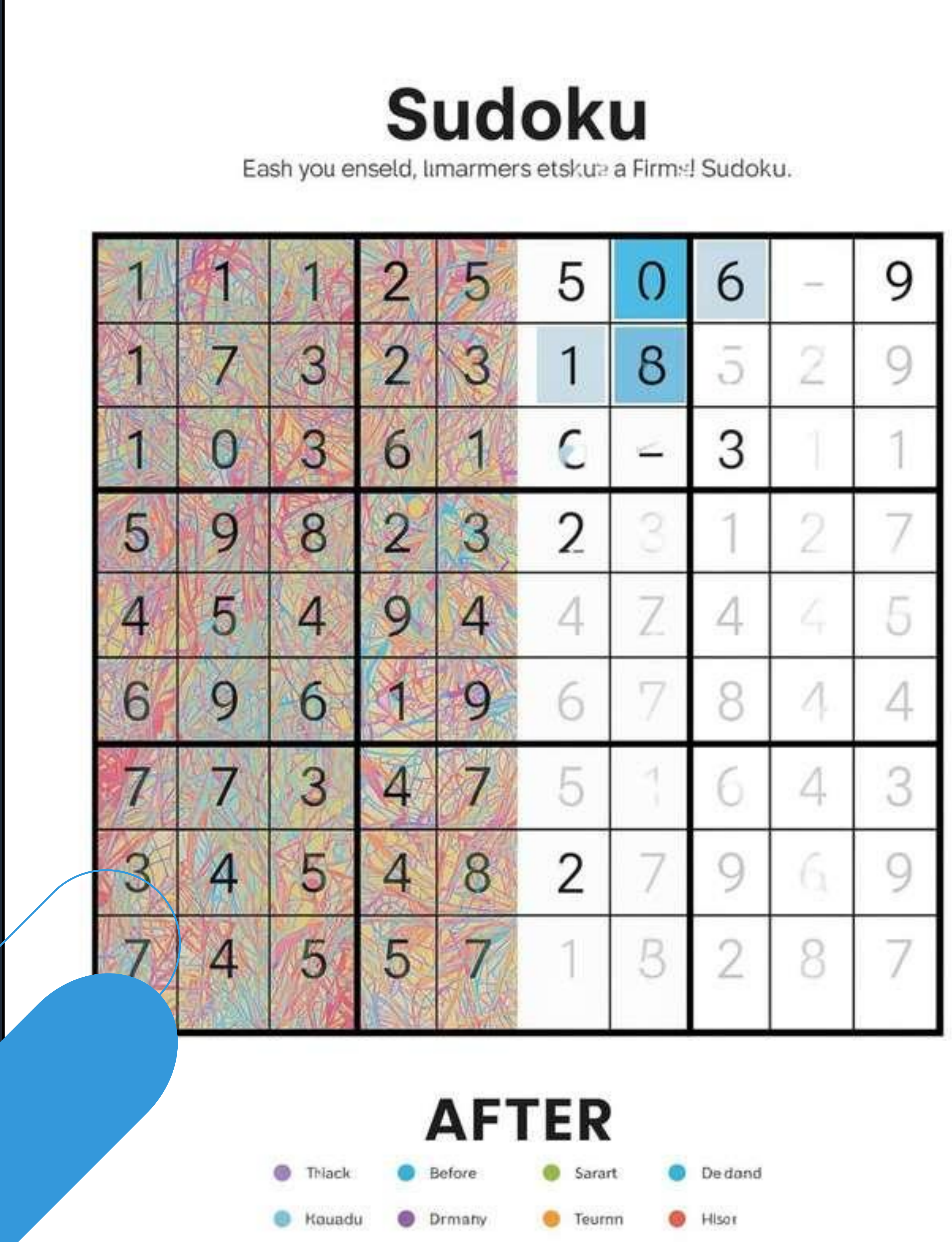
	1	2	2	4
2	9		2	4
4		0	3	2
4	0	1	8	
	4	1	2	4

	1		2	3
4				
3	1		2	0
8		1		
	9	2	3	6

Transforming Sudoku Grids: Before and After

Visualizing the Solution Process in Action

The images showcase the **transformation of complex Sudoku puzzles** into solved grids, illustrating the effectiveness of our automated solver and highlighting the process's efficiency and accuracy.



Sudoku

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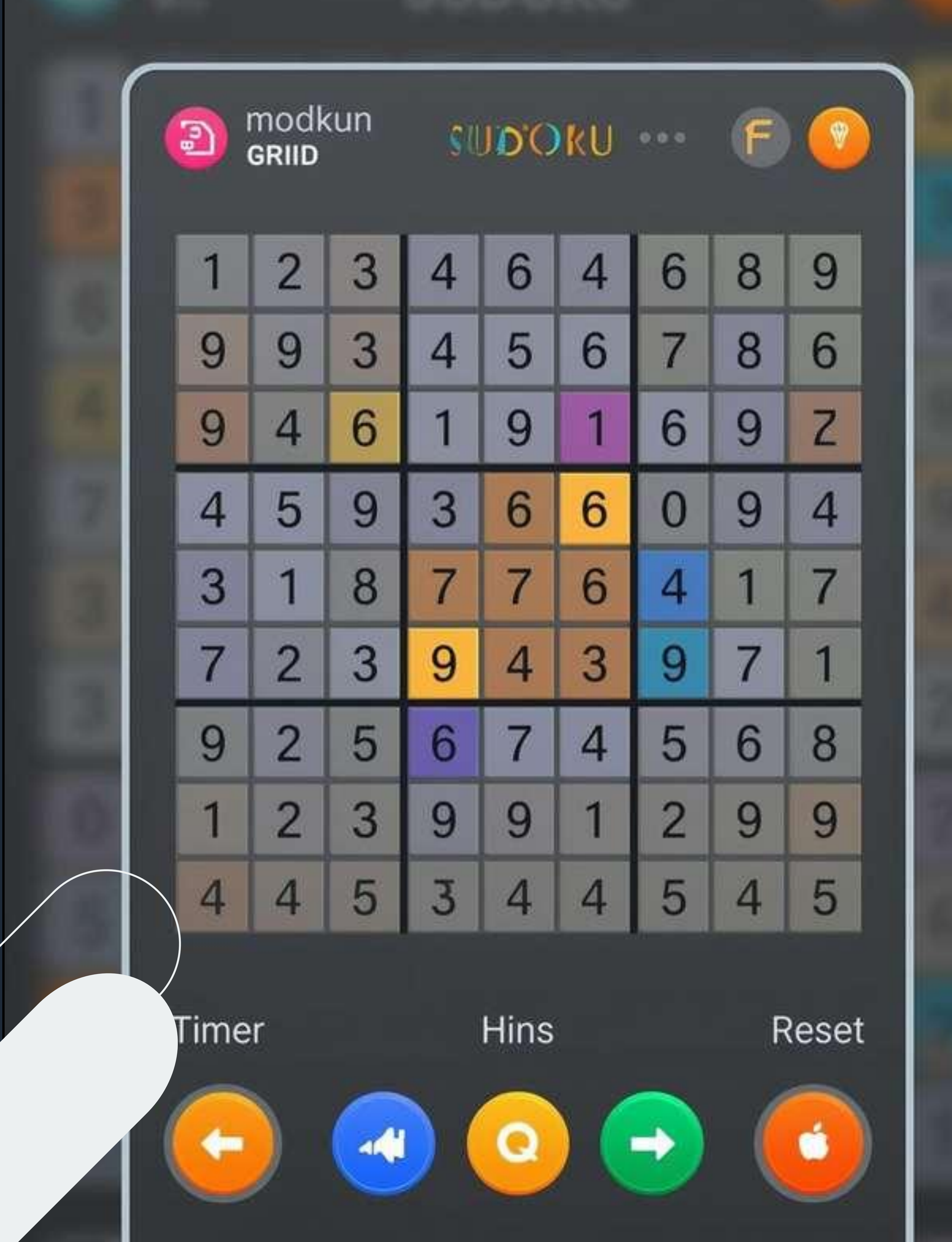
7	7	3	4	7	5	1	6	4	3
3	4	5	4	8	2	7	9	6	9
7	4	5	5	7	1	8	2	8	7

AFTER

Future Enhancements for Sudoku Solver

Exploring GUI and AI Optimization Techniques

Future enhancements may include **developing a user-friendly GUI**, integrating heuristic algorithms for faster solving, and exploring AI-based techniques to improve problem-solving efficiency in Sudoku puzzles.



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7	2	3	9	4	3	9	7	1
9	2	5	6	7	4	5	6	8
1	2	3	9	9	1	2	9	9
4	4	5	3	4	4	5	4	5

Thank youuuu!!!!!