

Sudoku Solver

In this problem we must fill a 9×9 board with digits 1-9 such that all Sudoku rules are satisfied, using backtracking.

[Key Steps:]

1. Find Empty Cell:
 - Scan the board to find the first '.'.
2. Try Digits 1-9
 - For each digit - Check if placing the digit is valid:
 - Not in current row
 - Not in current column
 - Not in current 3×3
3. Place Digit and Recurse
 - If valid, place digit and recursively solve the rest of the board.
4. Backtrack
 - If recursion fails, reset the cell to '.' and try next digit.
5. Base Case
 - If no empty cells remain \rightarrow puzzle solved.

[Complexity:]

Worst case: $O(9^81)$ theoretical, but pruning reduces drastically in practice.

[Why This Works:]

- Fills cells one by one, ensuring validity at each step.
- Backtracking reverts incorrect placements and explores other options.
- Guaranteed to find the unique solution per constraints.