Sudoku solving, efficiently: Applying constraints while maintaining an invariant

Constraints on a tile come from columns, rows, and blocks

Rows, columns, and blocks are in "groups", but not all together

If you scan the whole column, row, and block to find constraints for a single tile, you will wastefully repeat a lot of work

Scanning this column for this cell, and for every other cell in this column

Solving this cell
Instead, work group-by-group. Apply all constraints for this group.

Each of the OPEN cells has possible = (3, 4, 6, 8, 9).

Later we eliminate 8 and 3 from the possible sets of every tile in this row;
* tile is {3, 4, 6, 8, 9}.

Performance difference:

Looking at whole row, column, block for a tile:
Each tile inspected 27 times

Looking at groups individually:
Each tile inspected 3 times

“Just a constant factor”, but 9 times faster is substantial, especially with repeated scans to propagate solutions

Important general pattern:
Maintain an invariant
Make a little progress (we don’t have to solve it all at once)