ACCSO
Accelerated Solutions

Scala

# Scudoku – Sudoku in Scala

Martin Lehmann, Kristine Schaal – Scala Meetup 20151103

http://www.meetup.com/Rhein-Main-Scala-Enthusiasts/events/225920553/

# Problem

# Magic Square is nothing new…

Albrecht Dürer

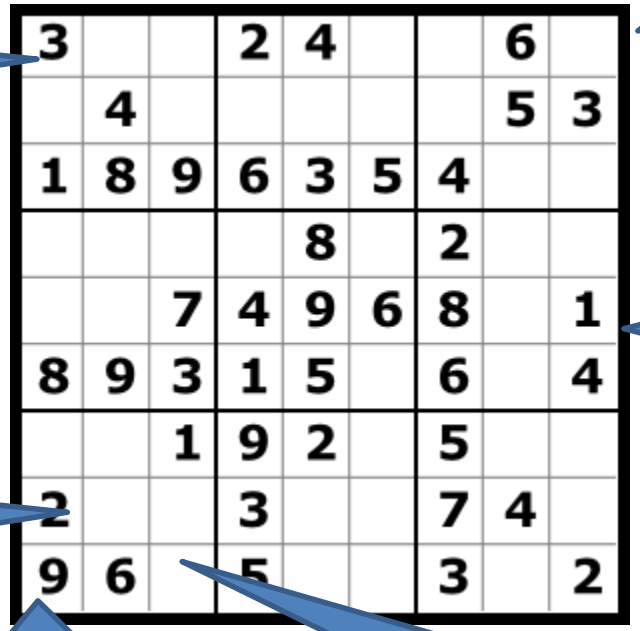

Melencolia I
(1514)

# Sudoku is … what, again?

9x9 grid (9 lines, 9 rows, 9 blocks)

The problem is NP complete. There is a whole theory of mathematics behind this. For the brave: Read [1]

Each cell is filled with 1, 2, … , 9




The number of valid Sudoku solution grids for the standard 9×9 grid was calculated (...) in 2005 to be 6670903752021072936960

i.e. > 6*10^21

No two cells in the same line have the same value

No two cells in the same row have the same value

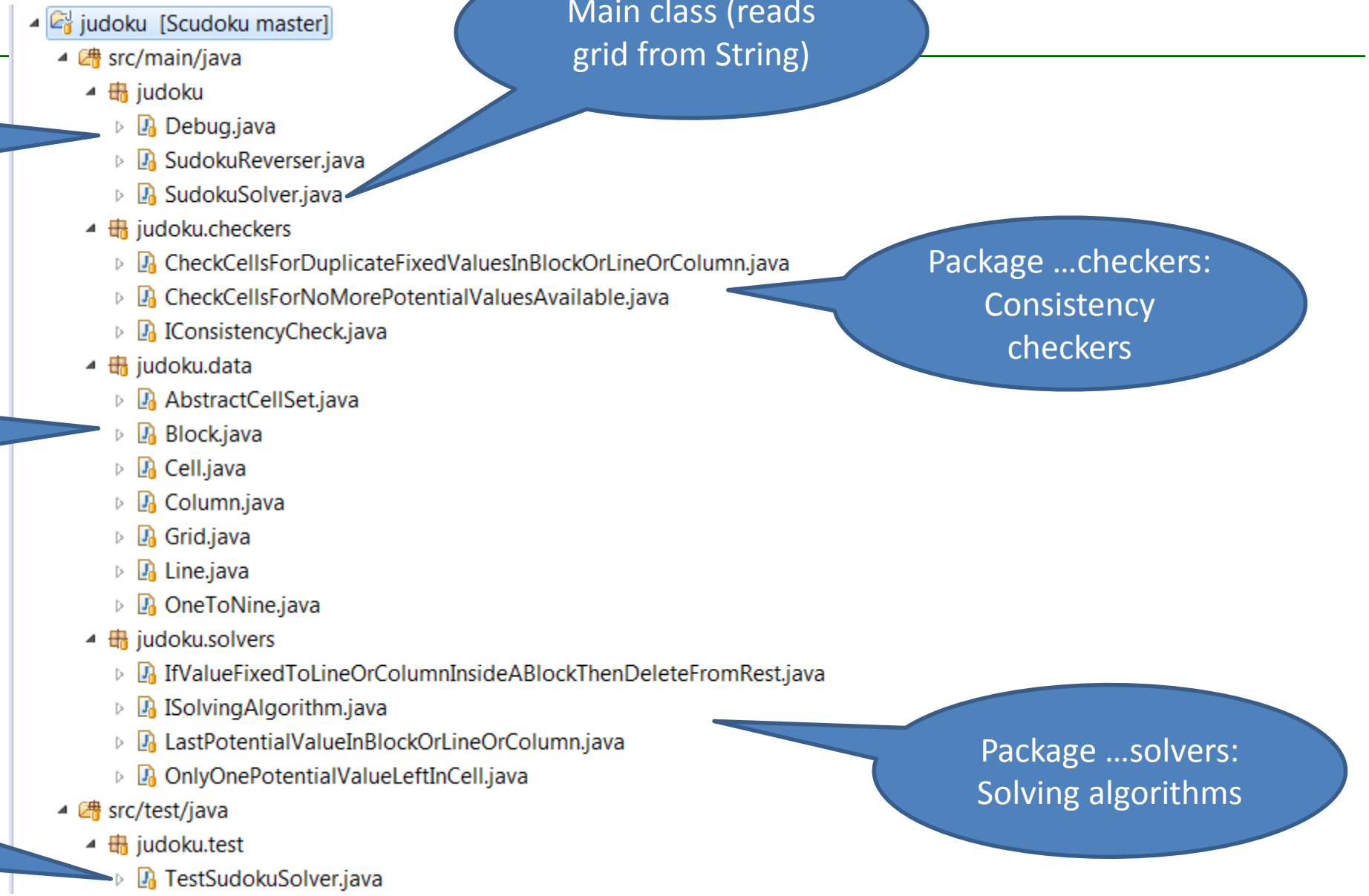
No two cells in the same block have the same value

[1] https://en.wikipedia.org/wiki/Mathematics_of_Sudoku

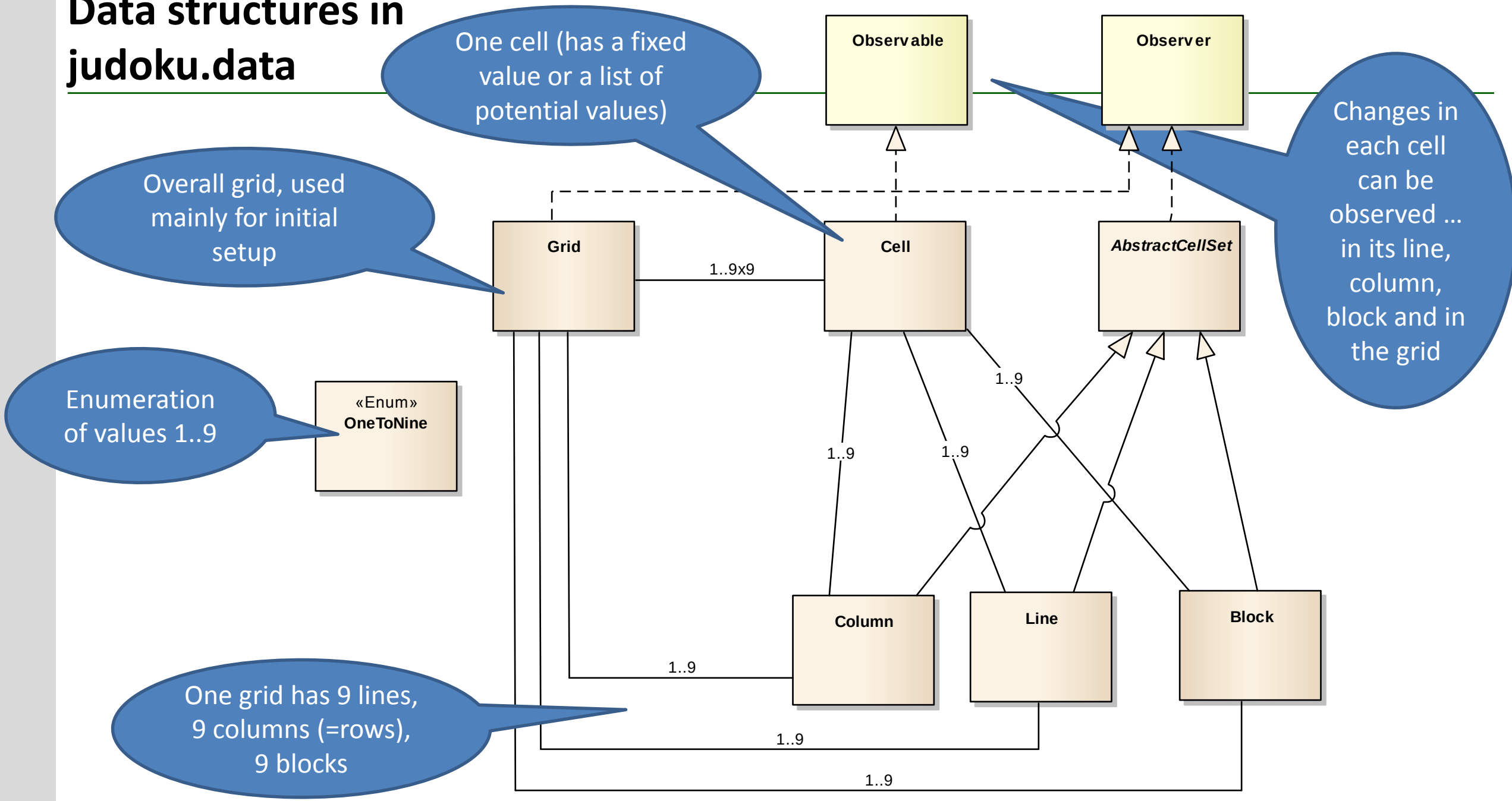
# Java solution

https://github.com/MartinLehmann1971/scudoku/tree/master/workspace/judoku

# Overall structure



# Data structures in judoku.data



# Algorithm

```
//MAIN
while (!solved) {
  apply each solver algorithm
  apply each checker
}
```

```
// Constraint propagation
if (cell.value is fixed) => eliminate the value
  from all potential values in all cells
  in its line, column and block
```

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

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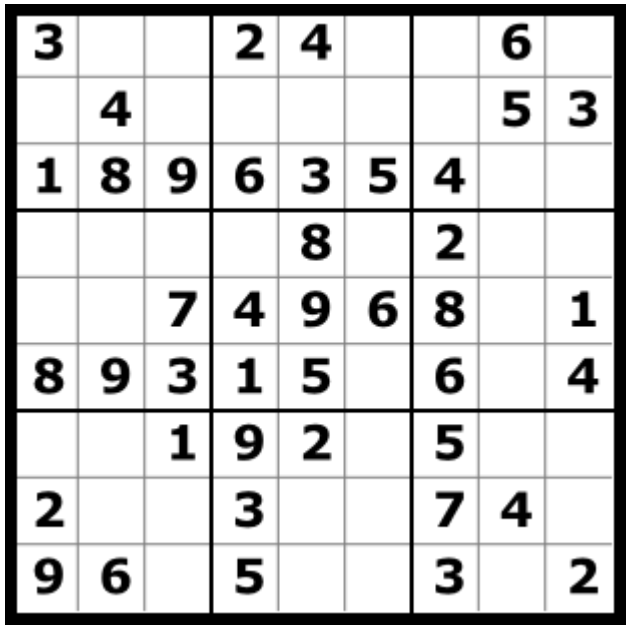

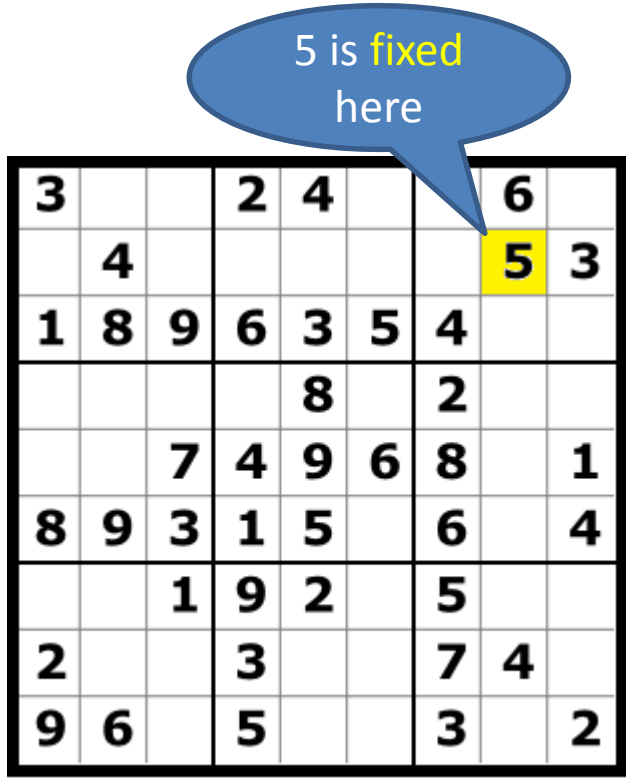

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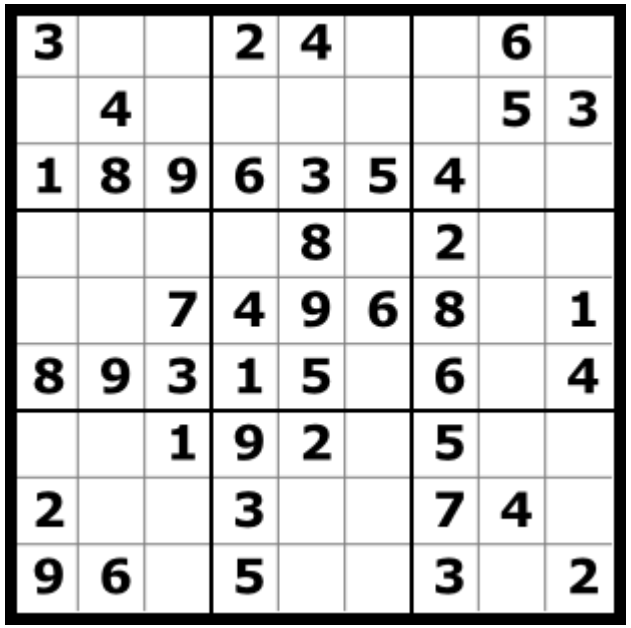

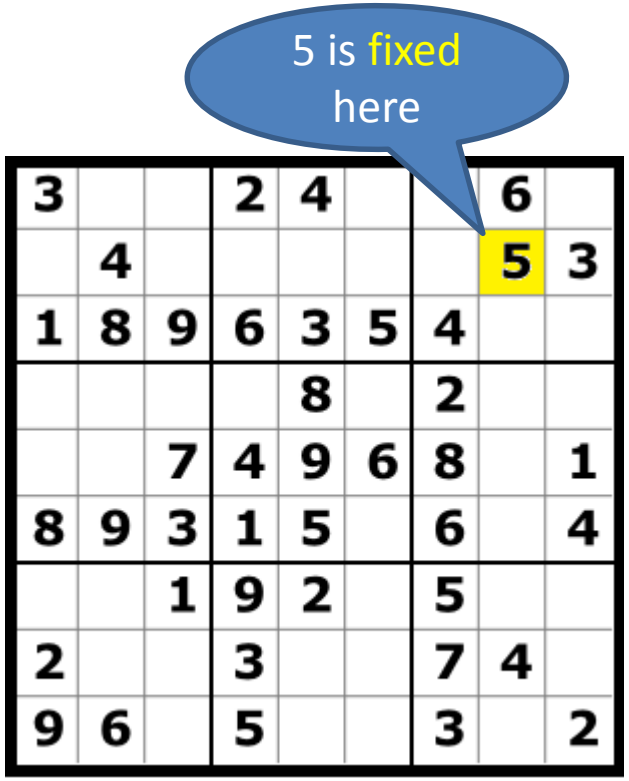


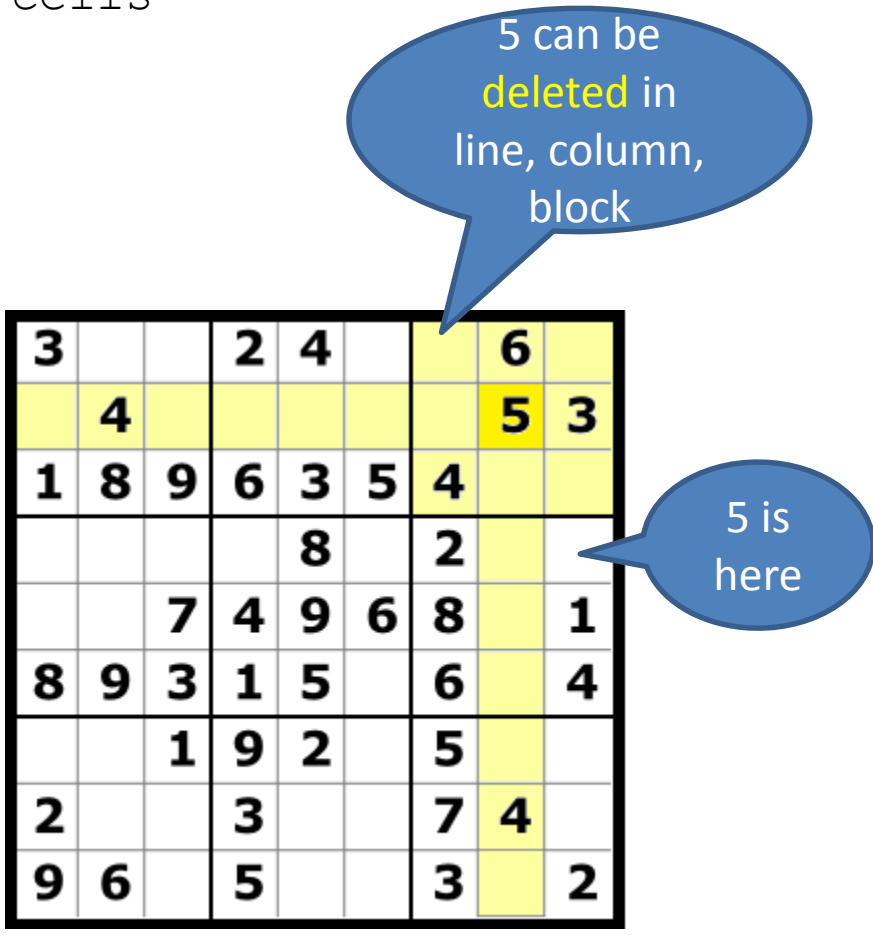

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}
```

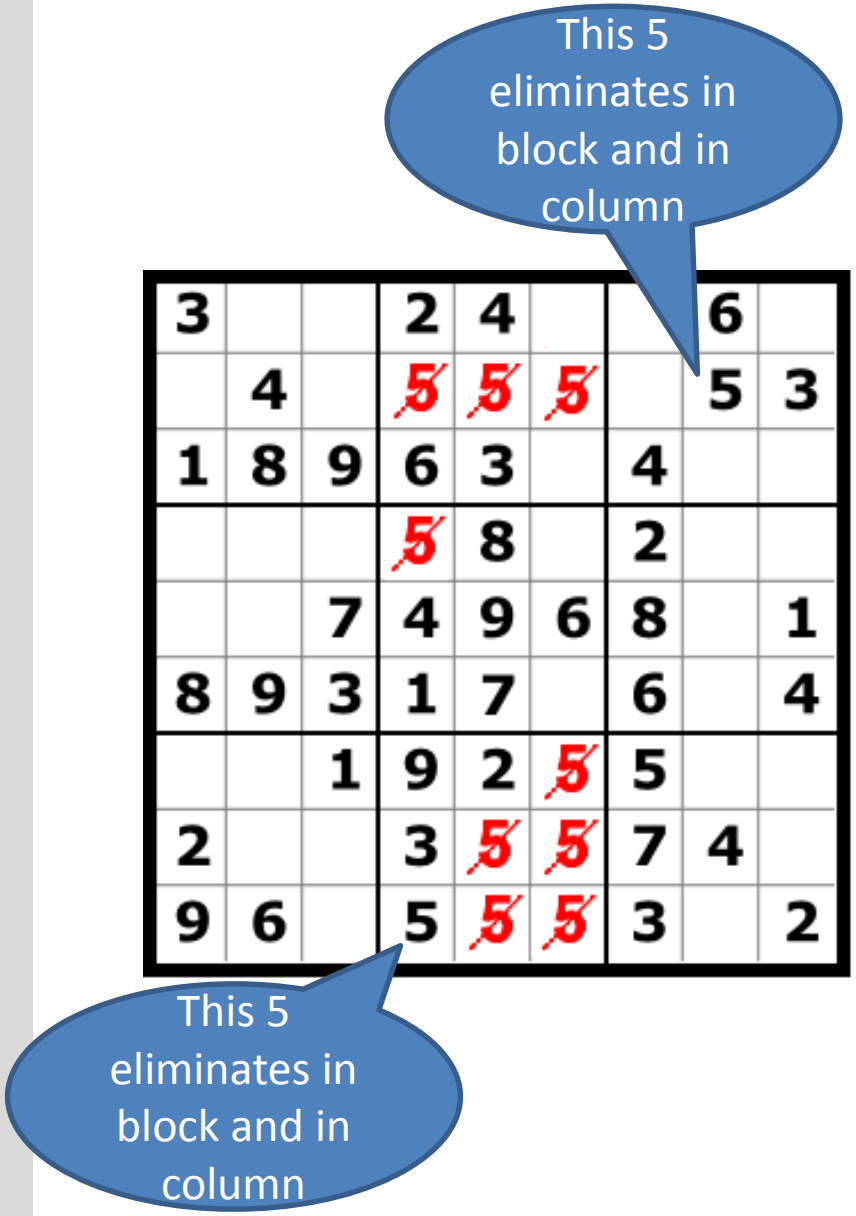
```
// Constraint propagation
if (cell.value is fixed) => eliminate the value
  … in all cells … its line, column and block

// Solver Algorithm: OnlyOnePotentialValueLeftInCell
if (cell has only one potential value left)
   => fix the cell.value

// Solver Algorithm: LastPotentialValueInBlockOrLineOrColumn
if (only one cell in a block/line/column where a value fits)
   => Fix the cell.value

// Solver Algorithm: IfValueFixedToLineOrColumnInside…
                     …ABlockThenDeleteFromRest
if (potential values are only possible in one line/column
    of a block - as others are fixed, for example)
=> delete this potential value from the rest of the line/column
```

# Example for IfValueFixedToLineOrColumnInsideABlockThenDeleteFromRest



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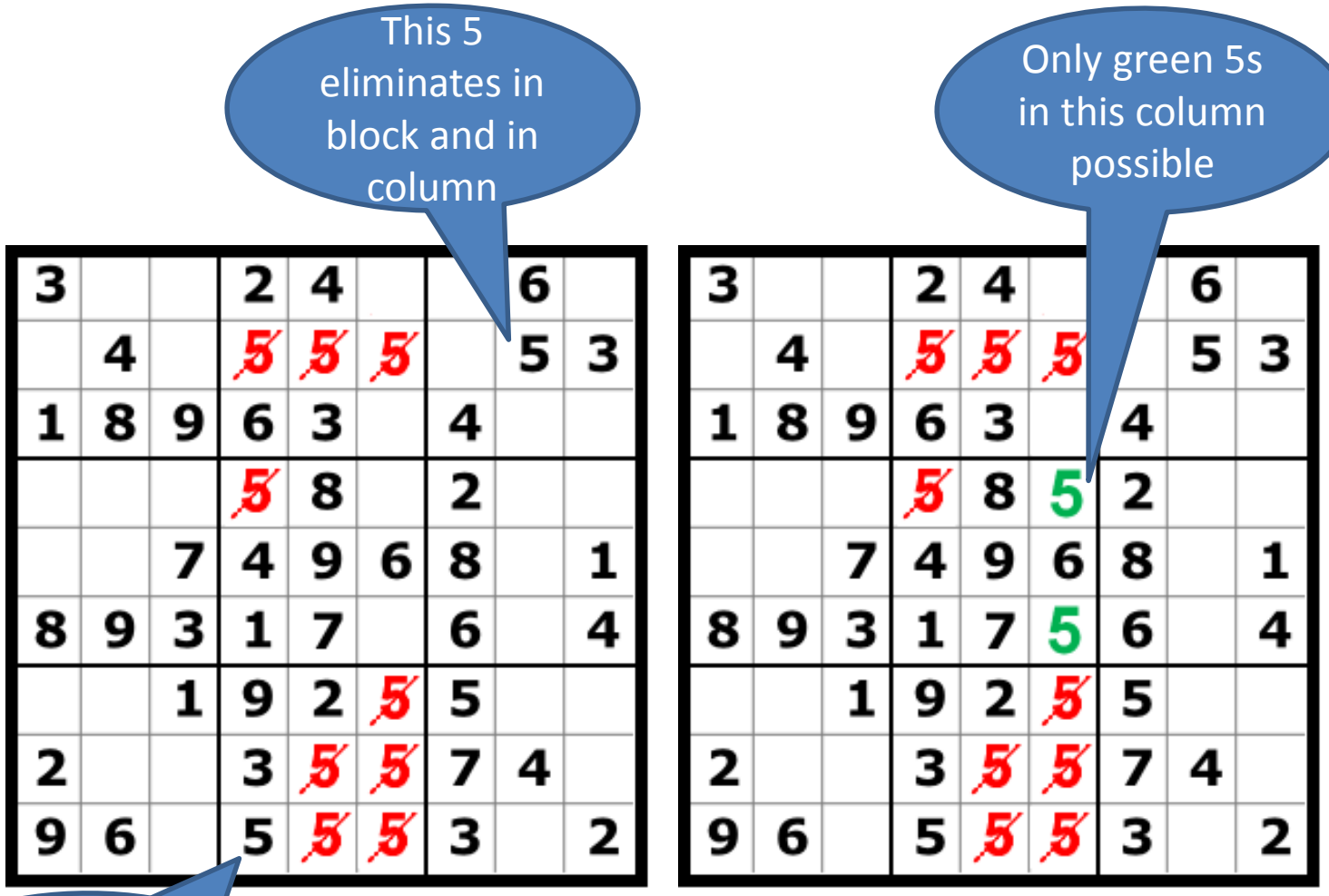

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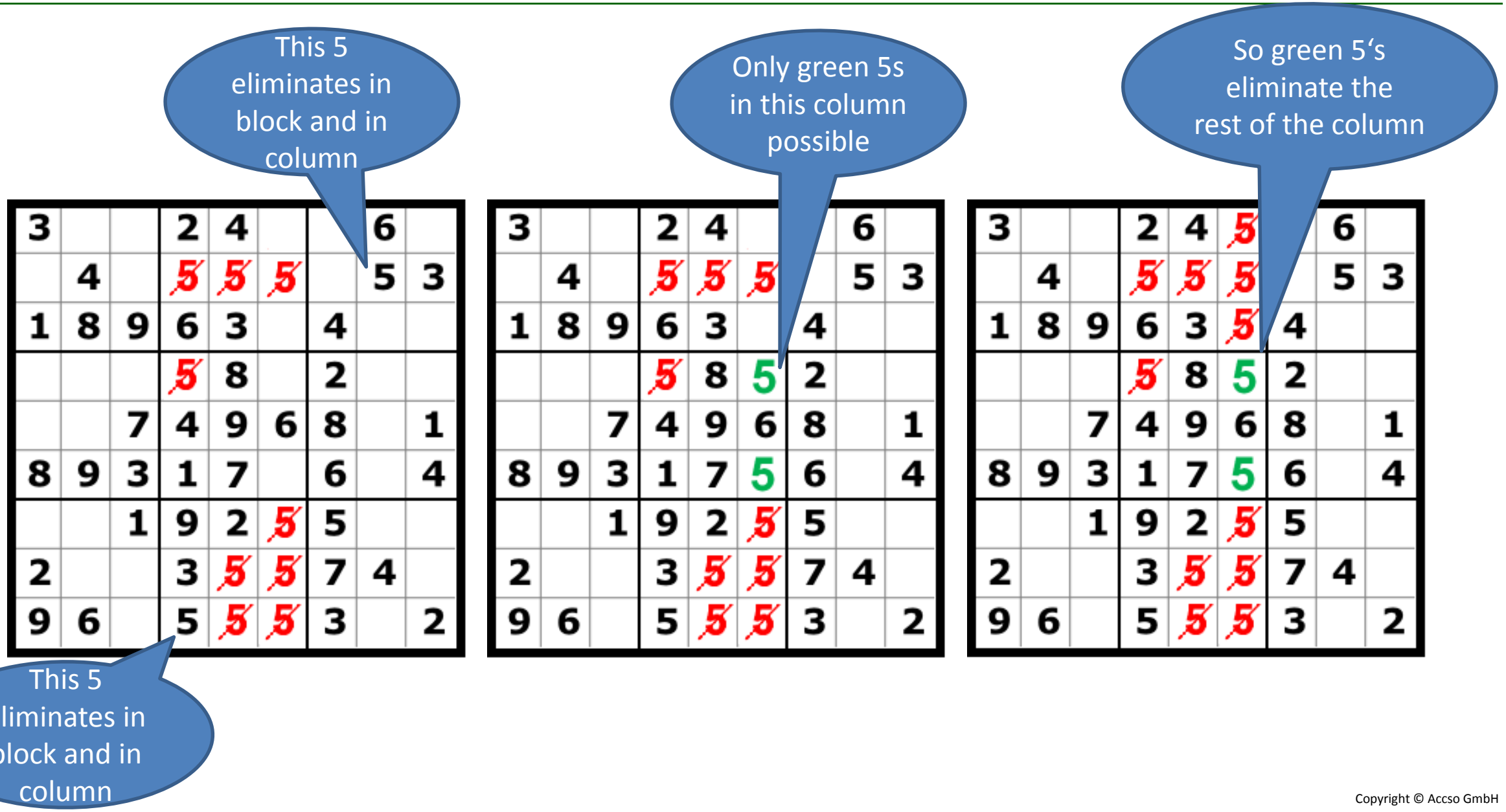

# Algorithm

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//MAIN
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}
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```
// Constraint propagation
if (cell.value is fixed) => eliminate the value
  … in all cells … in its line, column and block
```

```
// Checker Algorithm:
// CheckCellsForNoMorePotentialValuesAvailable
fails, if any cell found which is not fixed but has no
       more potential values left
```

```
// Checker Algorithm:
// CheckCellsForDuplicateFixedValuesInBlockOrLineOrColumn
fails, if there are two cells in a line/column/block
       with the same fixed value
```

# Scala solution

https://github.com/MartinLehmann1971/scudoku/tree/master/workspace/scudoku

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