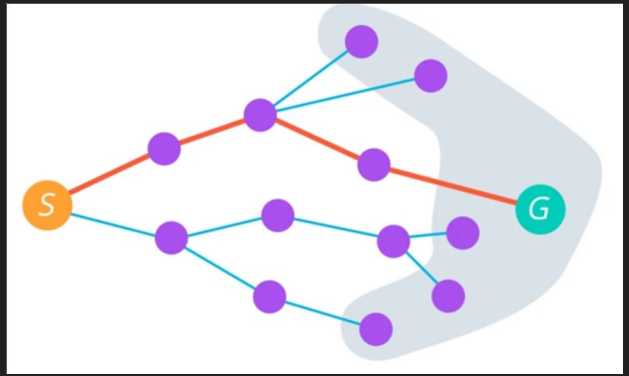
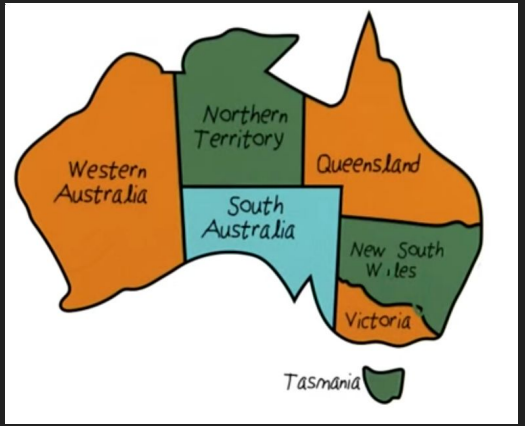
Sudoku

Traditional AI Techniques

45	4578	3	49	2	147	6	5789	57
9	24678	47	3	47	5	78	278	1
25	257	1	8	79	6	4	23579	2357
345	345	8	1	3456	2	9	34567	34567
7	123459	49	459	34569	4	1	13456	8
1345	13459	6	7	3459	8	2	1345	345
134	1347	2	6	478	9	5	1478	47
8	1467	47	2	457	3	17	1467	9
46	4679	5	4	1	47	3	24678	2467





Overview

Constraint Propagation

Search

Introduction of Sudoku

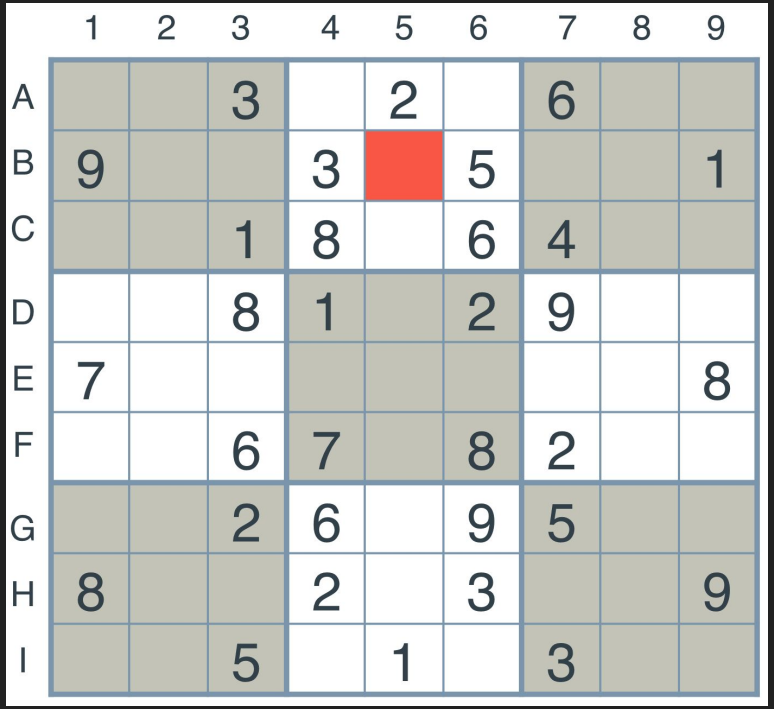
	1	2	3	4	5	6	7	8	9
A			3		2		6		
B	9			3		5			1
C			1	8		6	4		
D			8	1		2	9		
E	7								8
F			6	7		8	2		
G			2	6		9	5		
H	8			2		3			9
I			5		1		3		

	1	2	3	4	5	6	7	8	9
A	4	8	3	9	2	1	6	5	7
B	9	6	7	3	4	5	8	2	1
C	2	5	1	8	7	6	4	9	3
D	5	4	8	1	3	2	9	7	6
E	7	2	9	5	6	4	1	3	8
F	1	3	6	7	9	8	2	4	5
G	3	7	2	6	8	9	5	1	4
H	8	1	4	2	5	3	7	6	9
I	6	9	5	4	1	7	3	8	2

http://norvig.com/sudoku.html

Elimination

If a box has a value assigned, then none of the peers of this box can have this value.



Only Choice

If there is only one box in a unit which would allow a certain digit, then that box must be assigned that digit.

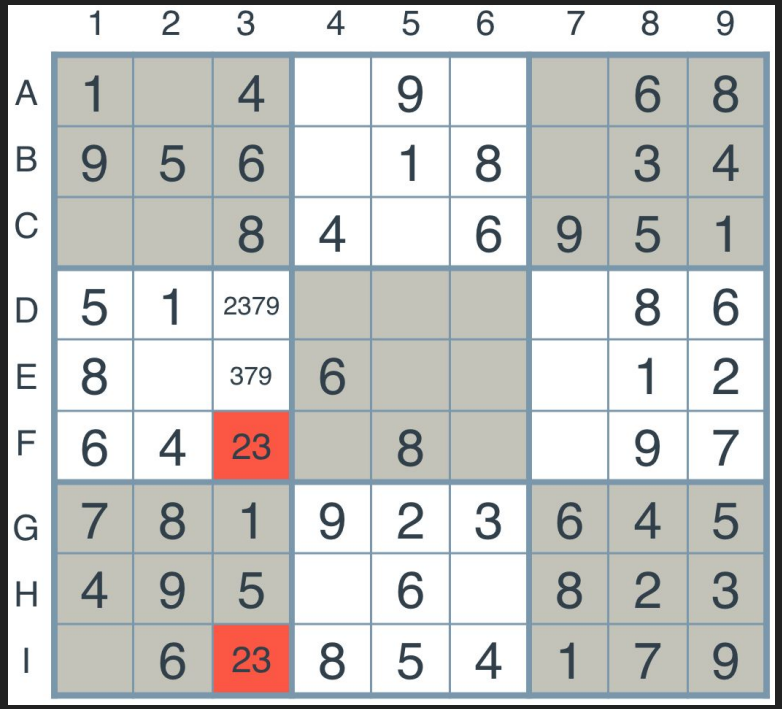
45	4578	3	49	2	147	6	5789	57
9	24678	47	3	47	5	78	278	1
25	257	1	8	79	6	4	23579	2357
345	345	8	1	3456	2	9	34567	34567
7	123459	49	459	34569	4	1	13456	8
1345	13459	6	7	3459	8	2	1345	345
134	1347	2	6	478	9	5	1478	47
8	1467	47	2	457	3	17	1467	9
46	4679	5	4	1	47	3	24678	2467

Search

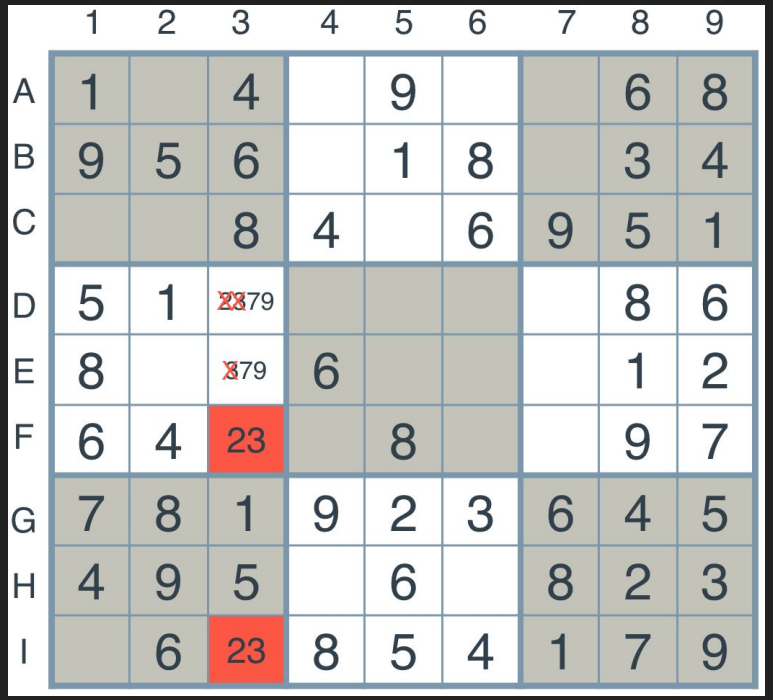
Better choice for a box than ‘A2’?

	1	2	3	4	5	6	7	8	9
A	4	16 79	126 79	139	23 69	269	8	12 39	5
B	267 89	3	1256 789	145 89	245 69	245 689	126 79	12 49	124 679
C	26 89	156 89	125 689	7	234 569	245 689	123 69	123 49	123 469
D	37 89	2	157 89	34 59	345 79	45 79	135 79	6	137 89
E	36 79	156 79	156 79	359	8	256 79	4	123 59	123 79
F	367 89	4	567 89	359	1	256 79	235 79	235 89	237 89
G	289	89	289	6	459	3	12 59	7	124 89
H	5	67 89	3	2	479	1	69	489	46 89
I	1	67 89	4	589	579	57 89	235 69	235 89	236 89

Naked Twins



	1	2	3	4	5	6	7	8	9
A	1		4		9			6	8
B	9	5	6		1	8		3	4
C			8	4		6	9	5	1
D	5	1	2379					8	6
E	8		379	6				1	2
F	6	4	23		8			9	7
G	7	8	1	9	2	3	6	4	5
H	4	9	5		6		8	2	3
I		6	23	8	5	4	1	7	9

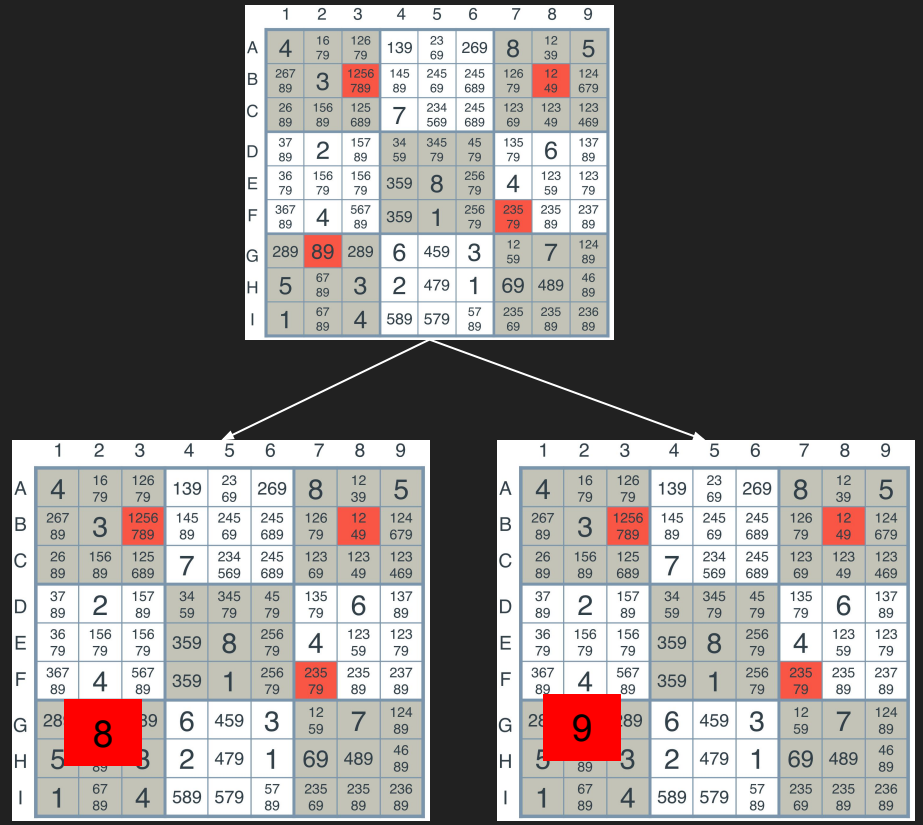


	1	2	3	4	5	6	7	8	9
A	1		4		9			6	8
B	9	5	6		1	8		3	4
C			8	4		6	9	5	1
D	5	1	2379					8	6
E	8		379	6				1	2
F	6	4	23		8			9	7
G	7	8	1	9	2	3	6	4	5
H	4	9	5		6		8	2	3
I		6	23	8	5	4	1	7	9

Search

Pick a box with a minimal number of possible values.

Try to solve each of the puzzles obtained by choosing each of these values, recursively.



Overview again

Constraint Propagation

- is all about using local constraints in a space (in the case of Sudoku, the constraints of each square) to dramatically reduce the search space.

Search

- is used throughout AI from Game-Playing to Route Planning to efficiently find solutions.

Book

http://aima.cs.berkeley.edu/