

# Contents

Table of Figures .....	vii
Table of Listings.....	xi
About the Author .....	xv
Introduction.....	xvii
<b>1. Modelling a Sudoku Puzzle in C .....</b>	<b>1</b>
Summary .....	8
<b>2. The Strategies .....</b>	<b>9</b>
Level 0 Strategies .....	9
Level 1 Strategies .....	11
Level 2 Strategies .....	14
Level 3 Strategies .....	18
Level 4 Strategies .....	25
Strategy Selection.....	26
Summary .....	26
<b>3. Main Program &amp; Utilities.....</b>	<b>27</b>
init() .....	35
cleanup().....	36
solve().....	40
Counting.....	44
Checking Consistency .....	45
Input/Output .....	47
Summary .....	51
<b>4. Implementing ‘unique’ .....</b>	<b>53</b>
unique_unit() .....	53
unique() .....	56
unique_loop() .....	57
<b>5. Implementing ‘naked’ Strategies.....</b>	<b>59</b>
naked_pair_unit() .....	62

**iv Contents**

naked_triple_unit()	67
naked_quad_unit()	71
<b>6. Implementing ‘hidden’ Strategies</b>	<b>77</b>
hidden_pair_unit()	78
hidden_triple_unit()	84
<b>7. Implementing ‘box-line’</b>	<b>87</b>
box_line()	87
box_line_unit()	88
<b>8. Implementing ‘pointing-line’</b>	<b>93</b>
pointing_line()	93
pointing_line_box()	94
<b>9. Implementing ‘lines’ Strategies</b>	<b>99</b>
lines_2()	99
lines_3()	100
lines_4()	101
lines()	102
An Example	104
<b>10. Implementing ‘Y-wing’</b>	<b>109</b>
pairs_find()	110
y_wing_digit()	114
intersection()	120
footprint()	123
An Example	124
<b>11. Implementing ‘XY-chain’</b>	<b>127</b>
xy_chain_digit()	127
xy_chain_step()	130
An Example	136
<b>12. Implementing ‘rectangle’</b>	<b>143</b>
rectangle()	143
rectangle_pattern()	144
rectangle_cell()	147
rectangle_step()	149
An Example	153

<b>13.</b>	<b>Implementing ‘backtrack’ .....</b>	<b>161</b>
	display_strats_in_clear() .....	167
	Optimisation .....	168
	An Example.....	171
<b>14.</b>	<b>Solving Thousands of Puzzles .....</b>	<b>177</b>
<b>15.</b>	<b>Generating Sudokus .....</b>	<b>181</b>
	Generating a Solved Sudoku .....	181
	Removing Clues to Make a Puzzle.....	194
	Check for Unicity of the Solution .....	215
	Completing the Generator .....	217
	Utilities for the Generator.....	219
<b>16.</b>	<b>Puzzle Statistics.....</b>	<b>223</b>
	Statistic on Number of Clues.....	223
	Statistic on Digits .....	226
	Statistic on Solutions .....	228
	Timing .....	232
	Generating more Puzzles.....	234
<b>17.</b>	<b>Puzzles.....</b>	<b>239</b>
	Cross Sudokus .....	239
	Diamond Sudokus .....	241
	Smiley Sudokus .....	244
	Heart Sudokus .....	247
	Two More Easy Sudokus .....	249
<b>18.</b>	<b>Samurai Sudokus.....</b>	<b>253</b>
<b>19.</b>	<b>Appendix A: Introduction to C.....</b>	<b>267</b>
	Program Structure.....	267
	Data .....	268
	The C Preprocessor .....	274
	Operators .....	275
	Compound and Flow-Control Statements .....	278
	Functions .....	282
<b>20.</b>	<b>Appendix B: Development Environment.....</b>	<b>285</b>
	Eclipse .....	285

Setting Up the Solver and the Generator .....	291
<b>21. Appendix C: Puzzle Solutions.....</b>	<b>299</b>
Sudoku 1 – Level 3.....	300
Sudoku 2 – Level 2.....	304
Sudoku 3 – Level 1.....	308
Sudoku 4 – Level 0.....	309
Sudoku 5 – Level 3.....	310
Sudoku 6 – Level 2.....	316
Sudoku 7 – Level 1.....	321
Sudoku 8 – Level 0.....	322
Sudoku 9 – Level 2.....	323
Sudoku 10 – Level 2.....	328
Sudoku 11 – Level 1.....	332
Sudoku 12 – Level 0.....	333
Sudoku 13 – Level 3.....	334
Sudoku 14 – Level 3.....	337
Sudoku 15 – Level 1.....	340
Sudoku 16 – Level 0.....	341
Sudoku 17 – Level 0.....	342
Sudoku 18 – Level 0.....	343
<b>Appendix D: Abbreviations &amp; Acronyms.....</b>	<b>345</b>
<b>Strategy Index .....</b>	<b>347</b>