Backtracking on Easy Board
Time: 0.7150s, Nodes/Iterations: 4,209
Easy Initial Board
Take 1,209
Easy Solved (Backtracking)

			asy i	nitiai	БОа	ra					Εc	15y 5	oive	и (Ба	CKLI	ackii	ig)	
5	3			7						5	3	4	б	7	8	9	1	2
6			1	9	5					6	7	2	1	9	5	3	4	8
	9	8					6			1	9	8	3	4	2	5	6	7
8				6				3		8	5	9	7	6	1	4	2	3
4			8		3			1		4	2	6	8	5	3	7	9	1
7				2				6		7	1	3	9	2	4	8	5	6
	6					2	8			9	6	1	5	3	7	2	8	4
			4	1	9			5		2	8	7	4	1	9	6	3	5
				8			7	9	] [	3	4	5	2	8	6	1	7	9

Constraint Prop. on Easy Board
Time: 3.5897s, Nodes/Iterations: 1.806
Easy Initial Board
Teasy Solved (Constraint Prop.)

		□(	asy i	nitiai	БОа	ra					Eas	y 50i	vea	(Con	Strai	nt Pi	op.)	
5	3			7						5	3	4	6	7	8	9	1	1
6			1	9	5				<b>1</b> F	6	7	2	1	9	5	3	4	8
	9	8					6			1	9	8	3	4	2	5	6	-
8				6				3		8	5	9	7	6	1	4	2	3
4			8		3			1		4	2	6	8	5	3	7	9	]
7				2				6		7	1	3	9	2	4	8	5	6
	6					2	8			9	6	1	5	3	7	2	8	4
			4	1	9			5	] [	2	8	7	4	1	9	6	3	5
				8			7	9		3	4	5	2	8	6	1	7	9
									1									

Dancing Links on Easy Board

Time: 0.0010s, Nodes/Iterations: 2
Easy Initial Board Easy Solved (Dancing Links)

						<u>.</u>			_				,,		, , , ,		9	,,	
5	3			7					-	5	3				7				
									1	_		$\pm$							
6			1	9	5					6				1	9	5			
	9	8					6				9		8					6	
8				6				3		8					6				3
4			8		3			1		4				8		3			1
7				2				6		7					2				6
	6					2	8				6						2	8	
			4	1	9			5						4	1	9			5
				8			7	9	] [						8			7	9

Sim. Annealing on Easy Board
Time: 12.6704s, Nodes/Iterations: 47,120
Easy Initial Board
Easy Solved (Sim. Annealing)

5       3       1       2       7       6       9       4       8         6       1       9       5       3       1       2       7       6       9       4       8         8       0 <th></th> <th></th> <th> usy i</th> <th>inciai</th> <th>БОС</th> <th>1 4</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>3y 30</th> <th>IVCG</th> <th>(5111</th> <th>. / \   </th> <th>iican</th> <th>1197</th> <th></th>			 usy i	inciai	БОС	1 4						3y 30	IVCG	(5111	. / \	iican	1197	
9       8       6         3       3         4       8       3         4       1         6       6         7       1         2       3         4       1         6       2         8       3         9       6         7       1         3       3         4       1         6       2         8       3         9       6         7       1         3       3         4       1         9       6         7       5         3       3         4       1         9       6         7       5         3       3         4       1         9       6         7       5         3       8         1       4         1       9         6       1         5       3         6       7         7       5         3       8 </td <td>5</td> <td>3</td> <td></td> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td>   </td> <td>5</td> <td>3</td> <td>1</td> <td>2</td> <td>7</td> <td>6</td> <td>9</td> <td>4</td> <td>8</td>	5	3		7						5	3	1	2	7	6	9	4	8
8       6       3         4       8       3         7       2         6       2         9       6         6       2         8       5         7       1         3       3         4       1         6       4         9       6         9       6         9       6         1       4         1       4         1       4         2       8         3       8         4       1         9       6         6       7         3       8         1       4         1       9         6       7         5       3         8       1         4       1         9       6         7       1         3       8         1       4         1       9         6       1         5       3         8       1         9       6 </td <td>6</td> <td></td> <td>1</td> <td>9</td> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td>6</td> <td>7</td> <td>4</td> <td>1</td> <td>9</td> <td>5</td> <td>3</td> <td>2</td> <td>1</td>	6		1	9	5					6	7	4	1	9	5	3	2	1
8       3       3       4       1       6       7       4       1       3         4       8       3       1       4       1       6       8       5       3       7       9       1         7       1       3       1       2       4       8       5       6         9       6       7       5       3       1       2       8       4         3       8       1       4       1       9       6       1       5		9					6			2	9	8	3	4	1	5	6	7
7     2     6     7     1     3     1     2     4     8     5     6       9     6     7     5     3     1     2     8     4       1     4     1     9     6     7     5     3     1     2     8     4       3     8     1     4     1     9     6     1     5	8			6				3		8	5	2	9	6	7	4	1	3
6     2     8       4     1     9       3     8     1       4     1     9       5     3     8       1     4     1     9       6     1     5	4		8		3			1		4	1	6	8	5	3	7	9	1
4 1 9 5 3 8 1 4 1 9 6 1 5	7			2				6		7	1	3	1	2	4	8	5	6
		6				2	8			9	6	7	5	3	1	2	8	4
			4	1	9			5		3	8	1	4	1	9	6	1	5
<del>                                     </del>				8			7	9		1	4	5	6	8	2	1	7	9

Genetic Alg. on Easy Board
Time: 9.6705s, Nodes/Iterations: 1,000
Easy Initial Board
Time: 9.6705s, Nodes/Iterations: 1,000

		E	asy II	nitiai	Boa	ra			_		Εč	asy S	oive	a (Ge	eneti	CAI	J.)	
5	3			7						Б	3	4	2	7	6	9	1	8
6			1	9	5					6	7	2	1	9	5	3	4	1
	9	8					6			1	9	8	3	4	1	5	6	2
8				6				3		8	5	9	7	6	4	1	2	3
4			8		3			1		4	2	6	8	5	3	7	9	1
7				2				6		7	1	3	9	2	1	8	5	6
	6					2	8			9	6	7	5	3	1	2	8	4
			4	1	9			5	]	2	8	1	4	1	9	6	3	5
				8			7	9	] [	3	4	5	6	8	2	1	7	9

Backtracking on Medium Board
Time: 0.5188s, Nodes/Iterations: 2,251
Medium Initial Board
Medium Solved (Backtracking)

		ME	alulli	IIIICI	al bo	Jaru						MEC	ilulli	3010	eu (L	back	LIACK	ing)	
	2		6		8						1	2	3	6	7	8	9	4	5
5	8				9	7					5	8	4	2	3	9	7	6	1
				4							9	6	7	1	4	5	3	2	8
3	7					5					3	7	2	4	6	1	5	8	9
6								4			5	9	1	5	8	3	2	7	4
		8					1	3			4	5	8	7	9	2	6	1	3
				2							3	3	6	9	2	4	1	5	7
		9	8				3	6			2	1	9	8	5	7	4	3	6
			3		6		9		<u> </u>		7	4	5	3	1	6	8	9	2
1 1	1 1	I	11	I	I I	1		1 1	1	1				1		I I	1		1 1

Constraint Prop. on Medium Board
Time: 3.2219s, Nodes/Iterations: 969
Medium Initial Board
Medium Solved (Constraint Prop.)

		1410	ararri	HIHCI	ai be	Jara				<u>.</u>		MCGI	uiii	OIVC	u (CC	711361	anne	ιορ	• /
	2		6		8						1	2	3	6	7	8	9	4	5
5	8				9	7					5	8	4	2	3	9	7	6	1
				4							9	6	7	1	4	5	3	2	8
3	7					5					3	7	2	4	6	1	5	8	9
6								4			6	9	1	5	8	3	2	7	4
		8					1	3			4	5	8	7	9	2	6	1	3
				2							8	3	6	9	2	4	1	5	7
		9	8				3	6			2	1	9	8	5	7	4	3	6
			3		6		9				7	4	5	3	1	6	8	9	2
		I	ll						l										1 1

Dancing Links on Medium Board
Time: 0.0020s, Nodes/Iterations: 2
Medium Initial Board
Medium Solved (Dancing Links)

		1.10	ararri	- 1111161	ui be	Juliu						incu	iuiii .	JOIV	- G (D	unci	119 -	11113	<u>′                                    </u>	
	2		6		8							2		6		8				
								-		-	_								+	_
5	8				9	7					5	8				9	7			
				4											4					
3	7					5					3	7					5			
6								4	l		6									4
		8					1	3					8					1		3
				2											2					
		9	8				3	6					9	8				3		6
			3		6		9							3		6		9	$\top$	_
			1	1					Π											

Sim. Annealing on Medium Board
Time: 7.1628s, Nodes/Iterations: 21,625
Medium Initial Board
Medium Solved (Sim. Annealing)

		Ме	dium	Initi	al Bo	pard		•	•		меа	iúm S	olve	d (Si	m. A	nnea	aling)	
	2		6		8					1	2	4	6	5	8	3	1	9
5	8				9	7				5	8	6	2	3	9	7	4	1
				4						7	9	3	1	4	1	8	5	2
3	7					5				3	7	1	9	6	4	5	2	8
6								4		6	5	2	7	8	3	9	1	4
		8					1	3		9	1	8	5	1	2	6	1	3
				2						8	6	7	4	2	5	1	1	1
		9	8				3	6		2	4	9	8	7	1	1	3	6
			3		6		9			1	1	5	3	1	6	2	9	1
1 1													1					

Genetic Alg. on Medium Board

Time: 10.3235s, Nodes/Iterations: 1,000 Medium Initial Board Medium Solved (Genetic Alg.)

				ararri		<u> </u>				_			ararri		· ·			9.,	
-		2		6		8				-	7	2	1	6	5	8	3	4	9
	5	8				9	7				5	8	4	2	1	9	7	6	1
					4						9	3	6	7	4	1	2	5	8
	3	7					5				3	7	2	9	6	4	5	8	1
	6								4		6	5	1	1	8	3	9	7	4
			8					1	3		4	9	8	5	7	2	6	1	3
					2						1	6	7	4	2	5	8	1	1
			9	8				3	6		2	4	9	8	1	7	1	3	6
				3		6		9			8	1	5	3	1	6	4	9	7
- 1	I			1	II .	ı 1		1	1 1	1 1	ı 1		1 1		l l		1	1	1 1

Backtracking on Advanced Board
Time: 10.7468s, Nodes/Iterations: 49,559
Advanced Initial Board

		Adva	ance	a inii	iai B	oard			_		Adva	ncec	1 501	vea (	васк	ctrac	King)	
8										8	1	2	7	5	3	6	4	9
		3	6							9	4	3	6	8	2	1	7	5
	7			9		2				6	7	5	4	9	1	2	8	3
	5				7					1	5	4	2	3	7	8	9	6
				4	5	7				3	6	9	8	4	5	7	2	1
			1				3			2	8	7	1	6	9	5	3	4
		1					6	8		5	2	1	9	7	4	3	6	8
		8	5				1			4	3	8	5	2	6	9	1	7
	9					4			] [	7	9	6	3	1	8	4	5	2

Constraint Prop. on Advanced Board
Time: 43.2804s, Nodes/Iterations: 44,545
Advanced Initial Board
Advanced Solved (Constraint Prop.)

		Auv	arice	u IIIII	tiai b	odiu			_		<del>l</del> uvai	iceu .	30100	zu (C	.01130	Tanic	1 10	J.)
8										8	1	2	7	5	3	6	4	9
		3	6							9	4	3	6	8	2	1	7	5
	7			9		2				6	7	5	4	9	1	2	8	3
	5				7					1	5	4	2	3	7	8	9	6
				4	5	7				3	6	9	8	4	5	7	2	1
			1				3			2	8	7	1	6	9	5	3	4
		1					6	8		5	2	1	9	7	4	3	6	8
		8	5				1			4	3	8	5	2	6	9	1	7
	9					4				7	9	6	3	1	8	4	5	2

Dancing Links on Advanced Board
Time: 0.0020s, Nodes/Iterations: 2
Advanced Initial Board
Advanced Solved (Dancing Links)

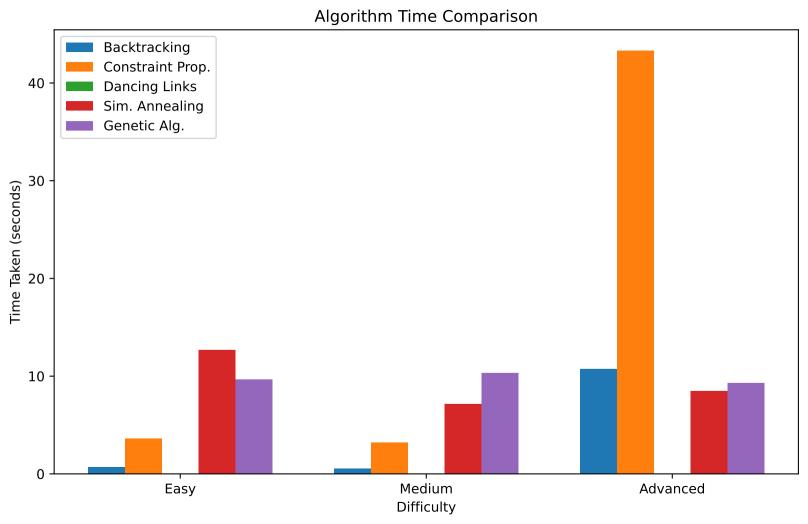
	Advanced Initial Board									Advanced Solved (Dancing Links)											
										] [		$\Box$									
	В										٦	1									
			3	6						]	1			3	6					1	
			3	6										3	6						
		7			9		2		$\vdash$	} [	+		7			9		2		+	
					9					]						9					
		5				7			$\Box$	1	寸	T	5				7			$\dagger$	
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	Ш										_										
				1				3							1				3		
F	H									1	₹	$\exists$					П			Ŧ	$\mp$
			1					6	8					1				3	6		8
	H									† †	+	_								+	-
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	$\vdash$	9					4			-	+	4	9					4		+	+

Sim. Annealing on Advanced Board
Time: 8.4799s, Nodes/Iterations: 30,230
Advanced Initial Board
Advanced Solved (Sim. Annealing)

Advanced initial Board										Advanced Solved (Sim. Annealing)								
8										8	1	4	3	2	1	9	7	б
		3	6							9	2	3	6	7	4	8	5	1
	7			9		2				5	7	6	8	9	1	2	4	3
	5				7					4	5	2	9	3	7	6	8	1
				4	5	7				3	6	9	2	4	5	7	1	1
			1				3			7	8	1	1	6	1	5	3	4
		1					6	8		2	3	1	4	1	9	1	6	8
		8	5				1			6	4	8	5	1	2	3	1	9
	9					4			] [	1	9	5	7	8	6	4	2	1
									1 Γ									

Genetic Alg. on Advanced Board
Time: 9.3175s, Nodes/Iterations: 1,000
Advanced Initial Board
Advanced Solved (Genetic Alg.)

Advanced Initial Board										Advanced Solved (Genetic Alg.)									
8										8	4	6	7	1	2	5	9	3	
		3	6							2	1	3	6	5	4	8	7	1	
	7			9		2				5	7	1	8	9	3	2	4	6	
	5				7					1	5	2	9	3	7	6	8	4	
				4	5	7				3	6	9	2	4	5	7	1	1	
			1				3			7	8	4	1	6	1	9	3	2	
		1					6	8		4	2	1	3	7	9	1	6	8	
		8	5				1			6	3	8	5	2	1	1	1	9	
	9					4			]	1	9	5	1	8	6	4	2		
										- 1									



## Algorithm Performance Summary

Algorithm	Difficulty	Solved	Time (s)	Nodes/Iterations
Backtracking	Easy	Yes	0.7150	4,209
Constraint Prop.	Easy	Yes	3.5897	1,806
Dancing Links	Easy	Yes	0.0010	2
Sim. Annealing	Easy	No	12.6704	47,120
Genetic Alg.	Easy	No	9.6705	1,000
Backtracking	Medium	Yes	0.5188	2,251
Constraint Prop.	Medium	Yes	3.2219	969
Dancing Links	Medium	Yes	0.0020	2
Sim. Annealing	Medium	No	7.1628	21,625
Genetic Alg.	Medium	No	10.3235	1,000
Backtracking	Advanced	Yes	10.7468	49,559
Constraint Prop.	Advanced	Yes	43.2804	44,545
Dancing Links	Advanced	Yes	0.0020	2
Sim. Annealing	Advanced	No	8.4799	30,230

No

9.3175

1,000

Advanced

Genetic Alg.