

Time: 0.7150s, Nodes/Iterations: 4,209

Easy Solved (Backtracking)

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

Time: 3.5897s, Nodes/Iterations: 1,806

Easy Solved (Constraint Prop.)

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

Dancing Links on Easy Board
Time: 0.0010s, Nodes/Iterations: 2
Easy Initial Board Easy

Dancing Links on Easy Board
Time: 0.0010s, Nodes/Iterations: 2
Easy Initial Board Easy

Dancing Links on Easy Board
Time: 0.0010s, Nodes/Iterations: 2
Easy Initial Board Easy

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Time: 0.0010s, Nodes/Iterations: 2
Easy Initial Board Easy

Dancing Links on Easy Board
Time: 0.0010s, Nodes/Iterations: 2
Easy Initial Board Easy

Dancing Links on Easy Board
Time: 0.0010s, Nodes/Iterations: 2
Easy Initial Board Easy

Easy Initial Board Time: 12.6704s, Nodes/Iterations: 47,120 Easy Sol

Time: 12.6704s, Nodes/Iterations: 47,120
Board: Easy Solv

5-47, 120 Easy Solved (Sim. Annealing)

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

Time: 9.6705s, Nodes/Iterations: 1,000

Easy Solved (Genetic Alg.)

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

Time: 0.5188s, Nodes/Iterations: 2,251

Medium Solved (Backtracking)

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

Medium Initial Board

Constraint Prop. on Medium Board
Time: 3.2219s, Nodes/Iterations: 969

Medium

Medium Initial Board

Constraint Prop. on Medium Board
Time: 3.2219s, Nodes/Iterations: 969

Medium

Medium Initial Board

Constraint Prop. on Medium Board
Time: 3.2219s, Nodes/Iterations: 969

Medium

Medium Initial Board

Constraint Prop. on Medium Board
Time: 3.2219s, Nodes/Iterations: 969

Medium

Medium Initial Board

Constraint Prop. on Medium Board
Time: 3.2219s, Nodes/Iterations: 969

Medium

Medium Initial Board

Constraint Prop. on Medium Board
Time: 3.2219s, Nodes/Iterations: 969

Medium

Dancing Links on Medium Board
Time: 0.0020s, Nodes/Iterations: 2

Dancing Links on Medium Board
Time: 0.0020s, Nodes/Iterations: 2

Dancing Links on Medium Board
Time: 0.0020s, Nodes/Iterations: 2

[illegible]

Medium Solved (Dancing Links)

[illegible]

Time: 7.1628s, Nodes/Iterations: 21,625

Medium Solved (Sim. Annealing)

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

Time: 10.3235s, Nodes/Iterations: 1,000

Medium Solved (Genetic Alg.)

[illegible]

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

Time: 10.7468s, Nodes/Iterations: 49.559

Advanced Solved (Backtracking)

Advanced Solved (Backtracking)

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

Time: 43.2804s, Nodes/Iterations: 44.545

Advanced Solved (Constraint Prop.)

Advanced Solved (Constraint Prop.)

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

Time: 0.0020s, Nodes/Iterations: 2

Advanced Solved (Dancing Links)

[illegible]

Time: 8.4799s, Nodes/Iterations: 30,230

Advanced Solved (Sim. Annealing)

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

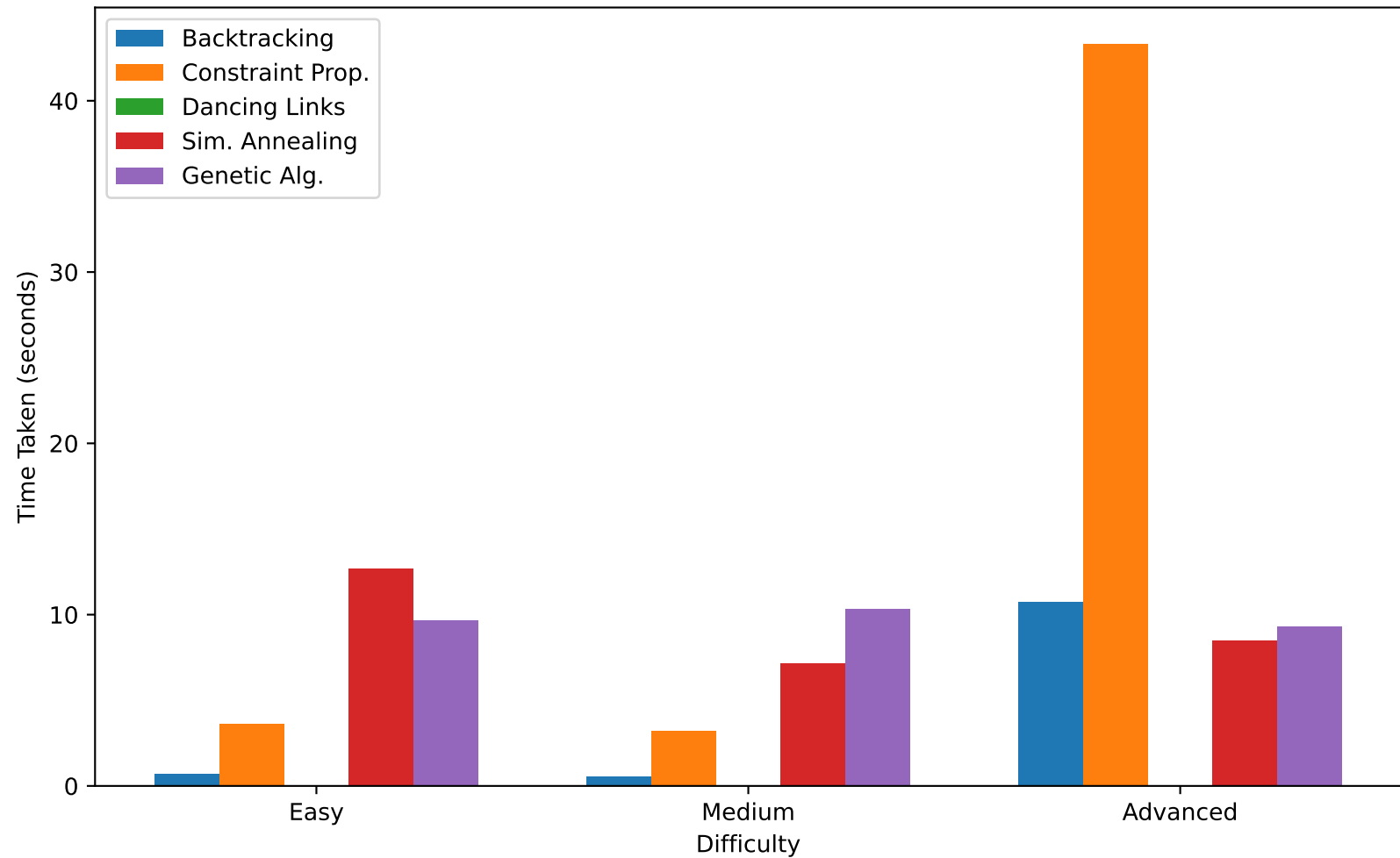
Time: 9.3175s, Nodes/Iterations: 1,000

Advanced Solved (Genetic Alg.)

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

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

Algorithm Time Comparison



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 |
| Genetic Alg. | Advanced | No | 9.3175 | 1,000 |