Compsci 367 A3 Report

# Table of Results

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| --- | --- | --- | --- | --- | --- | --- |
| # queens or Map for 4-colour | method | Average # of assignments ± std dev | Average time to solve ± std dev | Average # of backtracks ± std dev | Average # of repair assignments ± std dev | Probability of Success (%) |
| 10 queens | 1 | 91 ± 0 | 0.0013 ± 0.00046 | 81 ± 0 | NA ± NA | 100 |
| 10 queens | 2 | 73 ± 0 | 0.0011 ± 0.00054 | 35 ± 0 | NA ± NA | 100 |
| 10 queens | 3 | 50 ± 0 | 0.0081 ± 0.00071 | 40 ± 0 | NA ± NA | 100 |
| 10 queens | 4 | 220 ± 280 | 0.0051 ± 0.0065 | 210 ± 280 | NA ± NA | 100 |
| 10 queens | 5 | 18 ± 7.3 | 0.0048 ± 0.0021 | 8.1 ± 7.3 | NA ± NA | 100 |
| 10 queens | 6 | 94 ± 74 | 0.0029 ± 0.0027 | NA ± NA | 84 ± 74 | 100 |
| 30 queens | 1 | 1000 ± 0 | 0.027 ± 0.0022 | 980 ± 0 | NA ± NA | 0 |
| 30 queens | 2 | 1000 ± 0 | 0.024 ± 0.0013 | 570 ± 0 | NA ± NA | 0 |
| 30 queens | 3 | 1000 ± 0 | 0.8 ± 0.13 | 980 ± 0 | NA ± NA | 0 |
| 30 queens | 4 | 820 ± 250 | 0.043 ± 0.014 | 790 ± 250 | NA ± NA | 40 |
| 30 queens | 5 | 50 ± 28 | 0.13 ± 0.028 | 20 ± 28 | NA ± NA | 100 |
| 30 queens | 6 | 66 ± 13 | 0.0032 ± 0.00087 | NA ± NA | 36 ± 13 | 100 |
| 50 queens | 1 | 1000 ± 0 | 0.05 ± 0.012 | 970 ± 0 | NA ± NA | 0 |
| 50 queens | 2 | 1000 ± 0 | 0.045 ± 0.0014 | 570 ± 0 | NA ± NA | 0 |
| 50 queens | 3 | 1000 ± 0 | 2.5 ± 0.27 | 970 ± 0 | NA ± NA | 0 |
| 50 queens | 4 | 770 ± 350 | 0.062 ± 0.028 | 730 ± 350 | NA ± NA | 40 |
| 50 queens | 5 | 82 ± 42 | 1.2 ± 0.35 | 32 ± 42 | NA ± NA | 100 |
| 50 queens | 6 | 100 ± 30 | 0.0072 ± 0.0031 | NA ± NA | 52 ± 30 | 100 |
| 70 queens | 1 | 1000 ± 0 | 0.059 ± 0.0062 | 950 ± 0 | NA ± NA | 0 |
| 70 queens | 2 | 1000 ± 0 | 0.077 ± 0.0024 | 540 ± 0 | NA ± NA | 0 |
| 70 queens | 3 | 1000 ± 0 | 5.8 ± 0.68 | 950 ± 0 | NA ± NA | 0 |
| 70 queens | 4 | 910 ± 170 | 0.14 ± 0.036 | 840 ± 170 | NA ± NA | 40 |
| 70 queens | 5 | 450 ± 390 | 4 ± 1.1 | 380 ± 400 | NA ± NA | 70 |
| 70 queens | 6 | 130 ± 20 | 0.012 ± 0.0022 | NA ± NA | 62 ± 20 | 100 |
| 90 queens | 1 | 1000 ± 0 | 0.071 ± 0.0024 | 940 ± 0 | NA ± NA | 0 |
| 90 queens | 2 | 1000 ± 0 | 0.15 ± 0.038 | 540 ± 0 | NA ± NA | 0 |
| 90 queens | 3 | 1000 ± 0 | 13 ± 0.82 | 940 ± 0 | NA ± NA | 0 |
| 90 queens | 4 | 1000 ± 0 | 0.14 ± 0.0045 | 920 ± 2.6 | NA ± NA | 0 |
| 90 queens | 5 | 360 ± 320 | 10 ± 1.8 | 270 ± 320 | NA ± NA | 90 |
| 90 queens | 6 | 140 ± 50 | 0.016 ± 0.0072 | NA ± NA | 47 ± 50 | 100 |
| australia\_map | 1 | 6 ± 0 | 1e-04 ± 3e-04 | 0 ± 0 | NA ± NA | 100 |
| australia\_map | 2 | 6 ± 0 | 0 ± 0 | 0 ± 0 | NA ± NA | 100 |
| australia\_map | 3 | 6 ± 0 | 3e-04 ± 0.00046 | 0 ± 0 | NA ± NA | 100 |
| australia\_map | 4 | 9.2 ± 5.2 | 2e-04 ± 4e-04 | 3.2 ± 5.2 | NA ± NA | 100 |
| australia\_map | 5 | 6 ± 0 | 4e-04 ± 0.00049 | 0 ± 0 | NA ± NA | 100 |
| australia\_map | 6 | 6 ± 0 | 1e-04 ± 3e-04 | NA ± NA | 0 ± 0 | 100 |
| usa\_csp | 1 | 49 ± 0 | 8e-04 ± 4e-04 | 0 ± 0 | NA ± NA | 100 |
| usa\_csp | 2 | 49 ± 0 | 7e-04 ± 0.00046 | 0 ± 0 | NA ± NA | 100 |
| usa\_csp | 3 | 49 ± 0 | 0.0036 ± 0.00049 | 0 ± 0 | NA ± NA | 100 |
| usa\_csp | 4 | 900 ± 290 | 0.036 ± 0.012 | 860 ± 290 | NA ± NA | 10 |
| usa\_csp | 5 | 49 ± 0 | 0.0053 ± 0.00046 | 0 ± 0 | NA ± NA | 100 |
| usa\_csp | 6 | 65 ± 34 | 0.0041 ± 0.0079 | NA ± NA | 16 ± 34 | 100 |
| zebra | 1 | 1000 ± 0 | 0.029 ± 0.0047 | 990 ± 0 | NA ± NA | 0 |
| zebra | 2 | 1000 ± 0 | 0.022 ± 0.0043 | 650 ± 0 | NA ± NA | 0 |
| zebra | 3 | 1000 ± 0 | 0.099 ± 0.016 | 990 ± 0 | NA ± NA | 0 |
| zebra | 4 | 1000 ± 0 | 0.08 ± 0.0051 | 990 ± 2.7 | NA ± NA | 0 |
| zebra | 5 | 46 ± 3 | 0.0077 ± 0.00046 | 20 ± 3 | NA ± NA | 100 |
| zebra | 6 | 1000 ± 85 | 0.25 ± 0.023 | NA ± NA | 970 ± 85 | 10 |

# Discussion of Results

1. Which settings you think work best for the constraint satisfaction algorithm and whether they are specific to certain problems or are always better or worse. Why do you think they work best?
2. Talk about the growth of the number of assignments and time as the N-Queens problem and the Map-Colour Problem grow. Do the two domains act the same? If not why not?
3. When would you use Minimum Conflict instead of a Constraint Satisfaction Solver? Why?
4. How does Minimum Conflict (which is essentially a local search algorithm) Perform Compared to the Local Search Algorithms you used in Assignment 2? (You will need to run them on the same NQueens Size Problem to determine this)
5. In some problems there might be a large number of assignments, but no backtracking (or very little), why would this occur?