

PROGRAMMING ASSIGNMENT 2 – REPORT

Note: Although the results of 5 cases are presented in the report, there are total of 8 cases + USA.txt (3 colors) and USA4.txt (4 colors) in the test set submitted.

EVALUATIONS OF CSP USING -

1. **BREADTH FIRST SEARCH (BDS)**

number of states expanded:

case1.txt → 28

case2.txt → 28

case3.txt → 42

case4.txt → 52 (correctly FAILED)

case5.txt → 39

2. **DEPTH FIRST SEARCH (DFS)**

case1.txt → 19

case2.txt → 28

case3.txt → 42

case4.txt → 52 (correctly FAILED)

case5.txt → 27

3. **ITERATIVE DEEPENING SEARCH (IDS)**

NOT WORKING !!

case1.txt → 34

case2.txt → 34

case3.txt → 34

case4.txt → 34 (correctly FAILED)

case5.txt → 34

4. **A STAR**

case1.txt → 28

case2.txt → 28

case3.txt → 42

case4.txt → 52 (correctly FAILED)

case5.txt → 39

From the above tests, it is observed that Depth First Search (DFS) is faster than others. The A* could be made faster by choosing an efficient heuristic. But, BFS explores all the nodes and could be slower than the DFS.

Parameter affecting the runtime

The compact the map is, more the number of edges will be and therefore tighter constraints will be. This will make the algorithm to go back more often to recolor the state. So, the number of edges does affect the runtime.

More the colors are, easier the assignment of the color will be. This will make it faster.

More the number of nodes are, more the iterations would be which will make it little slower.

So, the most affecting parameter, which makes major effect in runtime is the number of edges.

EXTRA CREDIT

The USA map is tried with 3 colors using BFS which gives the following output

WITH 3 COLORS (CORRECTLY FAILED!!)

This might be because of the four corners states (Arizona, Utah, Colorado, and New Mexico)

FINAL ANSWER

```
state = 1 color = 0
state = 2 color = 1
state = 3 color = 0
state = 4 color = 2
state = 5 color = 0
state = 6 color = []
state = 7 color = 1
state = 8 color = 0
state = 9 color = 2
state = 10 color = 1
state = 11 color = 0
state = 12 color = 1
state = 13 color = 0
state = 14 color = 1
state = 15 color = 2
state = 16 color = 0
state = 17 color = 2
state = 18 color = 0
state = 19 color = 1
state = 20 color = 2
state = 21 color = []
state = 22 color = 2
state = 23 color = 0
state = 24 color = 1
state = 25 color = 1
state = 26 color = 2
state = 27 color = 1
state = 28 color = 0
state = 29 color = 2
state = 30 color = 1
```

```
state = 31 color = 0
state = 32 color = 1
state = 33 color = 2
state = 34 color = 0
state = 35 color = 0
state = 36 color = 2
state = 37 color = []
state = 38 color = 0
state = 39 color = 2
state = 40 color = 1
state = 41 color = 1
state = 42 color = 0
state = 43 color = 2
state = 44 color = []
state = 45 color = 0
state = 46 color = 2
state = 47 color = 0
state = 48 color = 1
state = 49 color = 0
state = 50 color = 1
```

number of states expanded: 261

number of states in the fringe: 0

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WITH 4 COLORS: (WORKED)

FINAL ANSWER

```
state = 1 color = 0
state = 2 color = 1
state = 3 color = 0
state = 4 color = 2
state = 5 color = 0
state = 6 color = 3
state = 7 color = 1
state = 8 color = 0
state = 9 color = 2
state = 10 color = 1
state = 11 color = 0
state = 12 color = 1
state = 13 color = 0
state = 14 color = 1
state = 15 color = 2
```

state = 16 color = 0
state = 17 color = 2
state = 18 color = 0
state = 19 color = 1
state = 20 color = 2
state = 21 color = 3
state = 22 color = 2
state = 23 color = 0
state = 24 color = 1
state = 25 color = 1
state = 26 color = 2
state = 27 color = 1
state = 28 color = 0
state = 29 color = 2
state = 30 color = 1
state = 31 color = 0
state = 32 color = 1
state = 33 color = 2
state = 34 color = 0
state = 35 color = 0
state = 36 color = 2
state = 37 color = 3
state = 38 color = 0
state = 39 color = 2
state = 40 color = 1
state = 41 color = 1
state = 42 color = 0
state = 43 color = 2
state = 44 color = 3
state = 45 color = 0
state = 46 color = 2
state = 47 color = 0
state = 48 color = 1
state = 49 color = 0
state = 50 color = 1

number of states expanded: 261