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QUESTION 1: DFS

DFS ANALYSIS:

TIME COMPLEXITY- In the worst case, search entire space, Particularly bad if tree is infinitely deep As we just traversing using stack no information about the goal node

Completeness – Yes, it always find the solution but may take time, as it not optimal,

For Calculating Time Complexity:In first step it checks the valid moves and push into the stack and traverse in that manner …so the time complexity can be as high as O(4^10) ,(O(B^m))

Space Complexity - Only need to save one set of children at each level O(b*m), where b is branching factor and m is max depth

In my code,Sometimes the time is as low as 1.3326435089111328 sec and sometimes as high as 8. 7491135597229 sec, It also depends on your processor speed

In my code , I am printing the total cost occurred and also whether it reaches the node or not

Space Complexity: Partition of a set of 591453 objects. Total size = 73209576 bytes.

QUESTION 2:BFS

Analysis

Time Complexity: In the worst case, search entire space

Completeness : Yes, it always find the solution but may take time, as it not optimal

Space Complexity: Its higher than DFS search, exponential in worst case

In my code,Sometimes the time is as low as 1.3326435089111328 sec and sometimes as high as 8. 7491135597229 sec, It also depends on your processor speed

In case of Space Complexity, as I am using a queue to visit the node and explore them in FIFO manner , so the size of the container may be very large in worst case as we are storing every Node

QUESTION 3: VCS

Analysis:

Time Complexity: as we are some cost , so time complexity is becomes better than dfs,bfs but in the worst case may

May be we need to fetch the all node

Completeness- Yes it is complete , always find the solution,it's a informed search so better than dfs,bfs

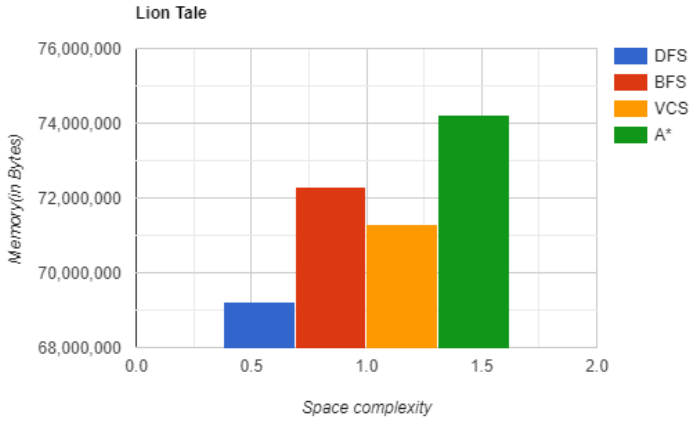
QUESTION 4: A *

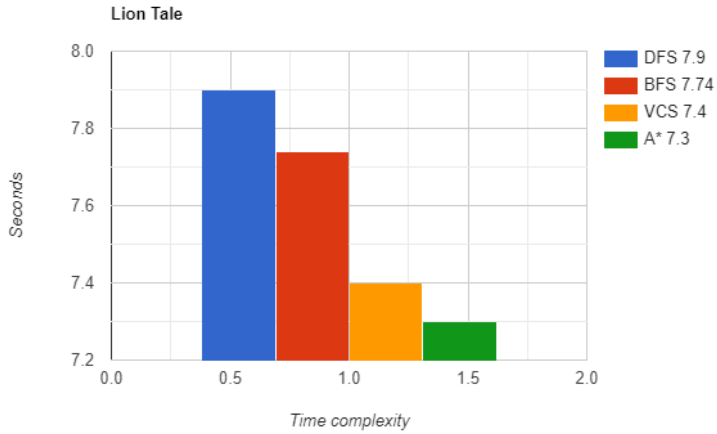
Analysis:

Time Complexity: if the heuristic value is admissible then better than VCS, else Exponential in **d** times the relative error with the heuristic function,

It’s a informed search algorithm , and space complexity is same as VCS as we have keep the function value in memory and use minheap data structure to implement the same,Yes It is optimal

Please Find the Comparison Bar Graph Below (in one of the Runtime)





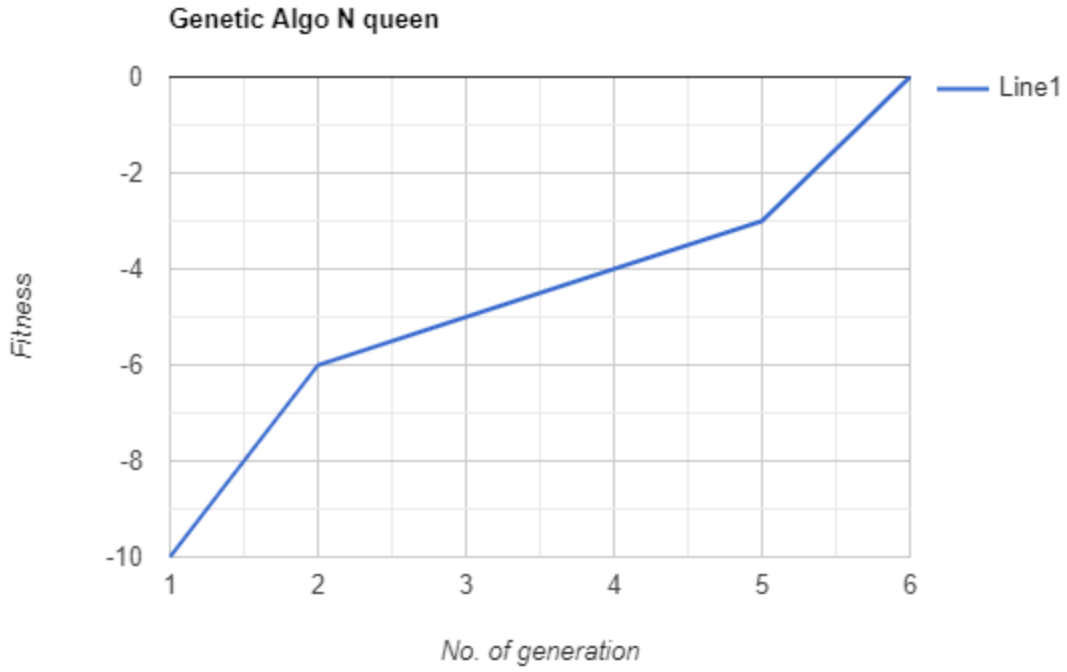
Section2:

N Queen Problem:

N=No. of queens, M=Mutation probability(in percentage), C=Cross Over prob(in percentage), P=Population size

N=5, M=4, C=40, P=100	[3, 5, 2, 4, 1]
N=6, M=5, C=41,P=1000	[4, 1, 5, 2, 6, 3]
N=8 M=7 C=50 P=10000	[5, 7, 2, 4, 8, 1, 3, 6]
N=9 M=10 C=60 P=9999	[9, 6, 2, 7, 1, 3, 5, 8, 4]
N=10 M=15 C=80 P=10000	[2, 4, 8, 10, 5, 9, 6, 1, 3, 7]

Please see the below graph for N=5 , No of generation = 6



Section 3:

The Time Complexity of CSP using Backtracking Search(similar to dfs O(b^m) to solve the puzzle is

For search algorithm- 0.05901050567626953 seconds

For Total time - 0.07117390632629395 seconds

Time Complexity of Min_conflict Search (it depends on number of steps,sometimes it may result in failure,means it couldn't find the solution in the prescribed steps)

For search time- 14.65990924835205

For Total Time – 15.000000005205

BACKTRACKING SEARCH	MIN CONFLICT SEARCH
TEST CASE1-	
TOTAL TIME-0.07117390632629395 seconds	15.000000005205 sec
SEARCH TIME -0.05901050567626953 seconds	14.65990924835205 sec
NUMBER OF NODES 49	1000000
Test Case2	
Total time - 0.2266829013824463	16.911339206877007
Search time- 0.15016698837280273	17.211338996887207
Number of nodes 124	1000000
Test case 3	
Total time - 0.08088517189025879	16.959058046340942
Search time- 0.0690762996673584	17.059058046340942
Number of nodes 55	1000000
Test case4	
Total time - 0.08029818534851074	15.019888354458393
Search time - 0.06429791450500488	15.213009357452393
Number of nodes 62	1000000
Test case5	
Total time 0.13468718528747559	24.743868589401245
Search time 0.13368725776672363	24.900056262463300
Number of nodes 102	1000000
Test case6	
Total time - 0.09104228019714355	87.743868589401245
Search time 0.07347846031188965	87.043865555555555
Number of nodes 65	100000000

ANALYSIS:

In case of Backtracking the solution takes fraction of seconds , but in case of min conflict , sometimes the solution may take around 30 seconds as its taking random values and verifying whether it is true or not, Sometimes it may result in failure so I have to increase the number of steps to get the result,but it also increases the time complexity..Many times I result in NO solution in min conflict search , so I ran alike 10 to 20 times to get the result..Backtracking search is faster then min conflict, and min conflict is simple than backtracking search,its easy to implement as we are just taking the random number and checking it whether it got the right place or not, in case of backtracking we have keep everything in memory and check which number suits there and if any time we caught an error then we backtrack to prev results

To get the desired result in min conflict I have increased the steps size, that’s why it sometimes takes more time,more a minutes