Ex. No: 1 Uniformed Search Strategies Name: ROHITH M
Date: 13-09-2023 Reg.No:3122215001085

AIM:

a. Given a box with combination of two color balls(red and green), create a state space tree and perform various search strategies.
b. Given two jugs, a 4-litre and a 3-litre one and a pump to fill the jugs with water, fill the 4-litre jug such that it exactly has 2 litres at the end.

OUTPUT:

RED AND GREEN BALLS

1) BFS

```
PS C:\Rohith\Backup\Desktop\SEM 5\Artificial Intelligence lab\Exercise-1> python bfs.py
no of numbers: 10
Enter Color Red/GreenRed
[1, 3, 5, 7, 9, 11, 13, 15, 17, 19]
Enter target7
1
3
5
7
Found
Cost to reach=  3
```

2) DFS

```
PS C:\Rohith\Backup\Desktop\SEM 5\Artificial Intelligence lab\Exercise-1> python dfs.py
no of numbers: 5
Enter Color Red or Green: Red
[1, 3, 5, 7, 9]
1
3
7
9
5
Cost =  5
found: 5
```

3) DLS

```
PS C:\Rohith\Backup\Desktop\SEM 5\Artificial Intelligence lab\Exercise-1> python dls.py
Enter no of numbers: 5
red or green: red
[1, 3, 5, 7, 9]
Enter target5
Enter Search Level2
1
3
7
9
5
Cost =  5
Element found at level 1 : 5
```

4) IDS

```
PS C:\Rohith\Backup\Desktop\SEM 5\Artificial Intelligence lab\Exercise-1> python ids.py
Enter no of numbers: 5
red or yellow: red
[1, 3, 5, 7, 9]
Enter Max Search Level : 3
1
3
5
Element not found up to level 1
1
3
7
9
5
Element not found up to level 2
1
3
7
9
5
Element not found up to level 3
```

WATER JUG PROBLEM

1) BFS

```
PS C:\Rohith\Backup\Desktop\SEM 5\Artificial Intelligence lab\Exercise-1> python wbfs.py
Goal State
(0, 2)
Transfer Contents of 3 Gallon to 4 Gallon
(2, 0)
Empty 4 Gallon Container
(2, 4)
Transfer Contents of 3 Gallon to 4 Gallon
(3, 3)
Fill 3 Gallon Container
(0, 3)
Transfer Contents of 3 Gallon to 4 Gallon
(3, 0)
Fill 3 Gallon Container
(0, 0)

Cost is: 7
Goal State
(3, 2)
Transfer Contents of 4 Gallon to 3 Gallon
(1, 4)
Fill 4 Gallon Container
(1, 0)
Transfer Contents of 4 Gallon to 3 Gallon
(0, 1)
Empty 3 Gallon Container
(3, 1)
Transfer Contents of 4 Gallon to 3 Gallon
(0, 4)
Fill 4 Gallon Container
(0, 0)

Cost is: 7
```

2) DFS

```
PS C:\Rohith\Backup\Desktop\SEM 5\Artificial Intelligence lab\Exercise-1> python wdfs.py
0 0 Parent Node ::  -1 -1


Fill 4 Gallon Container


0 4 Parent Node ::  0 0


Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 1 Parent Node ::  0 4


Empty 4 Gallon Container


3 0 Parent Node ::  3 1


Fill 4 Gallon Container


3 4 Parent Node ::  3 0


Transfer Contents of 3 Gallon to 4 Gallon - non overflow


0 3 Parent Node ::  3 0


Empty 3 Gallon Container


0 1 Parent Node ::  3 1


Transfer Contents of 4 Gallon to 3 Gallon - non overflow
```

```
1 0 Parent Node ::  0 1


Fill 4 Gallon Container


1 4 Parent Node ::  1 0


Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 2 Parent Node ::  1 4


Goal State
Empty 3 Gallon Container
```

3) DLS

```
PS C:\Rohith\Backup\Desktop\SEM 5\Artificial Intelligence lab\Exercise-1> python wdls.py
0 0 Parents ::  -1 -1 Level ::  0
Fill 4 Gallon Container
0 4 Parents ::  0 0 Level ::  1
Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 1 Parents ::  0 4 Level ::  2
Empty 4 Gallon Container


COST=: 3
Fill 4 Gallon Container


COST=: 4
Empty 3 Gallon Container


COST=: 5
Fill 3 Gallon Container
3 0 Parents ::  0 0 Level ::  1
Fill 4 Gallon Container
3 4 Parents ::  3 0 Level ::  2
Transfer Contents of 3 Gallon to 4 Gallon - non overflow
0 3 Parents ::  3 0 Level ::  2
```

4) IDS

```
PS C:\Rohith\Backup\Desktop\SEM 5\Artificial Intelligence lab\Exercise-1> python wids.py

--------------------------------------------------------------------------------

Level =  0
0 0 Parents ::  -1 -1 Level ::  0
Fill 4 Gallon Container


COST in this level= 1
Fill 3 Gallon Container


COST in this level= 2

--------------------------------------------------------------------------------

Level =  1
0 0 Parents ::  -1 -1 Level ::  0
Fill 4 Gallon Container
0 4 Parents ::  0 0 Level ::  1
Transfer Contents of 4 Gallon to 3 Gallon -  overflow


COST in this level= 4
Fill 3 Gallon Container
3 0 Parents ::  0 0 Level ::  1
Fill 4 Gallon Container


COST in this level= 6
Transfer Contents of 3 Gallon to 4 Gallon - non overflow


COST in this level= 7

--------------------------------------------------------------------------------
```

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```
Level =  2
0 0 Parents ::  -1 -1 Level ::  0
Fill 4 Gallon Container
0 4 Parents ::  0 0 Level ::  1
Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 1 Parents ::  0 4 Level ::  2
Empty 4 Gallon Container


COST in this level= 10
Fill 4 Gallon Container


COST in this level= 11
Empty 3 Gallon Container


COST in this level= 12
Fill 3 Gallon Container
3 0 Parents ::  0 0 Level ::  1
Fill 4 Gallon Container
3 4 Parents ::  3 0 Level ::  2
Transfer Contents of 3 Gallon to 4 Gallon - non overflow
0 3 Parents ::  3 0 Level ::  2

--------------------------------------------------------------------------------
```

```
Level =  3
0 0 Parents ::  -1 -1 Level ::  0
Fill 4 Gallon Container
0 4 Parents ::  0 0 Level ::  1
Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 1 Parents ::  0 4 Level ::  2
Empty 4 Gallon Container
3 0 Parents ::  3 1 Level ::  3
Fill 4 Gallon Container


COST in this level= 19
Transfer Contents of 3 Gallon to 4 Gallon - non overflow


COST in this level= 20
Fill 4 Gallon Container
3 4 Parents ::  3 1 Level ::  3
Empty 3 Gallon Container
0 1 Parents ::  3 1 Level ::  3
Transfer Contents of 4 Gallon to 3 Gallon - non overflow


COST in this level= 23

--------------------------------------------------------------------------------
```

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```
Level =  4
0 0 Parents ::  -1 -1 Level ::  0
Fill 4 Gallon Container
0 4 Parents ::  0 0 Level ::  1
Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 1 Parents ::  0 4 Level ::  2
Empty 4 Gallon Container
3 0 Parents ::  3 1 Level ::  3
Fill 4 Gallon Container
3 4 Parents ::  3 0 Level ::  4
Transfer Contents of 3 Gallon to 4 Gallon - non overflow
0 3 Parents ::  3 0 Level ::  4
Empty 3 Gallon Container
0 1 Parents ::  3 1 Level ::  3
Transfer Contents of 4 Gallon to 3 Gallon - non overflow
1 0 Parents ::  0 1 Level ::  4
Fill 4 Gallon Container


COST in this level= 31

--------------------------------------------------------------------------------
```

```
Level =  5
0 0 Parents ::  -1 -1 Level ::  0
Fill 4 Gallon Container
0 4 Parents ::  0 0 Level ::  1
Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 1 Parents ::  0 4 Level ::  2
Empty 4 Gallon Container
3 0 Parents ::  3 1 Level ::  3
Fill 4 Gallon Container
3 4 Parents ::  3 0 Level ::  4
Transfer Contents of 3 Gallon to 4 Gallon - non overflow
0 3 Parents ::  3 0 Level ::  4
Empty 3 Gallon Container
0 1 Parents ::  3 1 Level ::  3
Transfer Contents of 4 Gallon to 3 Gallon - non overflow
1 0 Parents ::  0 1 Level ::  4
Fill 4 Gallon Container
1 4 Parents ::  1 0 Level ::  5
Transfer Contents of 4 Gallon to 3 Gallon -  overflow


COST in this level= 40

--------------------------------------------------------------------------------
```

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```
Level =  6
0 0 Parents ::  -1 -1 Level ::  0
Fill 4 Gallon Container
0 4 Parents ::  0 0 Level ::  1
Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 1 Parents ::  0 4 Level ::  2
Empty 4 Gallon Container
3 0 Parents ::  3 1 Level ::  3
Fill 4 Gallon Container
3 4 Parents ::  3 0 Level ::  4
Transfer Contents of 3 Gallon to 4 Gallon - non overflow
0 3 Parents ::  3 0 Level ::  4
Empty 3 Gallon Container
0 1 Parents ::  3 1 Level ::  3
Transfer Contents of 4 Gallon to 3 Gallon - non overflow
1 0 Parents ::  0 1 Level ::  4
Fill 4 Gallon Container
1 4 Parents ::  1 0 Level ::  5
Transfer Contents of 4 Gallon to 3 Gallon -  overflow
3 2 Parents ::  1 4 Level ::  6
Goal State
Empty 3 Gallon Container


COST in this level= 50
```

LEARNING OUTCOMES:

- I've learned about different search algorithms like BFS, DFS, DLS, and IDS, and how they work in problem-solving.
- I also learned how to decompose complex problems and use data structures like trees.
- Comparing these algorithms, I can see that BFS is better for finding the shortest path, while DFS is more memory-efficient but may not guarantee the shortest path.
- DLS and IDS strike a balance between memory and path optimality.
- The correct choice of the search strategy depends on the type of application to be performed.