

# INTRO TO ARTIFICIAL INTELLIGENCE

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## Assignment – 3

For bfs, I wrote a method that will return the first sequence of moves found that reaches the solution state. It will first receive a sequence of moves which will be applied on the default state of the cube to make it the initial state. Then the bfs runs to show the entire sequence of moves and relative states to solve the changed cube with 3 cubes per line, the number of nodes that were explored and the time that the function took to find the solution.

BFS:

>> sh run.sh bfs "L D' R' F R D'"

```
yg444@tux5:~/RCP2$ sh run.sh bfs "L D' R' F R D'"
  B W
  G W
O Y R R B B O Y
W G W R B Y O O
  R Y
  G G
  R W
  W W
Y G R R B B O G
O W G R B Y O B
  O Y
  Y G
  W W
  R W
O G Y G R R B B
O W G R B Y O B
  O Y
  Y G
  B W
  B W
O O W G R R B Y
W G R R B Y O O
  Y Y
  G G
  B W
  B W
O O W G R R B Y
O O W G R R B Y
  G Y
  G Y
  W W
  W W
O O G G R R B B
O O G G R R B B
  Y Y
  Y Y
PATH found by bfs:['D', 'Li', 'Ui', 'L', 'D', 'Li']
time in secs by bfs:1.1158592700958252
Nodes explored: 41293
yg444@tux5:~/RCP2$
```

DLS:

I have used the dls command instead of ids as shown in pdf and it's not finding a solution at every depth so please try to change it while running.

For example:

>> sh run.sh dls "L D' R' F R D'" 10

```
yq444@tux1:~/RC2$ sh run.sh dls "L D' R' F R D'" 10
B' F' L' R' D' B' D' L' F' L'
  WO
  GW
RY RR BB YG
GR BY OW OW
  YG
  OB

  WO
  RY
RY BR GB YG
GG YR WW OW
  OB
  OB

  WO
  GY
GR WR GB YO
GY RR WW OO
  BB
  YB

  WR
  GR
GR WB WG YO
GY RB WB OO
  BO
  YY

  WR
  GR
GR WB WG YO
OO GY RB WB
  YB
  YO

  GB
  GR
RR WB WO WY
WO GY RY BO
  YB
  GO

  GB
  GR
RR WB WO WY
GY RY BO WO
  BO
  YG

  WB
  RR
RY BB WO WG
RG YY BO WG
  OO
```

```
  WB
  RR
RY BB WO WG
RG YY BO WG
  OO
  YG

  WB
  WB
RR BY OO WG
RR BY OO WG
  YG
  YG

  BB
  BB
RR YY OO WW
RR YY OO WW
  GG
  GG

Nodes Explored: 1627272
Time taken (in secs) by DLS: 20.438955068588257
```

Similarly for the other command from pdf, try this:

```
>> sh run.sh dls "L' B' U' D L' F B" 11
```

```
>> sh run.sh dls "L' B' U' D L' F B" 12
```

```
yg444@tux1:~/RC2$ sh run.sh dls "L' B' U' D L' F B" 12
B' B' L' B' F U L' L' B U' D
  BW
  BB
WW RR YG RO
WB OO GG RO
  YY
  GY

  WW
  BB
GW RR YB OO
YB OO GW RR
  YY
  GG

  RW
  OB
WB YR YB OB
GY GO GW RW
  RY
  OG

  GW
  OB
OB YR YR BW
GY GO GW OR
  RY
  WB

  GW
  YB
OR GY OR BW
GY OR BW OR
  GY
  WB

  YG
  BW
GY OR BW OR
GY OR BW OR
  GY
  WB

  OG
  OW
YY GR BW OB
GG WR BW OY
  RY
  RB

  GG
  WW
YG RR BW OO
YG RR BW OO
  YY
  BB
```

```
  WW
  WW
GG RR BB OO
GG RR BB OO
  YY
  YY

  WW
  WW
OO GG RR BB
GG RR BB OO
  YY
  YY

  WW
  WW
OO GG RR BB
OO GG RR BB
  YY
  YY

Nodes Explored: 468461
Time taken (in secs) by DLS: 5.14728045463562
```

IDS:

>> sh run.sh ids "L' B' U' D L' F B" 20

```
yg444@tux1:~/RC2$ sh run.sh ids "L' B' U' D L' F B" 20
Depth: 0
Depth: 1
Depth: 2
Depth: 3
Depth: 4
Depth: 5
IDS found a solution at depth 5
B' B' D' U' R
  BW
  BB
WW  RR  YG  RO
WB  OO  GG  RO
  YY
  GY

  WW
  BB
GW  RR  YB  OO
YB  OO  GW  RR
  YY
  GG

  WW
  BB
GW  RR  YB  OO
OO  GW  RR  YB
  YG
  YG

  WB
  WB
OO  GW  RR  YB
OO  GW  RR  YB
  YG
  YG

  WW
  WW
OO  GG  RR  BB
OO  GG  RR  BB
  YY
  YY

Nodes Explored: 6494
Time taken (in secs) by IDS: 0.06636881828308105
```

A\*:

>> sh run.sh astar "L D' R' F R D'"

```
yg444@tux1:~/RC2$ sh run.sh astar "L D' R' F R D'"
U F' L' F U L'
  GB
  WW
RR BB OY OY
WR BY OO WG
  YG
  RG

  GB
  OO
RW BY GY OY
WW BB YO WG
  RR
  RG

  BB
  BO
WW RY GY OO
RW RB YO WG
  GR
  YG

  BB
  WW
WG RR BY OO
RR BY OO WG
  YG
  YG

  WB
  WB
RR BY OO WG
RR BY OO WG
  YG
  YG

  BB
  BB
RR YY OO WW
RR YY OO WW
  GG
  GG

Nodes Explored: 70176
Time taken (in secs) by A*: 13.26170301437378
```