School of Computer Science and Engineering

VIT-AP University

Artificial Intelligence: CSE 3002

Laboratory Assignment-6

Topic: Puzzle Problem

1. Design a program to solve the given 8-puzzle problem using uninformed search. Also, print the intermediate steps.

Initial State

1	2	3
	4	6
7	5	8

Final State

1	2	3
4	5	6
7	8	

Code:

```
import numpy as np
import math import
time
 start =
np.array([1,2,3,0,4,6,7,5,8]).reshape(3,3)

goal = np.array([1,2,3,4,5,6,7,8,0]).reshape(3,3)
def actions_array(array):      goal =
np.array([1,2,3,4,5,6,7,8,0]).reshape(3,3)
possible_actions = []      new_arrays = {}      for
i in range(len(array)):
        for j in range(len(array)):
if array[i][j] == 0:
                if i > 0:
                    up_array = array.copy()
up_array[i][j], up_array[i-1][j] = up_array[i-1][j], up_array[i][j]
if not np.array_equal(up_array, start):
                        new_arrays["up"]   =   up_array
if i < len(array) - 1:
                    down_array = array.copy()
```

```
                    down_array[i][j], down_array[i+1][j] =
down_array[i+1][j], down_array[i][j]                        if not
np.array_equal(down_array, start):
                        new_arrays["down"]   =   down_array
if j < len(array) - 1:
                    right_array = array.copy()
right_array[i][j], right_array[i][j+1] = right_array[i][j+1],
right_array[i][j]                       if not
np.array_equal(right_array, start):
                        new_arrays["right"] = right_array
if j > 0 :
                    left_array = array.copy()
left_array[i][j], left_array[i][j-1] = left_array[i][j-1], left_array[i][j]
if not np.array_equal(left_array, start):
                        new_arrays["left"]     =     left_array
return new_arrays
 def
h_value(array):
    s = sum(abs((val-1)%3 - i%3) + abs((val-1)//3 - i//3)
for i, val in enumerate(array.reshape(1,9)[0]) if val)
return s
 def main():      run =
True     prev_step = []
array = start.copy()
ola = None     count =
0     while run:

        h={}
         if ola is not
None:
            array = ola         act =
actions_array(array)          for keys,
values in act.items():
            h[keys]=h_value(values)
         new_dic = dict(sorted(h.items(), key=lambda item:
item[1]))          res = list(new_dic.items())[0]          r, v =
res[0], res[1]          if not prev_step:
            prev_step.append(['start_array', array])
else:               for i in range(len(prev_step)):
if np.array_equal(act[r], prev_step[i][1]):
                    new_h = list(new_dic.items())[1]
```

```
                    r, v = new_h[0], new_h[1]
if np.array_equal(act[r], goal):
            print("\n")              print('''Problem Solved !.
Steps included are : \n''')
             prev_step.append([res[0], act[r]])
for i in prev_step:
                print(i[0])                  print(i[1])
print("\n")              run = False             print("Total
number of steps: " + str(count + 1))          else:
            prev_step.append([r, act[r]])
ola = act[r]               count+=1
     main()
```

Output:

```
Problem Solved !. Steps included are :

start_array
[[1 2 3]
 [0 4 6]
 [7 5 8]]


right
[[1 2 3]
 [4 0 6]
 [7 5 8]]


down
[[1 2 3]
 [4 5 6]
 [7 0 8]]


right
[[1 2 3]
 [4 5 6]
 [7 8 0]]


Total number of steps: 3
```

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