31115
Vedant Bothikar

Assignment 2

A* Algorithm

* Problem Statement :
Implement A* Algorithm for N-puzzle problem

* Objectives :
Students will be able to
① implement a* star algorithm for N-puzzle game
② learn concepts of OOP & search algorithms.

* Software Requirements:
Python 3.10.0
pycharm IDE

* Hardware Requirements :
Windows 10 8GB RAM
Intel i7 11th gen

* Theory:
There are 2 types of searching algorithms:

Uninformed Search	Informed Search
Binary Search	Eg: Heuristic Search
linear search	A* Algo
DFS & BFS	

* A* ~~&~~ Algorithm:

A* algorithm is one of the best & popular techniques used for path finding & graph traversal.
A lot of games & web based Maps use this algorithm for finding the shortest path efficiently.

- It is essentially a best fit search algorithm

* Working:

A* algorithm works as :

- It maintains a tree of paths originating at the start node.
- It extends those paths one edge at a time.
- It continues until its termination criterion is satisfied.

A* algorithm extends path that minimises fan function :

$$f(n) = g(n) + h(n)$$

h → Last node on path

g(n) → cost of path from start node to node 'n'

h(n) → heuristic func^{c} that estimates cost of the cheapest pattern from node 'n' to the goal node,

* Algorithm :

```
① Start
② openlist = closed list = [ ]
   put starting node to open list

③ while ( !open_list.empty() )
      3.1 find node with the least f on the open list → call it 'q'
      3.2. pop q off the open list
      3.3 generate q's 8 slice & set their parents to q.
      3.4 for each ~~Station~~ Successor
            3.4.1  if successor = goal
                          stop search
                   successor.g = q.g + dis b/w successor & q
                   successor.h = dist from goal to successor
                   succ.f = suc.g + succ.h
            3.4.2  if a node with the same position
                   an successor is in the open list which
                   has a lower 'f' than the succ. skip this
                                                     succ.
        end for loop

    3.5  push q on closed list
    end while loop
    Stop
```

* conclusion

We successfully solved N-puzzle problem using A* algorithm.