Name:- Prem Ubhe

Roll no:- B 66

Code:-

```
from collections import deque

class Graph():

    def __init__(self, adjacency_list):

        self.adjacency_list = adjacency_list

    def get_neighbors(self, v):

        return self.adjacency_list[v]

    # heuristic function with equal values for all nodes

    def h(self, n):

        H = {

            'A': 1,

            'B': 1,

            'C': 1,

            'D': 1

        }

        return H[n]

    def a_star_algorithm(self, start_node, stop_node):

        # open_list is a list of nodes which have been visited, but who's neighbors

        # haven't all been inspected, starts off with the start node

        # closed_list is a list of nodes which have been visited

        # and who's neighbors have been inspected

        open_list = set([start_node])

        closed_list = set([])

        # g contains current distances from start_node to all other nodes

        # the default value (if it's not found in the map) is +infinity

        g = {}

        g[start_node] = 0

        # parents contains an adjacency map of all nodes

        parents = {}

        parents[start_node] = start_node

        while len(open_list) > 0:
```

```
n = None
# find a node with the lowest value of f() - evaluation function
for v in open_list:
    if n == None or g[v] + self.h(v) < g[n] + self.h(n):
        n = v;
if n == None:
    print('Path does not exist!')
    return None
# if the current node is the stop_node
# then we begin reconstructin the path from it to the start_node
if n == stop_node:
    reconst_path = []
    while parents[n] != n:
        reconst_path.append(n)
        n = parents[n]
    reconst_path.append(start_node)
    reconst_path.reverse()
    print('Path found: {}'.format(reconst_path))
    return reconst_path
# for all neighbors of the current node do
for (m, weight) in self.get_neighbors(n):
    # if the current node isn't in both open_list and closed_list
    # add it to open_list and note n as it's parent
    if m not in open_list and m not in closed_list:
        open_list.add(m)
        parents[m] = n
        g[m] = g[n] + weight
    # otherwise, check if it's quicker to first visit n, then m
    # and if it is, update parent data and g data
    # and if the node was in the closed_list, move it to open_list
    else:
        if g[m] > g[n] + weight:
            g[m] = g[n] + weight
```

```
                parents[m] = n

                if m in closed_list:
                    closed_list.remove(m)
                    open_list.add(m)

        # remove n from the open_list, and add it to closed_list
        # because all of his neighbors were inspected
        open_list.remove(n)
        closed_list.add(n)

    print('Path does not exist!')
    return None

adjacency_list = {
    'A': [('B', 1), ('C', 3), ('D', 7)],
    'B': [('D', 5)],
    'C': [('D', 12)]
}
graph1 = Graph(adjacency_list)
graph1.a_star_algorithm('A', 'D')
```

Output:-

```
Path found: ['A', 'B', 'D']
Process finished with exit code 0
```