

AI LAB EXP – 5b

A* ALGORITHM FOR REAL WORLD PROBLEMS

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AIM

To implement A* Algorithm using python.

ALGORITHM

- We create two lists – Open List and Closed List (just like Dijkstra Algorithm)
- Initialize the open list
- Initialize the closed list put the starting node on the open list (you can leave its f at zero)
- While the open list is not empty
 1. Find the node with the least f on the open list, call it "q"
 2. Pop q off the open list
 3. Generate q's 8 successors and set their parents to q
 4. For each successor
 - i. If successor is the goal, stop search
 - ii. Else, compute both g and h for successor
 - $\text{successor.g} = \text{q.g} + \text{distance between successor and q}$
 - $\text{successor.h} = \text{distance from goal to successor}$ (This can be done using many ways, we will discuss three heuristics- Manhattan, Diagonal and Euclidean Heuristics)
 - $\text{successor.f} = \text{successor.g} + \text{successor.h}$
 - iii. If a node with the same position as successor is in the OPEN list which has a lower f than successor, skip this successor
 - iv. If a node with the same position as successor is in the CLOSED list which has a lower f than successor, skip this successor otherwise, add the node to the open list
 - end (for loop)
 - v. Push q on the closed list
 - end (while loop)

CODE

```
def aStarAlgo(start_node, stop_node):  
    open_set = set(start_node)
```

```

closed_set = set()
g = {}
parents = {}
g[start_node] = 0
parents[start_node] = start_node
while len(open_set) > 0:
    n = None
    for v in open_set:
        if n == None or g[v] + heuristic(v) < g[n] + heuristic(n):
            n = v
    if n == stop_node or Graph_nodes[n] == None:
        pass
    else:
        for (m, weight) in get_neighbors(n):
            if m not in open_set and m not in closed_set:
                open_set.add(m)
                parents[m] = n
                g[m] = g[n] + weight
            else:
                if g[m] > g[n] + weight:
                    g[m] = g[n] + weight
                    parents[m] = n
                    if m in closed_set:
                        closed_set.remove(m)
                    open_set.add(m)
    if n == None:
        print('Path does not exist!')
        return None
    if n == stop_node:
        path = []
        while parents[n] != n:
            path.append(n)

```

```
        n = parents[n]
        path.append(start_node)
        path.reverse()
        print('Path found: {}'.format(path))
        return path
    open_set.remove(n)
    closed_set.add(n)
    print('Path does not exist!')
    return None
```

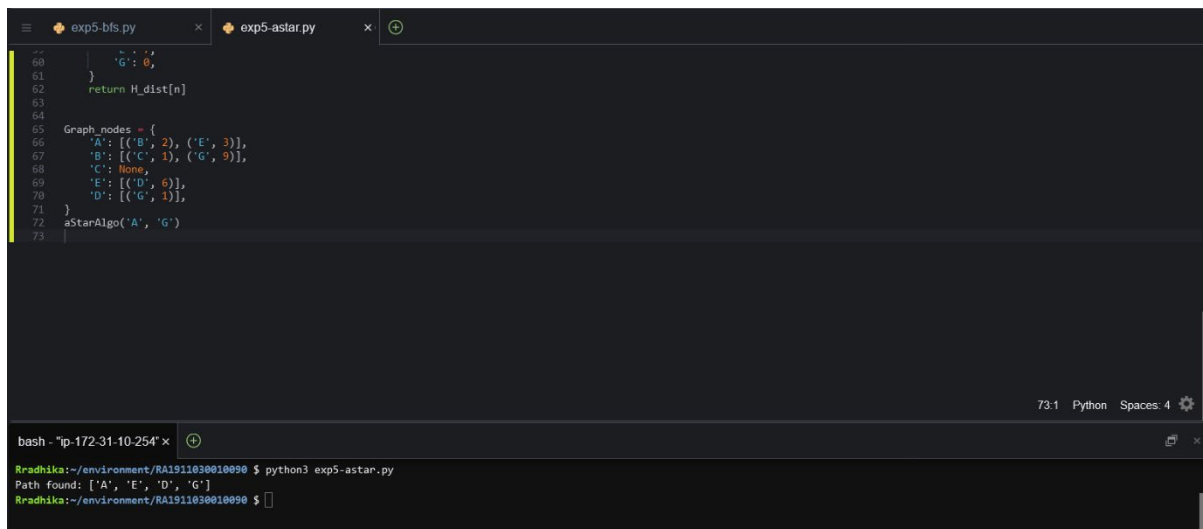
```
def get_neighbors(v):
    if v in Graph_nodes:
        return Graph_nodes[v]
    else:
        return None
```

```
def heuristic(n):
    H_dist = {
        'A': 11,
        'B': 6,
        'C': 99,
        'D': 1,
        'E': 7,
        'G': 0,
    }
    return H_dist[n]
```

```
Graph_nodes = {
    'A': [('B', 2), ('E', 3)],
```

```
'B': [('C', 1), ('G', 9)],  
'C': None,  
'E': [('D', 6)],  
'D': [('G', 1)],  
}  
aStarAlgo('A', 'G')
```

OUTPUT



The screenshot shows a code editor with two tabs: 'exp5-bfs.py' and 'exp5-astar.py'. The 'exp5-astar.py' tab is active, displaying a Python script that defines a graph and calls the 'aStarAlgo' function. The graph has nodes 'A', 'B', 'C', 'D', 'E', and 'G' with their respective neighbors and edge weights. The 'aStarAlgo' function is called with 'A' as the start node and 'G' as the goal node. Below the code editor, a terminal window shows the command 'python3 exp5-astar.py' being executed, resulting in the output 'Path found: ['A', 'E', 'D', 'G']'.

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exp5-bfs.py x exp5-astar.py x +  
60     'G': 0,  
61 }  
62 return H_dist[n]  
63  
64  
65 Graph_nodes = {  
66     'A': [('B', 2), ('E', 3)],  
67     'B': [('C', 1), ('G', 9)],  
68     'C': None,  
69     'E': [('D', 6)],  
70     'D': [('G', 1)],  
71 }  
72 aStarAlgo('A', 'G')  
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