Name: Richard Nadar

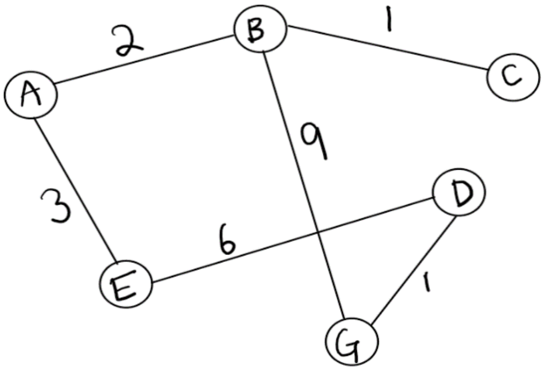
Reg No: RA1911030010109

AI LAB EXP-5

Implementation of A* Algorithm

AIM: To implement A* Algorithm using python

Graph:



Algorithm:

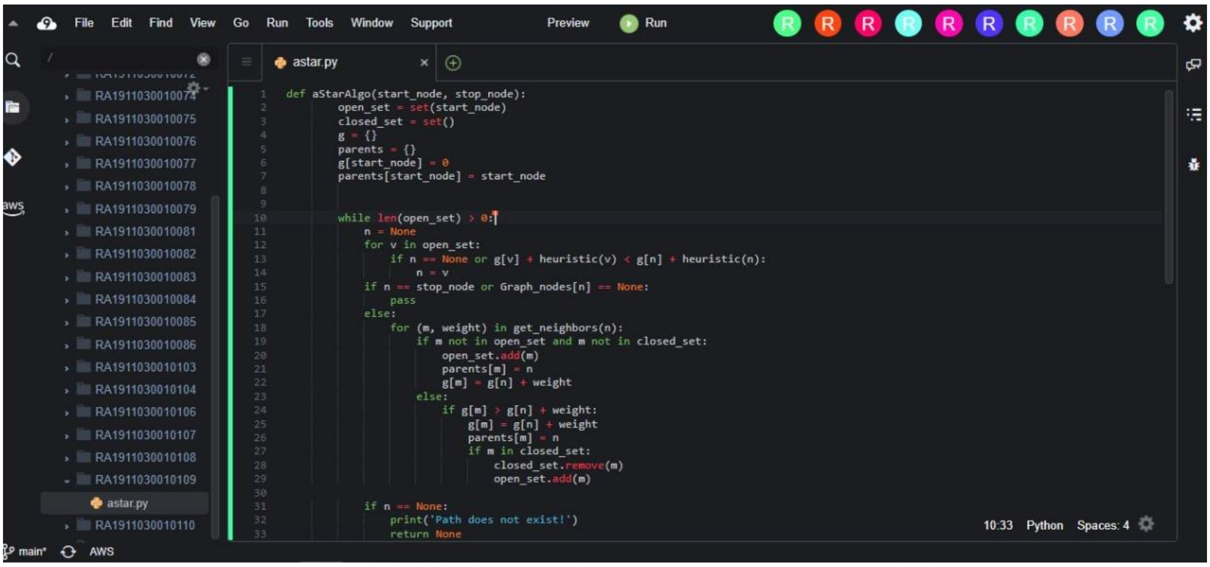
- *open set* is list of nodes which have been visited but neighbors haven't all been inspected whereas *closed set* is list of nodes which have been visited but neighbors have been inspected.
- *g* contains current distances from start node to all other nodes.
- parents contains adjacency map of all nodes
- we find a node with the lowest value of f() - evaluation function
- if the current node is the *stop_node* then we begin reconstructing the path from it to the *start_node*
- if the current node isn't in both *open set* and *closed set* add it to *open set* and note n as it's parent
- 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 set*, move it to *open set*
- remove n from the *open set*, and add it to *closed set* because all of his neighbors were inspected

CODE:

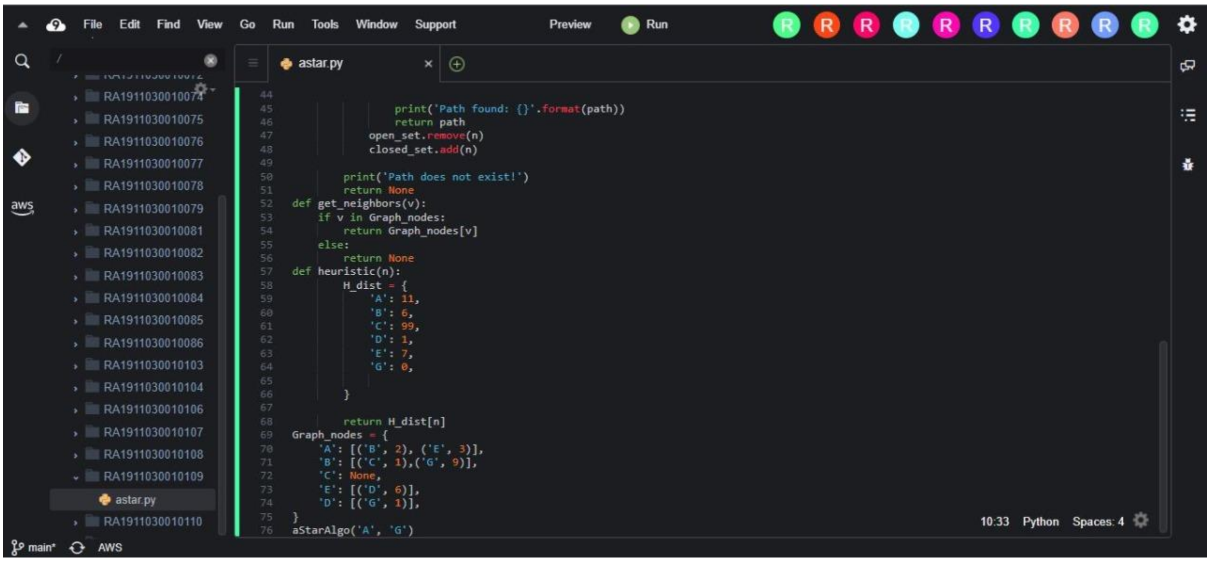
```
def aStarAlgo(start_node, stop_node):
    open_set = set(start_node)
    closed_set = set()
    g = {}
    parents = {}
    g[start_node] = 0
    parents[start_node] = start_node
    while len(open_set) > 0:
      n = None
      for v in open_set:
        if n == None or g[v] + heuristic(v) < g[n] + 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')
```

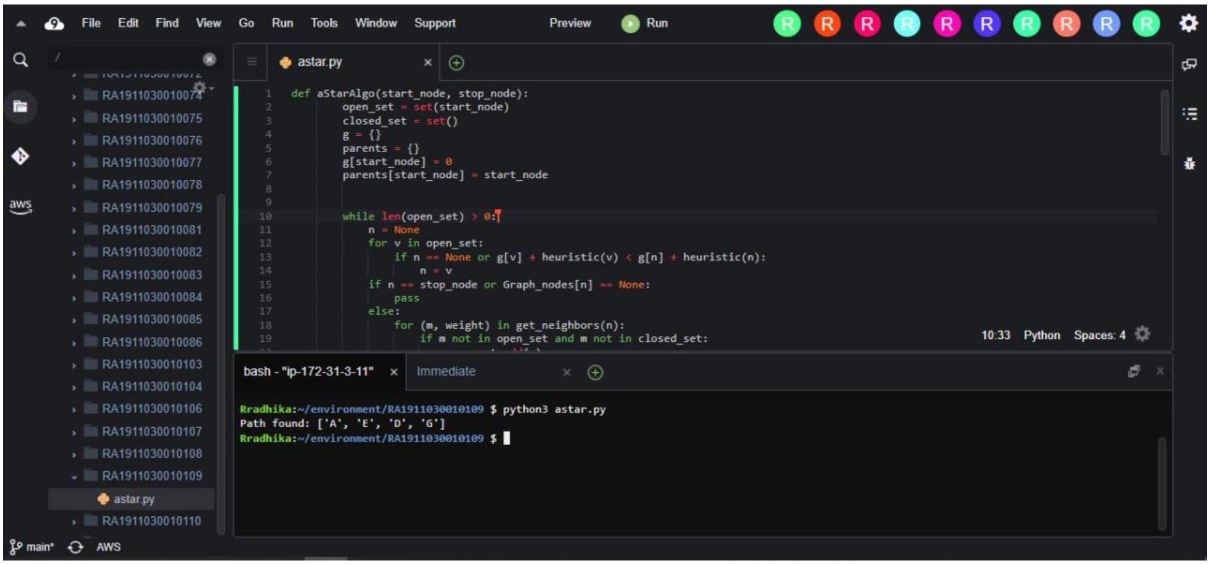
OUTPUT:



```python
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
```



```python

                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')
```



```python
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:
```

```
Rradhika:~/environment/RA1911030010109 $ python3 astar.py
Path found: ['A', 'E', 'D', 'G']
Rradhika:~/environment/RA1911030010109 $
```

RESULT: Therefore A* algorithm has been implemented successfully.