

Program 1: Implement A* Search algorithm.

```
def aStarAlgo(start_node, stop_node):

    open_set = set(start_node)
    closed_set = set()
    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
```

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        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': 10,
        'B': 8,
        'C': 5,
        'D': 7,
        'E': 3,
        'F': 6,
        'G': 5,
        'H': 3,
        'I': 1,
        'J': 0
    }

    return H_dist[n]

Graph_nodes = {

    'A': [('B', 6), ('F', 3)],
    'B': [('C', 3), ('D', 2)],
    'C': [('D', 1), ('E', 5)],
    'D': [('C', 1), ('E', 8)],
    'E': [('I', 5), ('J', 5)],
    'F': [('G', 1), ('H', 7)],
    'G': [('I', 3)],
    'H': [('I', 2)],
    'I': [('E', 5), ('J', 3)],

}

aStarAlgo('A', 'J')
```

Output

Path found: ['A', 'F', 'G', 'I', 'J']