

## LAB PROGRAM – 1

### A\* Search:

```
def aStarAlgo(start_node, stop_node):

    open_set = set(start_node)
    closed_set = set()

    g = {} #store distance from starting node
    parents = {} # parents contains an adjacency map of all nodes

    #distance of starting node from itself is zero
    g[start_node] = 0

    #start_node is root node i.e it has no parent nodes
    #so start_node is set to its own parent node
    parents[start_node] = start_node

    while len(open_set) > 0:
        n = None

        #node with lowest f() is found
        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):
                #nodes 'm' not in first and last set are added to first
                #n is set its parent
                if m not in open_set and m not in closed_set:
                    open_set.add(m)
```

```
parents[m] = n
g[m] = g[n] + weight
```

```
#for each node m,compare its distance from start i.e g(m) to the
#from start through n node
else:
```

```
    if g[m] > g[n] + weight:
        #update g(m)
        g[m] = g[n] + weight
        #change parent of m to n
        parents[m] = n
```

```
    #if m in closed set,remove and add to open
    if m in closed_set:
        closed_set.remove(m)
        open_set.add(m)
```

```
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:
    path = []
```

```
    while parents[n] != n:
        path.append(n)
        n = parents[n]
```

```
    path.append(start_node)
```

```
path.reverse()
```

```
print('Path found: {}'.format(path))
```

```
return path
```

```
# remove n from the open_list, and add it to closed_list
```

```
# because all of his neighbors were inspected
```

```
open_set.remove(n)
```

```
closed_set.add(n)
```

```
print('Path does not exist!')
```

```
return None
```

```
#define fuction to return neighbor and its distance
```

```
#from the passed node
```

```
def get_neighbors(v):
```

```
    if v in Graph_nodes:
```

```
        return Graph_nodes[v]
```

```
    else:
```

```
        return None
```

```
#for simplicity we ll consider heuristic distances given
```

```
#and this function returns heuristic distance for all nodes
```

```
def heuristic(n):
```

```
    H_dist = {
```

```
        'A': 11,
```

```
        'B': 6,
```

```
        'C': 5,
```

```
        'D': 7,
```

```
        'E': 3,
```

```
        'F': 6,
```

```
'G': 5,  
'H': 3,  
'I': 1,  
'J': 0  
}
```

```
return H_dist[n]
```

```
#Describe your graph here
```

```
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')
```