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)
```

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            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)
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            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,
```

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            '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')
```