**AI Lab – 5**

**BFS and A\***

**DIVYANSH SINHA**

**RA1811030010045**

**BFS (Best First Search)**

from queue import PriorityQueue

v = 14

graph = [[] for i in range(v)]

def best\_first\_search(source, target, n):

visited = [0] \* n

visited[0] = True

pq = PriorityQueue()

pq.put((0, source))

while pq.empty() == False:

u = pq.get()[1]

print(u, end=" ")

if u == target:

break

for v, c in graph[u]:

if (visited[v] == False):

visited[v] = True

pq.put((c, v))

print()

def addedge(x, y, cost):

graph[x].append((y, cost))

graph[y].append((x, cost))

addedge(0, 1, 6)

addedge(0, 2, 5)

addedge(1, 3, 9)

addedge(2, 4, 1)

addedge(2, 5, 8)

addedge(3, 6, 3)

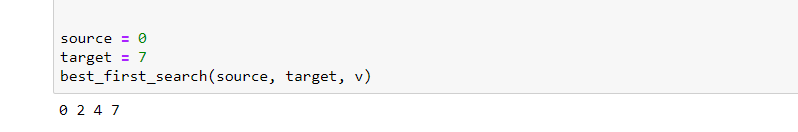
addedge(4, 7, 5)

source = 0

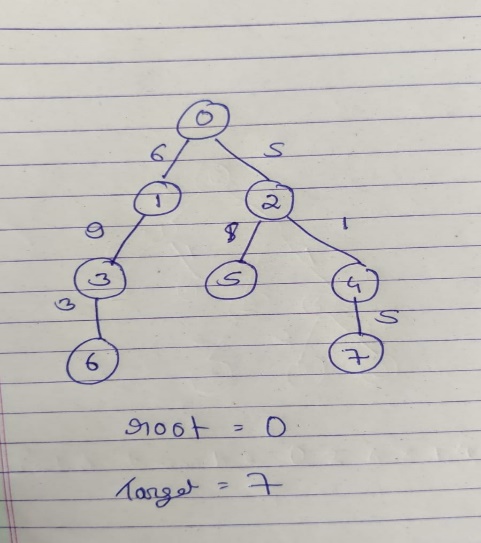
target = 7

best\_first\_search(source, target, v)

**Output:**



**Explanation:**



In this graph, we have applied the BFS, and the root node is 0, whereas the target node is 7, so the path which is more efficient that which cost less weight is 0, 2, 4, 7.

**A\***

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

#ditance 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': 99,

'D': 1,

'E': 7,

'G': 0,

}

return H\_dist[n]

#Describe your graph here

Graph\_nodes = {

'A': [('B', 2), ('E', 3)],

'B': [('C', 1),('G', 9)],

'C': None,

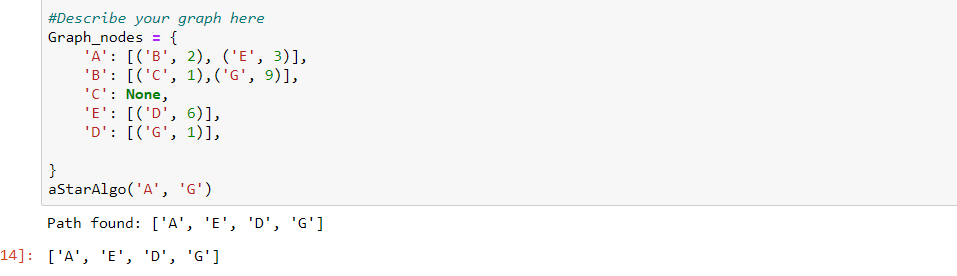
'E': [('D', 6)],

'D': [('G', 1)],

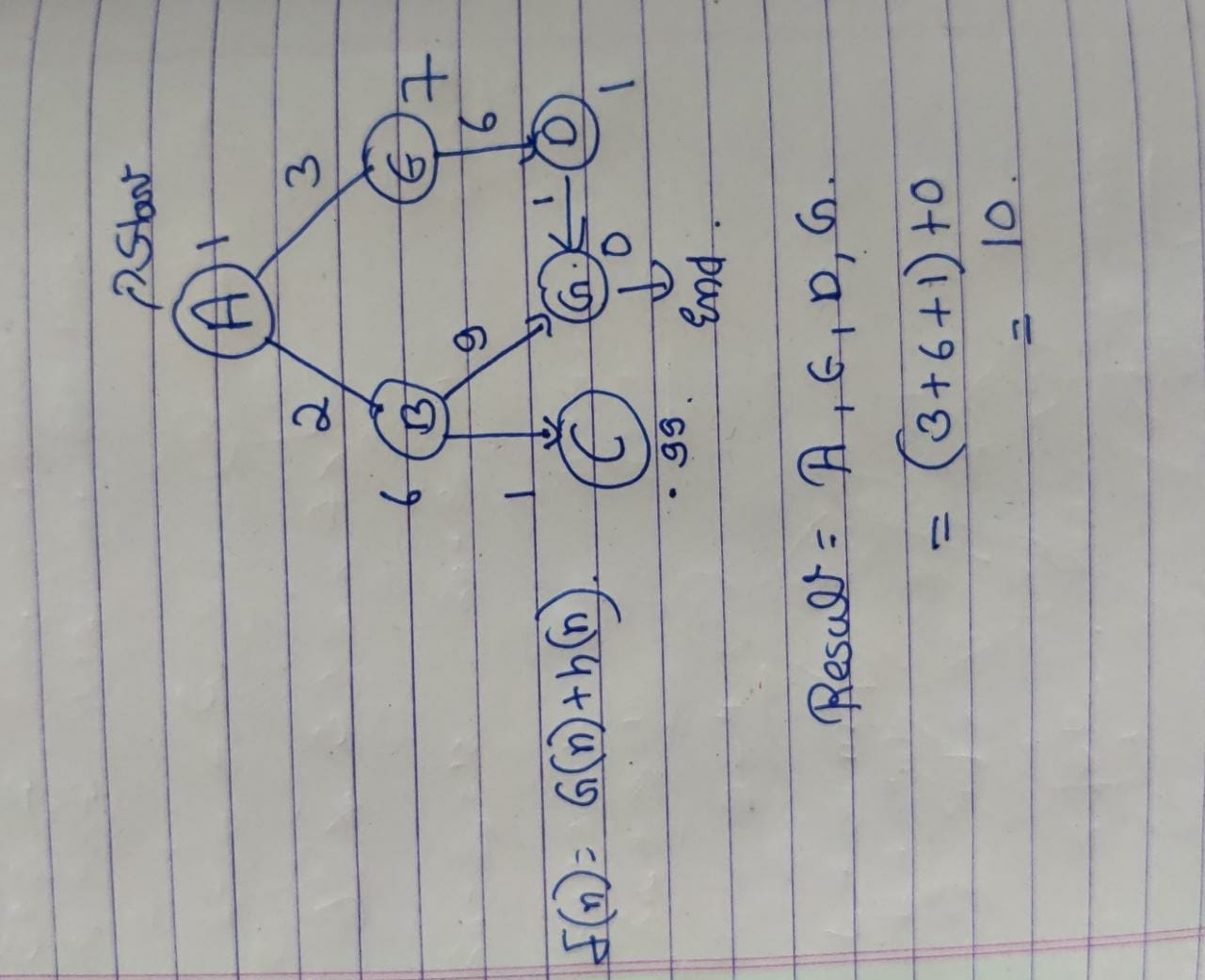
}

aStarAlgo('A', 'G')

**Output:**



**Explanation:**



In this graph, we have used the function F(n) = G(n) + h(n), where h(n) is the heuristic function and G(n) is holding the actual cost, thus from this graph the shortest path with least weight is A, E, D, G.

**Result:** Thus, both the algorithm code was written and executed successfully.