EX.No : 05 **DATE :30.08.2024**

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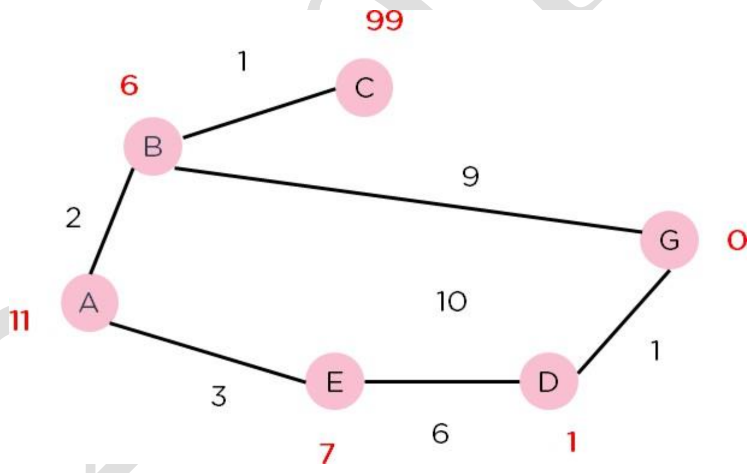
A* SEARCH ALGORITHM

- A heuristic algorithm sacrifices optimality, with precision and accuracy for speed, to solve problems faster and more efficiently.
- All graphs have different nodes or points which the algorithm has to take, to reach the final node. The paths between these nodes all have a numerical value, which is considered as the weight of the path. The total of all paths transverse gives you the cost of that route.
- Initially, the Algorithm calculates the cost to all its immediate neighboring nodes,n, and chooses the one incurring the least cost. This process repeats until no new nodes can be chosen and all paths have been traversed. Then, you should consider the best path among them. If f(n) represents the final cost, then it can be denoted as :

  f(n) = g(n) + h(n), where :

  g(n) = cost of traversing from one node to another. This will vary from node to node

  h(n) = heuristic approximation of the node's value. This is not a real value but an approximation cost.



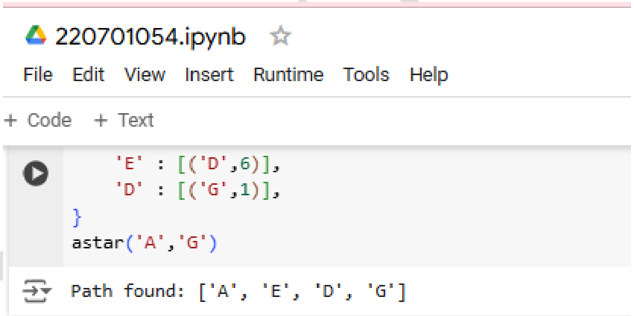
Code:

```
def astar(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

        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)],
}
astar('A','G')
```

Output:



Result:

Thus the code for A* is executed successfully.