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EXPERIMENT No. 4A - IMPLEMENTATION OF BFS

AIM.

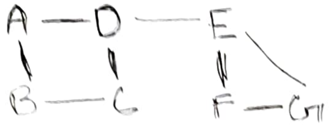
To implement BFS in python

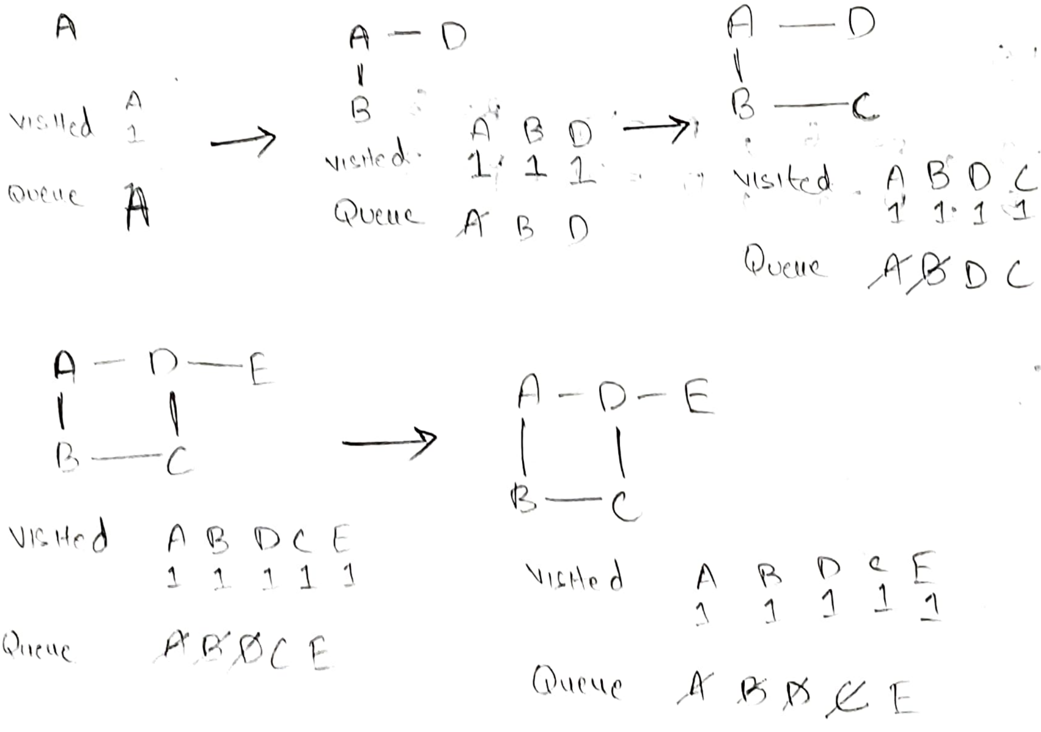
ALGORITHM

1. Create a queue
2. Mark each new node as visited and put that node into the queue
3. While Queue is non-empty
4. Remove the head of queue
5. Mark and enqueue all (unvisited) neighbors

ILLUSTRATION.

BFS





Visited A
1

Queue A

Visited A B D
1 1 1

Queue A B D

Visited A B D C
1 1 1 1

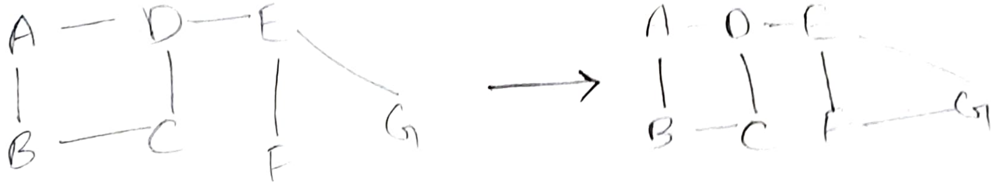
Queue ~~A~~ ~~B~~ D C

Visited A B D C E
1 1 1 1 1

Queue ~~A~~ ~~B~~ ~~D~~ C E

Visited A B D C E
1 1 1 1 1

Queue ~~A~~ ~~B~~ ~~D~~ ~~C~~ E

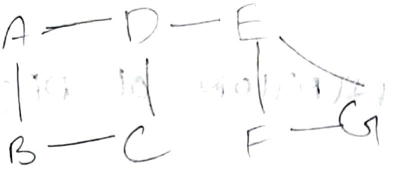


Visited	A	B	D	C	E	F	G
	1	1	1	1	1	1	1

Queue ~~A~~ ~~B~~ ~~D~~ ~~C~~ ~~E~~ F G

Visited	A	B	D	C	E	F	G
	1	1	1	1	1	1	1

Queue ~~A~~ ~~B~~ ~~D~~ ~~C~~ ~~E~~ ~~F~~ G

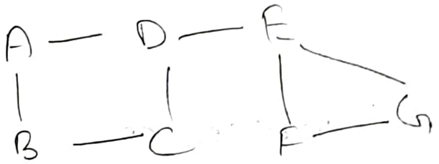


Visited	A	B	D	C	E	F	G
	1	1	1	1	1	1	1

Queue ~~A~~ ~~B~~ ~~D~~ ~~C~~ ~~E~~ ~~F~~ ~~G~~

BFS Traversal : ABDCEFG

DFS



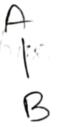
A

Visited	A
	1

Stack

B
D

→

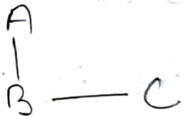


Visited	A	B
	1	1

Stack

C
D

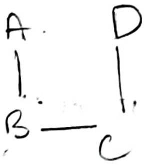
→



Visited	A	B	C
	1	1	1

Stack

D

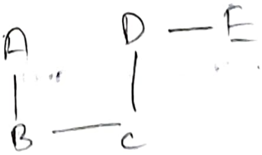


Visited	A	B	C	D
	1	1	1	1

Stack

E

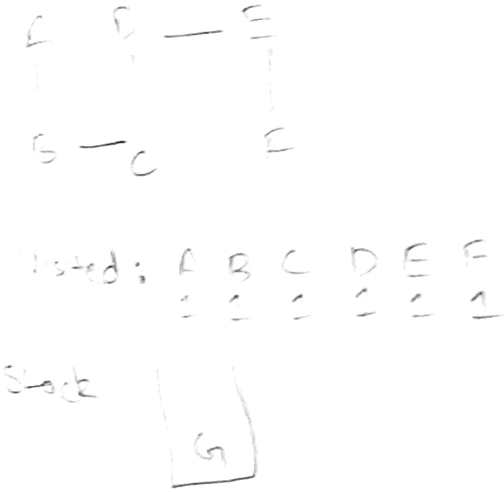
→

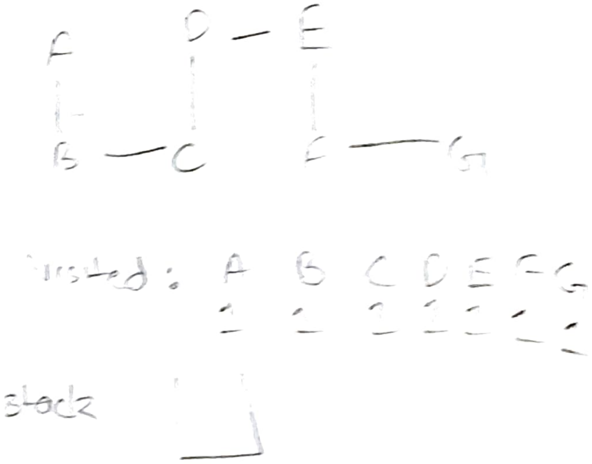


Visited	A	B	C	D	E
	1	1	1	1	1

Stack

F
G





EXPERIMENT No. 4b - IMPLEMENTATION OF DFS

AIM

To implement DFS in python

ALGORITHM

The DFS algorithm works as follows:

1. Start by putting any one of the graphs' vertices on top of stack
2. Take the top item of the stack and add it to the visited list
3. Create a list of that vertex's adjacent nodes.
4. Add the ones which aren't in the visited list to the top of the stack
5. Keep reapeating steps 2 and 3. until, the stack is empty.

EXPERIMENT No. 4c - IMPLEMENTATION OF UCS

AIM

To calculate the shortest path with cost for the given problem using UCS. (Uniform Cost Search)

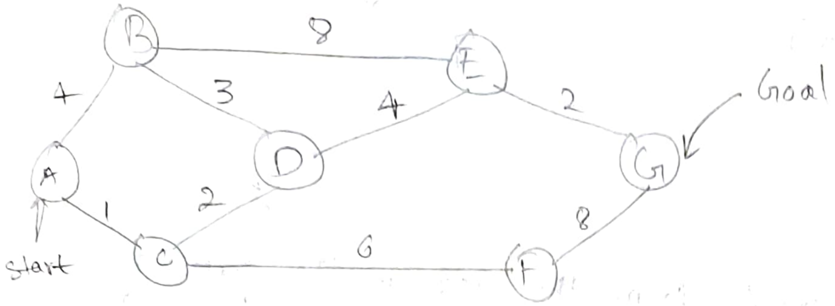
ALGORITHM

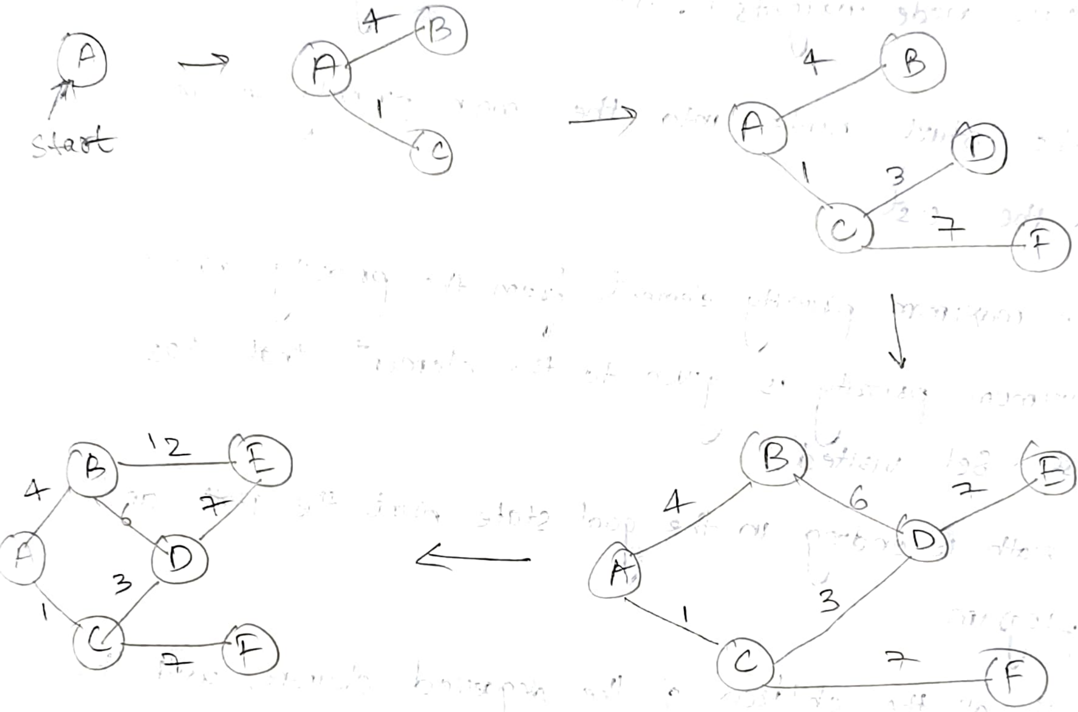
1. Start
2. Get the grap as an input from the user in the form of (node, adjacent, node, weights). Get start and goal node also in the input.
3. Insert the start node into the main priority queue along with the cost.
4. Deque the maximum priority element from the priority queue. Here the maximum priority is given to the element that has minimum cost. Set visited.
5. If the path is ending in the goal state print the path and exit the program.
6. Else insert all the children of the dequeued element, with the cumulative costs in the priority queue if not visited.
7. Repeat given step 4 again until the queue is empty.
8. Stop.

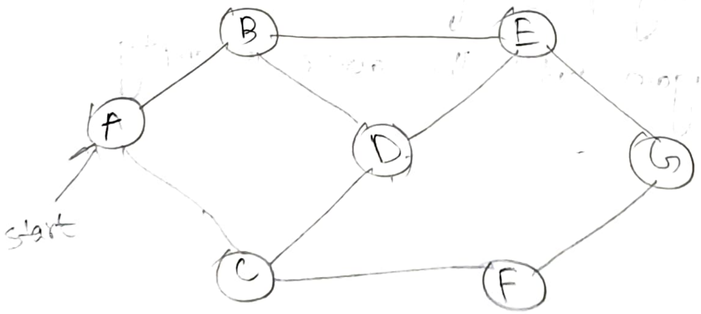
RESULT

BFS, DFS and UCS was successfully implemented in Python.

I- ILLUSTRATION



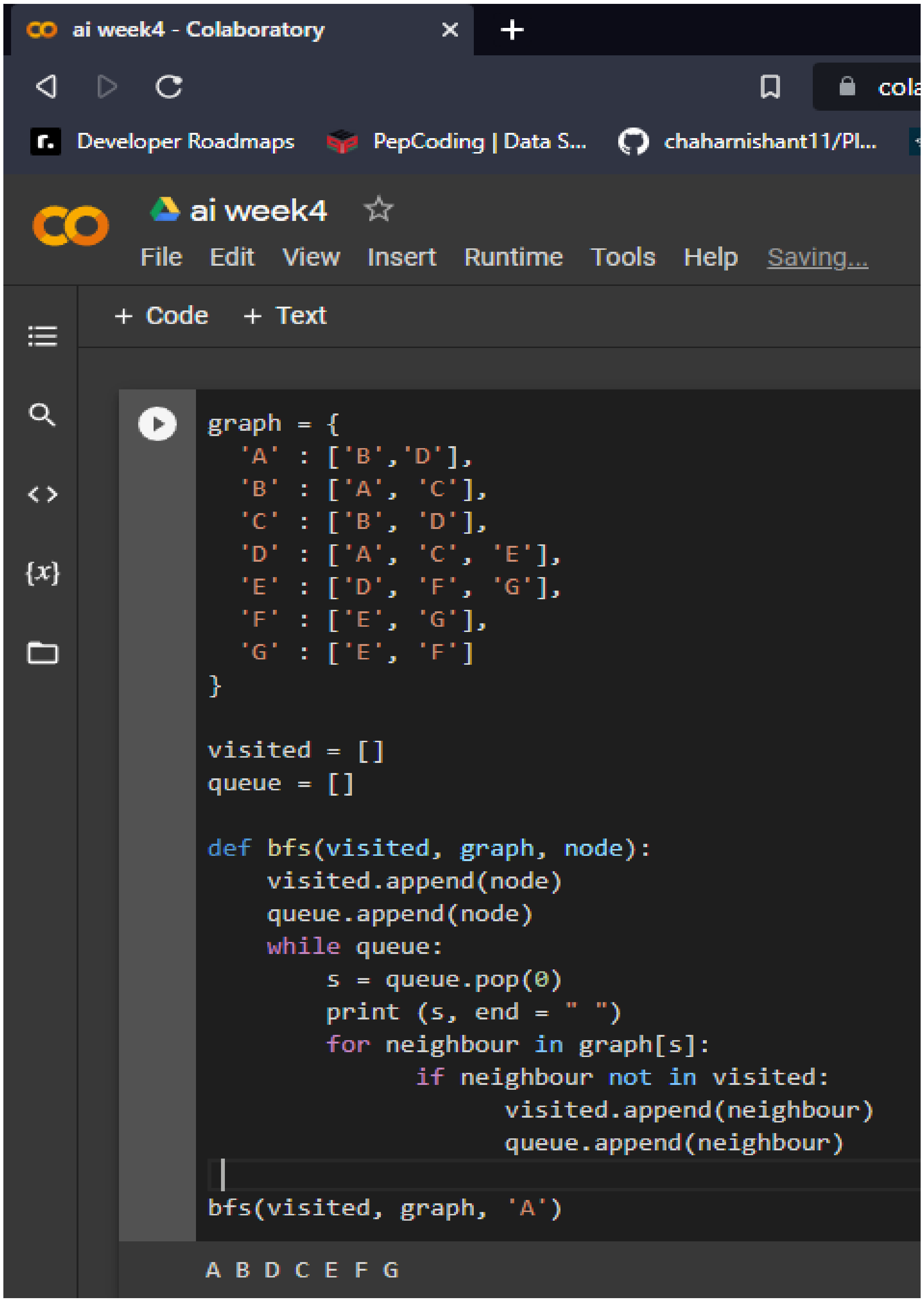




Minimum Cost = 9

Path = [A, C, D, E, G]

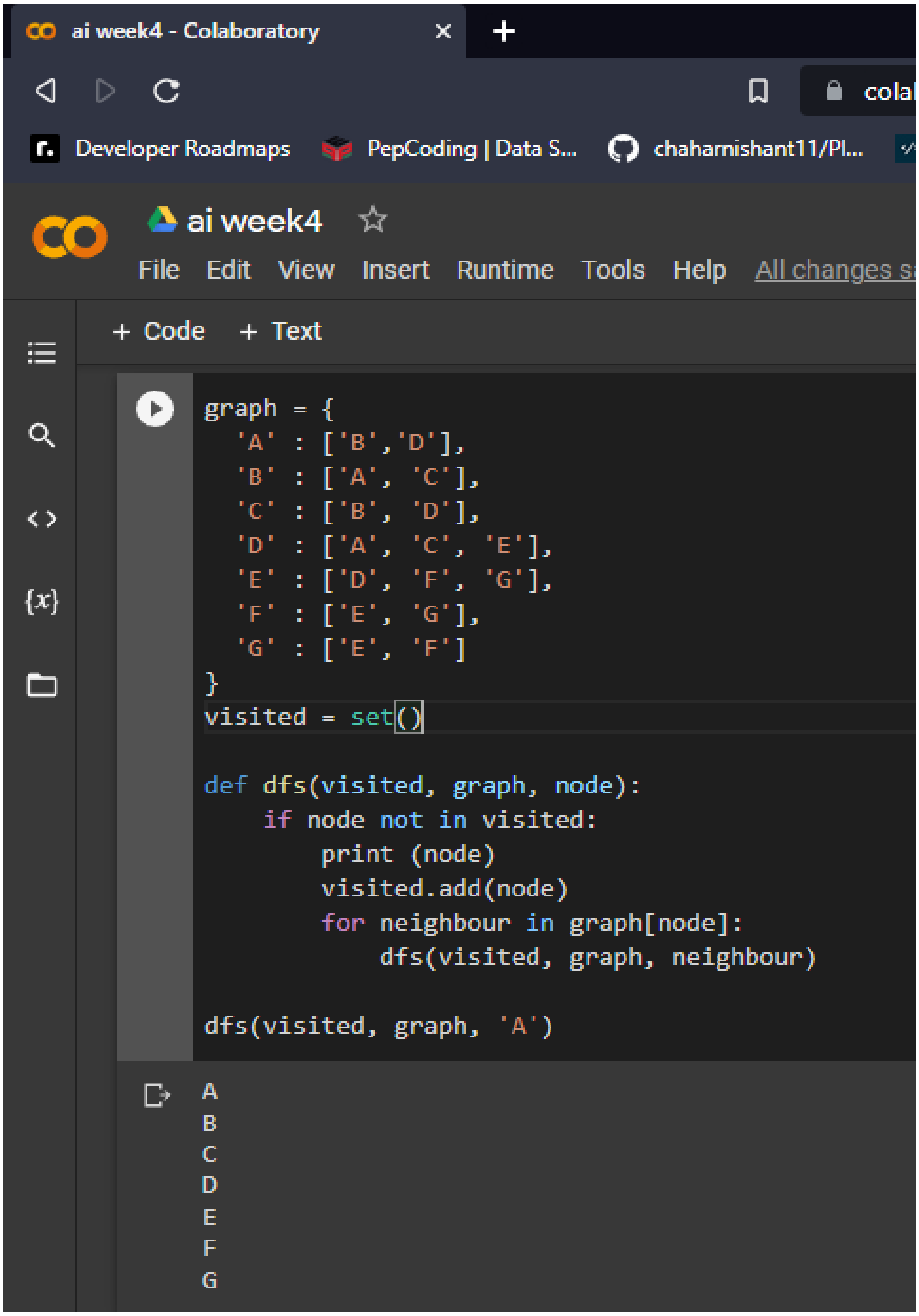
BFS



```
graph = {
  'A' : ['B','D'],
  'B' : ['A', 'C'],
  'C' : ['B', 'D'],
  'D' : ['A', 'C', 'E'],
  'E' : ['D', 'F', 'G'],
  'F' : ['E', 'G'],
  'G' : ['E', 'F']
}

visited = []
queue = []

def bfs(visited, graph, node):
    visited.append(node)
    queue.append(node)
    while queue:
        s = queue.pop(0)
        print (s, end = " ")
        for neighbour in graph[s]:
              if neighbour not in visited:
                    visited.append(neighbour)
                    queue.append(neighbour)

bfs(visited, graph, 'A')
```

```
A B D C E F G
```

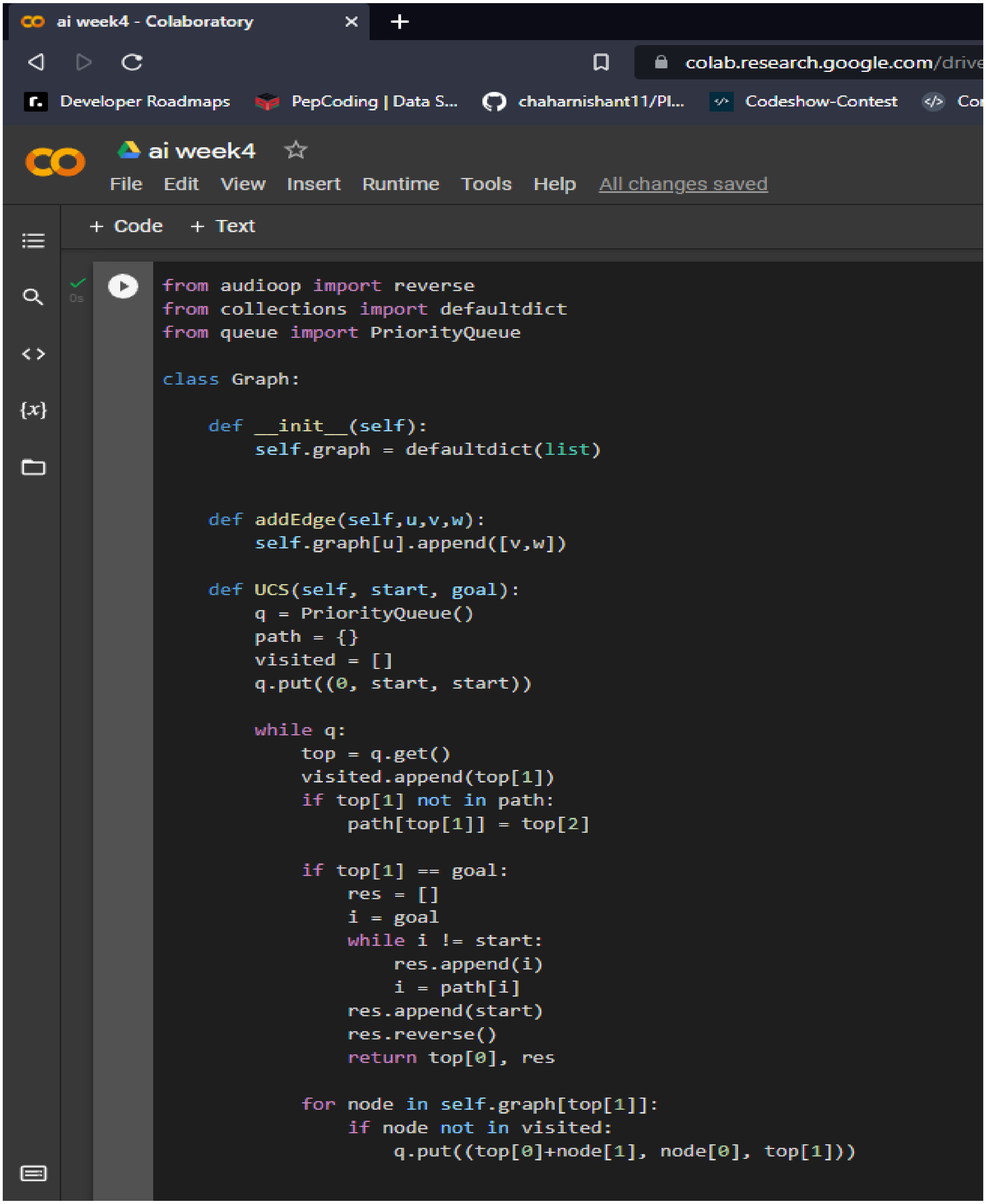
DFS



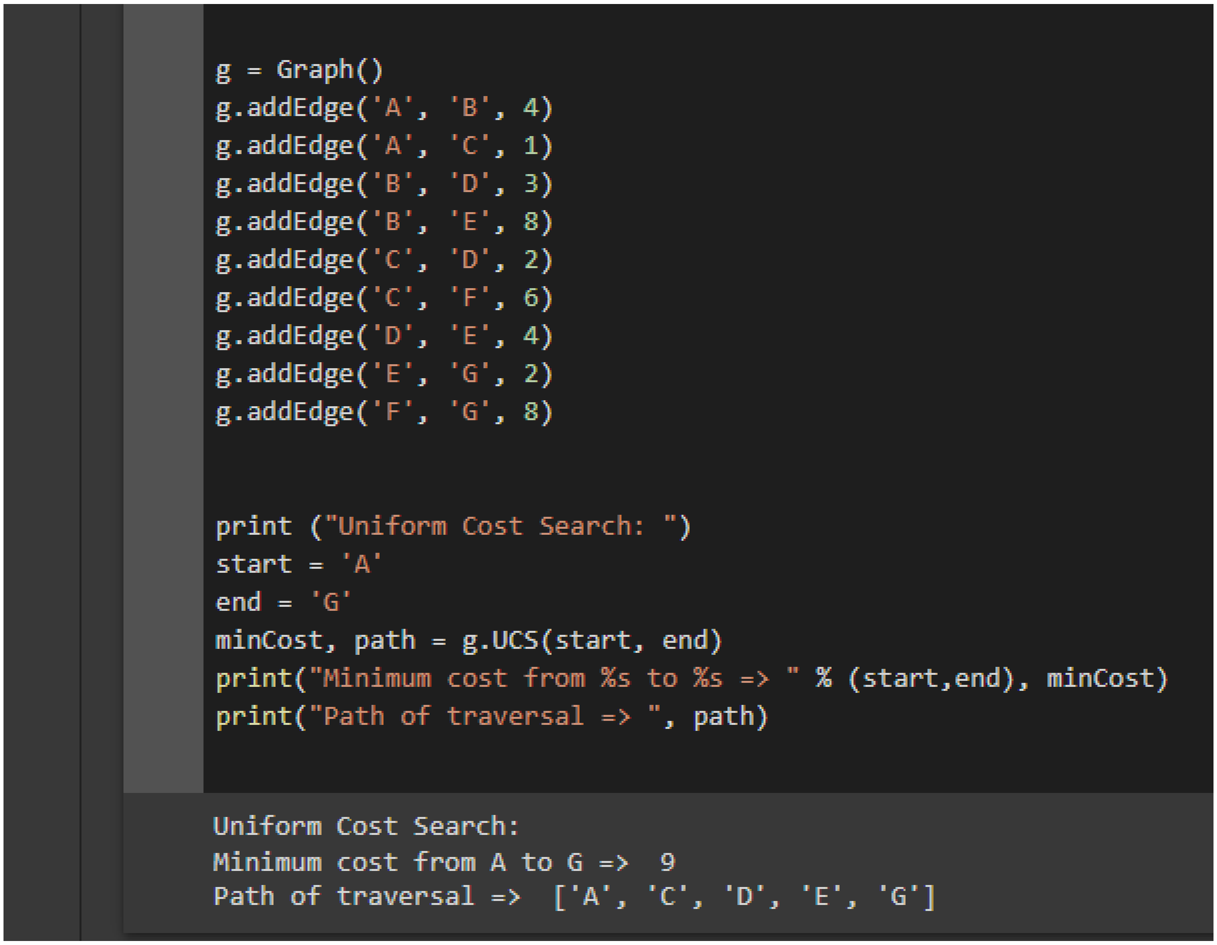
```
graph = {
  'A' : ['B','D'],
  'B' : ['A', 'C'],
  'C' : ['B', 'D'],
  'D' : ['A', 'C', 'E'],
  'E' : ['D', 'F', 'G'],
  'F' : ['E', 'G'],
  'G' : ['E', 'F']
}
visited = set()

def dfs(visited, graph, node):
    if node not in visited:
        print (node)
        visited.add(node)
        for neighbour in graph[node]:
            dfs(visited, graph, neighbour)

dfs(visited, graph, 'A')
```

```
A
B
C
D
E
F
G
```

UCS



```python
from audioop import reverse
from collections import defaultdict
from queue import PriorityQueue

class Graph:

    def __init__(self):
        self.graph = defaultdict(list)


    def addEdge(self,u,v,w):
        self.graph[u].append([v,w])

    def UCS(self, start, goal):
        q = PriorityQueue()
        path = {}
        visited = []
        q.put((0, start, start))

        while q:
            top = q.get()
            visited.append(top[1])
            if top[1] not in path:
                path[top[1]] = top[2]

            if top[1] == goal:
                res = []
                i = goal
                while i != start:
                    res.append(i)
                    i = path[i]
                res.append(start)
                res.reverse()
                return top[0], res

            for node in self.graph[top[1]]:
                if node not in visited:
                    q.put((top[0]+node[1], node[0], top[1]))
```



```
g = Graph()
g.addEdge('A', 'B', 4)
g.addEdge('A', 'C', 1)
g.addEdge('B', 'D', 3)
g.addEdge('B', 'E', 8)
g.addEdge('C', 'D', 2)
g.addEdge('C', 'F', 6)
g.addEdge('D', 'E', 4)
g.addEdge('E', 'G', 2)
g.addEdge('F', 'G', 8)


print ("Uniform Cost Search: ")
start = 'A'
end = 'G'
minCost, path = g.UCS(start, end)
print("Minimum cost from %s to %s => " % (start,end), minCost)
print("Path of traversal => ", path)
```

```
Uniform Cost Search:
Minimum cost from A to G =>  9
Path of traversal =>  ['A', 'C', 'D', 'E', 'G']
```