Experiment No. 3

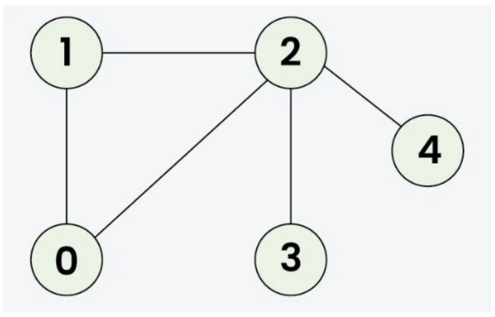
Aim: To implement DFS algorithm using python.

Theory:

Depth First Traversal (or DFS) for a graph is similar to Depth First Traversal of a tree. The only catch here is, that, unlike trees, graphs may contain cycles (a node may be visited twice). To avoid processing a node more than once, use a Boolean visited array. A graph can have more than one DFS traversal.

Note : There can be multiple DFS traversals of a graph according to the order in which we pick adjacent vertices. Here we pick vertices as per the insertion order.

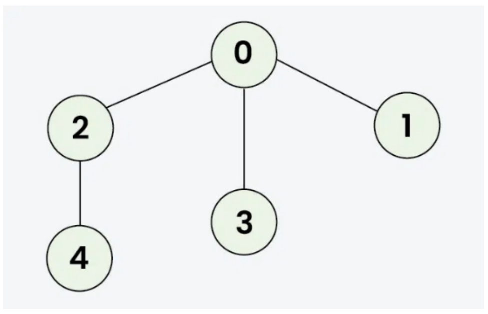
Input: adj = [[1, 2], [0, 2], [0, 1, 3, 4], [2], [2]]



Output: 1 0 2 3 4
Explanation: The source vertex s is 1. We visit it first, then we visit an adjacent.
Start at 1: Mark as visited. Output: 1
Move to 0: Mark as visited. Output: 0 (backtrack to 1)
Move to 2: Mark as visited. Output: 2 (backtrack to 0)
Move to 3: Mark as visited. Output: 3 (backtrack to 2)
Move to 4: Mark as visited. Output: 4 (backtrack to 2)

Not that there can be more than one DFS Traversals of a Graph. For example, after 1, we may pick adjacent 2 instead of 0 and get a different DFS. Here we pick in the insertion order.

Input: [[2,3,1], [0], [0,4], [0], [2]]



Output: 0 2 4 3 1
Explanation: DFS Steps:

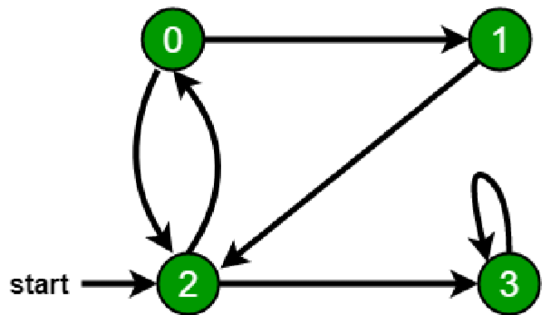
Start at 0: Mark as visited. Output: 0
Move to 2: Mark as visited. Output: 2

Move to 4: Mark as visited. Output: 4 (backtrack to 2, then backtrack to 0)
Move to 3: Mark as visited. Output: 3 (backtrack to 0)
Move to 1: Mark as visited. Output: 1

DFS Algorithm Time Complexity: O(V+E) where V is the number of vertices in the graph and E is the number of edges

Auxiliary Space: O(V+E)

Python Code:



```
from collections import defaultdict

# This class represents a directed graph using
# adjacency list representation
class Graph:

# Constructor
def __init__(self):

# Default dictionary to store graph
self.graph = defaultdict(list)


# Function to add an edge to graph
def addEdge(self, u, v):
self.graph[u].append(v)


# A function used by DFS
def DFSUtil(self, v, visited):

# Mark the current node as visited
# and print it
visited.add(v)
print(v, end=' ')

# Recur for all the vertices
# adjacent to this vertex
for neighbour in self.graph[v]:
```

```
if neighbour not in visited:
self.DFSUtil(neighbour, visited)


# The function to do DFS traversal. It uses
# recursive DFSUtil()
def DFS(self, v):

# Create a set to store visited vertices
visited = set()

# Call the recursive helper function
# to print DFS traversal
self.DFSUtil(v, visited)


# Driver's code
if __name__ == "__main__":
g = Graph()
g.addEdge(0, 1)
g.addEdge(0, 2)
g.addEdge(1, 2)
g.addEdge(2, 0)
g.addEdge(2, 3)
g.addEdge(3, 3)

print("Following is Depth First Traversal (starting from vertex 2)")

# Function call
g.DFS(2)
```

Procedure:

1)
2)
3)

Result:

Conclusion: