Depth First Search

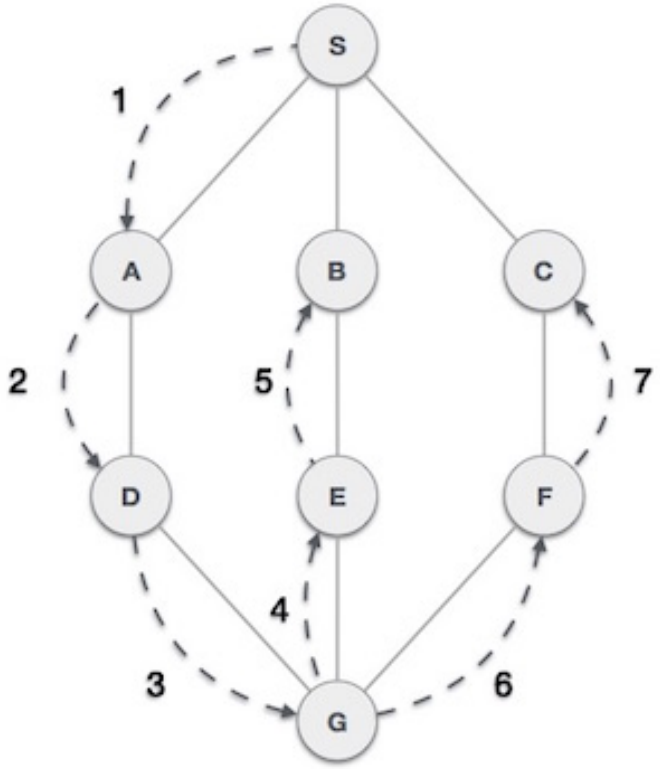
> 💡 Depth first Search or Depth first traversal is a recursive algorithm for searching all the vertices of a graph or tree data structure. Traversal means visiting all the nodes of a graph

This algorithm traverses a graph in a depth-ward motion and uses a stack to remember to get the next vertex to start a search, when a dead end occurs in any iteration.

A standard DFS implementation puts each vertex of the graph into one of two categories:

1. Visited
2. Not Visited

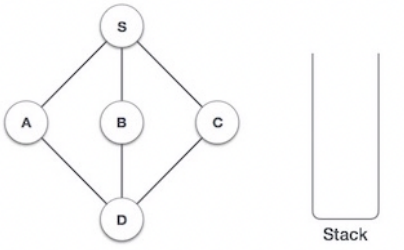
The purpose of the algorithm is to mark each vertex as visited while avoiding cycles.

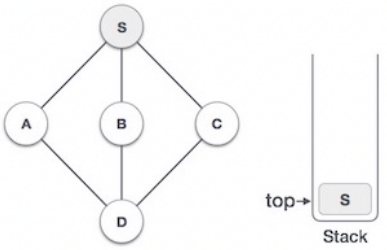
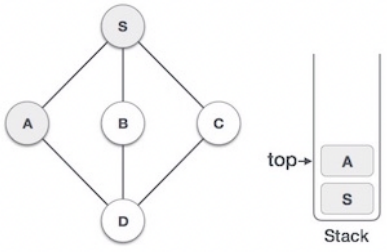
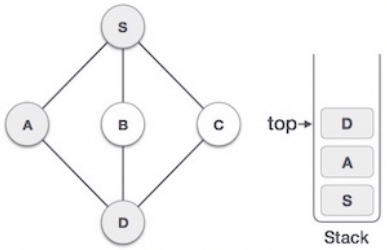
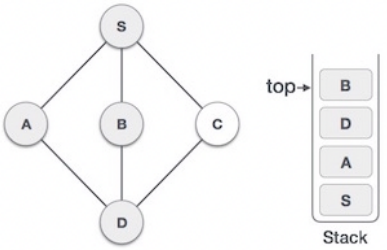
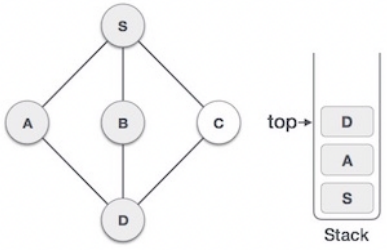


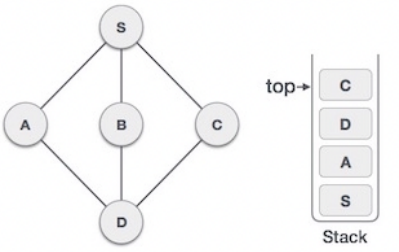
→ Depth First Search in Queue Structure

Algorithm steps

1. Start by putting any one of the graph's vertices on top of a 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. Add the ones which aren't in the visited list to the top of the stack.
4. Keep repeating steps 2 and 3 until the stack is empty.

1		Initialize the stack.

2		Mark **S** as visited and put it onto the stack. Explore any unvisited adjacent node from **S**. We have three nodes and we can pick any of them. For this example, we shall take the node in an alphabetical order.
3		Mark **A** as visited and put it onto the stack. Explore any unvisited adjacent node from A. Both **S** and **D** are adjacent to **A** but we are concerned for unvisited nodes only.
4		Visit **D** and mark it as visited and put onto the stack. Here, we have **B** and **C** nodes, which are adjacent to **D** and both are unvisited. However, we shall again choose in an alphabetical order.
5		We choose **B**, mark it as visited and put onto the stack. Here **B** does not have any unvisited adjacent node. So, we pop **B** from the stack.
6		We check the stack top for return to the previous node and check if it has any unvisited nodes. Here, we find **D** to be on the top of the stack.

7		Only unvisited adjacent node is from **D** is **C** now. So we visit **C**, mark it as visited and put it onto the stack.

Depth First Search : S A D B C

Pseudocode

```
DFS(G, u)
    u.visited = true
    for each v ∈ G.Adj[u]
        if v.visited == false
            DFS(G,v)

init() {
    For each u ∈ G
        u.visited = false
     For each u ∈ G
       DFS(G, u)
}
```

Analysis

- The time complexity of the DFS algorithm is represented in the form of O(V + E), where V is the number of nodes and E is the number of edges.

Real World Application of Depth First Search

1. For finding the path
2. To test if the graph is bipartite

3. For finding the strongly connected components of a graph
4. For detecting cycles in a graph

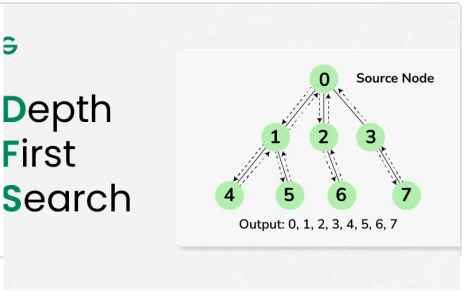
📌 Java implementation can be found under Implementation_Java folder

📚 References

DFS traversal of a Tree - GeeksforGeeks

A Computer Science portal for geeks. It contains well written, well thought and well explained computer science and programming articles, quizzes and practice/competitive

https://www.geeksforgeeks.org/dfs-traversal-of-a-tree-using-recursion/



Depth First Search (DFS) Algorithm

Depth First Search (DFS) Algorithm - Depth First Search (DFS) algorithm is a recursive algorithm for searching all the vertices of a graph or tree data structure. This algorithm

https://www.tutorialspoint.com/data_structures_algorithms/depth_first_traversal.htm

tutorialspoint

Depth First Search (DFS) Algorithm

Depth First Search is a recursive algorithm for searching all the vertices of a graph or tree data structure. In this tutorial, you will learn about the depth-first search with examples in Java, C, Python, and C++.

https://www.programiz.com/dsa/graph-dfs

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SerhatKumas - Overview

Computer engineering student who loves coding in different fields instead of focusing on a one spesific area. - SerhatKumas

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