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**DFS with stack**

**Introduction:**

DFS stands for depth first search it is an algorithm that is used to explore all the nodes in a graph or tree. DFS start at a given node and explore as far as possible along each branch before backtracking. this makes it a good choice when you are looking to explore deep path first.

It can be used in two main ways:

1: recursive DFS that is used in system call.

2: iterative DFS that uses a manually controlled stack.

**Usage:**

* Path finding for example in games and maps.
* Solving puzzle.
* Checking if a graph is connected.
* Topological sorting.
* Finding connected components in the graphs.
* Detecting cycles in a graph.

**Advantages:**

* You avoid recursion limits by using your own stack.
* DFS can be more memory efficient than the BFS
* DFS is good when you want to go in deep search before checking others.
* With a manual stack you can customize how nodes are pushed and proceed.
* DFS is help full in solving puzzle.
* Puzzle like maze**.**

**Disadvantages:**

* DFS might follow a long path and miss shorter solutions.
* Unlike BFS, DFS does not guarantee the shortest path in an unweighted path.
* If the graph is very deep or has many branches the stack can grow large.
* The order of traversal can vary depending on how neighbors are added to the stack.

**Topic: research on in order, preorder, Post order in DFS.**

**In order DFS:**

**Introduction:**

In order DFS in a way to traverse a binary tree. It is one of the most common tree traversal method and is especially useful when working with binary search tree. In order DFS each node has at most two children’s a left and right child.

In order we first go to left then the root and then right.

**Example by graph:**

If we take the example of in order DFS we came to know that there are two children of each node.

**1**

**/ \**

**2 3**

**/ \**

**4 5**

In this graph 1 have two children’s then as 2 have two children’s.

**Preorder:**

**Introduction:**

Preorder DFS is a fundamental method for exploring or processing a binary tree. It gets its name from the fact that the current node is proceed before its child hence pre order.

It copies or clone a tree because visiting the node first ensure you know its structure before moving on.

We have to generate a prefix expression from the expression tree which is helpful in compiler and calculator.

**Example graph:**

Here is the example graph preorder in DFS. there are two children of each node but there are two children and then the two child of C.

**A**

**/ \**

**B C**

**/ / \**

**D E F**

**Post order:**

**Introduction:**

Post order traversal is a type of DFS strategy used primarily in trees and graphs, where the nodes are processed after all their descendants have been visited.

In post order your first recursively visit all the child nodes and then only proceed the current node.

In tropical sorting of graphs, post-order can help order nodes based on dependencies**.**

**Example graph:**

In this graph it will visit the child first then it visits the nodes.

**A**

**/ \**

**B C**

**/ / \**

**D E F**