Lab Practice - V

Assignment No. 1

Title : Design and implement Parallel Breadth First Search and Depth First Search based on existing algorithms using OpenMP. Use a Tree or Undirected graph for BFS and DFS.

Objective : Students should be able to perform parallel DFS and BFS on existing algorithms using OpenMP.

Prerequisite :-
1. Basics of Programming Language
2. Concepts of BFS and DFS
3. Concept of Parallelism

Contents For theory :
1. What is DFS and BFS ?
2. Example of DFS and BFS
3. Concept of Open MP
4. How Parallel DFS work

Theory :-

What is DFS

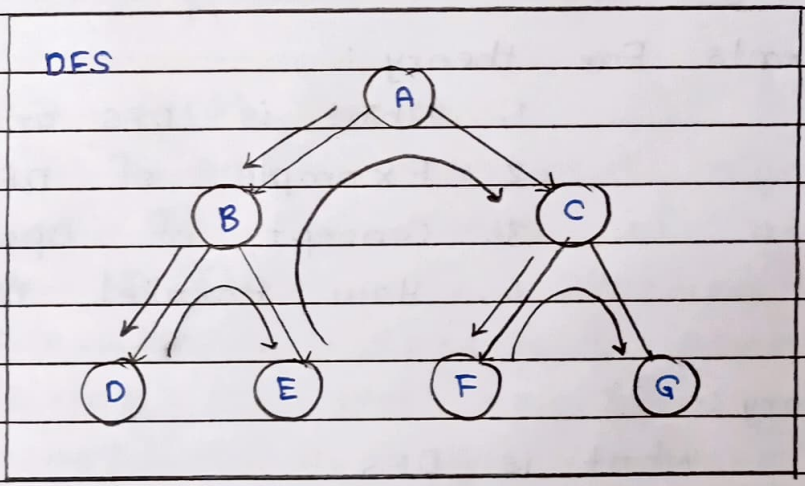
DFS Stands for Depth First Search. It is a popular Graph traversal algorithm that explores as far as possible along each branch before backtracking. This algorithm can be used to find shortest path

between two vertices or to traverse a graph in a systematic way. The algorithm starts at the root node and explores as far as possible along each branch before backtracking.

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

1. Visited
2. Non-visited

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



To implement DFS traversal:

Step 1: Create a stack with total number of vertices in graph as size

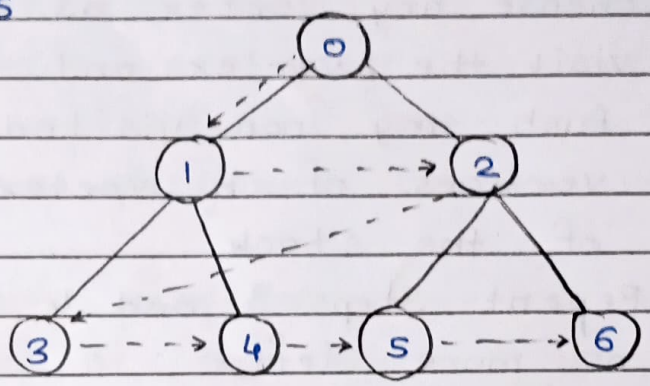
Step 2: Choose any vertex as beginning point, visit the vertex and add to stack.
Step 3: Push any non-visited adjacent vertices of a vertex at the top of the stack.
Step 4: Repeat steps 3 and 4 until there are no more left
Step 5: If there are no new vertices to visit, go back and pop one using backtracking.
Step 6: Continue using steps 3 to 5 until stack is empty.
Step 7: When stack is empty, create the final spanning tree by deleting graph's unused edges.

Breadth First Search:-

BFS is a graph traversal algorithm used to explore all the nodes of a graph or tree systematically. Starting from the root node or a specified starting point and visiting all the neighbouring nodes at the current depth level before moving on to the next depth level.

BFS is commonly used in many applications, such as finding the shortest path between two nodes, solving puzzles and searching through a tree or graph

BFS



Steps in traversing a graph using BFS

Step 1: Take an empty Queue

Step 2: Select starting node and insert it into Queue

Step 3: Extract the node from the Queue and insert its child nodes into the Queue

Step 4: Print the extracted node

Concept of OpenMP :-

> OpenMP (Open Multi-Processing) is an API that supports shared-memory parallel programming in C, C++ and Fortran. It can be used to write parallel programs that can run on multicore processors.

> OpenMP provides a set of directives and functions that can be inserted into the source code of a program to

parallelize its execution. These Directives are simple and easy to use, and they can be applied to loops, sections, functions and other program constructs.

> OpenMP programs are designed to take advantage of the shared-memory architecture of Modern processors, where multiple processor cores can access the same memory.

How Parallel DFS, BFS work:

> Parallel DFS work by dividing the graph into smaller subgraphs that are explored simultaneously. Each processor or thread is assigned a subgraph to explore, and they work independently to explore the subgraph using standard DFS algorithm.

> Parallel BFS algorithm starts by selecting a root node or a specified starting point, and assigning it to a thread or processor in the system. Each thread maintains a local queue of nodes to be visited and marks each visited node to avoid processing it again.

Conclusion: In this way we can achieve Parallelism implementing BFS and DFS.