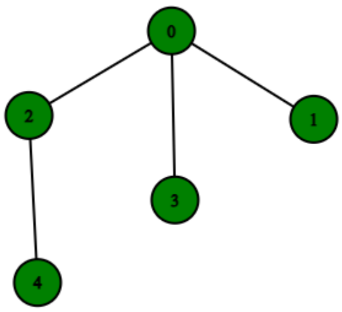
Depth First Search Traversal of Graph CodeStudio

You are given a undirected graph. Perform a Depth First Traversal of the graph.

Example:



Output: {0, 2, 4, 3, 1}

Explanation:

addEdge Function:

- **Purpose:**
  - Populates the graph's adjacency list based on the provided edge list.
- **Explanation:**
  - Iterates through each edge in the **edges** vector.
  - For each edge, extracts the source vertex **u** and iterates over the connected vertices.
  - Adds an edge from **u** to **v** in the adjacency list.
  - If the graph is undirected, adds an edge from **v** to **u** as well.
- **Time Complexity:**
  - **O(E), where E is the number of edges in the input vector.**
- **Space Complexity:**
  - **O(E), where E is the number of edges. Each edge results in the creation of one or two entries in the adjacency list.**

Approach 1: Function to perform Depth-First Search (DFS) on the entire graph

- **Purpose:**
    - Performs DFS traversal on the entire graph, handling disconnected components.
- **Explanation:**
    - Stores the DFS traversal result.
    - Marks nodes as visited.
    - Iterates through each node in the graph, starting DFS from unvisited nodes.
    - Constructs DFS traversal components and adds them to the overall result.
- **Time Complexity:**
    - **O(V + E), where V is the number of vertices and E is the number of edges. Accounts for the traversal of all vertices and edges, even in the presence of disconnected components.**
- **Space Complexity:**
    - **O(V + E), where V is the number of vertices and E is the number of edges. This includes space for the visited map, DFS traversal result vector, and recursion stack.**

Overall Time and Space Complexity:

- **Overall Time Complexity:**
    - **Using addEdge: O(V + E) for both connected graphs and graphs with disconnected components.**
    - **Without addEdge (only DFS): O(V + E) for the DFS traversal alone, considering all vertices and edges.**
- **Overall Space Complexity:**
    - **O(V + E), considering the adjacency list, visited map, and auxiliary data structures in the dfsOfGraph function.**

Conclusion:

- The program efficiently performs DFS traversal on both connected graphs and graphs with disconnected components.
- The time complexity remains O(V + E) even when dealing with disconnected components, primarily due to the **addEdge** function. If DFS alone is considered, the time complexity is O(V + E).