



**K. J. Somaiya College of Engineering, Mumbai-77**  
(A constituent College of Somaiya Vidyavihar University)

**Batch:-B2-2      Roll. No.: Hyder Presswala**

**Experiment:08**

**Grade: AA / AB / BB / BC / CC / CD /DD**

**Title:** Using virtual labs to understand the data structures

**Objective:** Use of virtual labs to understand the concepts and theory with examples and verify the same with practice questions.

**Expected Outcome of Experiment:**

CO	Outcome
CO1	Explain the different data structures used in problem solving
CO2	Apply linear and non-linear data structure in application development
CO3	Demonstrate sorting and searching methods.

**Websites/books referred:**

1.<https://www.vlab.co.in/participating-institute-iit-bombay2>.

2.<https://www.vlab.co.in/participating-institute-iit-bombay>

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**Abstract:** the virtual lab experiments help in understanding how various data structures work. They also emphasize on some important applications of various data structures and enable students to get familiarized with how certain applications can benefit from the choice of data structures.



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Assigned data structure: (Teacher would assign one of the following to one student)

1. Graph DFS - <https://ds1-iiith.vlabs.ac.in/exp/depth-first-search/index.html>
2. Graph BFS - <https://ds1-iiith.vlabs.ac.in/exp/breadth-first-search/index.html>

**Concept and algorithm of the application/activity followed:**

**1) Breadth First Search:-**

BFS Algorithm

The algorithm starts with examining the source node and all of its neighbours. In the next step, the neighbours of the nearest node of the source node are explored. The algorithm then explores all neighbours of all the nodes and ensures that each node is visited exactly once and no node is visited twice.

**STEP 1:** Set visited as 0 for all nodes in the Graph.

**STEP 2:** Enqueue the selected source node into the queue.

**STEP 3:** Dequeue a node N from queue and update its visited as 1.

**STEP 4:** Enqueue all the neighbours of node N which are not present in the queue and whose visited is 0.

**STEP 5:** Repeat steps 3 and 4 until queue is empty.

**STEP 6:** EXIT

**2) Depth First Search:-**

Understanding the Depth First Search (DFS) Algorithm

Depth first search (DFS) algorithm starts with the initial node of the graph G, and then goes deeper and deeper until we find the goal node or the node which has no children. The algorithm, then backtracks from the dead end towards the most recent node that is yet to be completely explored. The data structure which is being used in DFS is stack.

- **STEP 1:** Start by putting any one of the graph's vertices on top of a stack (acts as source node of DFS).
- **STEP 2:** Take the top item of the stack and set its visited as 1.
- **STEP 3:** Create a list of that vertex's adjacent nodes. Add the ones whose visited is 0 to the top of stack.
- **STEP 4:** Keep repeating steps 2 and 3 until the stack is empty.



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**Aim / learning objective of the assigned expt:**

**1) Breadth First Search:-**

Learning Objectives of this Module:

Welcome to this module on BFS! Take a look at what we will learn in this module:

- Graph traversal and its types
- What is BFS and when is it used?
- Practice BFS Algorithm
- Interactive BFS Exercise
- A quiz to check your understanding of BFS

**2) Depth First Search:-**

Learning Objectives of the Experiment

In this experiment, we will be learn about:

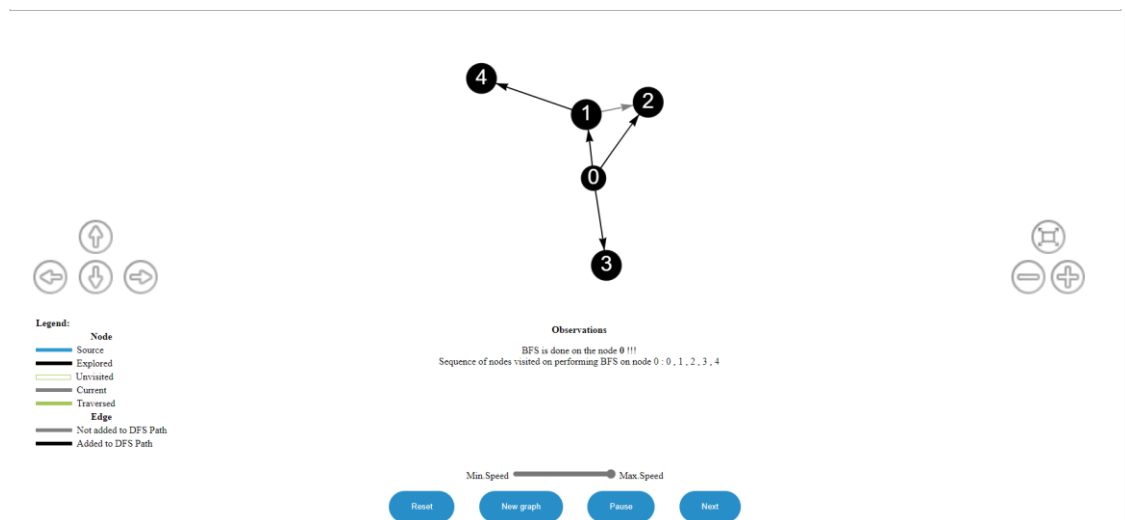
- Understand the basics of graphs and their representations.
- Understand the working of Depth First Traversal Algorithm for searching nodes.
- Given a graph, understand the progression of the Depth First Traversal Algorithm and search for particular nodes.
- Demonstrate the knowledge of time complexity of the Depth First Search Traversal algorithm.



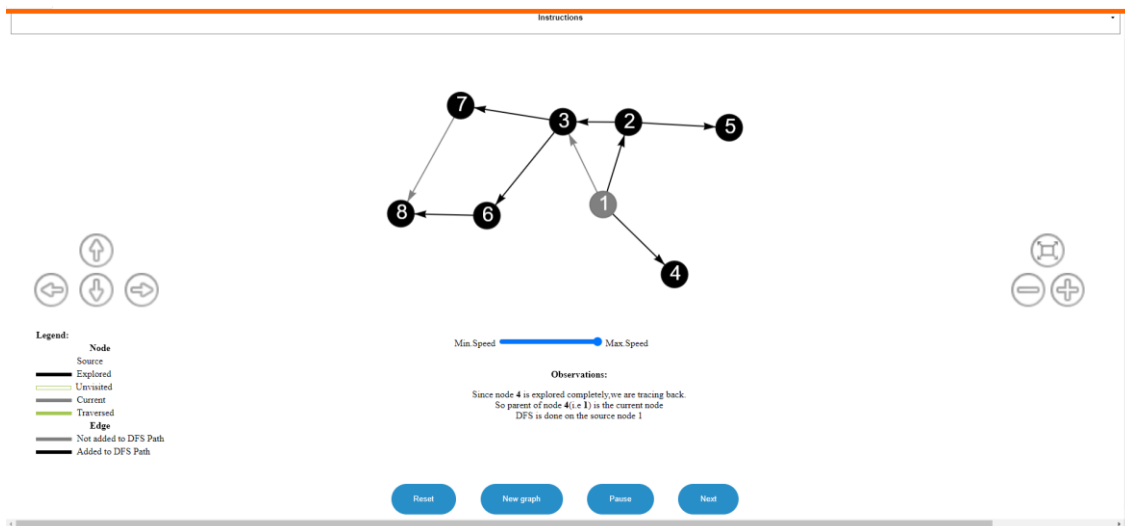
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**Demo execution screenshots:**

**1) Breadth First Search:-**



**2) Depth First Search:-**

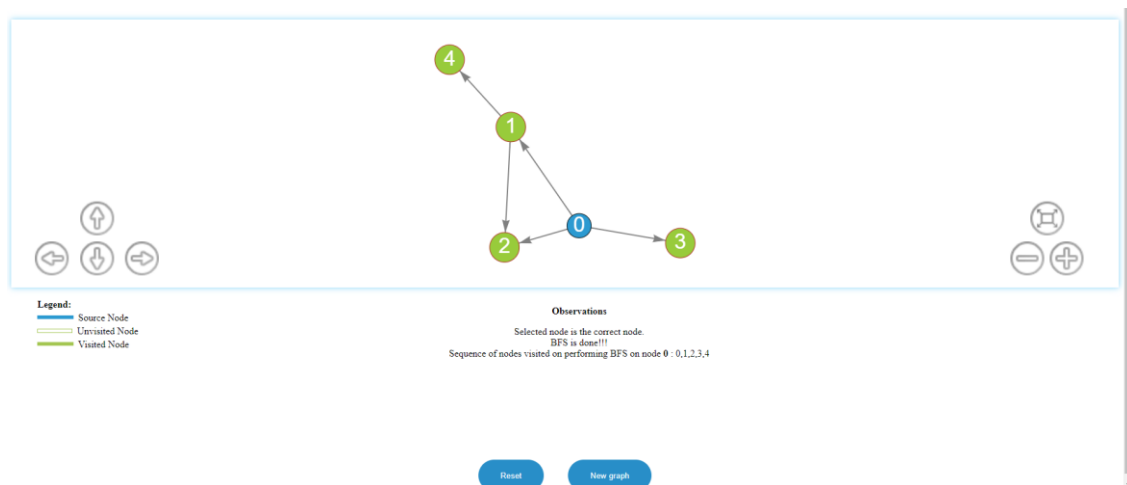
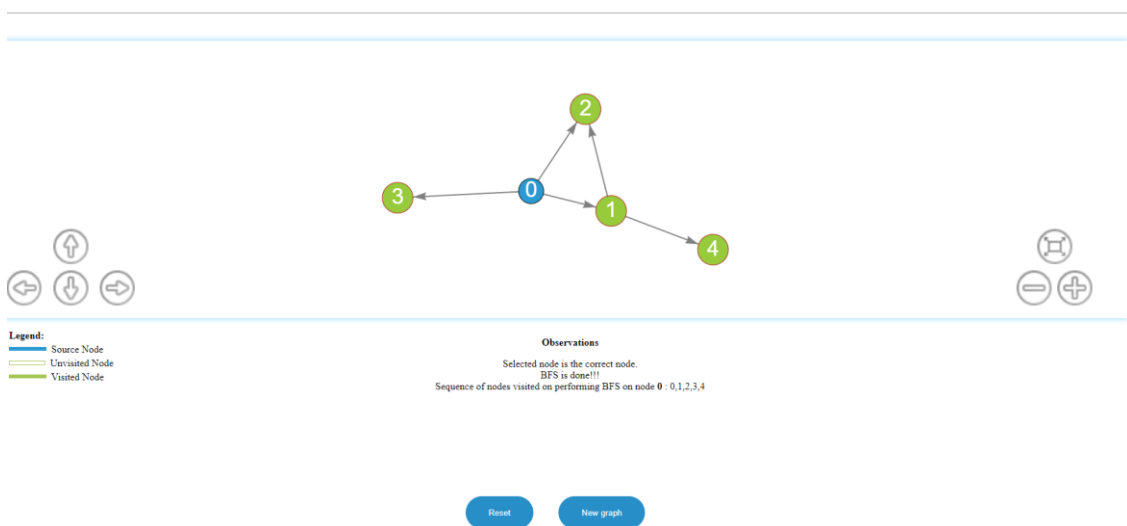




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**Practice problem screenshots:**

**1) Breadth First Search:-**





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Instructions

Legend:

Source Node

Unvisited Node

Visited Node

Observations

Selected node is the correct node.

BFS is done!!!

Sequence of nodes visited on performing BFS on node 0 : 0,3,1,2,4

Reset

New graph

Instructions

Legend:

Source Node

Unvisited Node

Visited Node

Observations

Selected node is the correct node.

BFS is done!!!

Sequence of nodes visited on performing BFS on node 0 : 0,3,1,2,4

Reset

New graph

Instructions

Legend:

Source Node

Unvisited Node

Selected Node

Observations

Your sequence : 0,1,3,2,4

Correct!

Reset

New graph

Submit

Department of Computer Engineering

DS Sem-III – July-Dec 2021

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Virtual Labs

Breadth First Search

Instructions

Legend:

- Source Node
- Unselected Node
- Selected Node

Observations

Your sequence : 0 , 1 , 2 , 3 , 4  
Correct!

Reset New graph Submit

## 2)Depth First Search:-

Instructions

Legend:

- Source Node
- Unvisited Node
- Visited Node

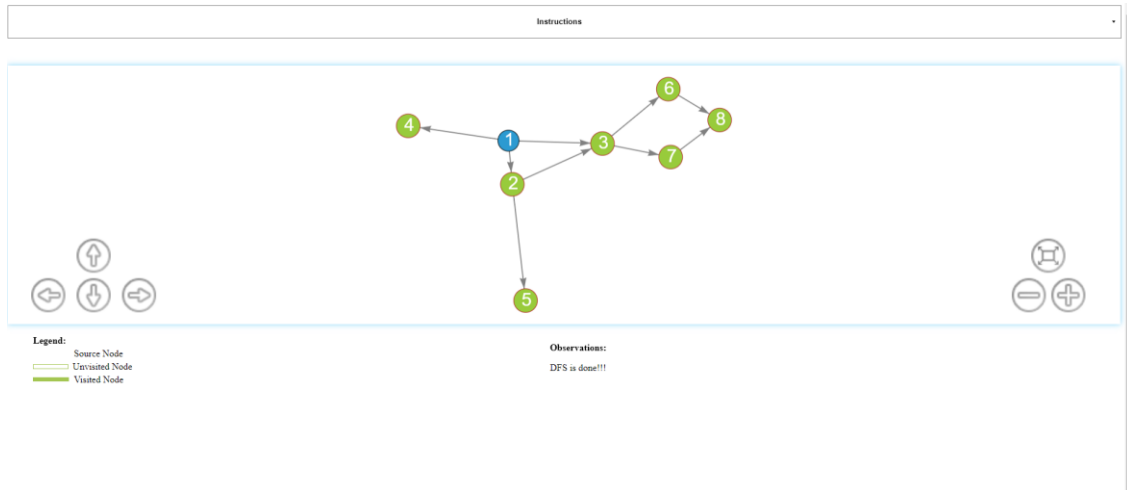
Observations:

DFS is done!!!!!!

Reset New graph



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## Quiz screenshots:

### 1) Breadth First Search:-

### Breadth First Search

Choose difficulty: ☒ Beginner ☒ Intermediate

1. Which of the following are applications of BFS?

- ☐ a: To find the Minimum Spanning Tree (MST) [Explanation](#)
- ☐ b: To find the shortest distance to a node from the root [Explanation](#)
- ☐ c: Cycle detection in undirected graphs [Explanation](#)
- ☒ d: All of the above [Explanation](#)

2. Imagine a 4X4 grid (assume 1 indexing) where the hero stands in the cell (2,3) and the villain is in the cell (3,1). Assuming the hero can only move up, down, left and/or right to the immediately adjacent cells and cannot move out of the grid, how many steps will it take for the hero to reach the villain (given that the villain is stationary)?

- ☐ a: 1 [Explanation](#)
- ☐ b: 2 [Explanation](#)
- ☒ c: 3 [Explanation](#)
- ☐ d: 4 [Explanation](#)

[Submit Quiz](#)

2 out of 2

### 2) Depth First Search:-





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**Conclusion and your take away after performing the virtual lab experiment: -**

**1) Breadth First Search:-**

Breadth Search Algorithm comes with some great advantages to recommend it. One of the many applications of the BFS algorithm is to calculate the shortest path.

**2) Depth First Search:-**

The best First Search algorithm in artificial intelligence is used for finding the shortest path from a given starting node to a goal node in a graph. The algorithm works by expanding the nodes of the graph in order of increasing the distance from the starting node until the goal node is reached.