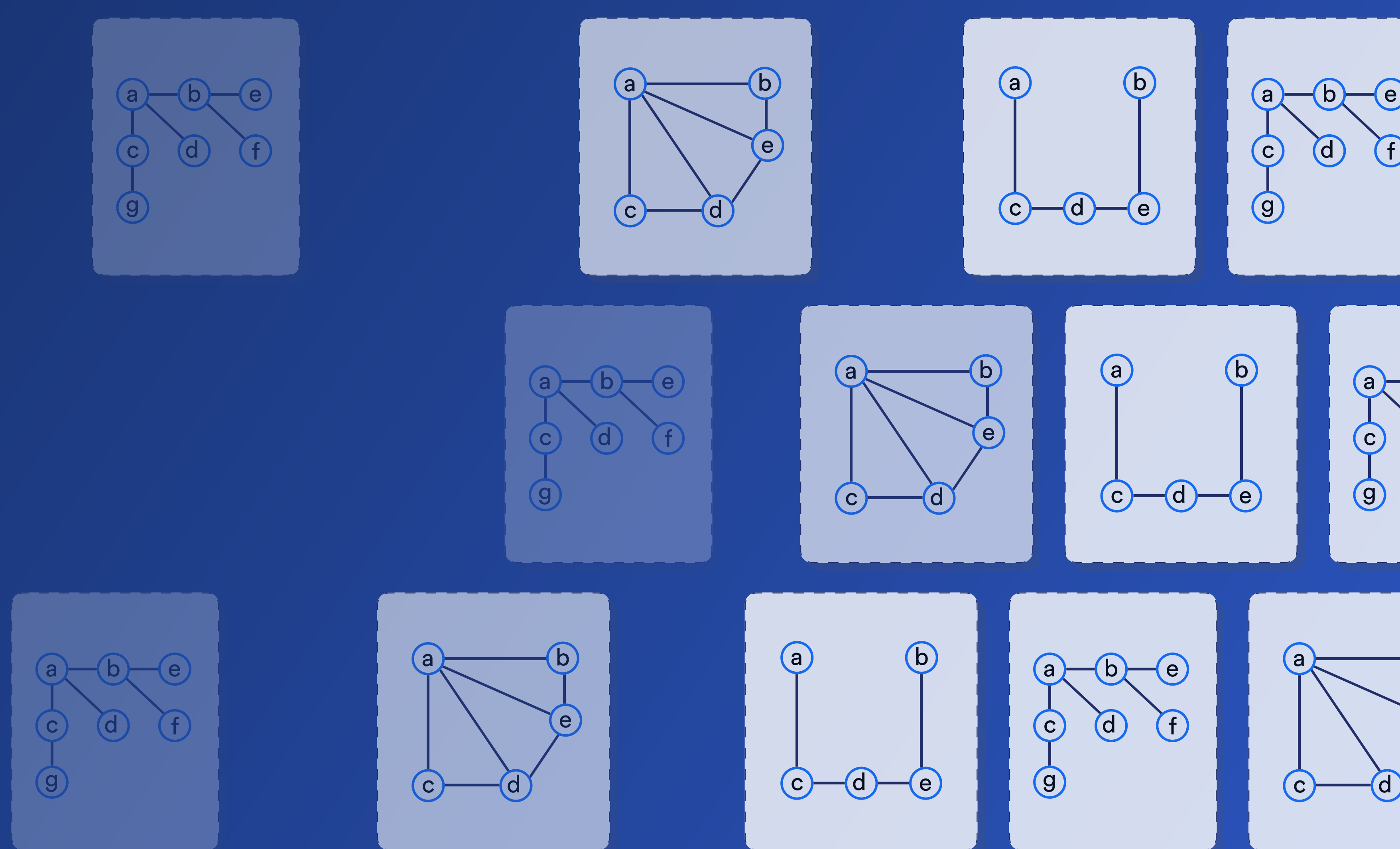
IMPORTANT **GRAPH ALGORITHMS**

Explained in the simplest way

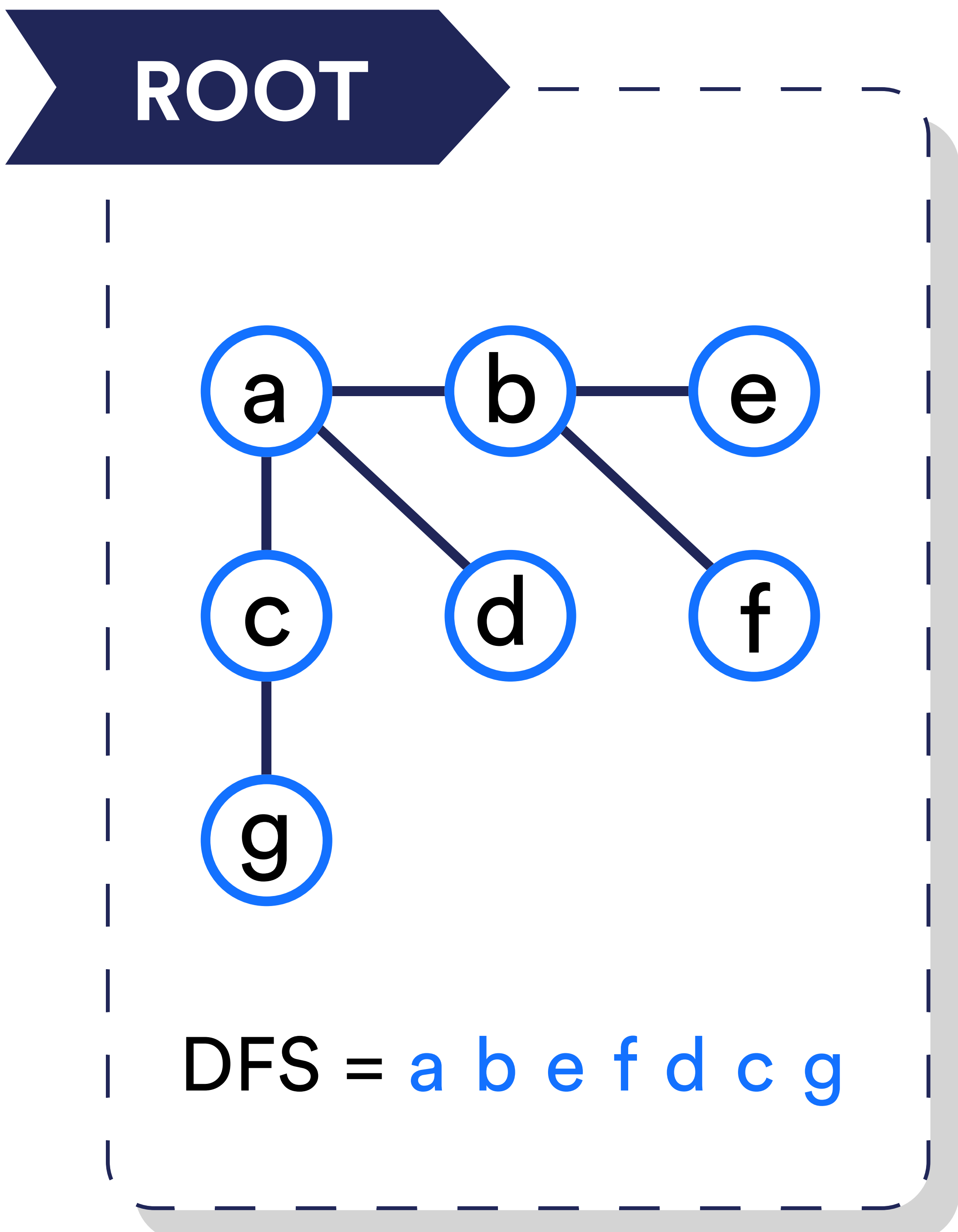


DISCLAIMER

This document Will walk you through the most important graph algorithms from the standpoint Of learning and cracking DSA Interviews.

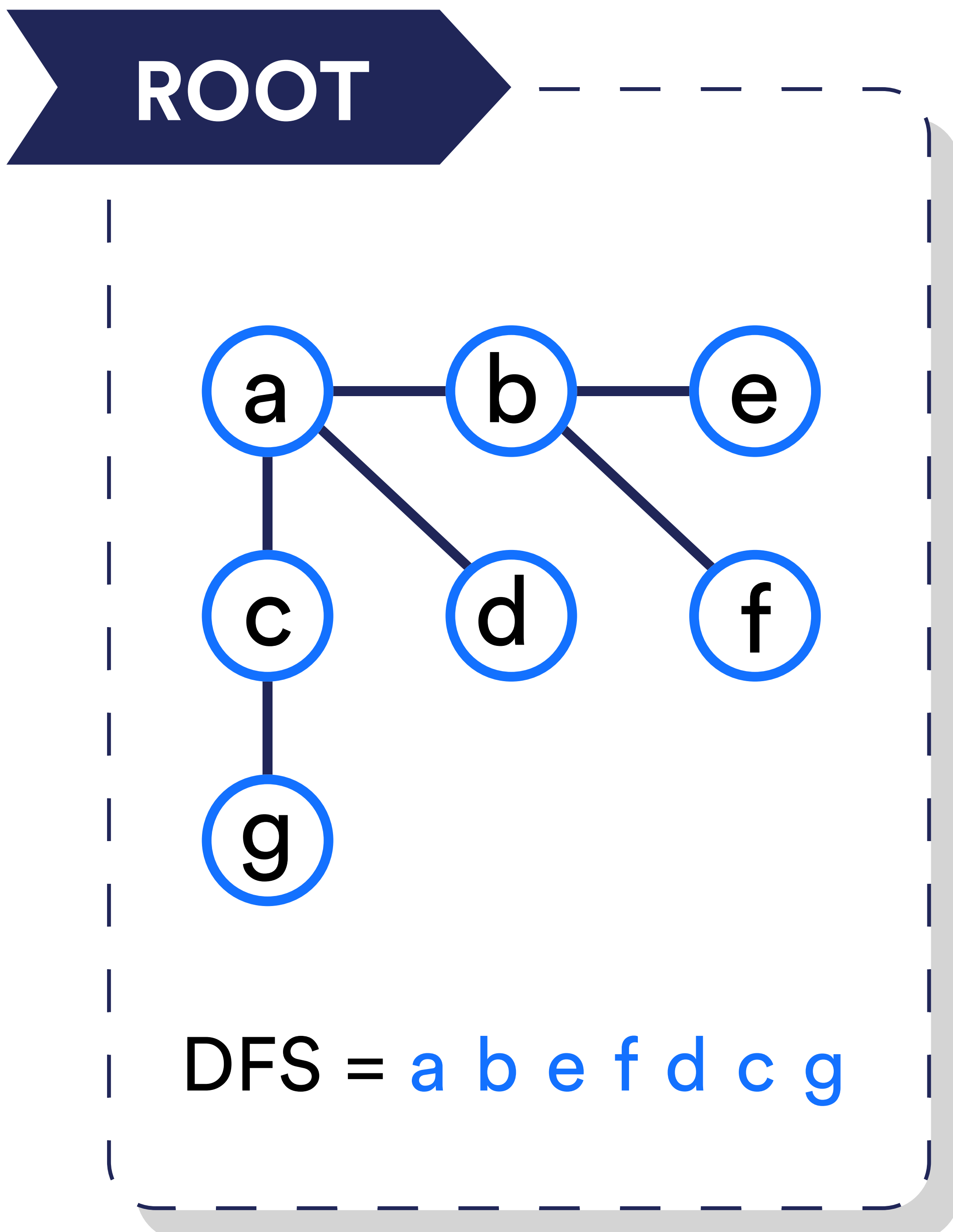
TRAVERSALS IN GRAPH

- There are two types of graph traversals :



Depth First search

(DFS)

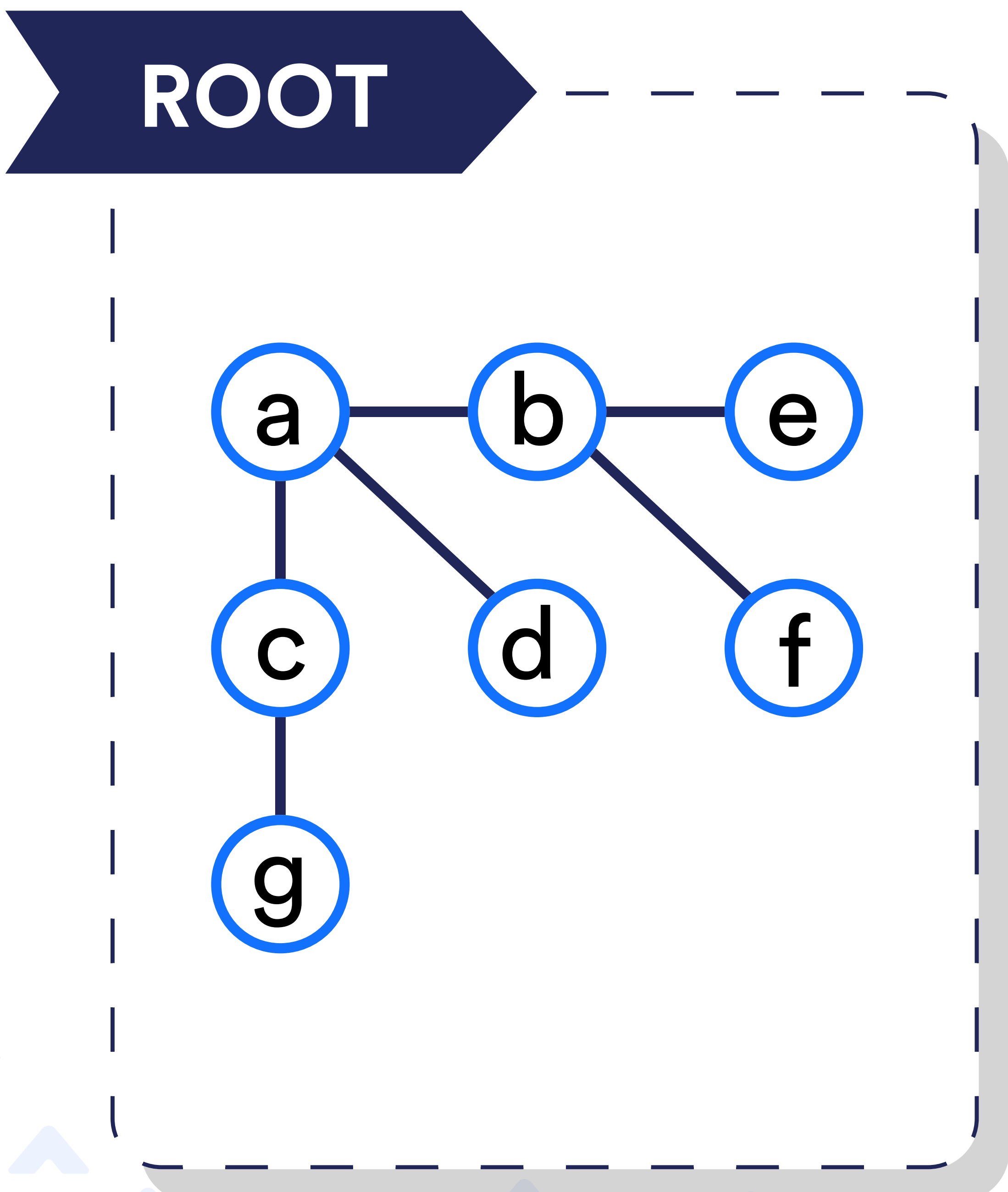


Breadth First search

(BFS)

DEPTH FIRST SEARCH (DFS)

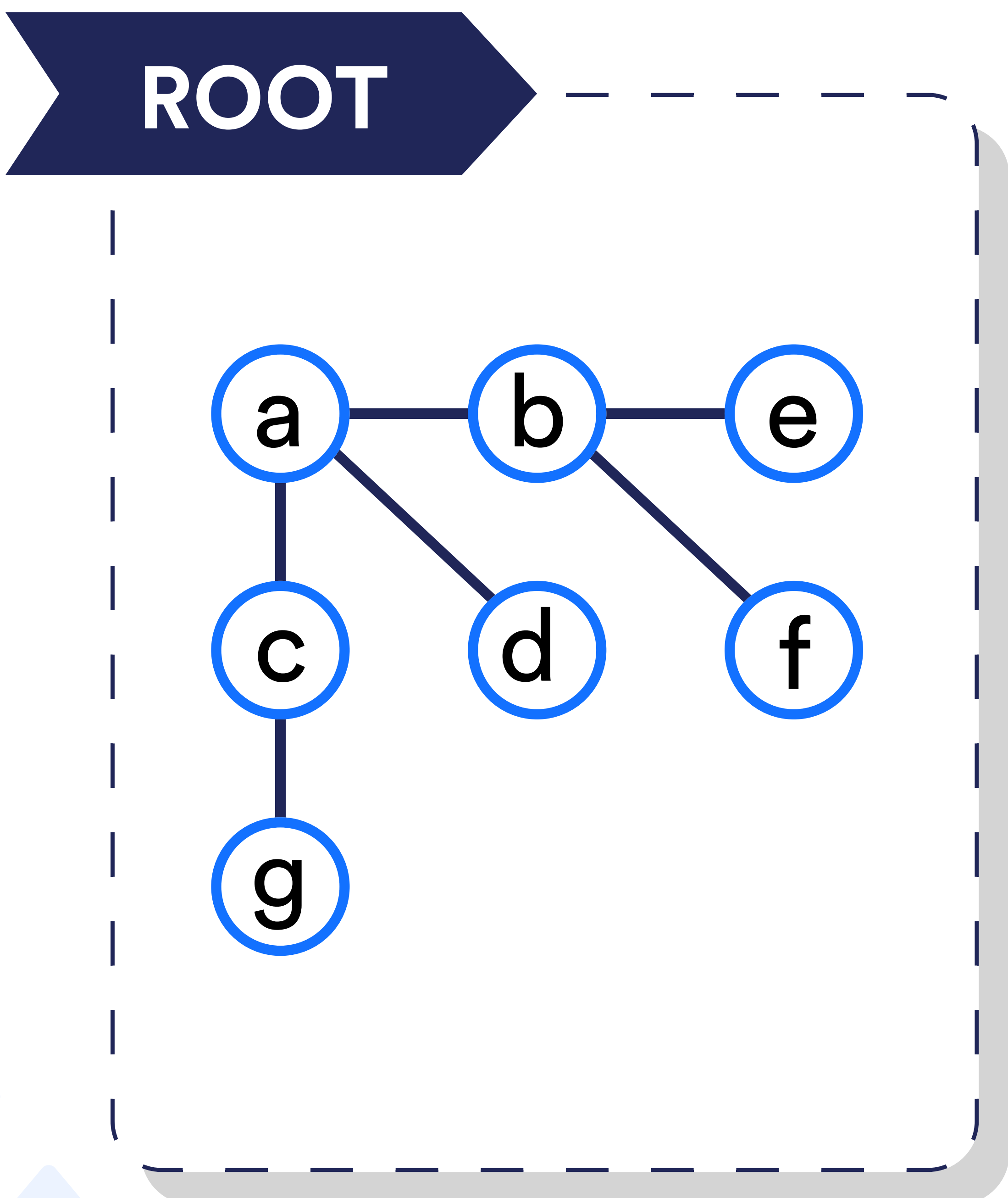
- **Traverse** from a node (often termed as root node), and keep going as deep as possible on a branch until you hit the dead end, and then traverse back on the branch and again go deep exploring the other paths.



DFS = a b e f d c g

BREADTH FIRST SEARCH (DFS)

- **Traverses** from a node (also called root node), and explores the neighbouring nodes first, and then selects one neighbour node and again explores its neighbour nodes until it hits the dead end.



DFS = a b d c e f g

MINIMUM SPANNING TREE (MST)

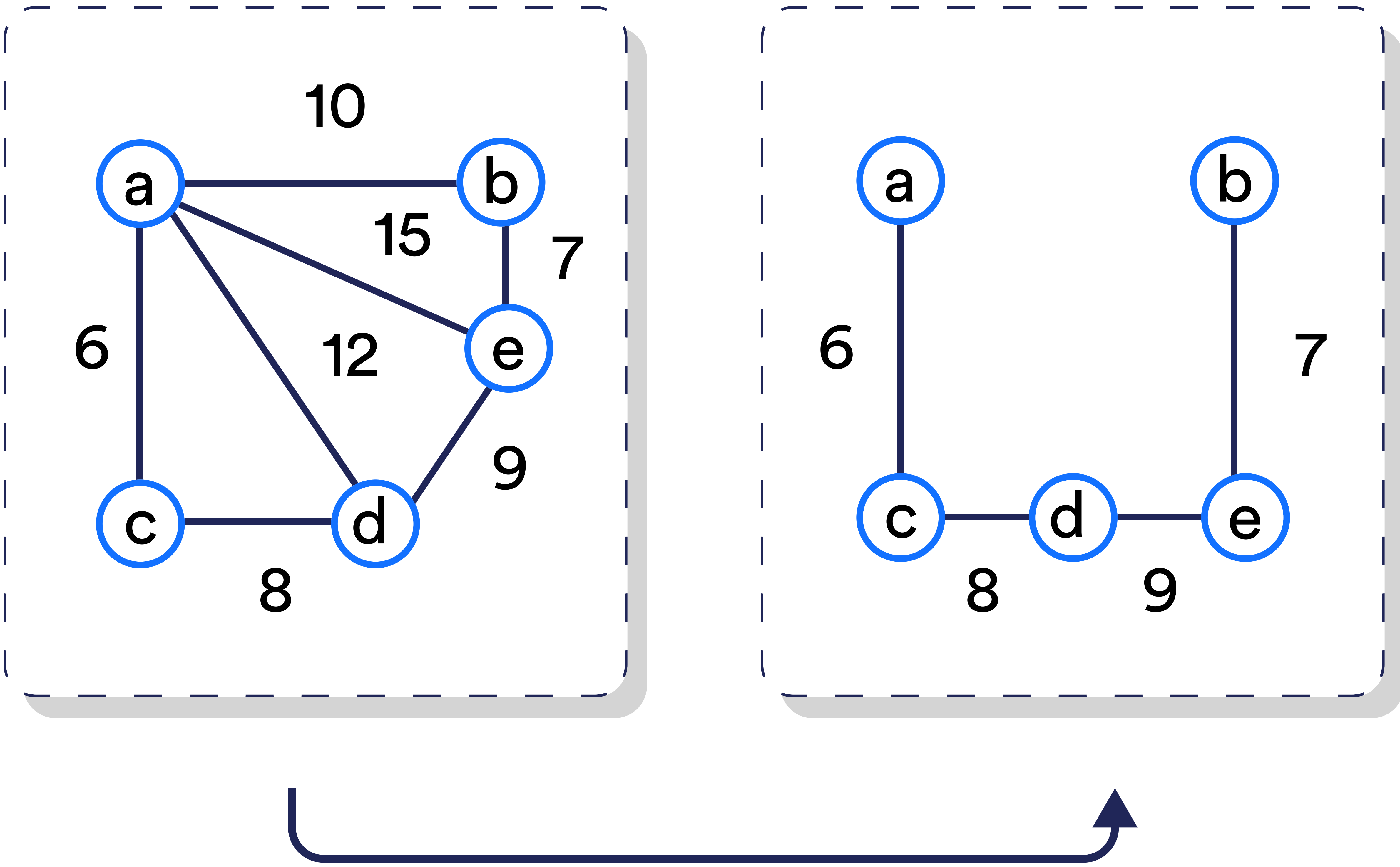
In an **undirected** and a **connected graph**, a spanning tree is a connected subgraph that doesn't have a cycle.

And, if the connected graph has N vertices, the spanning tree has **N-1 edges** (ensures no cycle is formed).

Here, remember that a single graph can have many spanning trees.

Sum of weights of the edges in a **spanning tree** is called the cost.

In a minimum spanning tree for an undirected, weighted & connected graph this cost is the least out of all other spanning trees.

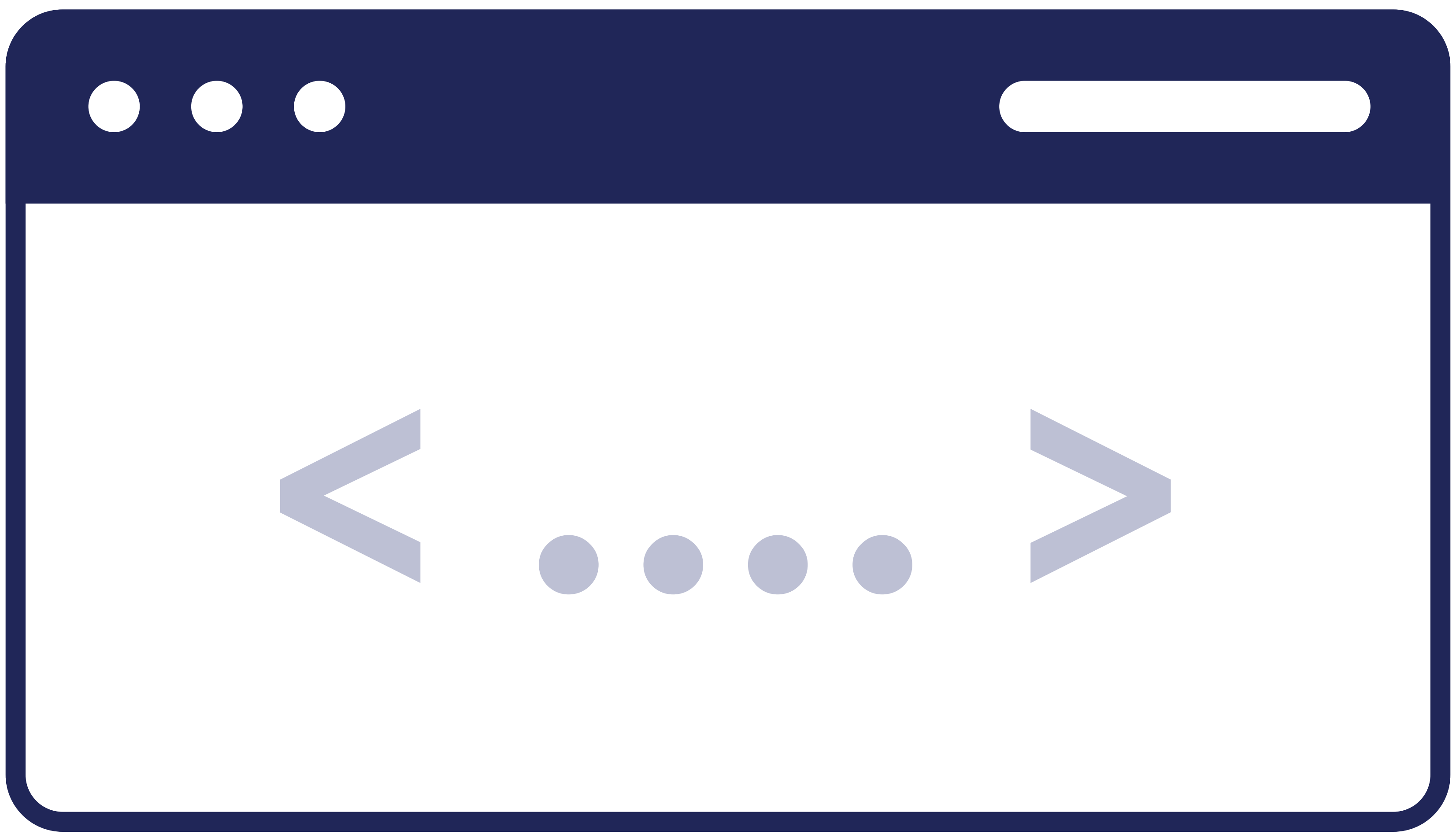


Minimum Spanning Tree (MSP)

TRAVERSALS IN GRAPH

There are two algorithms to build MST

- **Prim's algorithm**
- **Kruskal's algorithm**



PRIM'S ALGORITHM

This is a **greedy algorithm** which starts with a vertex, & tries to add the minimum edge connected to this vertex out of all the edges, & repeats the same process till the MST is formed

KRUSKAL'S ALGORITHM

Again a greedy algorithm where we start with sorting all the edges first, and then picking the edge with lowest weight and repeating the process.

At any point of time, if it forms a cycle, discard this edge and continue till the MST is formed.

PS : Remember, Prim's algorithm builds MST by connecting vertices and Kruskal's algorithm builds MST by connecting edges

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HANG ON!

PREPARINC FOR

THEN, ALONG WITH GRAPH YOUR WHOLESOME
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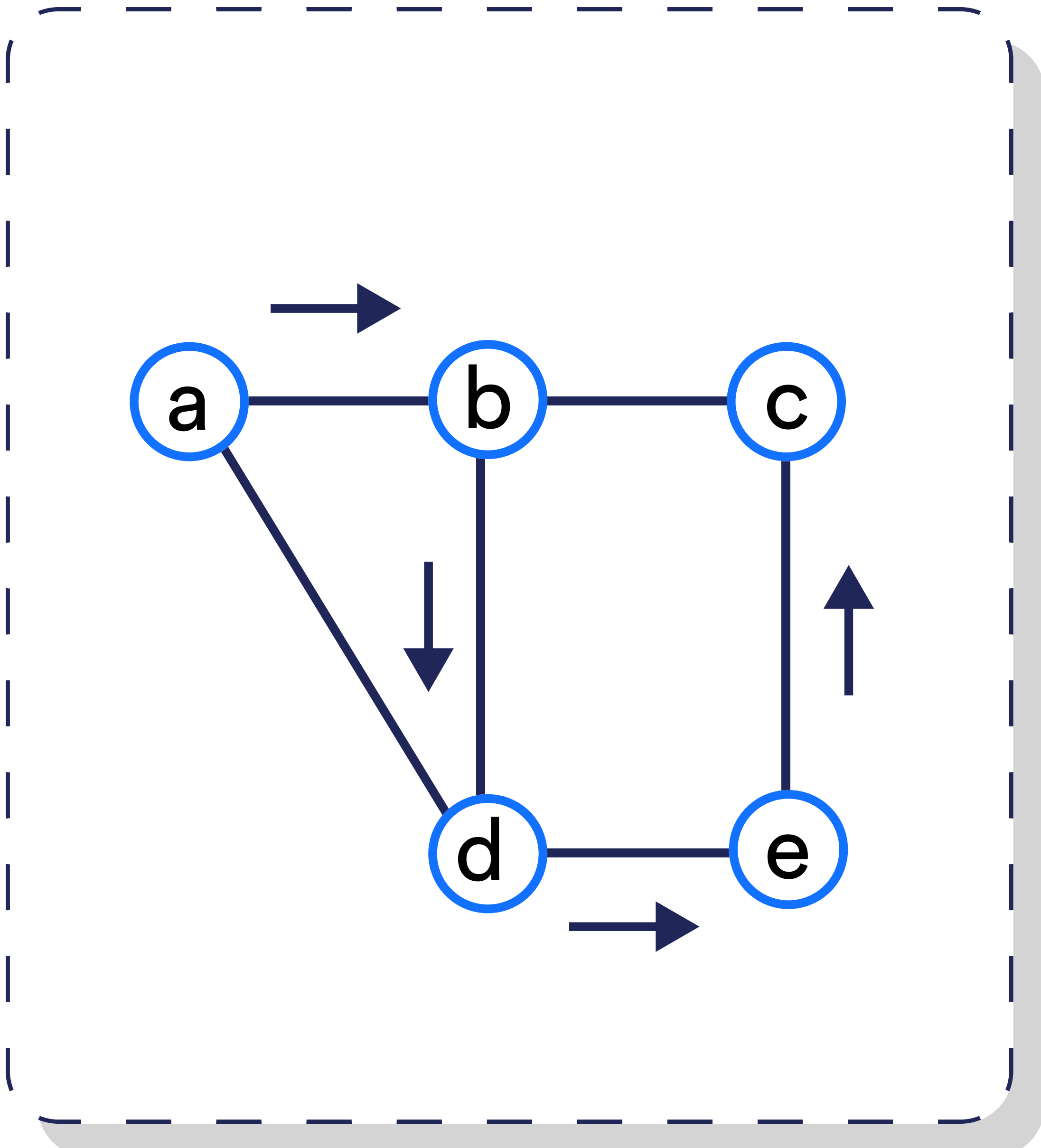
EULERIAN PATH & CIRCUIT

Eulerian Path - A path that visits all the edges in a graph exactly one time!

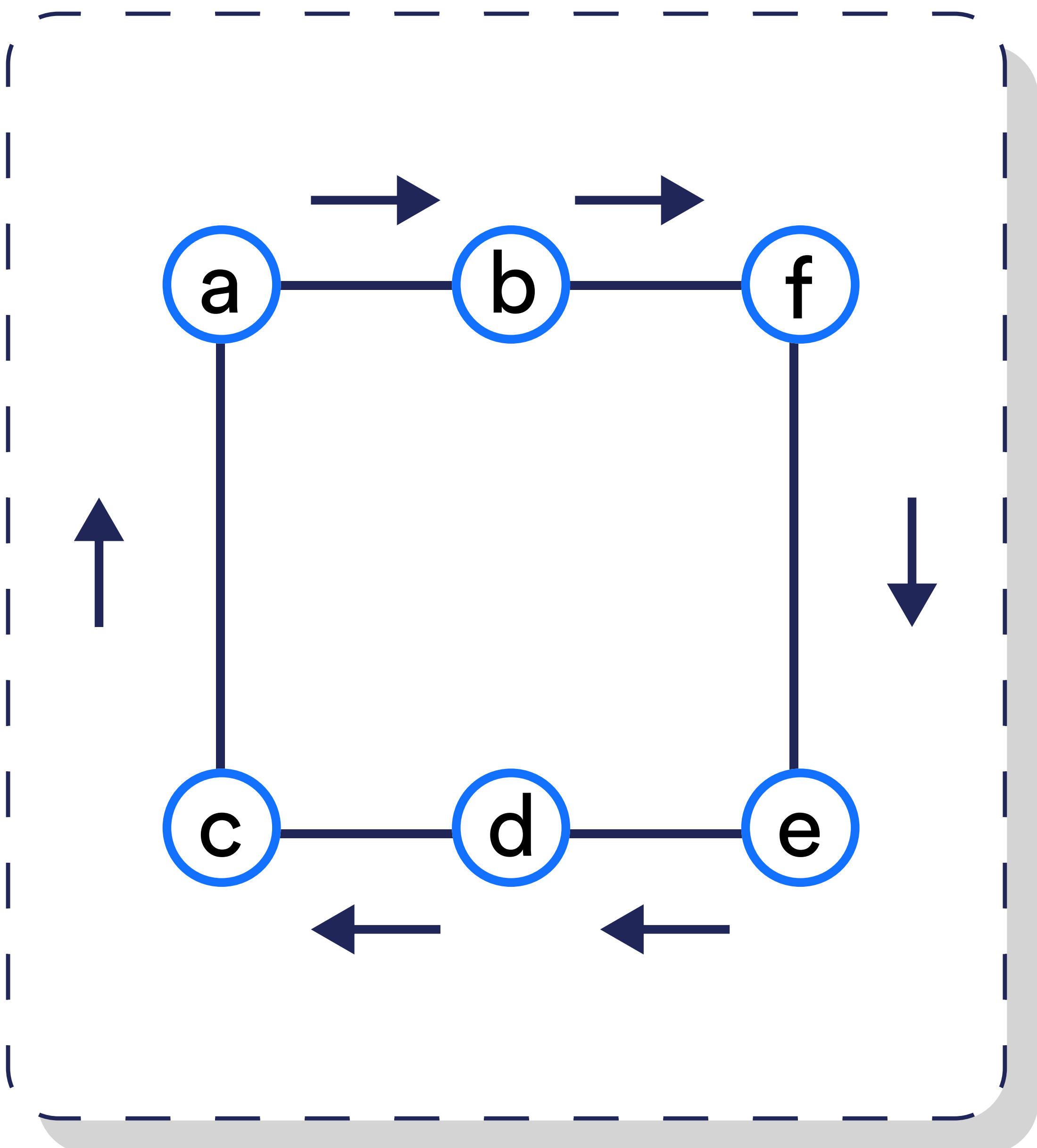


HP = a b d e c

Euler Path Diagram

EULERIAN PATH & CIRCUIT

Eulerian Circuit - A Euler path that visits all the edges in a graph exactly one time, but has the same starting and ending Vertex!



EC = a b f e d c a

Euler Circuit Diagram

You can say if a graph has :

Eulerian Path -

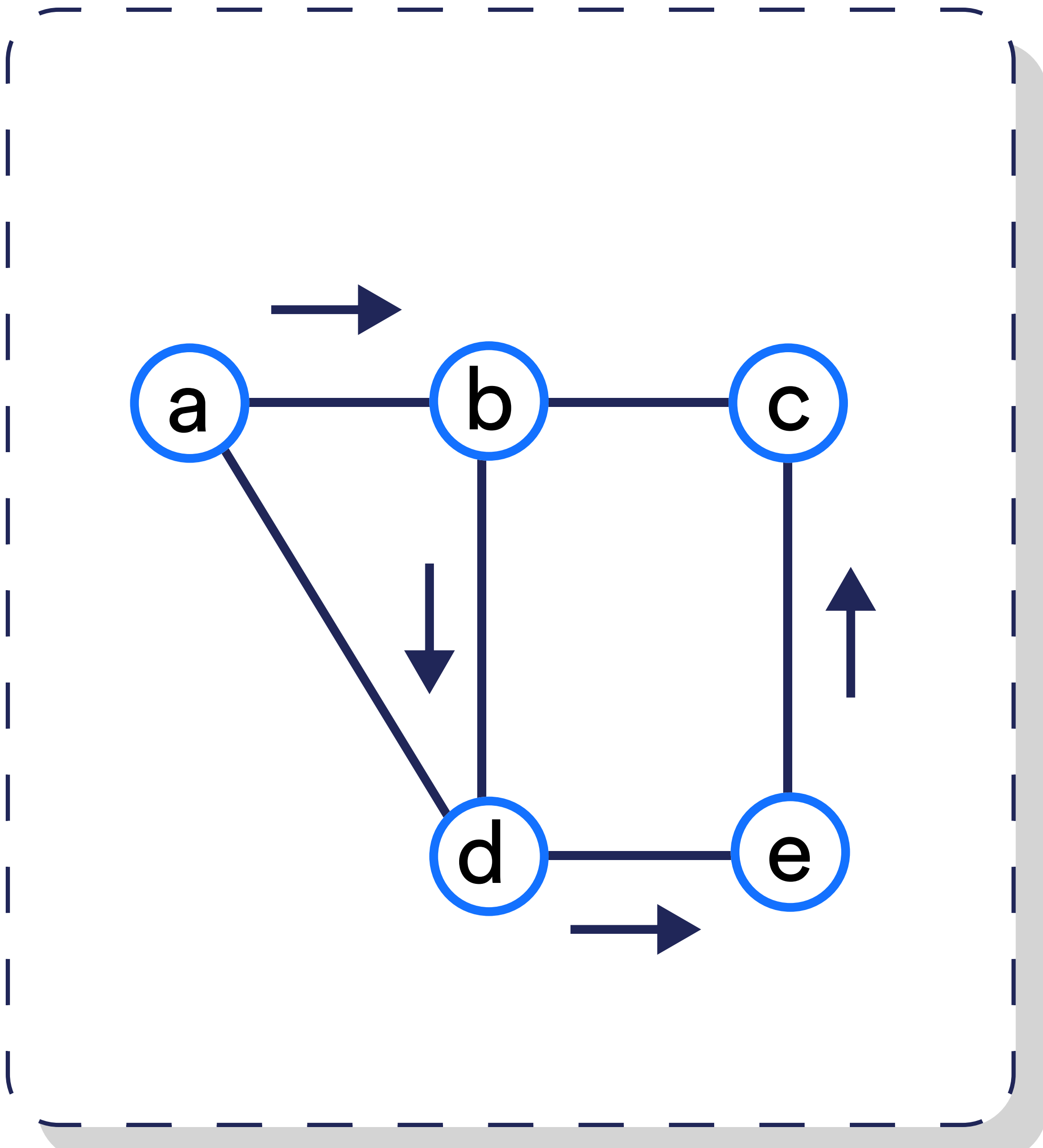
- If the graph has 0 or 2 nodes have odd degree & all other nodes have even degree .

Eulerian Circuit -

- If the graph has all vertices even degree.

HAMILTONIAN PATH & CIRCUIT

Hamiltonian Path - A path which visits every vertex exactly once in a graph.

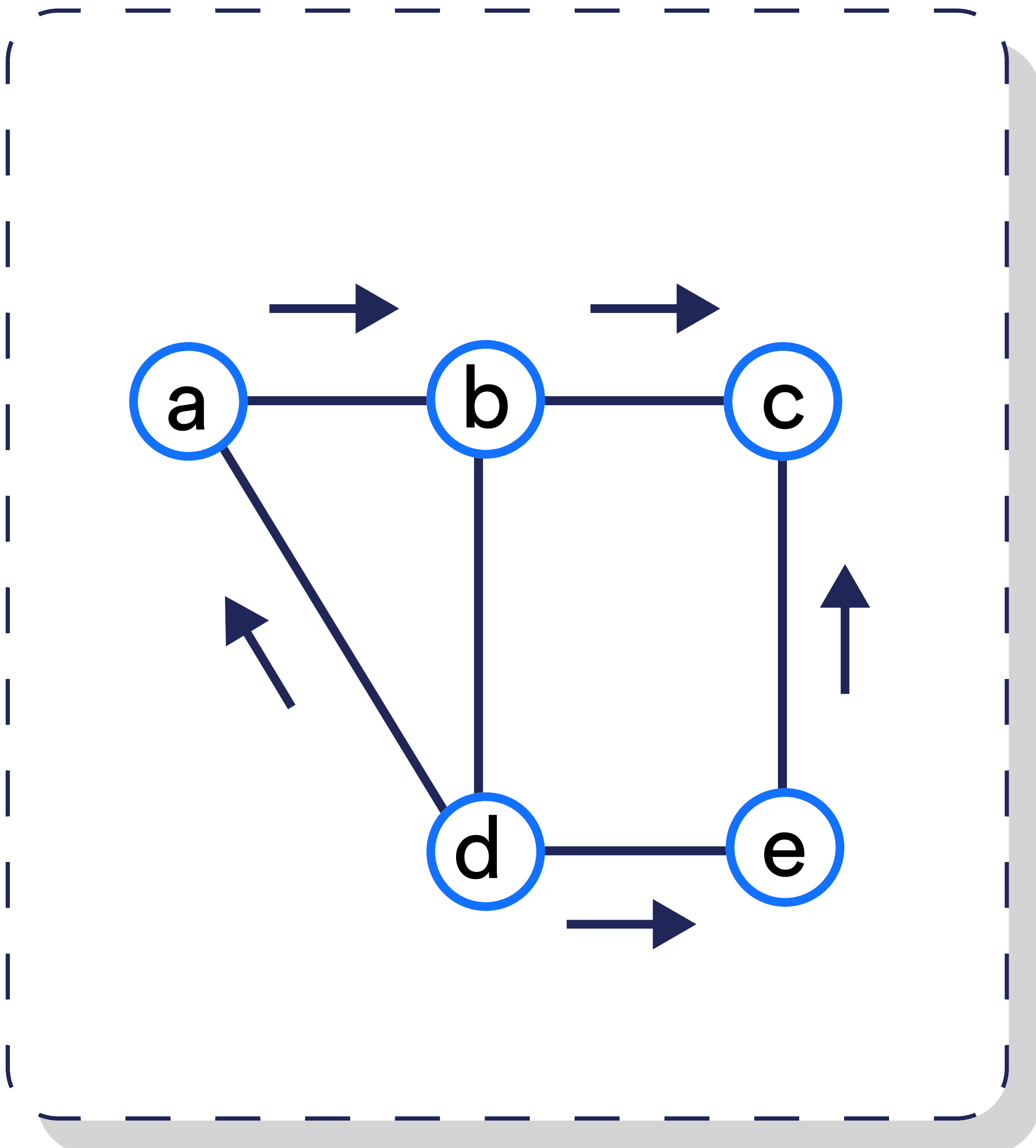


HP = a b d e c

Hamiltonian Path Diagram

HAMILTONIAN PATH & CIRCUIT

Hamiltonian Circuit - A Hamiltonian path that starts with a vertex, and ends at the same vertex.

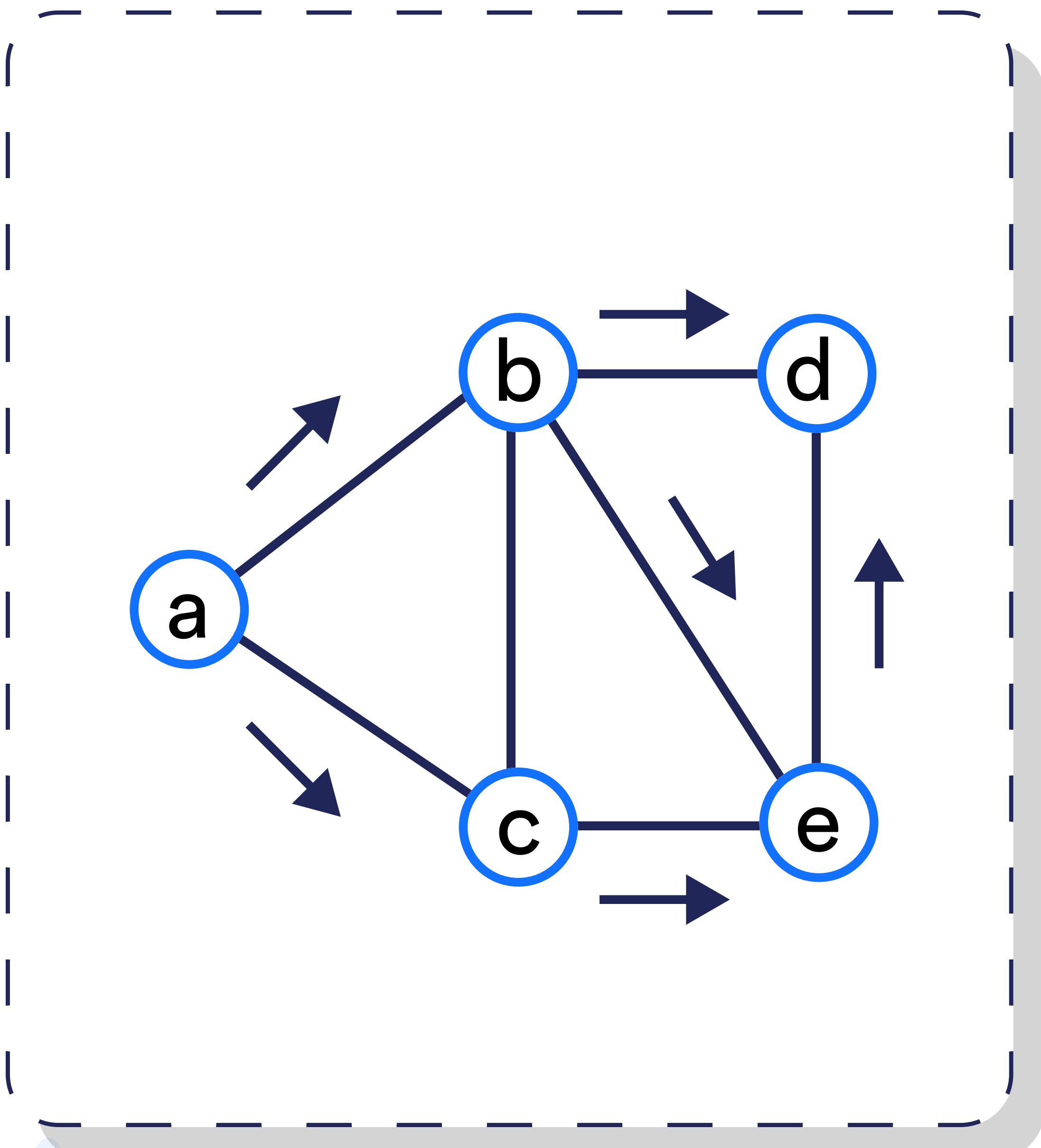


HC = a b c e d a

Hamiltonian Circuit Diagram

TOPOLOGICAL SORT

Topological sort can only be done on a directed acyclic graph (DAG). It returns an array, basically an ordering of vertices, where, if there is a directed edge from I-J to V, then IJ vertex is present before V in the ordering list/array.



TS = a b c e d

Topological Sort Diagram

WIDELY USED SHORTEST PATH GRAPH ALGOS

To find the shortest path in a graph, you have multiple algorithms :

BFS algorithm -

- Use BFS if the graph is undirected with unit weights

Djikstra's Algorithm -

- If graph is directed and has no negative weight cycles then You can use Djikstra Algorithm.

Bellman Ford Algorithm -

- If the graph has negative weight cycles, then use Bellman Ford Algorithm.