

Ans 1

**BFS**

- It stands for Breadth first Search
- It uses Queue data Structure
- Suitable for searching vertices closer to source.
- It considers all neighbours first and thus not suitable for decision making trees used in games & puzzles.
- Siblings are visited before children.
- no concept of backtracking
- It requires more memory

**DFS**

- It stands for Depth first Search
- It uses stack data str.
- Suitable for searching vertices away from source.
- More suitable for game & puzzle problem.
- Children are visited before parent.
- It is a recursive algorithm that uses backtracking.
- It requires less memory.

**Applications :-**

- BFS → Bipartite graph and shortest path, p2p networking, Crawlers in search engine & GPS Navigation System.
- DFS → acyclic graph, topological order, scheduling problems, Sudoku puzzle



Ans 2 :-

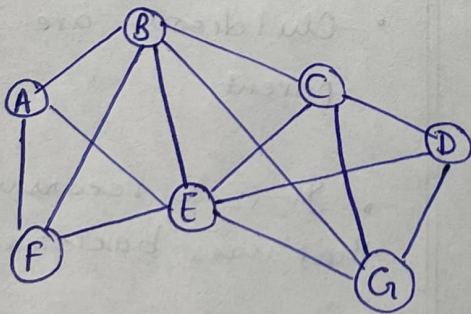
for implementing BFS we need a queue data structure for finding shortest path b/w any node. We use queue because things don't have to be processed immediately. BFS searches for node levelwise. For this queue is better to use in BFS.

for implementing DFS we need a stack data str. as it traverses in depthward motion.

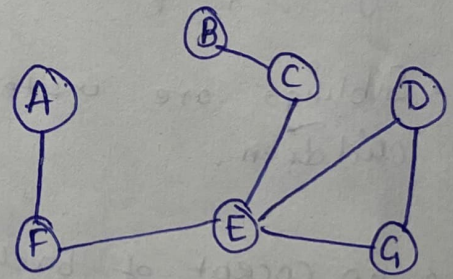
Ans 3 :-

Dense graph is a graph in which no. of edges is close to maximal no. of edges

Sparse graph is a graph in which no. of edges is very less.



Dense graph  
(many edges b/w nodes)



Sparse graph  
(few edges b/w nodes)

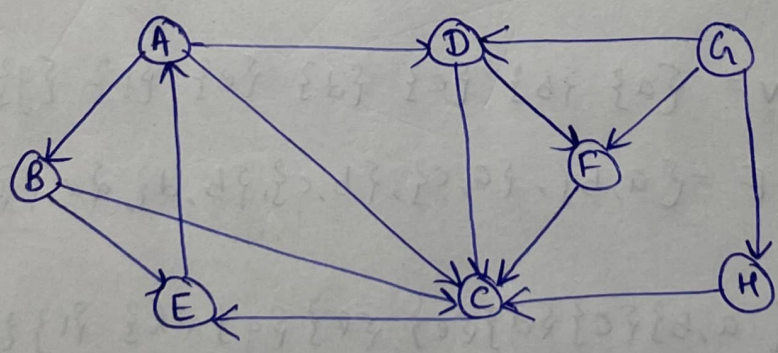


Ans 4:- For detecting a cycle in a graph using BFS :-

Steps Involved are :-

- 1). Compute in-degree (no. of incoming edges) for each of vertex present in graph
- 2). Pick all vertices with in degree as 0 and add them in queue.
- 3). Remove a vertex from queue and then
  - inc. count of visited nodes by 1.
  - dec. in degree by 1 for all its neighbouring nodes.
- 4). Repeat 3 until queue is empty
- 5). If count of visited nodes is not eq. to no. of nodes in graph, has cycle otherwise not.

Ans :-



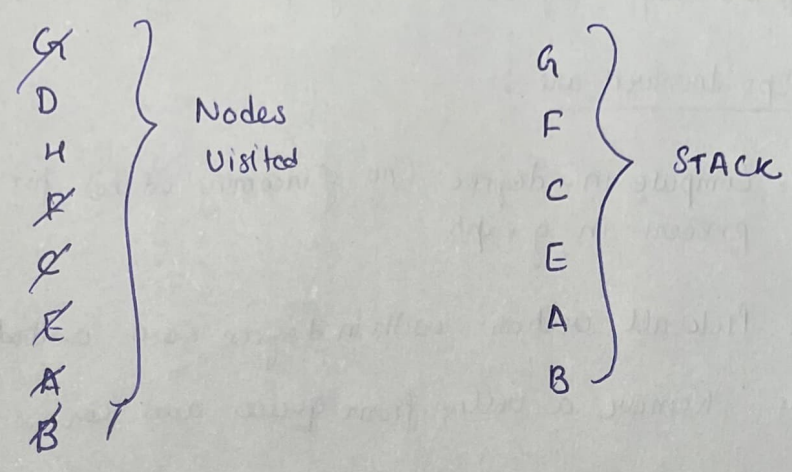
BFS

Child	G	H	D	F	C	E	A	B
Parent		G	G	G	H	C	E	A

Path :- G → H → C → E → A → B

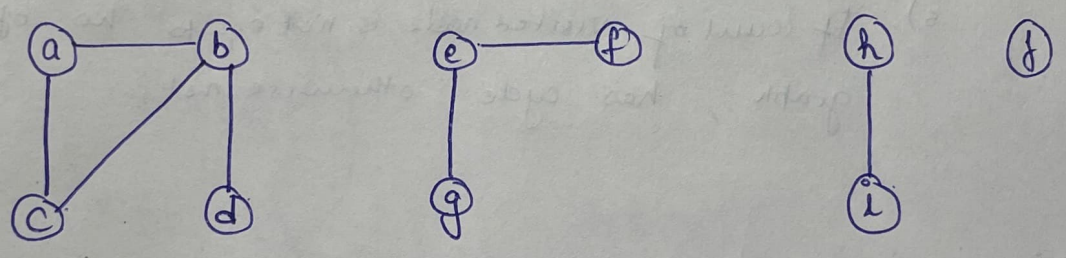


DFS



Path:-  $G \rightarrow F \rightarrow C \rightarrow E \rightarrow A \rightarrow B$

Ans :-



$V = \{a\} \{b\} \{c\} \{d\} \{e\} \{f\} \{g\} \{h\} \{i\} \{j\}$

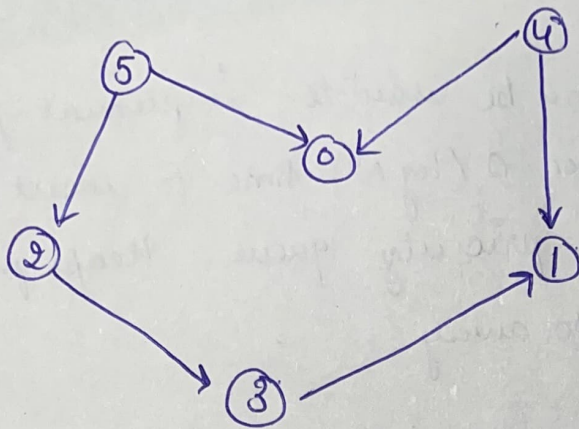
$E = \{a, b\}, \{a, c\}, \{b, c\}, \{b, d\}, \{e, f\}, \{e, g\}, \{h, i\}, \{i, j\}$

- (a, b)  $\{a, b\} \{c\} \{d\} \{e\} \{f\} \{g\} \{h\} \{i\} \{j\}$
- (a, c)  $\{a, b, c\} \{d\} \{e\} \{f\} \{g\} \{h\} \{i\} \{j\}$
- (b, c)  $\{a, b, c\} \{d\} \{e\} \{f\} \{g\} \{h\} \{i\} \{j\}$
- (b, d)  $\{a, b, c, d\} \{e\} \{f\} \{g\} \{h\} \{i\} \{j\}$
- $\{e, f\}$   $\{a, b, c, d\} \{e, f\} \{g\} \{h\} \{i\} \{j\}$
- $\{e, g\}$   $\{a, b, c, d\} \{e, f, g\} \{h\} \{i\} \{j\}$
- $\{h, i\}$   $\{a, b, c, d\} \{e, f, g\} \{h, i\} \{j\}$

No. of connected components = 3  $\rightarrow$  Ans

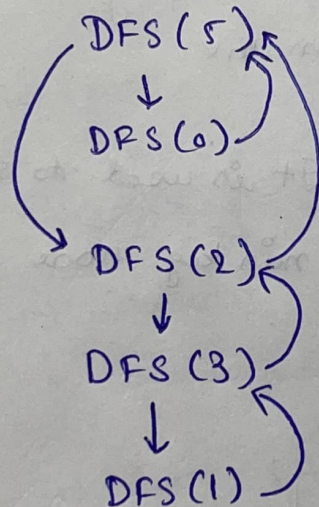


Ans:-



We take Source Node as 5

Applying Topological sort

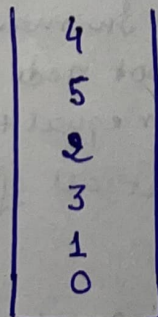


DFS(4)



Not possible

DFS



Stack

4 → 5 → 2 → 3 → 1 → 0



Ans 9

Yes heap data str. can be used to implement priority queue. It will take  $O(\log N)$  time to insert & delete each element in priority queue. Heaps provide <sup>performance</sup> Better <sup>^</sup> Comparison to array.

The graphs like Dijkstra's Shortest Path Algorithm, Prim's minimum spanning tree uses priority queue.

• Dijkstra's Algorithm:- When graph is stored in form of adjacency list or matrix.

• Prim's Algorithm - It is used to store key of nodes and extract min key node at every step.

Ans 10 :-

Min-Heap

→ In min-heap, key present at root node must be less than or equal to among keys present at all of its children.

→ min key element → present at root

→ It uses Ascending priority.

Max-Heap

→ In max heap key present at root node must be greater than or equal to among keys present at all of its children.

→ max. key element present at root.

→ It uses descending priority.