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TUTORIAL-5

Sol 1. Using BFS, we can find the minimum no. of nodes b/w a source node and destination node, while using DFS, we can find if a path exists b/w two nodes.

- Applications :-
  BFS - To detect cycles in graph, min distance comparison
  DFS - To detect & compare multiple paths, detect cycle in a graph.

Sol 2. DFS: We use stack to implement DFS because "order doesn't has much importance."

BFS: We use queue Data structure to implement BFS because "order matters in this case".

Sol 3. Sparse Graph: No. of edges is close to minimal no. of edges
Dense Graph: No. of edges is close to maximal no. of edges.

Sol 4. Cycle Detection in BFS :-

1. Compute in-degree (no. of incoming edges) for each of the vertex present in graph & count no. of ~~edges~~ nodes = 0
2. Pick all the vertices with in degree as 0 & add them to queue.
3. Remove a vertex from the queue, then
   - increment count by 1.
   - Decrease in-degree by 1 for all neighbours.
   - If in-degree of a neighbouring node is = 0, add to queue.
4. Repeat 3 until queue is empty.
5. If no. of visited nodes is not equal to no. of nodes, then graph has a cycle.

P.T.O.

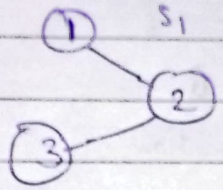
Cycle Detection in DFS:-

- A similar process is done in DFS as well, but in DFS we have the option of doing recursive calls for vertices which are adjacent to the current node & are not yet visited. If recursive function return false, then graph does not have a cycle.

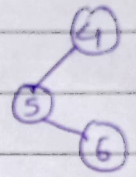
Sols. Disjoint Set Data Structure :-

It is a DS that is used in various aspects of cycle detection. This is literally a grouping of two or more disjoint sets.

eg -



S_1



S_2

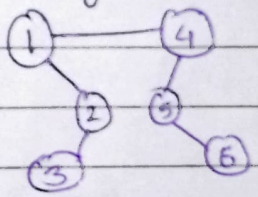
$S_1 = \{1, 2, 3\}$

$S_2 = \{4, 5, 6\}$

Operations :-

1. Union - Merge two sets when edge is added.

$S_1 \cup S_2 = S_3 \rightarrow$



2. Find() tells which element belongs to which set.

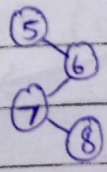
Find (1) = S_1 | Find (4) = S_2

3. Intersection - output another set as common elements.

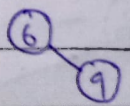
$S_1 \cap S_2 = \{\phi\}$

$S_4 \cap S_5 = \{6\}$

S_4 -

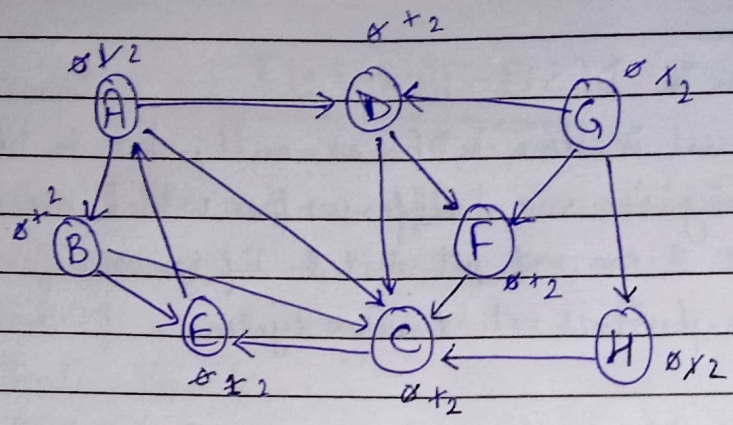


S_5



- BFS

Sol 6.



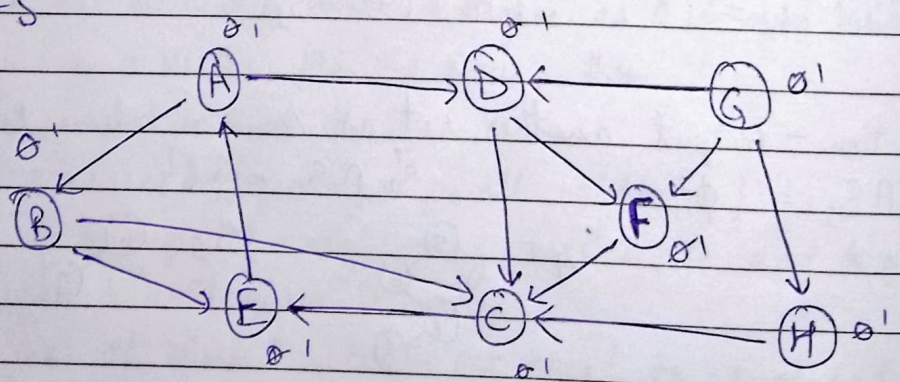
Taking G as Root

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

All visited from source G.

Source	Destination	Path
G	A	G → H → C → E → A
G	B	G → H → C → E → A → B
G	C	G → H → C
G	D	G → D
G	E	G → H → C → E
G	F	G → F
G	H	G → H

- DFS

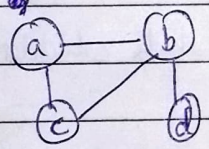


Nodes Processed	Stack
	G
G	DFH
D	CFH
C	EFH
E	AFH
A	BFH
B	FH

Already processed

Source	Destination	Path
G	A	G→D→C→E→A
G	B	G→D→C→E→A→B
G	C	G→D→C
G	D	G→D
G	E	G→D→C→E
G	F	G→F
G	H	G→H

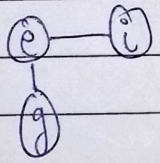
Sol 7. (1)



No. (v) = 4

No. (cc) = 1

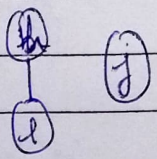
(2)



No. (v) = 3

No. (cc) = 1

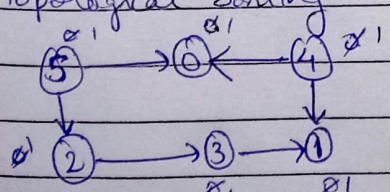
(3)



No. (v) = 3

No. (cc) = 2

Sol 8. Topological Sorting.



Adjacency List

0 →

1 →

2 → 3

3 → 1

4 → 0, 1

5 → 2, 0

Head →

Stack	0	1	3	2	4	5

Topological = 5 4 2 3 1 0

- DFS Stack → | 4 | 0 | 1 | 3 | 2 | 5 | Head →

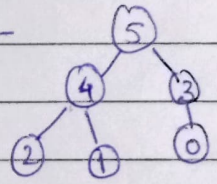
  DFS → 5 → 2 → 3 → 1 → 0 → 4

Sol 9. Application of Priority Queue

1. Dijkstra's algo – we need to use a priority queue here so that ~~minimal edges~~ minimal edges can have higher priority.
2. Load Balancing – Load balancing can be done from branches of higher priority to those of lower priority.
3. Interrupt Handling – To provide proper numerical priority to more imp interrupts
4. Huffman Code – For data compression in Huffman code.

Sol 10. Max Heap where parent is bigger than both children.

eg –



Min Heap where parent is smaller than both children

eg –