Tutorial - 5

Soln 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 a graph, min distance comparison, gps navigation.

DFS - To detect & compare multiple paths, detect cycle in a graph.

Soln 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."

Soln 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.

Soln 4: Cycle Detection in BFS :

1. Compute in degree (no. of incoming edges) for each of the vertex present in graph & count no. of nodes = 0.
2. Pick all the vertices with ing indegree as 0 & add them to queue.
3. Remove a vertex from two queue, then
   - increment count by 1.
   - decrease in degree by 1 for the 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.

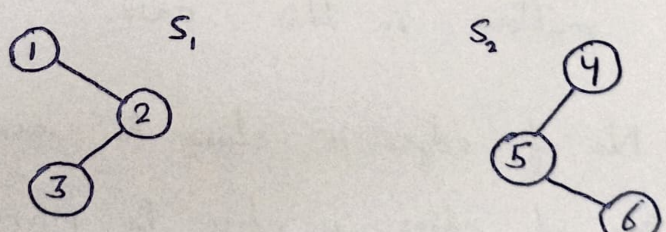
Cycle Detection in DFS.

- 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 ~~fu~~ function returns false, then graph does not have a cycle.

Soln 5: Disjoint Set Data Structure:

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

eg.

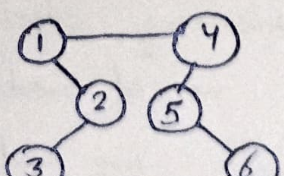


$S_1 = \{1, 2, 3\}$
$S_2 = \{4, 5, 6\}$

Operations:

① Union: Merge two sets when edge is added $S_1 \cup S_2 = S_3$

$\Rightarrow$

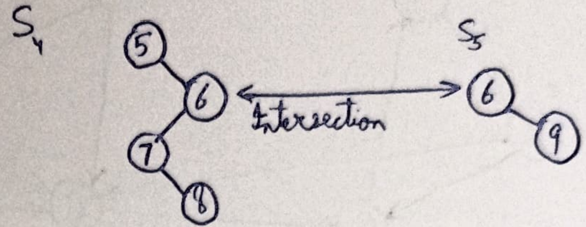


② Find() tells which element belongs to which set

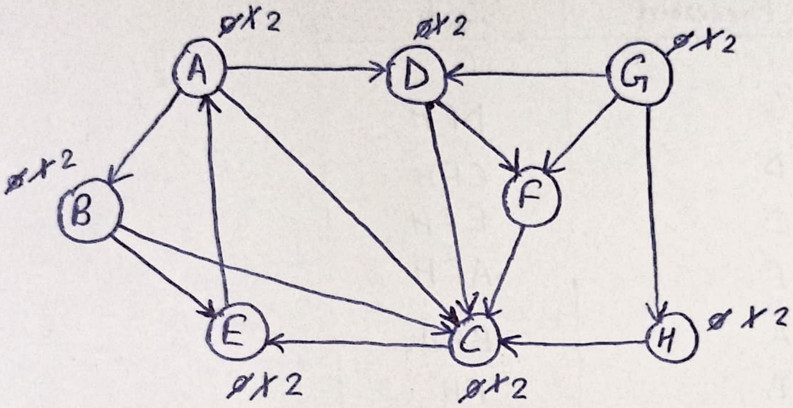
Find(1) = S_1 Find(4) = S_2.

③ Intersection - outputs another set as common elements

$S_1 \cap S_2 = \{\phi\}$ $\quad\quad$ $S_4 \cap S_5 = \{6\}$



Sol 6:- BFS

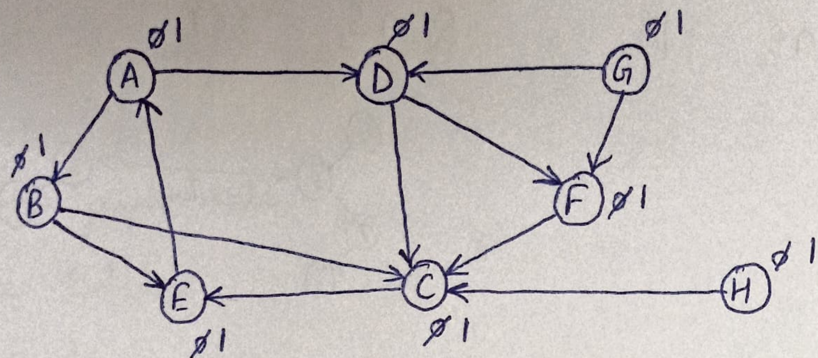


Node	G	H	F	D	C	E	A	B
Parent		G	G	G	H	C	E	A

All visited from source G.

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

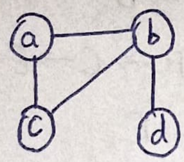
• DFS



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

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

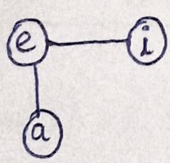
Sol 7: ①



No (V) = 4

No (CC) = 1

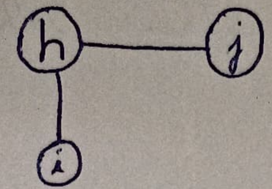
②



No (V) = 3

No. (CC) = 1

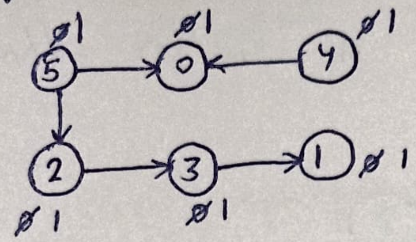
3



No. (V) = 3

No (cc) = 2

Sol 8 : Topological Sorting



Ajacent List

0 →
1 →
2 → 3
3 → 1
4 → 0,1
5 → 2,0

Stack

0	1	3	2	4	5

Topological = 5 4 2 3 1 0

DFS

Stack →

4	0	1	3	2	5

Head →

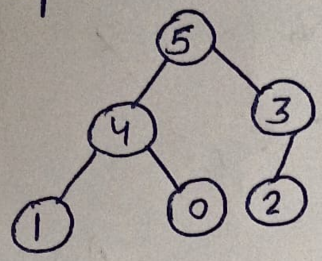
DFS → 5 → 2 → 3 → 1 → 0 → 4

Soln 10 : Applications of Priority Queue.

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

Soln 10: Max Heap :- where parent is bigger than both children.

eg :-



Min Heap :- where parent is smaller than both children

eg :-