



IQRA NATIONAL UNIVERSITY  
Phase II, Hayatabad Peshawar

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ID# 14486

Dept: BS(CS)

Final-Term (1)

paper: Design & Analysis of Algorithms

-: Q1 :-

Answers :- Fill in the blanks.

(1) vertex

(6) Source Node

(2) Multiple / Parallel Edge

(7) Sink

(3) Adjacent edges.

(8) Isolated or Null graph

(4) Simple Path

(9) Regular Graph

(5) Cycle

(10) Labeled Graph

-: Q2 :-

Answers :-

(i)  $D - Y^* (F/G)$

Pre-fix Notation :-

=  $D - Y^* (F/G)$

=  $-D Y^* (F/G)$

=  $-D * Y (E/G)$

=  $-D * Y (IFG)$  Ans





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Post-fix Notation:-

$$\begin{aligned}
 &= \underline{D} - \underline{y} * \underline{(F/G)} \\
 &= \underline{Dy} * \underline{(F/G)} - \\
 &= \underline{Dy} \underline{(F/G)} * - \\
 &= \underline{Dy} \underline{(FG)} * - \text{ Ans}
 \end{aligned}$$

(ii)  $T/W^R + S * M - Y^K$

Pre-fix Notation:-

$$\begin{aligned}
 &= \underline{T/W^R + S * M - Y^K} \\
 &= + \underline{T/W^R} \underline{S * M} - \underline{Y^K} \\
 &= + / \underline{TW^R} - \underline{S * M} \underline{Y^K} \\
 &= + / T^R W - * S M^R Y K \text{ Ans}
 \end{aligned}$$

Post-fix Notation:-

$$\begin{aligned}
 &= \underline{T/W^R} + \underline{S * M} - \underline{Y^K} \\
 &= \underline{T/W^R} \underline{S * M} - \underline{Y^K} + \\
 &= \underline{TW^R} / \underline{S * M} \underline{Y^K} - + \\
 &= \underline{TWR^R} / \underline{SM} * \underline{YK}^R - + \text{ Ans}
 \end{aligned}$$





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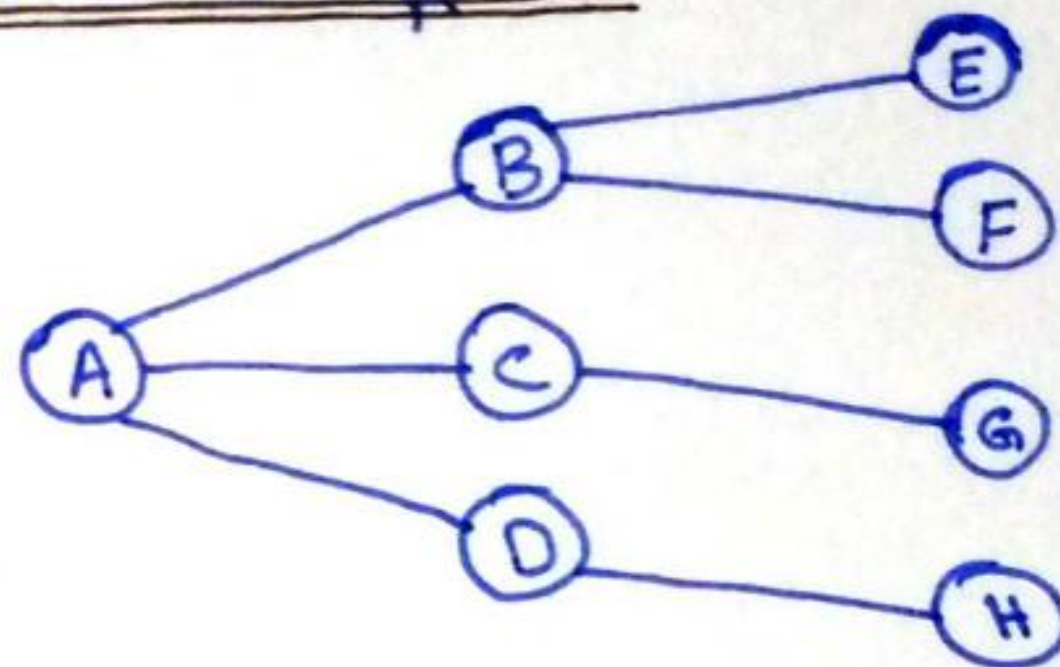
paper: \_\_\_\_\_

(3)

-: Q3 :-

Answers:-

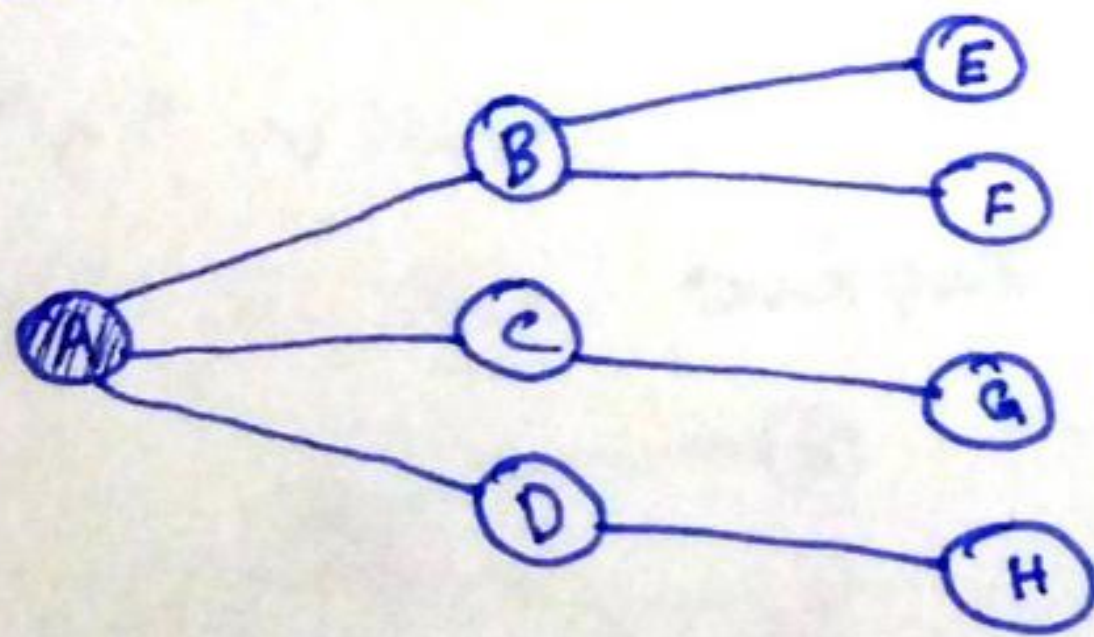
Breadth-First Technique:-



(i)  $\Rightarrow$  Root "A" is Current working Node (CWN).

$\Rightarrow$  Mark "A" visited.

$\Rightarrow$  Add "A" to the output sequence.

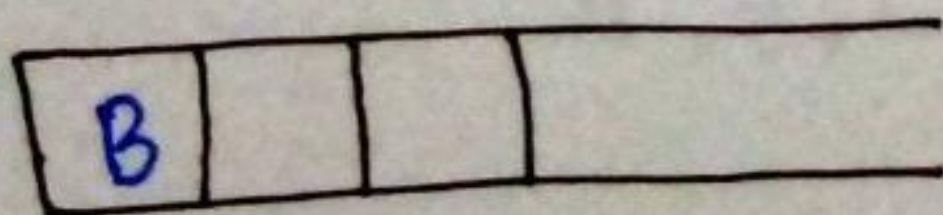


output Sequence:-

A,

(ii)  $\Rightarrow$  A is adjacent to B, C and D.

$\Rightarrow$  Select "B" and push it into Q



$\Rightarrow$  Mark "B" visited.

$\Rightarrow$  Add "B" to the output sequence.





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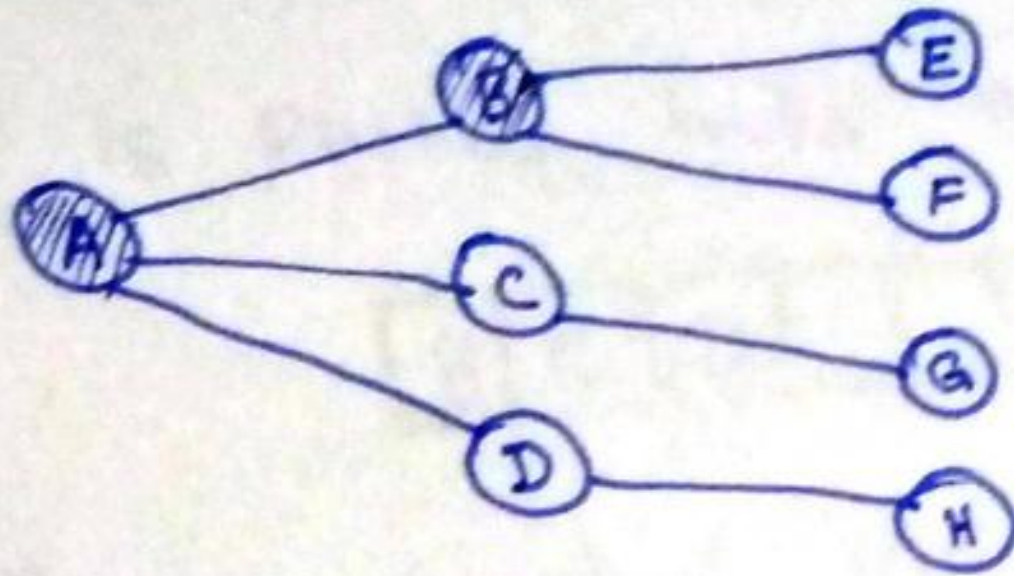
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paper: \_\_\_\_\_



Output Sequence :-

A, B

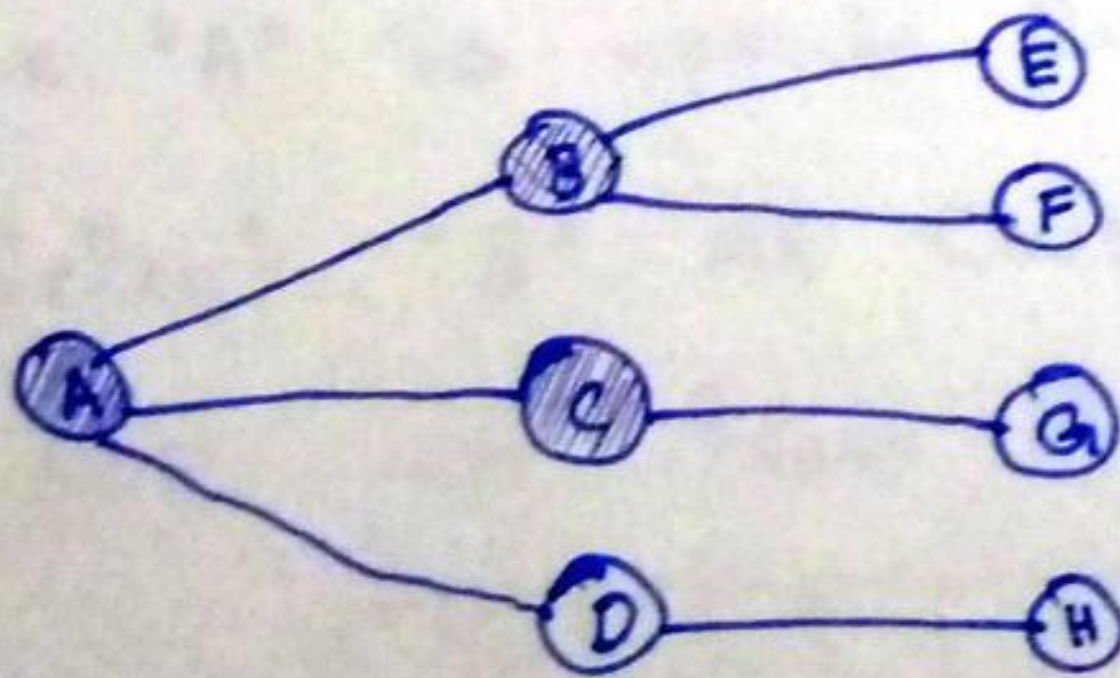
(iii) ⇒ Accessing "c" from CWN i.e "A"

⇒ push "c" into Q



⇒ Mark "c" visited.

⇒ Add "c" to the output Sequence.



Output Sequence :-

A, B, C





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ID# \_\_\_\_\_

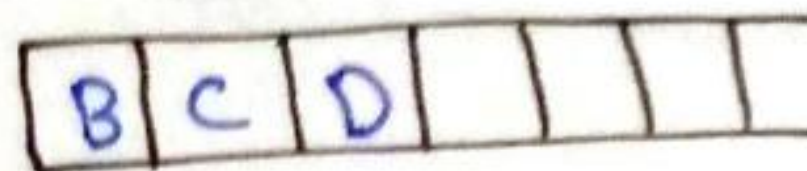
Dept: \_\_\_\_\_

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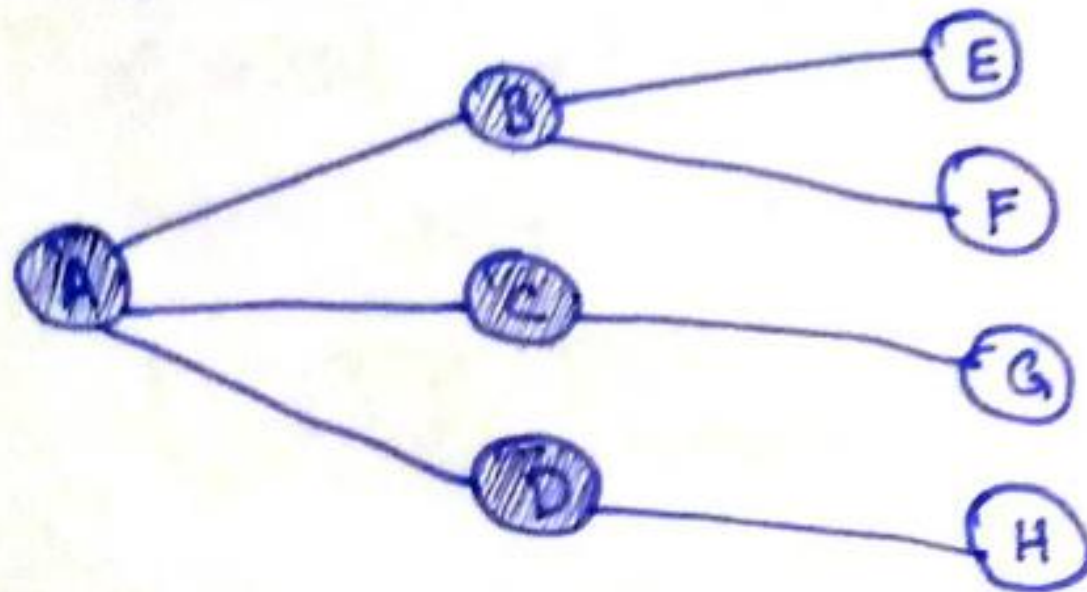
(iv) From CWN i.e "A" the adjacent node "D" is selected.

⇒ "D" is pushed into the Q.



⇒ "D" is marked visited.

⇒ "D" is added to the output sequence.



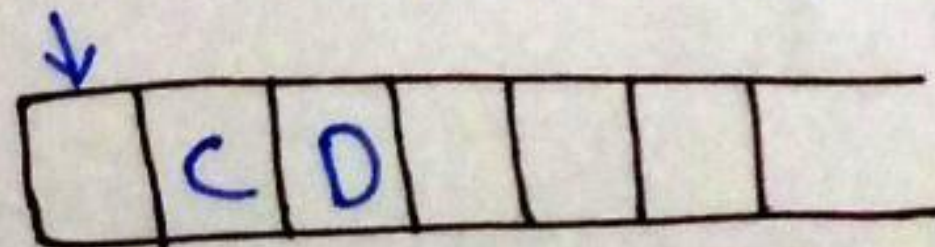
Output Sequence :-

A, B, C, D

(v) ⇒ Now as there are no more nodes adjacent to CWN i.e "A" so update CWN.

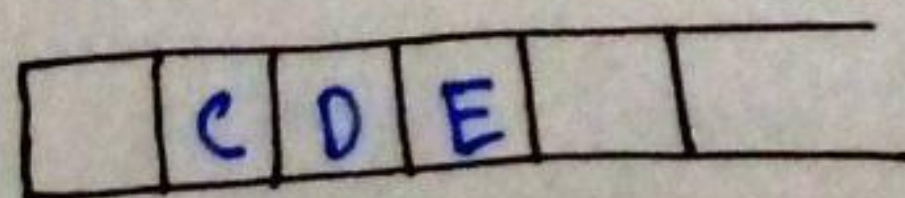
⇒ Select "B" as CWN.

⇒ pop it from Q



⇒ "B" is adjacent to E and F

⇒ Select "E" to Q push it into Q.



⇒ Add "E" to the output sequence.

⇒ Mark "E" visited.





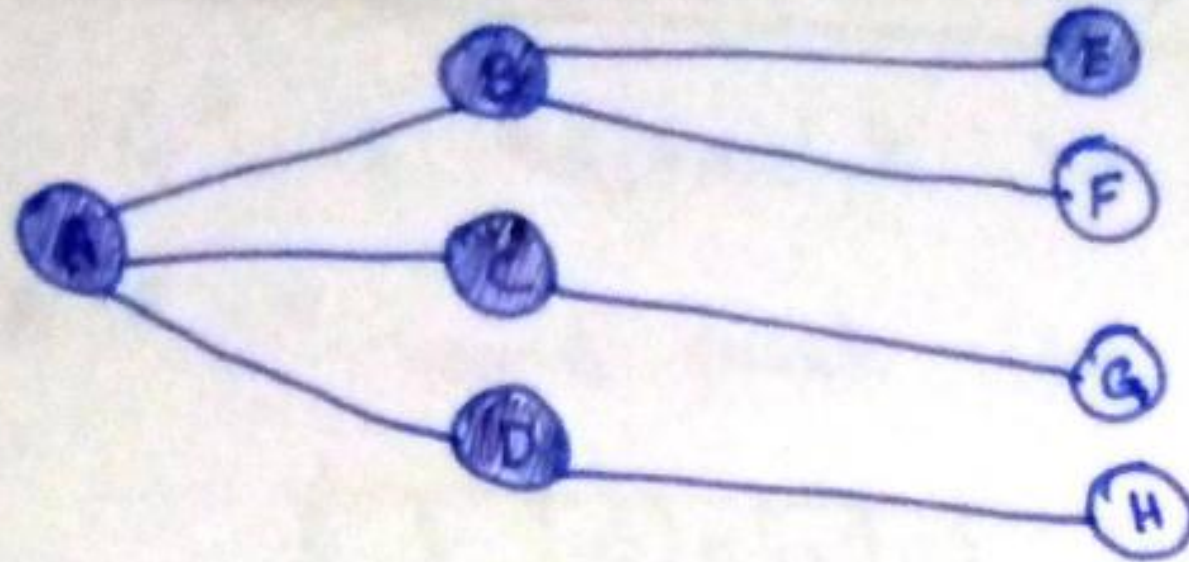
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Output Sequence :-

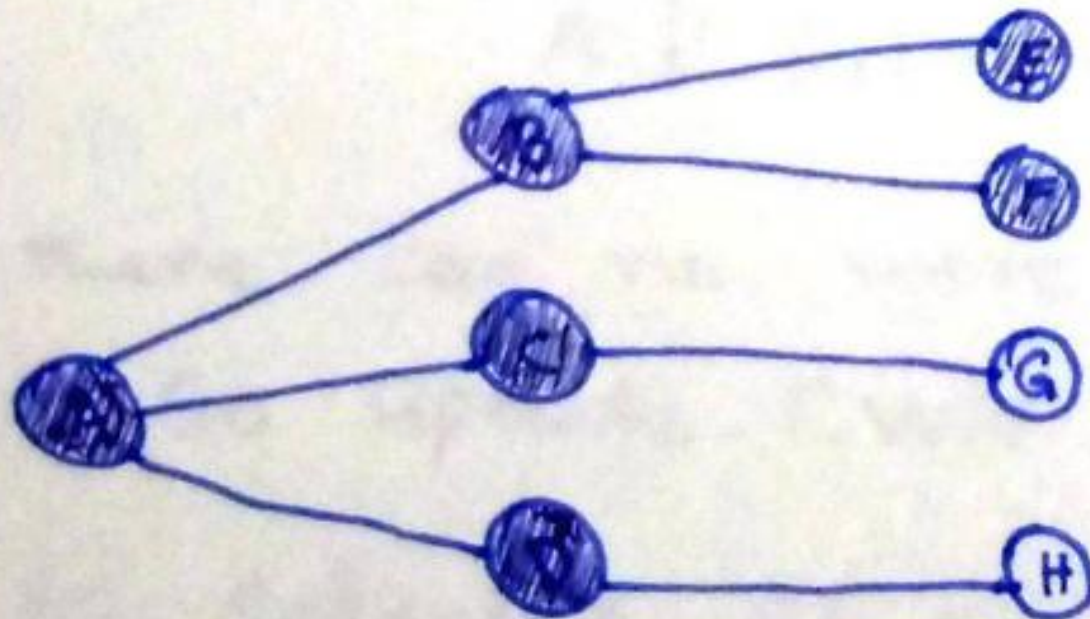
A, B, C, D, E

(vi) From CWN i.e "B" access "F"  
 => push "F" into Q.



=> Mark "F" visited.

=> Add "F" to the output sequence.



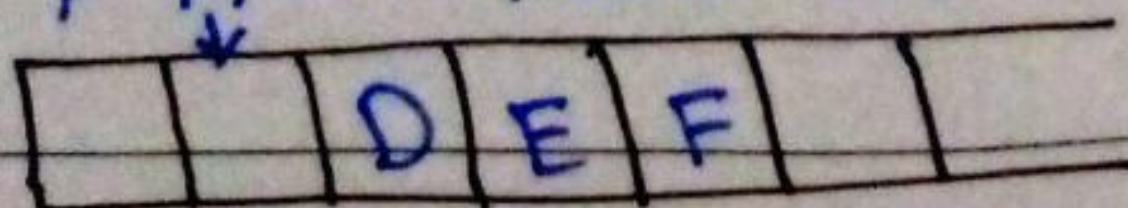
Output Sequence :-

A, B, C, D, E, F

=> As there are no more nodes adjacent to CWN i.e "B", so  
 update CWN again.

=> Select "C" as CWN. (New)

=> "C" is popped from Q.







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paper: \_\_\_\_\_

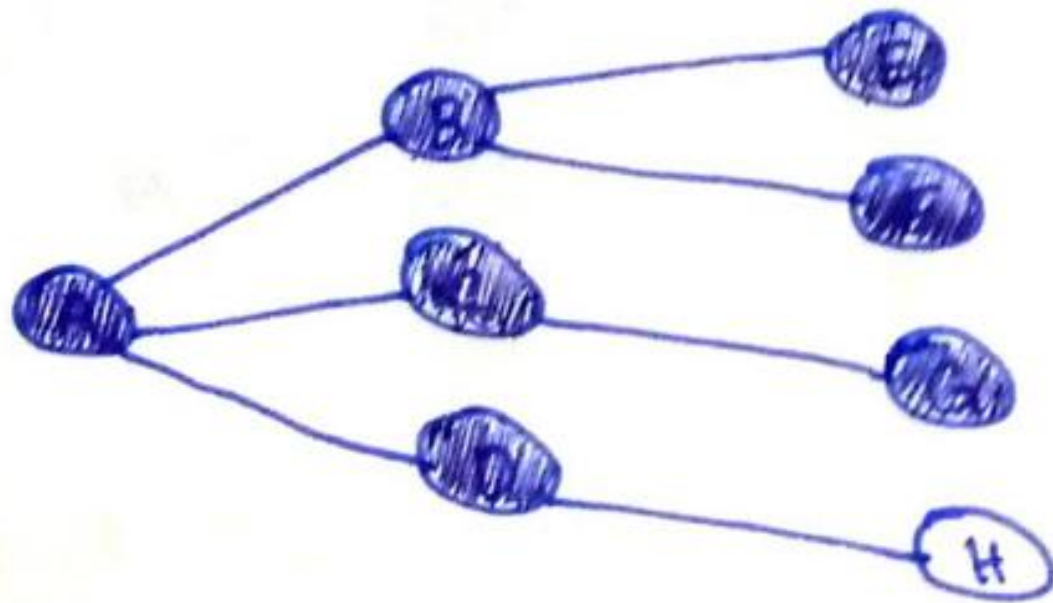
(vii) Now "C" is adjacent to "G".

⇒ Select "G" and push it into the Q.



⇒ "G" is marked visited.

⇒ "G" is added to output sequence.



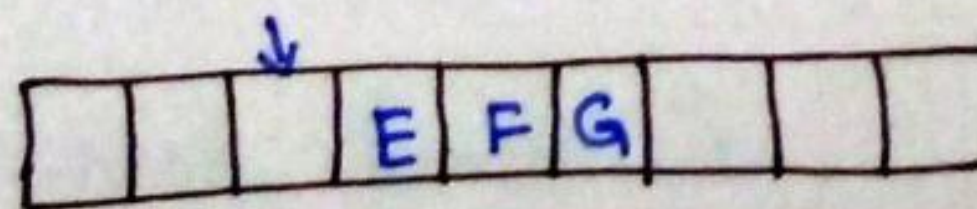
Output Sequence :-

A, B, C, D, E, F, G

⇒ Again there are no more nodes adjacent to CWN  
i.e "C", so update CWN.

⇒ "D" is selected as new CWN.

⇒ "D" is popped from Q.







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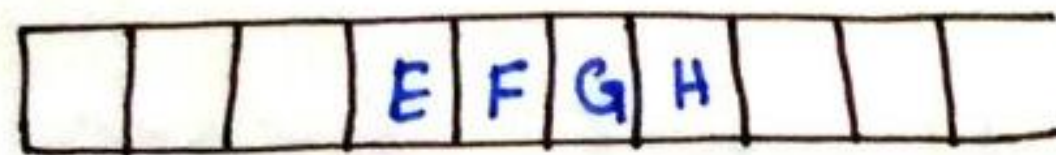
Dept: \_\_\_\_\_

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paper: \_\_\_\_\_

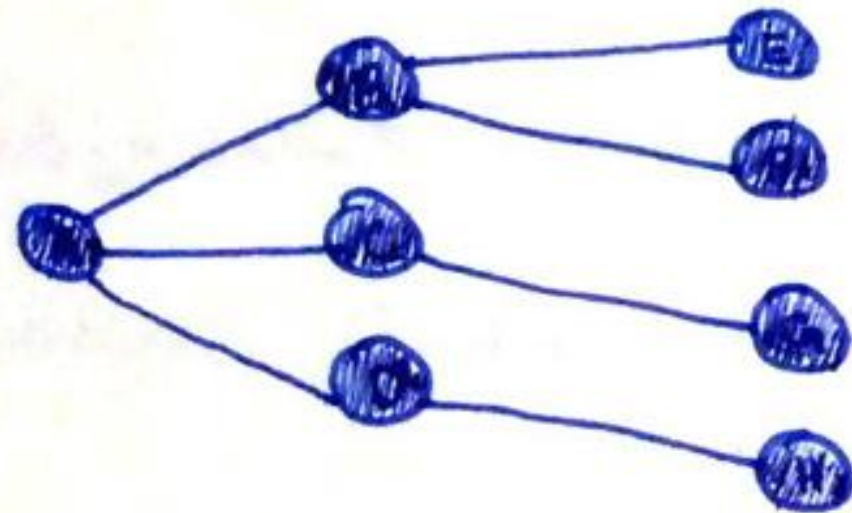
(viii) ⇒ From CWN i.e "D" adjacent node is H.

⇒ "H" is selected and is pushed into the Q.



⇒ "H" is marked visited.

⇒ "H" is added to output sequence.

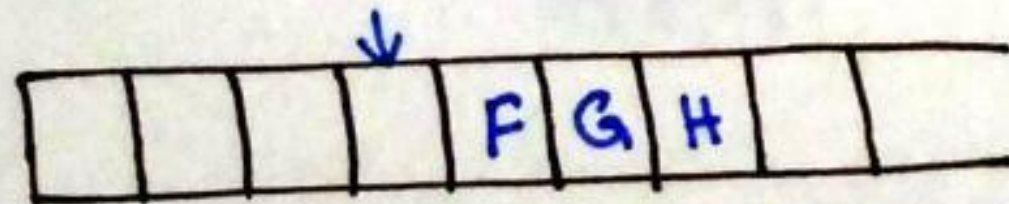


Output Sequence :-

A, B, C, D, E, F, G, H

⇒ Now CWN is updated to "F"

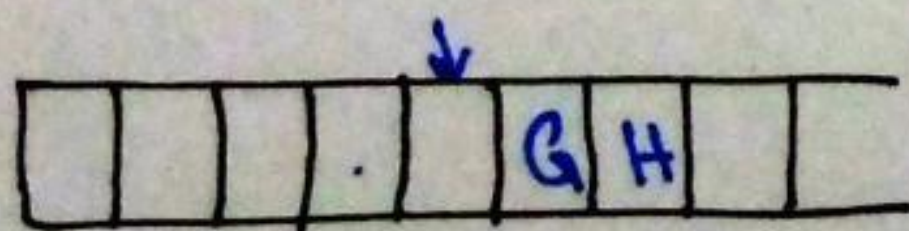
⇒ "F" is popped from Q.



⇒ No adjacent node to "F"

⇒ Again CWN is updated to "F"

⇒ "F" is popped from Q.







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ID# \_\_\_\_\_

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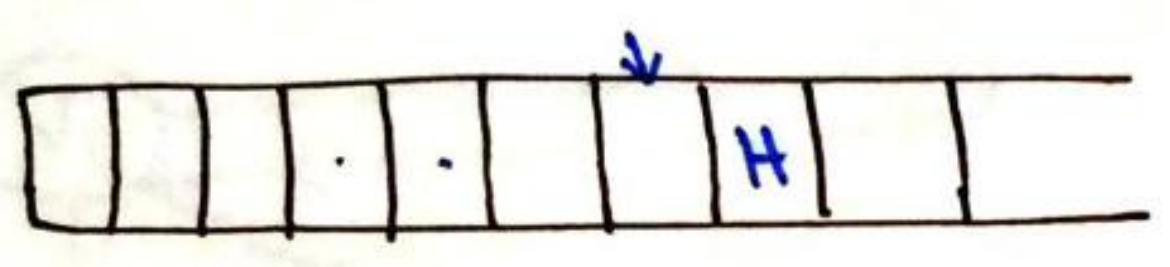
paper: \_\_\_\_\_

(9)

⇒ No adjacent node to "F"

⇒ Now again CWN is updated to "G"

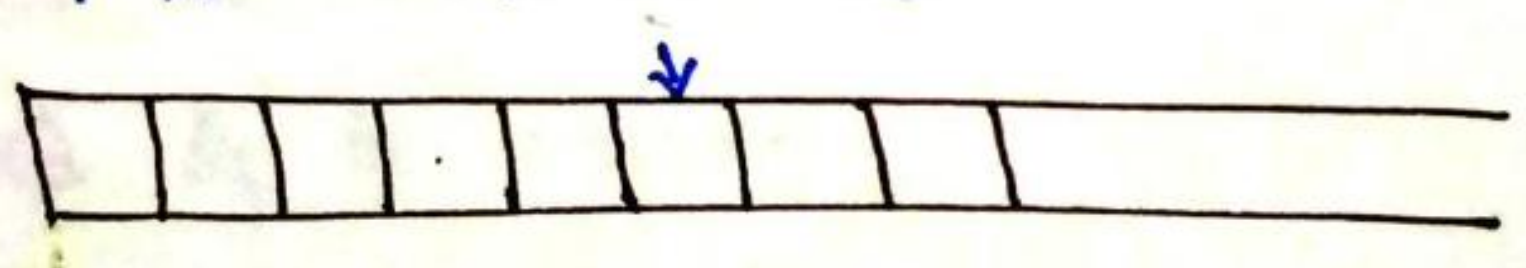
⇒ "G" is popped from Q.



⇒ No adjacent node to "G"

⇒ Now again CWN is updated to "H"

⇒ "H" is popped from Q.



⇒ Q is now empty, so Breadth-First Search stops.





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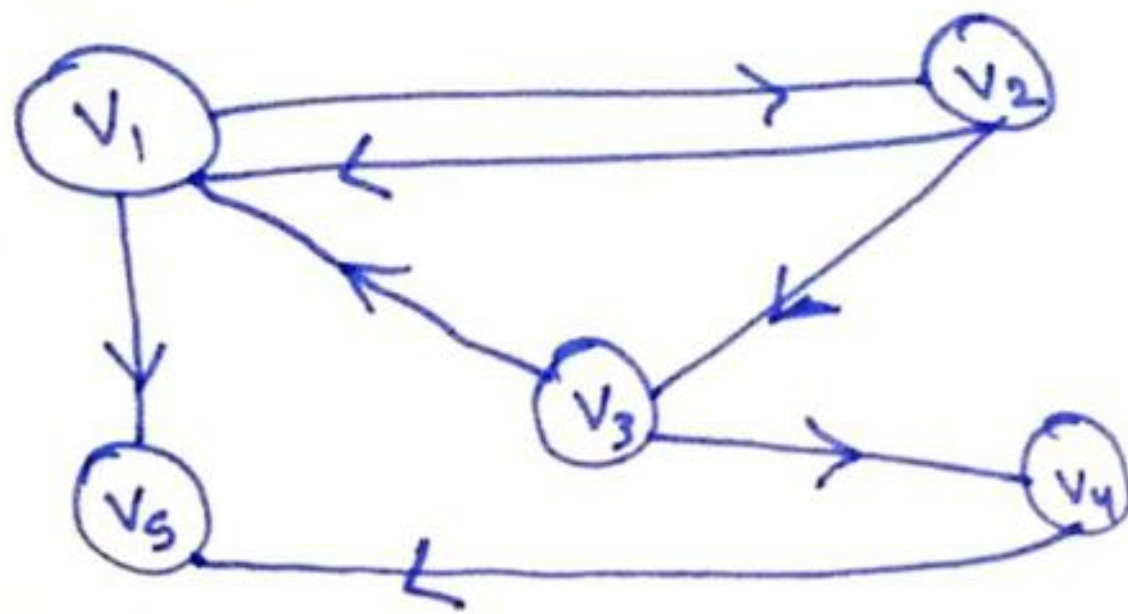
(10)

paper: \_\_\_\_\_

-: Q4 :-

Answer:-

Adjacency Matrix :-



in The graph:

Number of nodes =  $m = 5$

Order of  $A = m \times m$

$= 5 \times 5$

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{bmatrix}$$

Now

$a_{11} = 0$  ; There is no edge from  $V_1$  to  $V_1$

$a_{12} = 1$  ; There is an edge from  $V_1$  to  $V_2$

$a_{13} = 0$  ; There is no edge from  $V_1$  to  $V_3$

$a_{14} = 0$  ; There is no edge from  $V_1$  to  $V_4$





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paper: \_\_\_\_\_

$a_{15} = 1$  : There is an edge from  $v_1$  to  $v_5$   
 $a_{21} = 1$  : // // an // // from  $v_2$  to  $v_1$   
 $a_{22} = 0$  : // // no // // from  $v_2$  to  $v_2$   
 $a_{23} = 1$  : // // an // // from  $v_2$  to  $v_3$   
 $a_{24} = 0$  : // // no // // from  $v_2$  to  $v_4$   
 $a_{25} = 0$  : // // no // // from  $v_2$  to  $v_5$   
 $a_{31} = 1$  : // // an // // from  $v_3$  to  $v_1$   
 $a_{32} = 0$  : // // no // // from  $v_3$  to  $v_2$   
 $a_{33} = 0$  : // // no // // from  $v_3$  to  $v_3$   
 $a_{34} = 1$  : // // an // // from  $v_3$  to  $v_4$   
 $a_{35} = 0$  : // // no // // from  $v_3$  to  $v_5$   
 $a_{41} = 0$  : // // no // // from  $v_4$  to  $v_1$   
 $a_{42} = 0$  : // // no // // from  $v_4$  to  $v_2$   
 $a_{43} = 0$  : // // no // // from  $v_4$  to  $v_3$   
 $a_{44} = 0$  : // // no // // from  $v_4$  to  $v_4$   
 $a_{45} = 1$  : // // an // // from  $v_4$  to  $v_5$





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$a_{51} = 0$  : There is no edge from  $v_5$  to  $v_1$

$a_{52} = 0$  : // // no // from  $v_5$  to  $v_2$

$a_{53} = 0$  : // // no // from  $v_5$  to  $v_3$

$a_{54} = 0$  : // // no // from  $v_5$  to  $v_4$

$a_{55} = 0$  : // // no // from  $v_5$  to  $v_5$

$$A = \begin{matrix} & \begin{matrix} v_1 & v_2 & v_3 & v_4 & v_5 \end{matrix} \\ \begin{matrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{matrix} & \begin{bmatrix} 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \end{matrix}$$

out degree

2  
2  
2  
2  
1  
0  
7

indegree 1 2 1 1 1 2

which is required Adjacency Matrix.





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∴ Q5 :-

Answer :-

$$A = \begin{bmatrix} 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

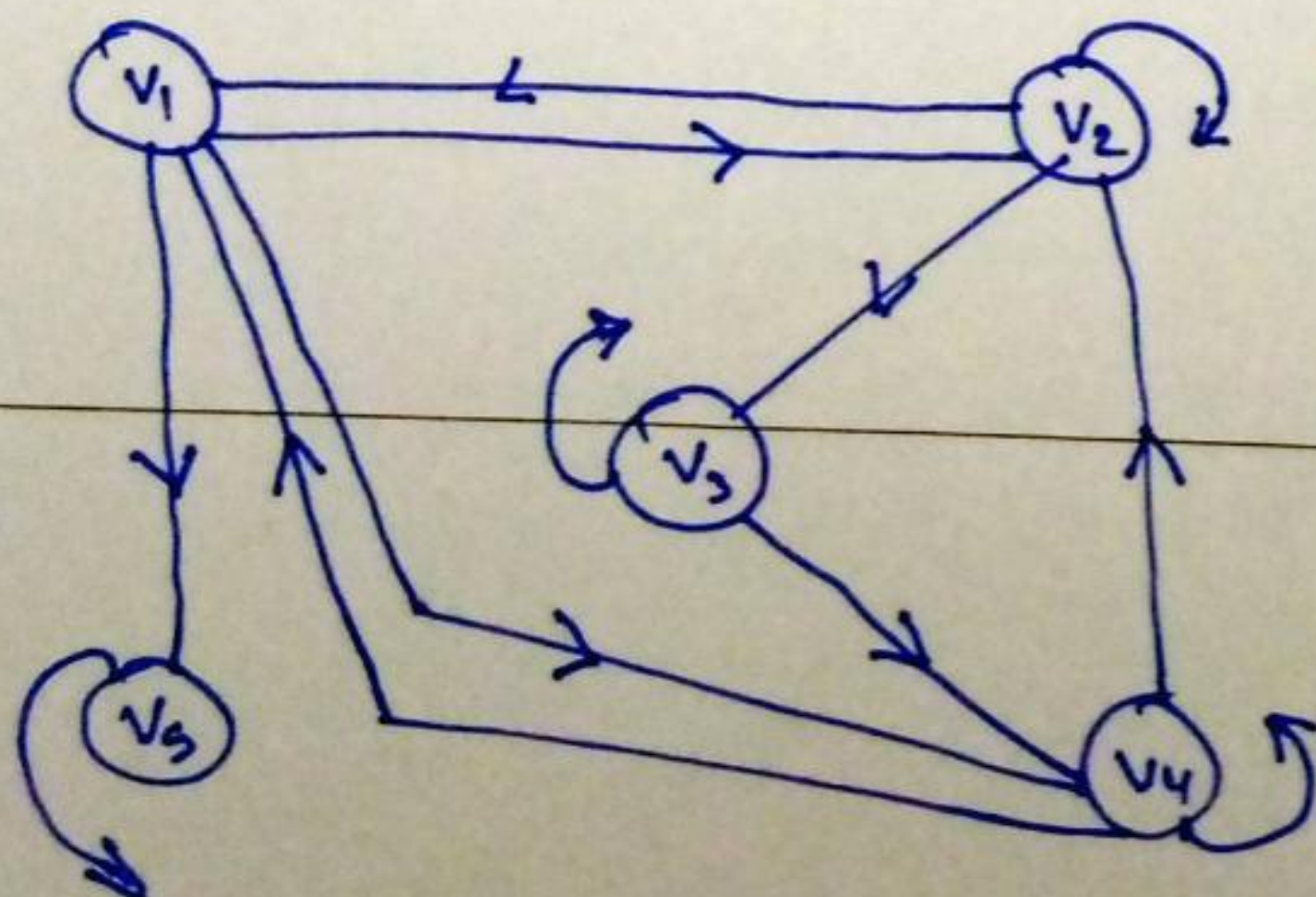
As order of  $A = m \times m$   
 $= 5 \times 5$

So Number of nodes = 5

lets

The nodes be  $v_1, v_2, v_3, v_4, v_5$

$$A = \begin{matrix} & \begin{matrix} v_1 & v_2 & v_3 & v_4 & v_5 \end{matrix} \\ \begin{matrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{matrix} & \begin{bmatrix} 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \end{matrix}$$



which is the required directed Graph.