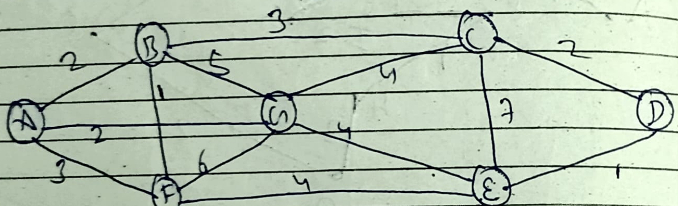
Date : / /
Page No.

Krouskal's algorithm

* It uses the concept of disjoint set.
* It is also a greedy algorithm.
* Everytime there is a choice it choices the cheapest edge.
* In this algorithm we start with the cheapest edge.

Kroushkal's algorithm for MST :-



Edges	Weight
AB	2
AG	2
AF	3
BF	1
BC	3
BG	5
CG	4
CE	7
CD	2
DE	1
EG	4

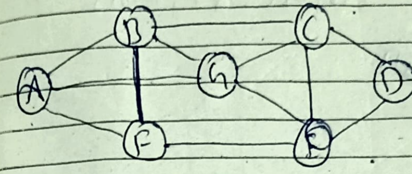
Disjoint set
{A} {B} {C} {D} {E} {F} {G}

EF	4
FG	6

if the number of disjoint set them only join + minimum.

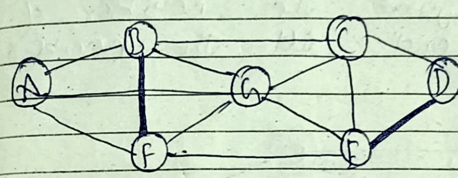
Date : / /
Page No.

minimum weight BF = 1 Disjoint set



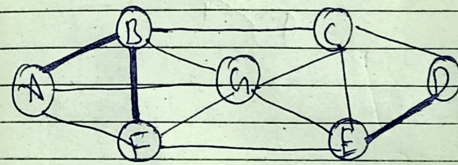
Then remove BF
{A} {BF} {C} {D} {E} {G}

minimum weight DE = 1



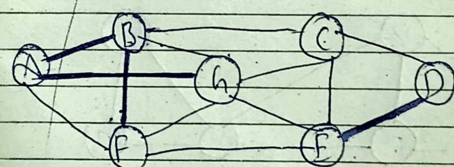
{A} {BF} {C} {DE} {G}

minimum weight AB = 2



{A, B, F}, {C} {DE} {G}

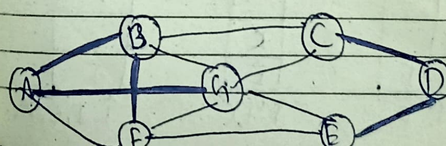
minimum weight AG = 2



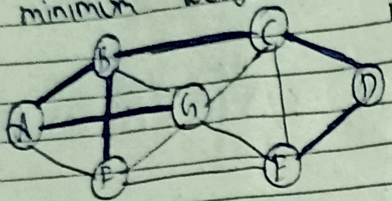
{A, B, F, G}, {C}, {DE}

minimum weight CD

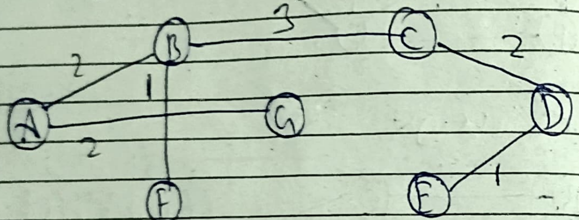
{A, B, F, G}, {C, D, E}



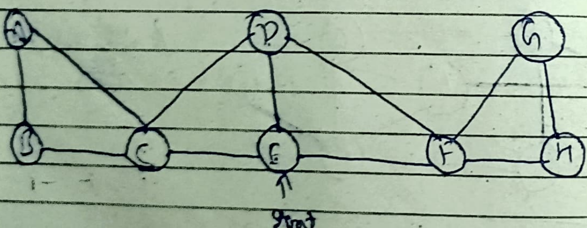
minimum weight BC {A,B,C,D,E,F,G}

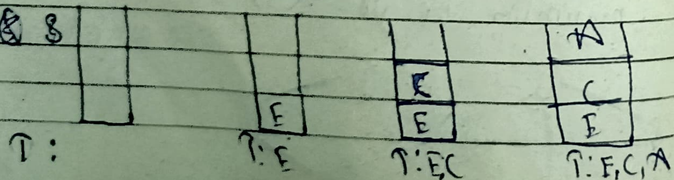


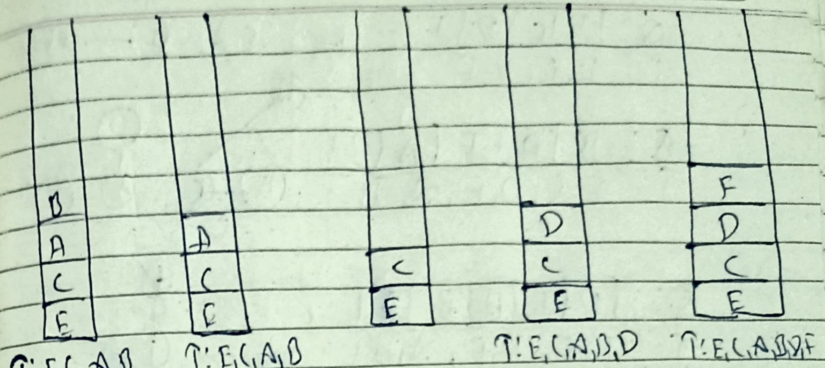
All the remaining edges can't be joined because we joind the member of disjoint set and all the member are joined.

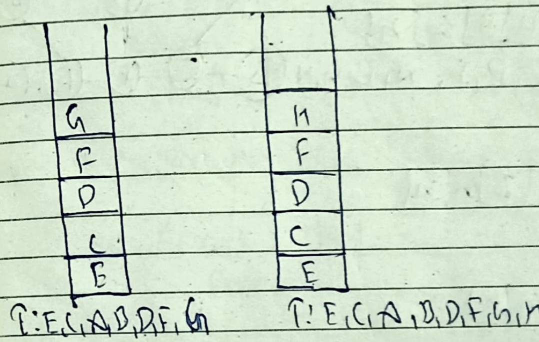


Q Apply DFS algorithm to find the spanning tree from given graph.

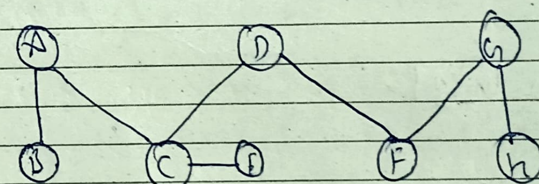




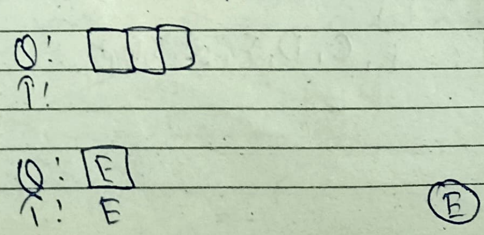




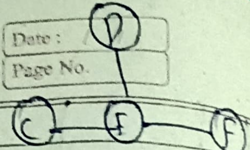
Then pop one by one



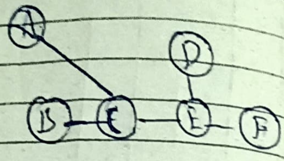
Q Apply BFS in same question solved above. (queue)



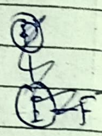
Q: $\boxed{E}\boxed{C}\boxed{D}\boxed{F}$
T: E, C, D, F



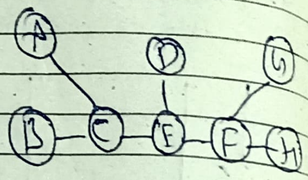
Q: $\boxed{C}\boxed{D}\boxed{F}\boxed{A}\boxed{B}$
T: E, C, D, F, A, B



Q: $\boxed{D}\boxed{F}\boxed{A}\boxed{B}\boxed{\ }$
T: E, C, D, F, A, B



Q: $\boxed{F}\boxed{A}\boxed{B}\boxed{G}\boxed{H}$
T: E, C, D, F, A, B, G, H



Q: $\boxed{A}\boxed{B}\boxed{G}\boxed{H}$
T:

Q: $\boxed{B}\boxed{G}\boxed{H}$
T:

Q: $\boxed{G}\boxed{H}$
T:

Q: $\boxed{H}$
T:

Q: $\boxed{\ }$
T: E, C, D, F, A, B, G, H

All pair shortest path algorithm
Floyd-Warshall's algorithm

Step 1: Find the weight matrix for given graph (W)

Step 2: Obtain the cost matrix (Q) from (W) using ~~the~~ following rules:

if $[W[i,j]] = 0$
then $Q[i,j] = \infty$
(else) otherwise $Q[i,j] = W[i,j]$

Step 3: Repeat K 1 to n

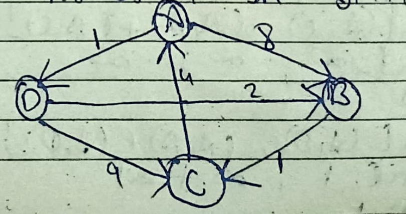
Repeat i 1 to n

Repeat j 1 to n

$$Q^k[i,j] = \min[Q^{k-1}[i,j],\ Q^{k-1}[i,k] + Q^{k-1}[k,j]]$$

$$Q^k[i,j] = \min[Q^{k-1}[i,j],\ Q^{k-1}[i,k] + Q^{k-1}[k,j]]$$

Q. Use Floyd-Warshall's method to find the shortest path among all the pair of vertices in the given graph



Date: / /
Page No.

$$
W = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array}
\begin{array}{c}
\begin{array}{cccc} A & B & C & D \end{array} \\
\begin{bmatrix} 0 & 8 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 4 & 0 & 0 & 0 \\ 0 & 2 & 9 & 0 \end{bmatrix}
\end{array}
$$

$$
Q^0 = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array}
\begin{array}{c}
\begin{array}{cccc} A & B & C & D \end{array} \\
\begin{bmatrix} \infty & 8 & \infty & 1 \\ \infty & \infty & 1 & \infty \\ 4 & \infty & \infty & \infty \\ \infty & 2 & 9 & \infty \end{bmatrix}
\end{array}
$$

$$
Q^1 = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array}
\begin{array}{c}
\begin{array}{cccc} A & B & C & D \end{array} \\
\begin{bmatrix} \infty & 8 & \infty & 1 \\ \infty & \infty & 1 & \infty \\ 4 & 12 & \infty & 5 \\ \infty & 2 & 9 & \infty \end{bmatrix}
\end{array}
$$

$$Q^k[i,j] = \min[Q[i,j] : Q^{k-1}[i,k] + Q^{k-1}[k,j]]$$

$A,A = \min[(A,A), (A,A) + (A,A)]$
$= \infty, \infty + \infty$
$= \infty$

$A,B = \min[(A,B), (A,A) + (A,B)]$
$= \min[8, \infty + 8$
$= 8$

$A,C = \min[(A,C), (A,A) + (A,C)]$
$= \min[\infty, \infty, \infty$
$= \infty$

$A,D = \min[(A,D), (A,A) + (A,D)]$
$= \min[1, \infty + \infty)$
$= \min 1$

$B,A = \min[(B,A), (B,A) + (A,A)]$
$= \min[\infty, \infty + \infty]$
$= \infty$

Date: / /
Page No.

$B,B = \min[(B,B), (B,A) + (A,B)]$
$= \min[\infty, \infty + 8]$
$= \min[\infty, \infty]$
$= \infty$

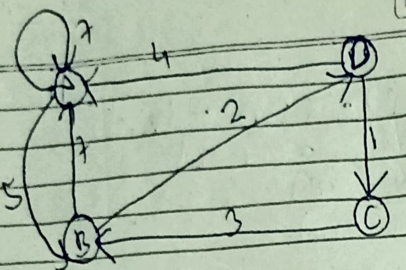
$B,C = \min[(B,C), (B,A) + (A,C)]$
$= \min[1, \infty + \infty]$
$= \cancel{\min}[1$

$$
Q^1 = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array}
\begin{array}{c}
\begin{array}{cccc} A & B & C & D \end{array} \\
\begin{bmatrix} \infty & 8 & \infty & 1 \\ \infty & \infty & 1 & \infty \\ 4 & 12 & \infty & 5 \\ \infty & 2 & 9 & \infty \end{bmatrix}
\end{array}
$$

$$
Q^2 = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array}
\begin{array}{c}
\begin{array}{cccc} A & B & C & D \end{array} \\
\begin{bmatrix} \infty & 8 & \infty & 1 \\ \infty & \infty & 1 & \infty \\ 4 & & \infty & \\ \infty & 2 & 9 & \infty \end{bmatrix}
\end{array}
$$

Date: / /
Page No.

Q



$$D^0 = \begin{array}{c|cccc} & A & B & C & D \\ \hline A & 7 & 5 & \infty & \infty \\ B & 7 & \infty & \infty & 2 \\ C & \infty & 3 & \infty & \infty \\ D & 4 & \infty & 1 & \infty \end{array}$$

$$D^1 = \begin{array}{c|cccc} & A & B & C & D \\ \hline A & 7 & 5 & \infty & \infty \\ B & 7 & 12 & \infty & 2 \\ C & \infty & 3 & \infty & \infty \\ D & 4 & 9 & 1 & \infty \end{array}$$

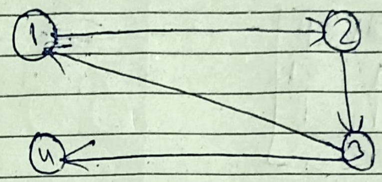
$$D^2 = \begin{array}{c|cccc} & A & B & C & D \\ \hline A & 7 & 5 & \infty & 7 \\ B & 7 & 12 & \infty & 2 \\ C & 10 & 3 & \infty & 5 \\ D & 4 & 9 & 1 & 11 \end{array}$$

$$D^3 = \begin{array}{c|cccc} & A & B & C & D \\ \hline A & 7 & 5 & \infty & 7 \\ B & 7 & 12 & \infty & 2 \\ C & 10 & 3 & \infty & 5 \\ D & 4 & 4 & 1 & 6 \end{array}$$

Date: / /
Page No.

$$D^4 = \begin{array}{c|cccc} & A & B & C & D \\ \hline A & 7 & 5 & 8 & 7 \\ B & 6 & 6 & 3 & 2 \\ C & 9 & 3 & 6 & 5 \\ D & 4 & 4 & 1 & 6 \end{array}$$

Q



Find TC using warshall's algorithm

$$A = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 1 & 0 & 0 \\ 2 & 0 & 0 & 1 & 0 \\ 3 & 1 & 0 & 0 & 1 \\ 4 & 0 & 0 & 0 & 0 \end{array}$$

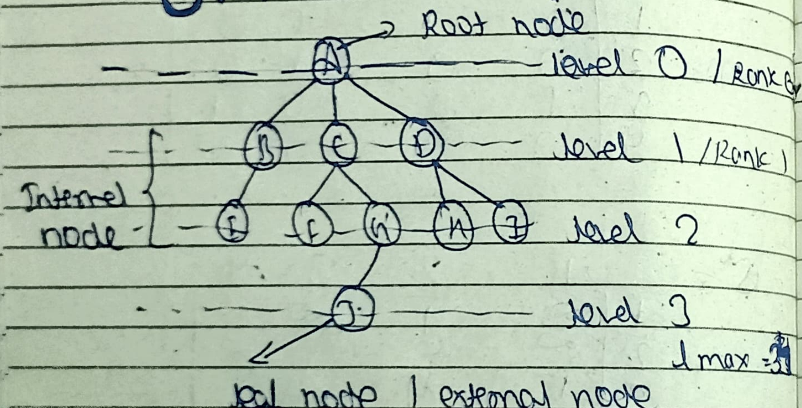
$$A^2 = A \times A = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 0 & 1 & 0 \\ 2 & 1 & 0 & 0 & 1 \\ 3 & 0 & 1 & 0 & 0 \\ 4 & 0 & 0 & 0 & 0 \end{array}$$

$$A^3 = A \times A \times A = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 1 & 0 & 0 & 1 \\ 2 & 0 & 1 & 0 & 0 \\ 3 & 0 & 0 & 1 & 0 \\ 4 & 0 & 0 & 0 & 0 \end{array}$$

$$A^2 = \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 1 & 0 & 0 \\ 2 & 0 & 0 & 1 & 0 \\ 3 & 1 & 0 & 0 & 1 \\ 4 & 0 & 0 & 0 & 0 \end{array}$$

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

UNIT - 4



All the nodes with degree 0 is known as leaf node.

Height / Depth : The maximum number of nodes that are possible in a path starting from the root node to the leaf node is known as height of the tree.

Degree or entry : Number of child nodes of a parent node.

Level of the root node is always 0.

Height of the tree implies height of the root node.

In diagram height of tree is 4

A → C → G → J

Height = level (max) + 1

Binary tree : In binary tree one node to should have 2 child node.

Maximum degree of binary tree is 2.

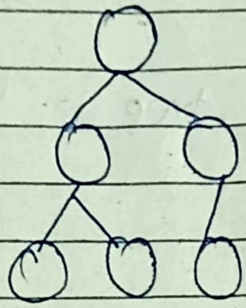
Full binary tree and complete binary tree (heap)

CBT

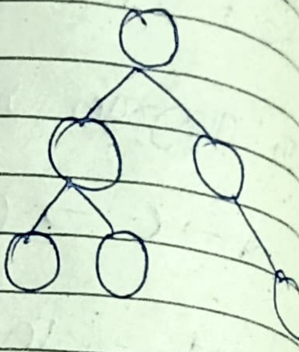
A binary tree is said CBT if all its levels (except possibly the last level) have the maximum number of possible nodes and the last level has all its nodes to the left side as far as possible.

FBT

A binary is Full if each node is either leaf node or possesses exactly two child nodes and none of a tree which has degree 1 is known as FBT.



CBT ✓ FBT ✗



CBT ✗ FBT ✗