(1) A minimum spanning tree is a tree in which the sum of weights of the edges is as minimum as possible, connecting all the vertices of the tree.

Applications:

1. Telephone wiring system through different housing.
2. Electrical network designing.
3. Travelling salesman problem.

(2) • Kruskal's algorithm

$T.C = O(|E| \log |E|)$.

$S.C = O(|V|)$.

• Dijkstra's Algorithm.

$T.C = O(V^2)$

$T.C = O(E + V\log V)$ (Fibonacci heap as PQ)

$T.C = O(E\log V)$ (Binary heap as PQ).

$S.C = O(V^2)$

• Bellman ford's Algorithm

$T.C = O(VE)$ $TC = O(V^3)$

Complete Graph

$S.C = O(V)$

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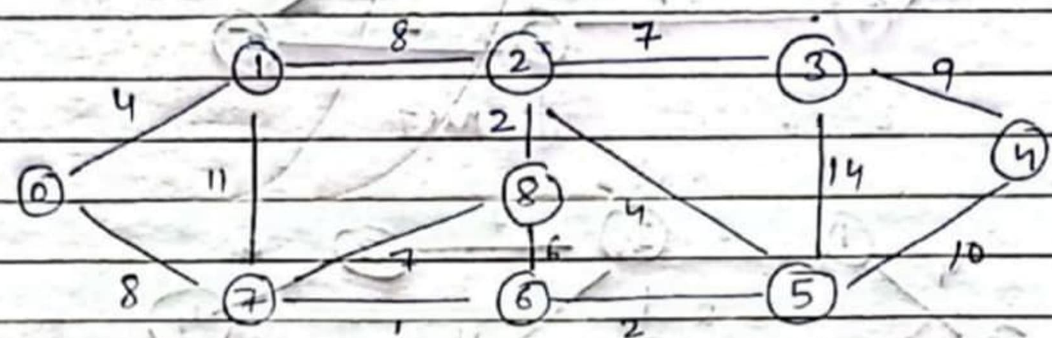
(4) Prism's Algorithm

$T.C = O(|E| \log |V|)$

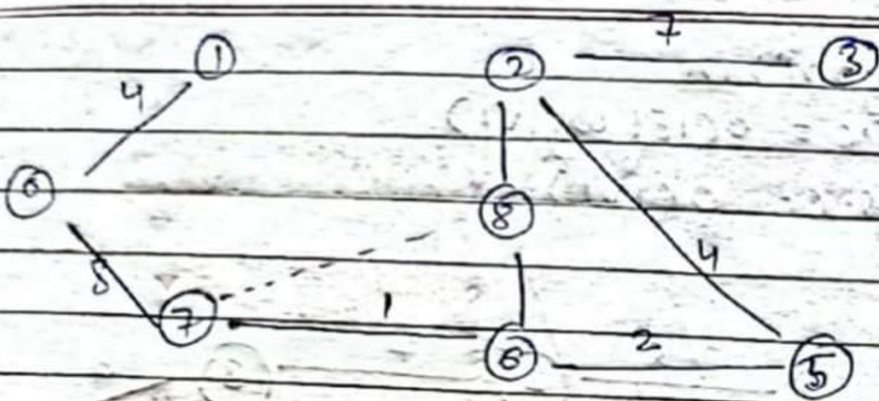
$S.C = O(|V|)$

Ans (3)

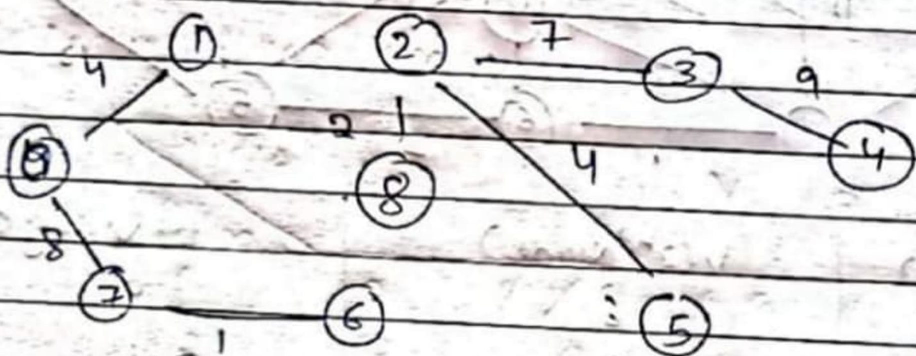


u (1st node)	V (2nd Node)	u-v edge
7	6	0
6	5	1
2	8	2
0	1	2
2	5	4
8	6	4
2	3	6
7	8	7
0	7	7
1	2	8
3	4	8
5	4	9
1	7	10
3	5	11

Date :

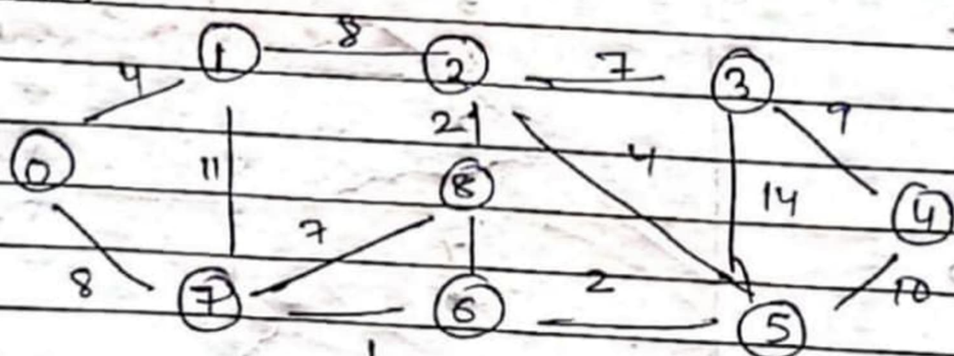


⇓ MST



Total weight = 37.

2. Prism's



weigut tabu

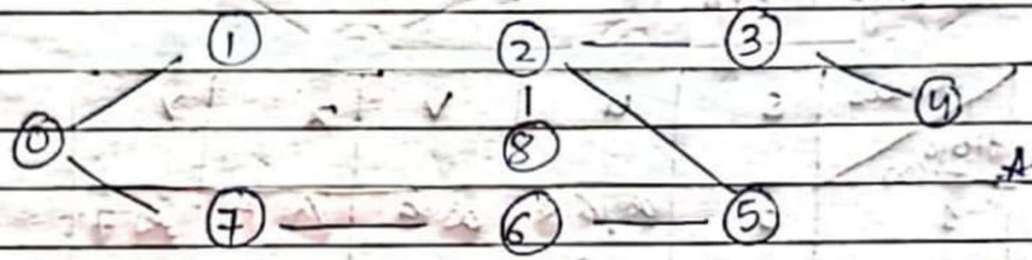
0	1	2	3	4	5	6	7	8
~~∞~~	~~∞~~	~~∞~~	∞	∞	∞	∞	∞	∞
0	4	8	~~∞~~	~~∞~~	~~∞~~	∞	8	~~∞~~
			7	∞	4	∞	~~8~~	2~~0~~
			7	10	4	6	7	
			7	~~10~~		2	7	
			7	9		1		

Parent table 1

0	1	2	3	4	5	6	7	8
-1	~~-1~~	~~-1~~	~~-1~~	~~-1~~	~~-1~~	~~-1~~	~~-1~~	~~-1~~
	0	1	2	~~3~~	2	~~8~~	~~0~~	2
				3		~~5~~	8	
						7		

⇓

MST

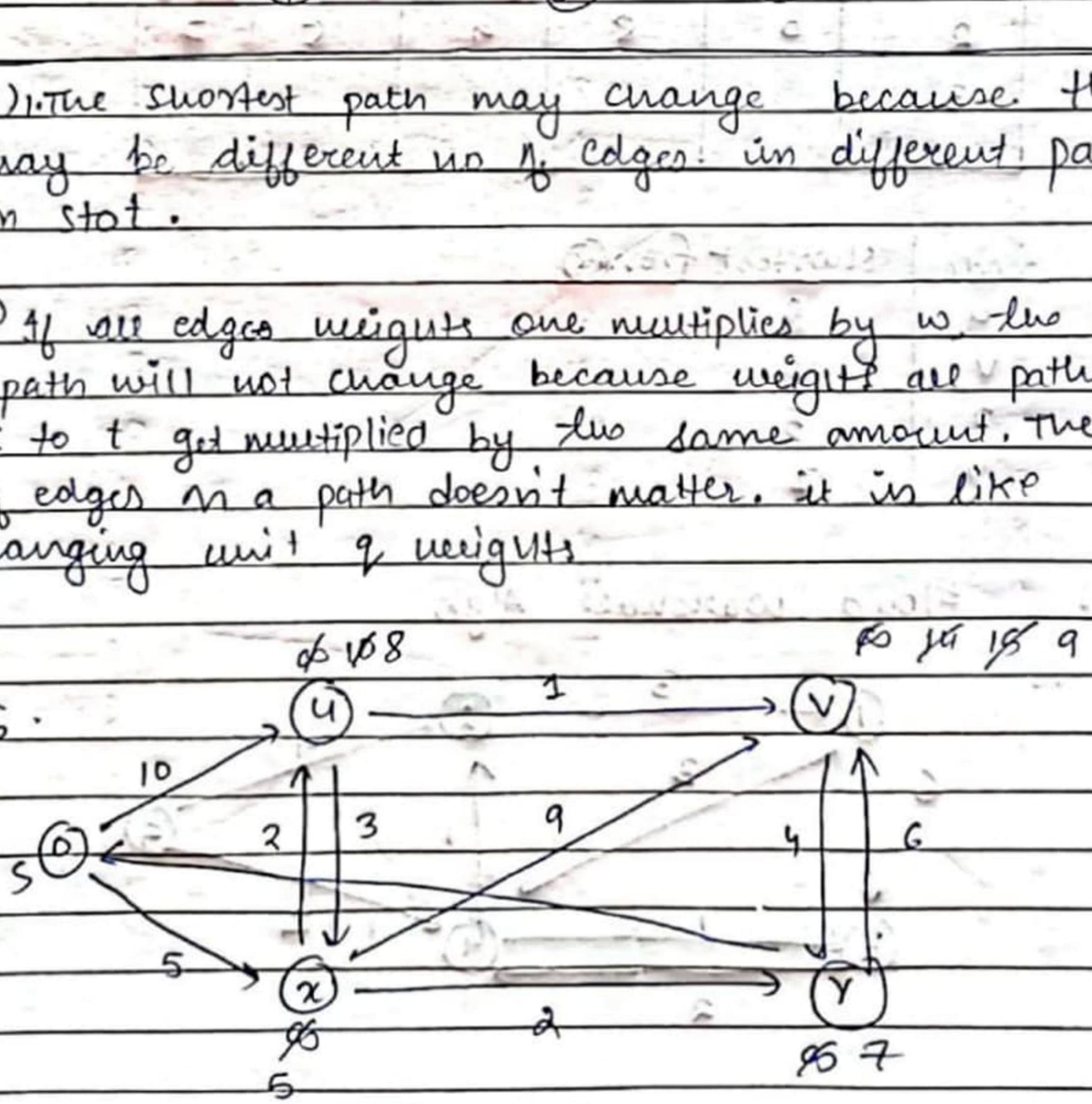


Ans

(4) 1. The shortest path may change because there may be different no of edges in different paths from s to t.

(2) If all edges weights are multiplies by w the shortest path will not change because weights all paths from s to t get multiplied by the same amount. The no of edges in a path doesn't matter. it is like changing unit of weights

Ans 5.



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Dijkstra's algo

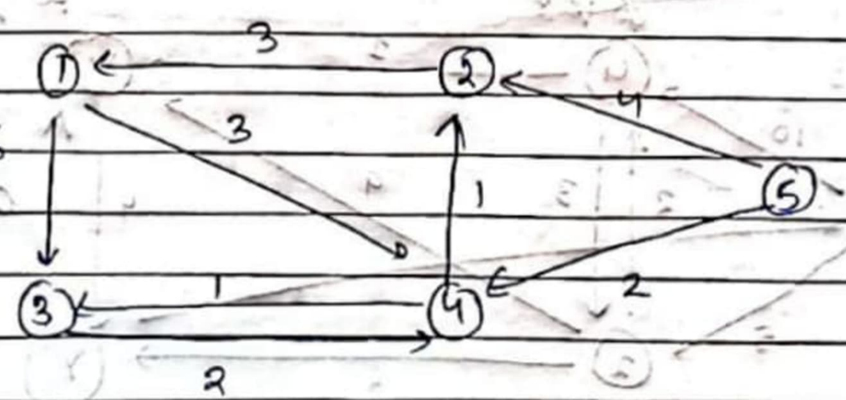
node	shortest distance from s
u	8
v	9
x	5
y	7

Bellman Algorithm

Nodes / Iteration	s	u	v	x	y
1	0	~~∞~~ ~~10~~ 8	~~∞~~ 9	~~∞~~ 5	~~∞~~ 7
2	0	8	9	5	7
3					
4					

node.	shortest from (s)
u	8
v	9
x	5
y	7

Ans 6. Floyd warshall Algo



	1	2	3	4	5
1	0	∞	6	3	∞
2	3	0	∞	∞	∞
3	∞	∞	0	2	∞
4	0	1	1	0	∞
5	∞	4	∞	2	0

$$\text{dist 1} = \begin{bmatrix} 0 & 4 & 4 & 3 & \infty \\ 3 & 0 & \infty & \infty & \infty \\ \infty & \infty & 0 & 2 & \infty \\ 0 & 1 & 1 & 0 & \infty \\ \infty & 4 & \infty & 2 & 0 \end{bmatrix}$$

$$\text{dist 2} = \begin{bmatrix} 0 & 4 & 4 & 3 & \infty \\ 3 & 0 & 7 & 6 & \infty \\ \infty & \infty & 0 & 2 & \infty \\ 0 & 1 & 1 & 0 & \infty \\ \infty & 4 & \infty & 2 & 0 \end{bmatrix}$$

$$\text{dist 3} \begin{bmatrix} 0 & 4 & 4 & 3 & \infty \\ 3 & 0 & 7 & 6 & \infty \\ 2 & 3 & 0 & 2 & \infty \\ 0 & 1 & 1 & 0 & \infty \\ \infty & 4 & \infty & 2 & 0 \end{bmatrix}$$

$$\text{dist 4} \begin{bmatrix} 0 & 4 & 4 & 3 & \infty \\ 3 & 0 & 7 & 6 & \infty \\ 2 & 3 & 0 & 2 & \infty \\ 0 & 1 & 1 & 0 & \infty \\ \infty & 4 & \infty & 2 & 0 \end{bmatrix}$$

$$\text{dist 4} \begin{bmatrix} 0 & 4 & 4 & 3 & \infty \\ 3 & 0 & 7 & 6 & \infty \\ 2 & 3 & 0 & 2 & \infty \\ 0 & 1 & 1 & 0 & \infty \\ 2 & 3 & 3 & 2 & 0 \end{bmatrix}$$

T.C $= O(V^3)$

S.C $= O(V^2)$