Tutorial - 6

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Sec - I

Ans 1 → Minimum Spanning Tree :

It is a subset of the edges of a connected edge-weighted undirected graph that connects all the vertices together without any cycle & with the minimum possible total edge weight.

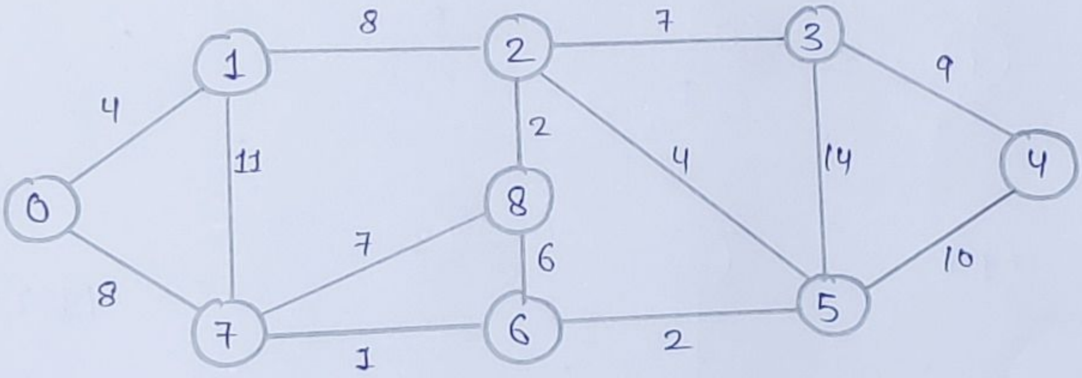
Applications :-

1. Design of networks.
2. Traveling Salesman Problem.
3. Constructing trees for broadcasting in computer networks.

Ans 2 →

Algorithm	Time Complexity	Space Complexity
Prim's	$O((V+E)\log V)$	$O(V)$
Kruskal	$O(E\log V)$	$O(\log E)$
Dijkstra	$O(V^2)$	$O(V^2)$
Bellman Ford	$O(V \cdot E)$	$O(E)$

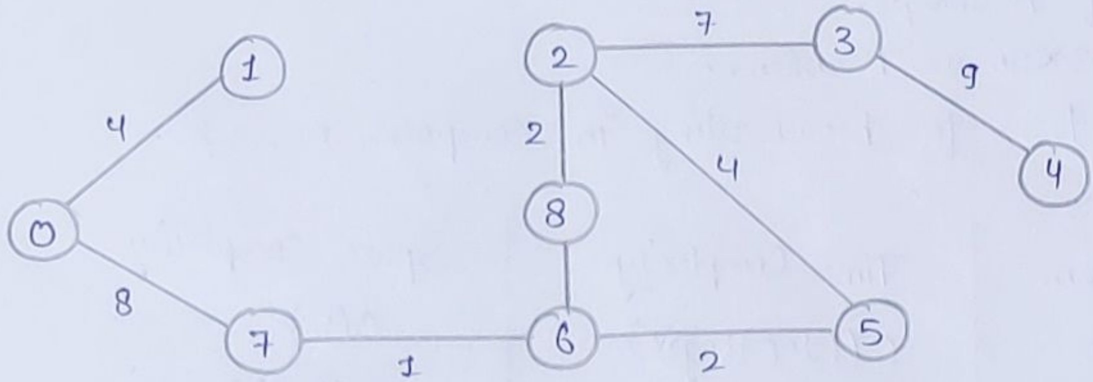
Ans 3 →



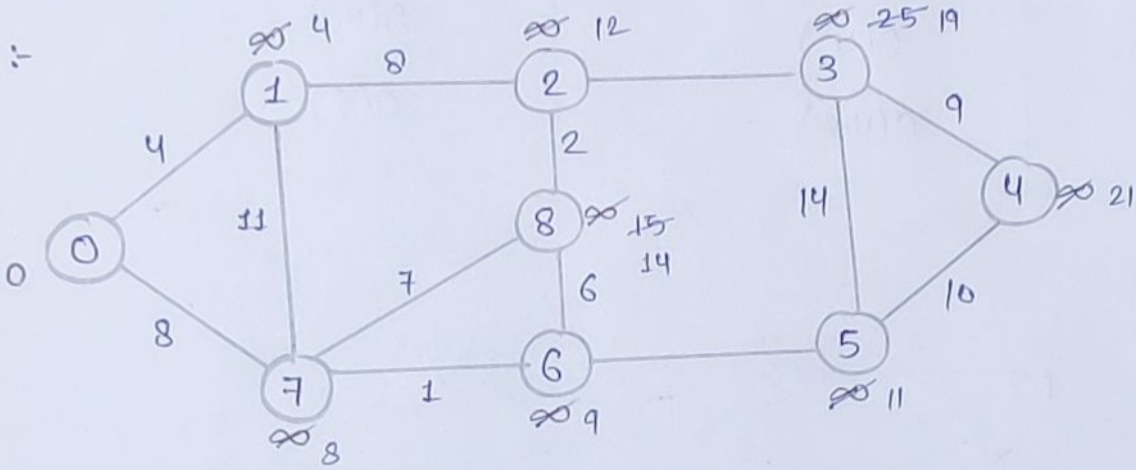
Kruskal :-

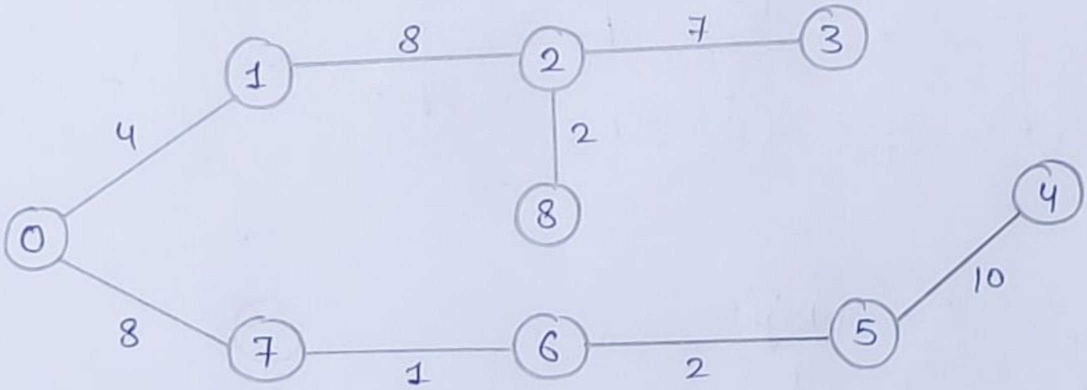
Path	Weight
$7 \to 6$	1
$6 \to 5$	2
$2 \to 8$	2
$0 \to 1$	4
$2 \to 5$	4
$8 \to 6$	6
$2 \to 3$	7
$7 \to 8$	7

0 → 7	8
1 → 2	8
3 → 4	9
5 → 4	10
1 → 7	11
3 → 5	14



Prim :-





MST

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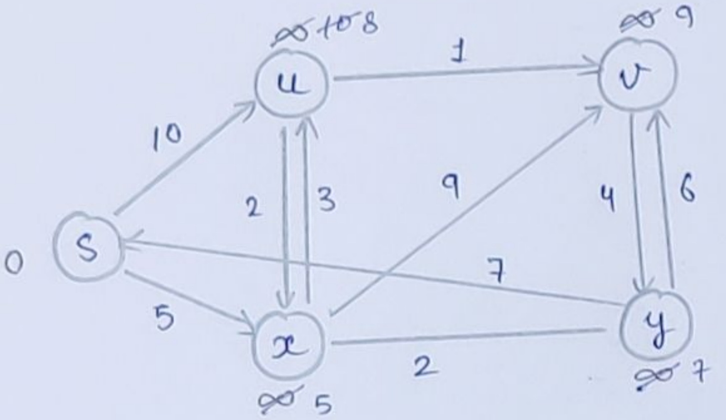
Ans 4 → (i). The shortest path may change. The reason is that there may be different number of edges in different path from 's' to 't'.

Eg- Let shortest path be of weight 15 and has 5 edges. Let there be another path with 2 edges and total weight is 25. The weight of the shortest path is increased by 5 * 10 and hence becomes 15 + 50 (65), while the weight of other path is increased by 2 * 10, it becomes 25 + 10 (45), so shortest path has changed to other path whose weight is 45.

(ii). If we multiply all the edges with 10, the shortest path does not change. The reason is that weight of all paths from 's' to 't' multiplied by some amount. The number of edges on a path does not matter.

Ans 5 →



Node	Shortest distance from Source Node
u	8
x	5
v	7
y	9

Bellman - Ford :-

	S	u	v	x	y
1^{st} →	0	10	∞	~~∞~~ 5	∞
2^{nd} →	0	10	~~∞~~ 11	5	∞
3^{rd} →	0	~~10~~ 8	~~11~~ 9	5	~~∞~~ 7
4^{th} →	0	10	9	5	7