DAA

Tutorial-6

Answer-1) Minimum spanning tree is a subset of the edges of a connected edge-weighted undirected graph that connects all the vertices together without any cycles and with minimum possible ~~total~~ edge weighted.

Applications →

(i) Consider n stations are to be linked using a communication network and lying of communication link between any two stations involves a cost. The ideal solution would be to extract a sub-graph termed as minimum cost spanning tree.

(ii) Suppose you want to construct highways or railroads spanning several cities, then we can use the concept of minimum spanning trees.

(iii) Designing LAN

(iv) Suppose you meant to apply a set of houses with:-

- electric Power
- water
- Telephone Lines
- Sewage Lines

Answer-2) Time Complexity of Prim's Algo : $O(|E| \log |V|)$
Space Complexity of Prim's Algo : $O(|V|)$

Kruskal's Algo

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

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

Dijkstra's Algo

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

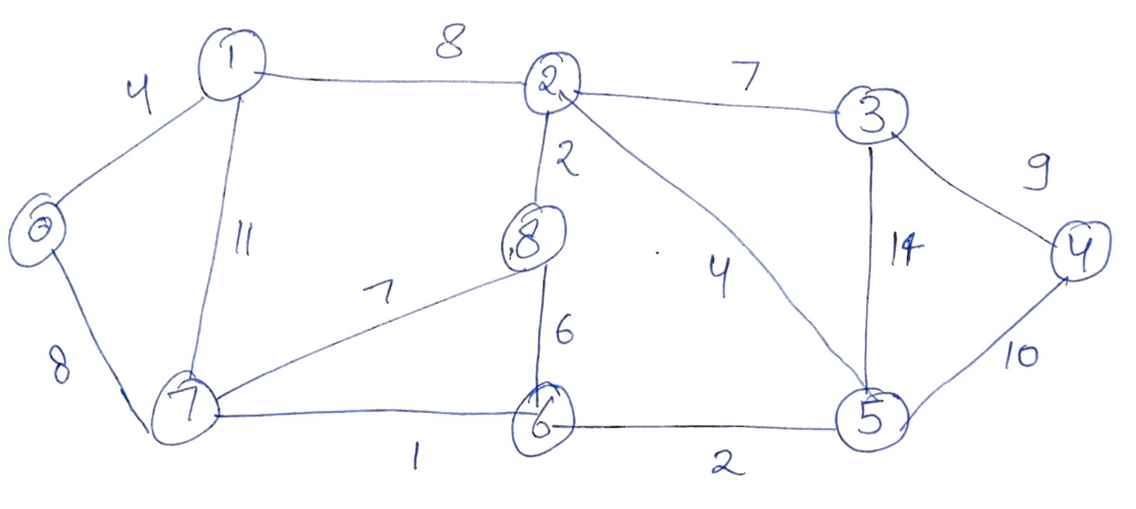
$S.C. = O(V^2)$

BellmanFord's Algo

$T.C. = O(VE)$

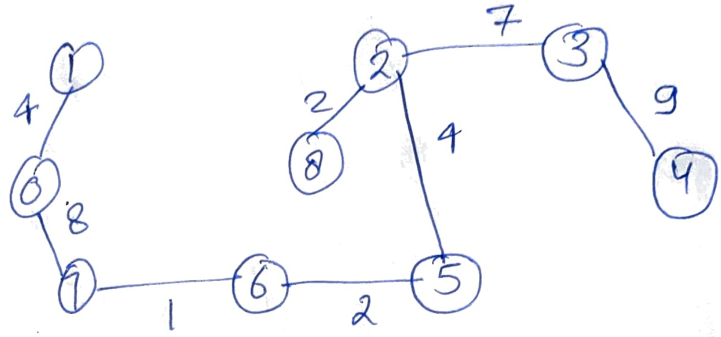
$S.C. = O(E)$

Answer-3)



Kruskal's Algorithm

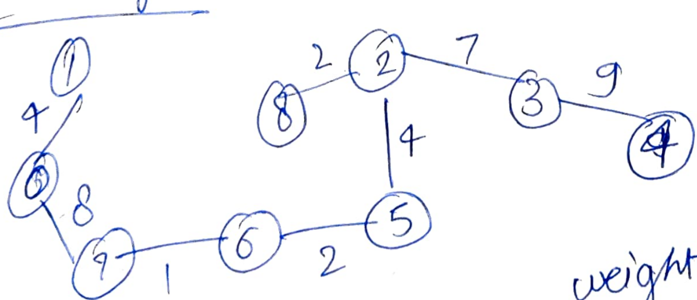
D	V	W	
6	7	1	✓
5	6	2	✓
2	8	2	✓
0	1	4	✓
2	5	4	✓
6	8	6	×
2	3	7	✓
7	8	7	×
0	7	8	✓
1	2	8	×
4	3	9	✓
4	5	10	×
1	7	11	×
3	5	14	×



weight = 1+2+2+4+4+7+8+9

= 37

Prim's Algo



weight = 37

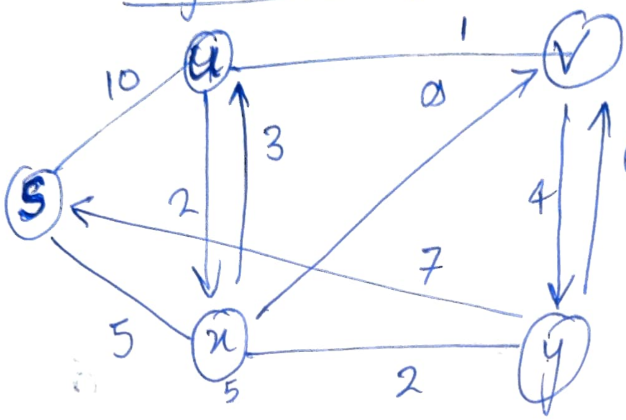
Answer - 4)

(i) The Shortest path may change. The reason is there may be different number of edges in different paths 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 25. The weight of the shortest path is increased by 5*10 and becomes 15+50. Weight of the other path is increased by 2*10 and becomes 25+20 so the shortest path changes to the other path with weight so 45.

(ii) If we multiply all edges weight by 10, the shortest path doesn't change. The reason is simple, weight of all path from 's' to 't' got multiplied by same amount. The no. of edges on a path don't matter. It is like changing limits of weight.

Answer - 5

Dijkstra Algorithm

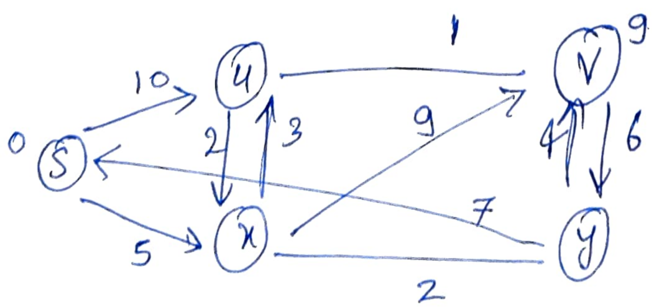


node	Shortest distance from source node
u	8
x	5
v	9
y	7

Bellman Ford Algorithm

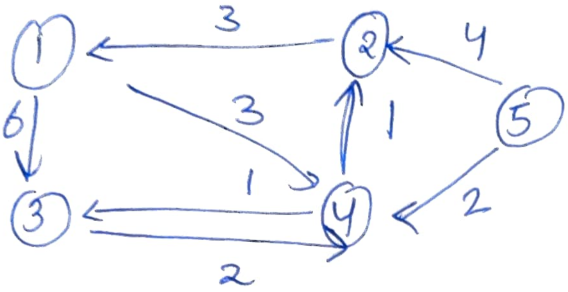
	s	u	v	x	y
1st →	0	10	∞	5	∞
2nd →	0	10	11	5	∞
3rd →	0	8	9	5	7
4th →	0	8	9	5	7

graph does not have cycle



Answer-6

Flloyd Warshall's



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

$$G_1 = \begin{bmatrix} 0 & \infty & 6 & 3 & \infty \\ 3 & 0 & 9 & 6 & \infty \\ \infty & \infty & 0 & 2 & \infty \\ \infty & 1 & 1 & 0 & \infty \\ \infty & 4 & \infty & 2 & 0 \end{bmatrix}$$

$$G_2 = \begin{bmatrix} 0 & \infty & 6 & 3 & \infty \\ 3 & 0 & 9 & 6 & \infty \\ \infty & \infty & 0 & 2 & \infty \\ 4 & 1 & 1 & 0 & \infty \\ 7 & 4 & 13 & 1 & 0 \end{bmatrix}$$

$$G_3 = \begin{bmatrix} 0 & \infty & 6 & 3 & \infty \\ 3 & 0 & 9 & 6 & \infty \\ \infty & \infty & 0 & 2 & \infty \\ 4 & 1 & 1 & 0 & \infty \\ 7 & 4 & 13 & 2 & 0 \end{bmatrix}$$

$$G_4 = \begin{bmatrix} 0 & 4 & 4 & 3 & \infty \\ 3 & 0 & 7 & 6 & \infty \\ 6 & 3 & 0 & 2 & \infty \\ 4 & 1 & 1 & 0 & \infty \\ 6 & 3 & 3 & 2 & 0 \end{bmatrix}$$

$$G_5 = \begin{bmatrix} 0 & 4 & 4 & 3 & \infty \\ 3 & 0 & 7 & 6 & \infty \\ 6 & 3 & 0 & 2 & \infty \\ 4 & 1 & 1 & 0 & \infty \\ 6 & 3 & 2 & 2 & 0 \end{bmatrix}$$