DAA

Tutorial - 6

Ans 1

Minimum spannig tree:- A minimum spanning tree (MST) or minimum weight 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 the minimum possible total edge weight.

- Applications:

i) Suppose you want to construct highways or railroads spanning several cities then we can use the concept of minimum spanning tree.

ii) Designing LAN.

iii) Laying pipelines connecting offshore drilling sites, refineries and consumer markets.

iv) Suppose you want to apply a set of houses with

- Electric Power
- Water
- Telephone Lines
- Sewage Lines

Ans 2

- Prim's Algorithm:-

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

  Space Complexity (S.C.) = $O(V)$

- Kruskal's algorithm:- $O(|E| \cdot \log |E|)$ = (Time complexity)

  Space complexity = $O(|V|)$

- Dijkstra's Algorithm:

  Time Complexity = $O(V^2)$

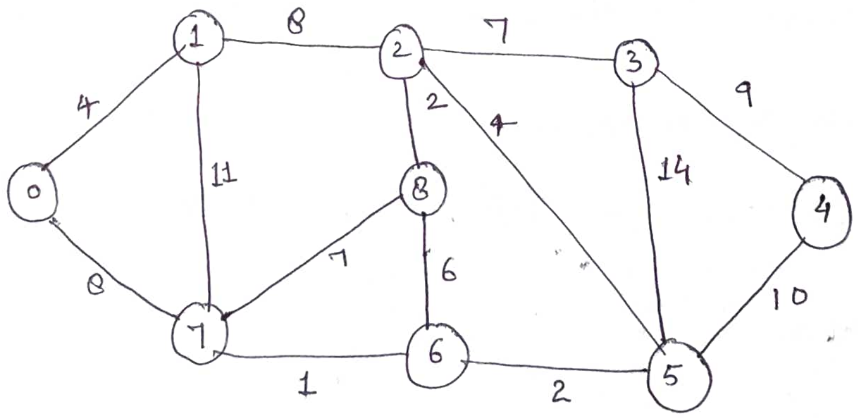
  Space Complexity = $O(V^2)$

- Bellman Ford's Algorithm:

  Time Complexity = $O(VE)$

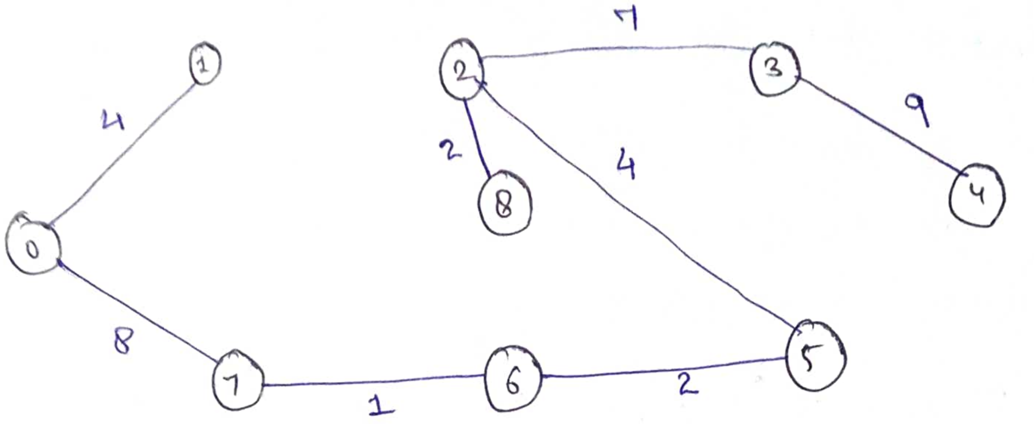
  Space Complexity = $O(E)$

Ans 3 Kruskal's



u	v	weight
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 ✗

u	v	w
4	3	9 ✓
4	5	10 ✗
1	7	11 ✗
3	5	14 ✗



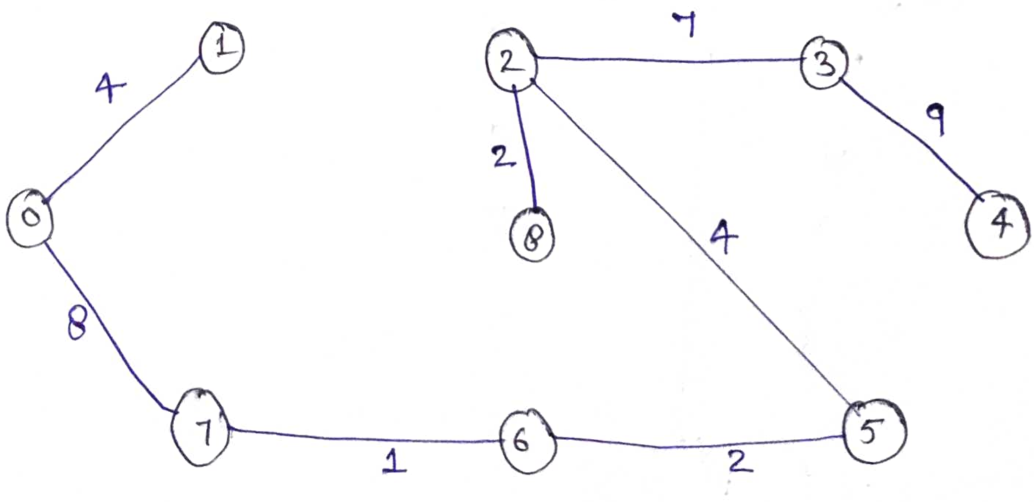
Total weight = $1+2+2+4+4+7+8+9 = 37$.

- Prim's :-

Source	Nodes :- 1	2	3	4	5	6	7	8
0	1	2	3	4	5	6	7	8
0	∞	∞	∞	∞	∞	∞	∞	∞
							$\boxed{8}$	
	$\boxed{4}$							
		$\boxed{8}$				$\boxed{1}$		7
	11							
			7		4			$\boxed{2}$
					$\boxed{2}$			6
		$\boxed{4}$	14					
			$\boxed{7}$		$\boxed{9}$			

Parent :-

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

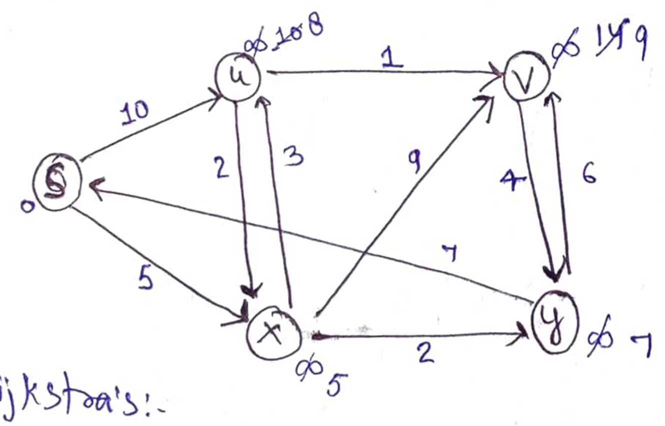


Ans 4

i) The shortest path may change. The reason is, there may be different number of edges in different paths from 's' to 't'. For eg, let shortest path be weight 15 and has edge 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 as 45.

ii) If we multiply all edges weight by 10, the shortest path doesn't change, the reason is simple, weights of all paths from 's' to 't' get multiplied by same amount. It's like changing units of weights.

Ans 5



Dijkstra's:-

node	shortest dist. from source node
u	8
v	9
x	5
y	7

• Bellman Fard Algorithm:-

1st → S^{0} $u^{\cancel{\infty}\,10}$ v^{∞} $x^{\cancel{\infty}\,5}$ y^{∞}

2nd → S^{0} u^{10} $v^{\cancel{\infty}\,11}$ x^{5} y^{∞}

3rd → S^{0} $u^{\cancel{10}\,8}$ $v^{\cancel{11}\,9}$ x^{5} $y^{\cancel{\infty}\,7}$

4th → S^{0} u^{8} v^{9} x^{5} y^{7}

final graph:-