TUTORIAL 6

Ans 1) Minimum Spanning 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

1. Consider n stations are to be linked using a communication network and laying of communication link between any two stations involved a cost. The ideal solution would be to exact a subgraph turned as minimum cost spanning tree.
2. Suppose you meant to construct highways or railroads spanning several cities then we can use the concept of minimum spanning tree
3. Design LAN
4. Laying pipelines connecting offshore drilling sites, refineries and consume markets

Ans 2) Time Complexity of Prim's algorithm → $O((V+E)\log V)$

Space Complexity of Prim's algorithm → $O(V)$

Time Complexity of Kruskal's algorithm → $O(E(\log V))$

Space Complexity of Kruskal's algorithm → $O(|V|)$

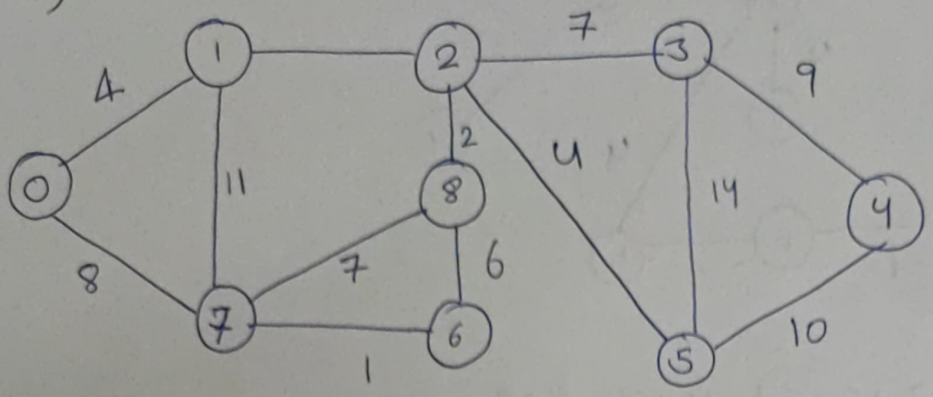
Time Complexity of Dijkstra's algorithm → $O(V^2)$

Space Complexity of Dijkstra's algorithm → $O(V^2)$

Time Complexity of Bellman Ford → $O(VE)$

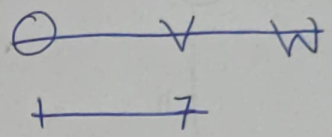
Space Complexity of Bellman Ford → $O(E)$

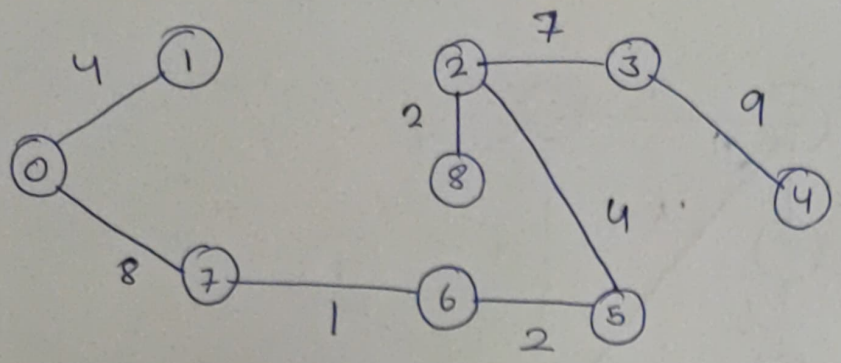
Ans 3)



Kruskal's algorithm

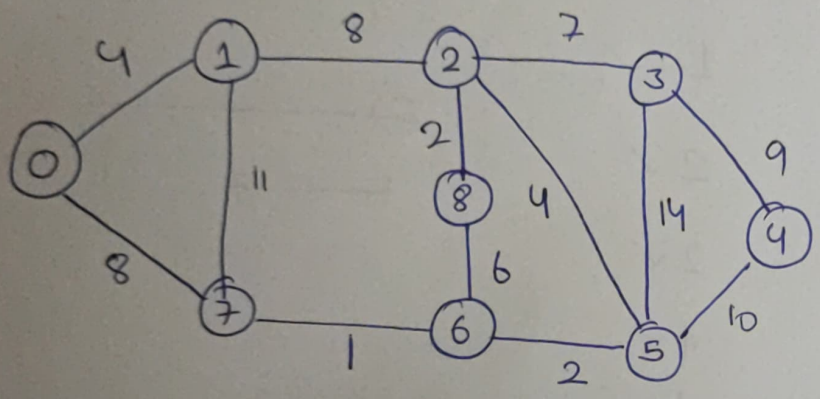
O	V	W	
6	7	1	✓
5	6	2	✓
2	8	2	✓
0	1	4	✓
2	5	4	✓
6	8	6	×
2	3	7	✓
7	8	7	×
0	7	8	✓
1	2	8	×
4	3	9	✓
4	3	10	×
1	7	11	×
3	5	14	×





Weight = 1 + 2 + 2 + 2 + 4 + 4 + 7 + 8 + 9 = 37

Prim's Algorithm

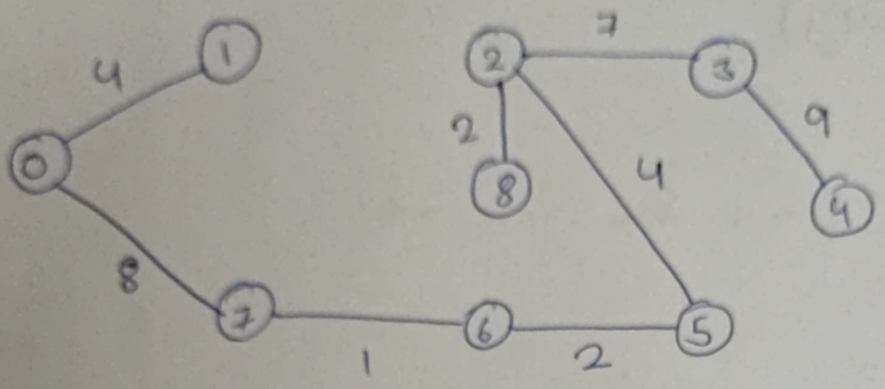


Weight :-

0	1	2	3	4	5	6	7	8
0 ∞	∞	∞	∞	∞	∞	∞	∞	∞
	4	∞	∞	∞	∞	∞	8	∞
	4	8	∞	∞	∞	1	8	7
	11	8	7	∞	4	1	8	2
	11	8	7	∞	2	1	8	6
	4	14	1	10	2	1	8	6
	4	7	1	10	2	1	8	6
	4	7	1	9	2	1	8	6

Parent :-

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

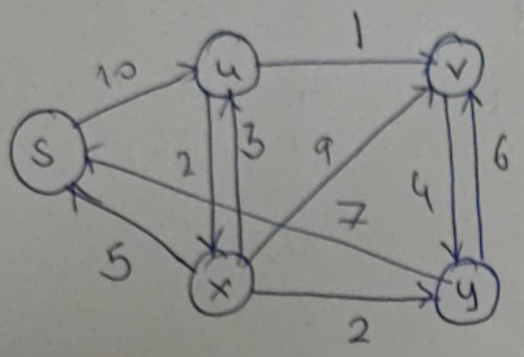


Weight = 4 + 8 + 1 + 2 + 4 + 2 + 7 + 9 = 37

Ans 4)(i) The shortest path may change. The reason is that ~~they~~ there may be different paths from 's' to 't'. for example:- Let shortest path be of weight 15 and has edge 5. Let ~~they~~ be another path with 2 edge 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 of 45

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

Ans 5) Dijkstra's Algorithm



node	shortest distance from source node
u	8
x	5
y	9
z	7

Bell man Ford algorithm

1st → (s: 0) (u: 10) (v: ∞) (x: 5) (y: ∞)

2nd → (s: 0) (u: 10) (v: 11) (x: 5) (y: ∞) → graph does not have cycle

3rd → (s: 0) (u: 8) (v: 9) (x: 5) (y: 7)

4th → (s: 0) (u: 8) (v: 9) (x: 5) (y: 7)