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Tutorial 06

1. What do you mean by minimum spanning tree? What are the applications of MST?

Ans⇒ 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 station are to be linked using a communication network and lying of communication link b/w any two station involved a cost. The ideal soln would be to exact a subgraph termed as minimum cost spanning tree

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

(iii) Design LAN

(iv) Laying pipeline connecting offshore drilling sites, refineries and consume markets.

2. Please analyze the time & space complexity of Prism, Kruskal, Dijkstra & Bellman ford algorithm.

Ans⇒ Time complexity of Prism's algorithm: $O((V+E)\log)$.
Space complexity of Prism's algorithm: $O(V)$.

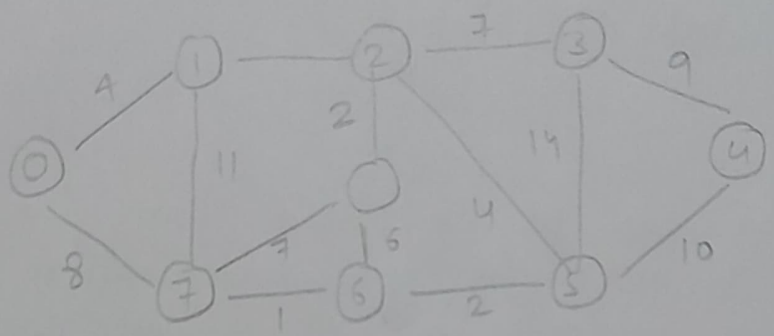
Time Complexity of Kruskal's Algo:→ $O(E(\log V))$
Space Complexity of Kruskal's Algo:→ $O(|V|)$

Time complexity of Dijkstra Algo:→ $O(V^2)$
Space complexity of Dijkstra Algo:→ $O(V^2)$

Time complexity of Bellmanford:→ $O(VE)$
Space complexity of Bellmanford:→ $O(E)$

Q.3 Apply Kruskal & Prim's algorithm on graph given on right side to compute MST & its weight?

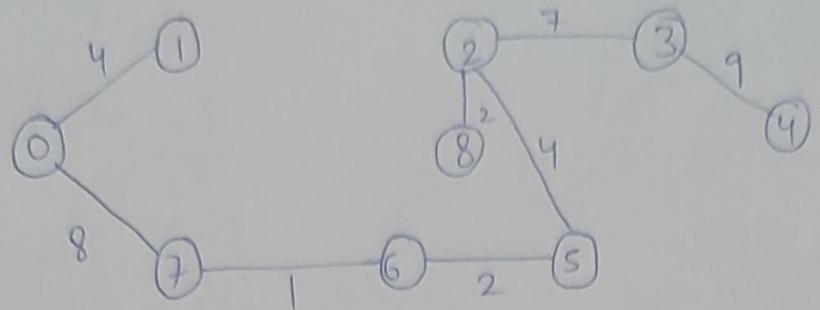
Ans ⇒



→ Kruskal's Algorithm

U	V	W
6	7	1 ✓
5	6	2 ✓
2	8	2 ✓
0	1	4 ✓
2	5	4 ✓
6	8	6 X
2	3	7 X
7	8	7 ✓
0	7	8 ✓
1	2	8 X
4	3	9 ✓
4	5	10 X

U	V	W
0	7	11 X
3	5	14 X



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

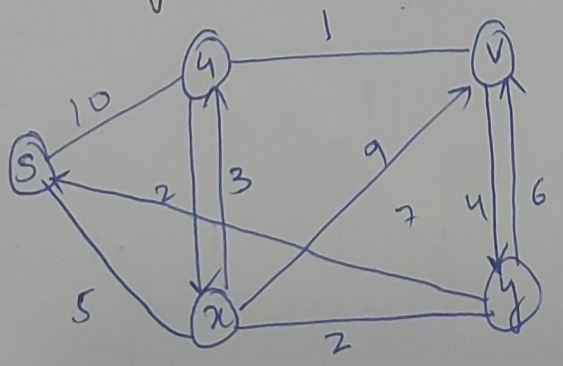
Q.4

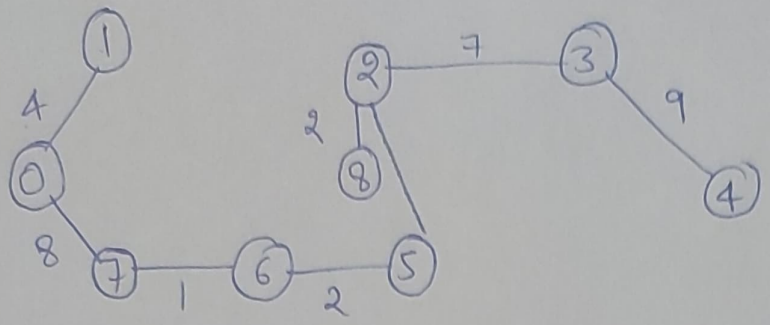
Soln i) The shortest path may changes. The reason is these may be different number of edges in different paths from 's' to 't'. For example:→ Let shortest path be of weight 15 and how edge 5. Let there be another path with 2 edge and total weight 25. The weight of the shortest path is increased by 5'10 and become 15 + so weight of the other path is increased by 2'10 and becomes 25+20 so the shortest path engages to the other path with weight as 45.

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

Q.5

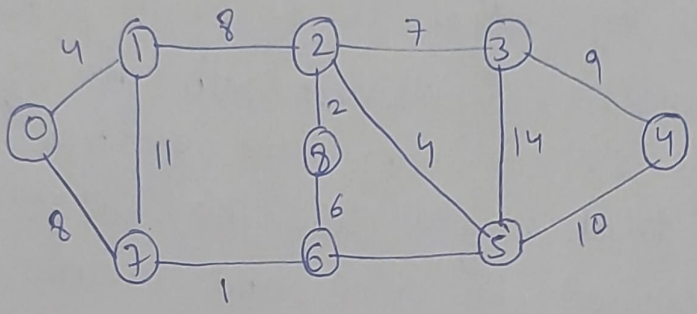
Ans⇒ Dijkstra Algorithm





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

Prism's Algorithm



Weight :→

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

Parent :→

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

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

Bellman ford algorithm

1st →	s(0)	u(10)	v(∞)	x(5)	y(∞)	
2nd →	s(0)	u(10)	v(11.1)	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)