Tutorial-6

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1. What do you mean by Minimum spanning tree? What are its applications?

Ans- It is a subset of edges of a connected edge-weighted undirected graph that contains all the matrices together without any cycles & with minimum possible edge weighted.

Applications →

1) Consider n stations are to be linked using a communication network and laying of communication link between any 2 stations involves a cost. The ideal solution would be to extract a subgraph termed as minimum cost spanning tree.

2) Designing LAN.

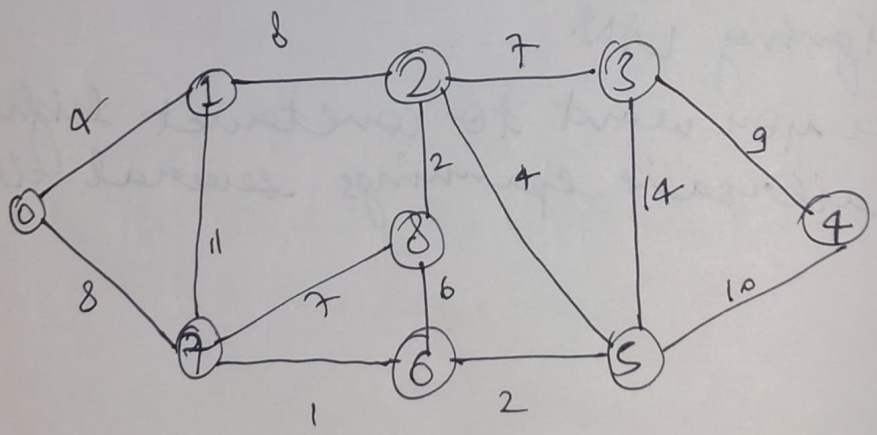
3) Suppose you want to construct highways or railroads spannings several cities.

2. Analyze time & space complexity for Prim, Kruskal, Dijkstra & Bellman Ford's algorithm.

Ans:-

Time Complexity of Prim's → $O(|E| \log |V|)$
Space Complexity of Prim's → $O(|V|)$
Time Complexity of Kruskal's → $O(|E| \log |E|)$
Space Complexity of Kruskal's → $O(|V|)$
Time Complexity of Dijkstra's → $O(V^2)$
Space Complexity of Dijkstra's → $O(V^2)$
Time Complexity of Bellman Ford → $O(VE)$
Space Complexity of Bellman Ford → $O(E)$

3) Apply Kruskal and Prim's Algorithm on given graph to compute MST & its weight.



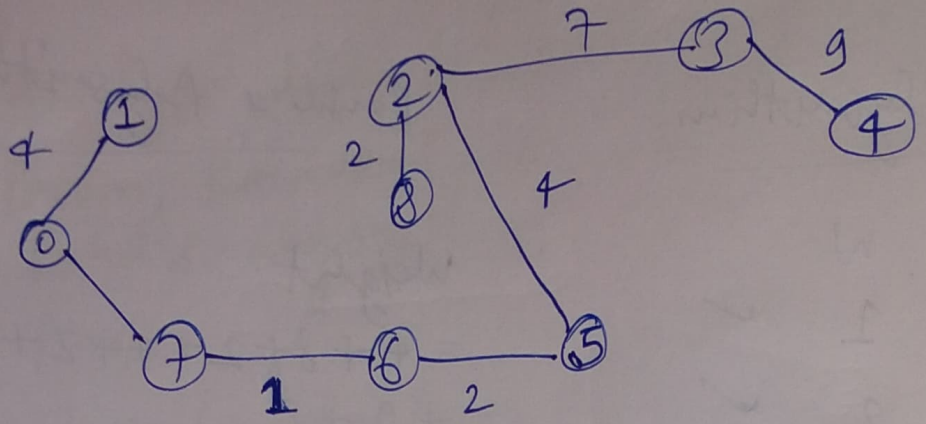
Ans:

Kruskal's Algorithm

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

Prim's Algorithm

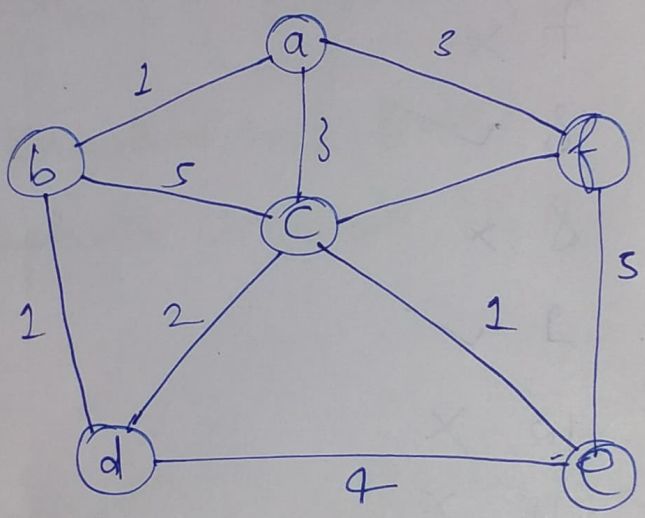
Weight
= 4 + 8 + 2 + 4 + 2 + 7 + 9 + 3
= 37



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

= 37

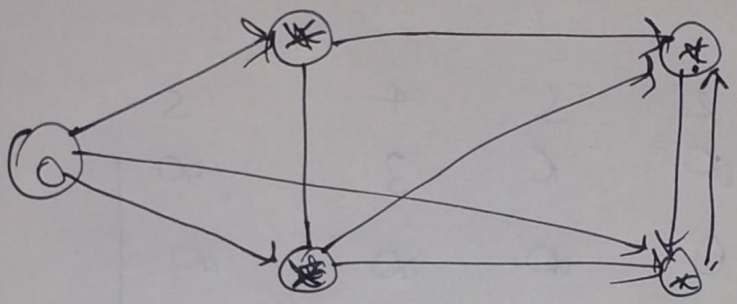
4. Given a directed weighted graph. You are also given the abstract path from a source vertex 's'



i.) The shortest path may change. The reason is that there may be different no. of edges in different paths from 's' to 't'.

(ii) If we multiply all edges weights by 10, the shortest path does not change.

5. Apply Dijkstra's & Bellman Ford algorithm on graph given right side to compare shortest path.



Ans: Dijkstra's

u	8
x	5
v	9
y	7

Bellman Ford

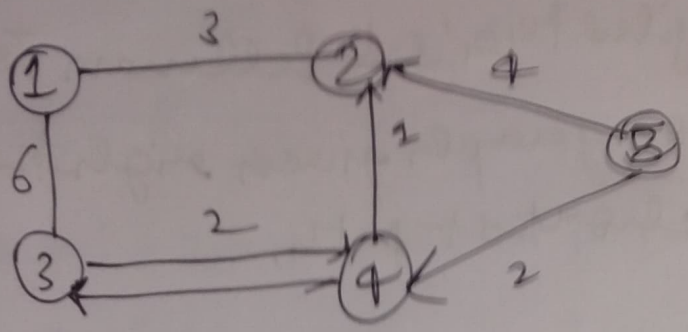
1st → (s) (u) (v) (x) (y)

2nd → (s) (u) (v) (x) (y)

3rd → (s) (u) (v) (x) (y)

4th → (s) (u) (v) (x) (y)

6. Apply all paths shortest path algorithm.
Floyd Warshall.



	1	2	3	4	5
1	0	∞	6	3	∞
2	2	0	∞	∞	∞
3	∞	∞	0	2	∞
4	∞	1	1	0	∞
5	∞	4	∞	2	0

	1	2	3	4	5
1	0	∞	6	3	∞
2	2	0	8	5	∞
3	∞	∞	0	2	∞
4	∞	1	1	0	∞
5	∞	4	∞	2	0

	1	2	3	4	5
1	0	∞	6	3	∞
2	2	0	8	5	∞
3	∞	∞	0	2	∞
4	3	1	1	0	∞
5	0	4	12	2	0

	1	2	3	4	5
1	0	∞	6	3	∞
2	2	0	8	5	∞
3	∞	∞	0	2	∞
4	3	1	1	0	∞
5	6	4	12	2	0

Time Complexity → $O(|V|^3)$

Space Complexity → $O(|V|^2)$