Tutorial-6.

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40(I)

Que-1. What do you mean by Minimum Spanning Tree? What is the application of MST.

Ans-1. A minimum spanning tree 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 cycle and with minimum possible total edge weight.

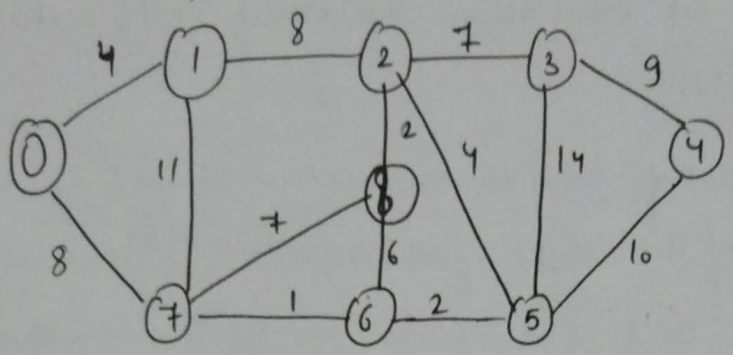
Application -

- Designing local area network.
- Laying pipelines connecting offshore drilling sites, refineries and consumers markets.
- Suppose you want to construct highways or roadways spanning several cities, then we can use the concept of MST.
- To reduce cost, you use the concept of MST to connect the house

Que-2. Please analyze the Time and space complexity of Prism's kruskal, dijkstra's and Bullman Ford Algorithm.

Algorithm	Time Complexity	Space Complexity
Prim's	$O(V^2)$	$O(V+E)$
Kruskal	$O(E \log V)$	$O(\log E)$
Dijkstra	$O(V+E)$	$O(V+E)$
Bullman	$O(VE)$	$O(V)$

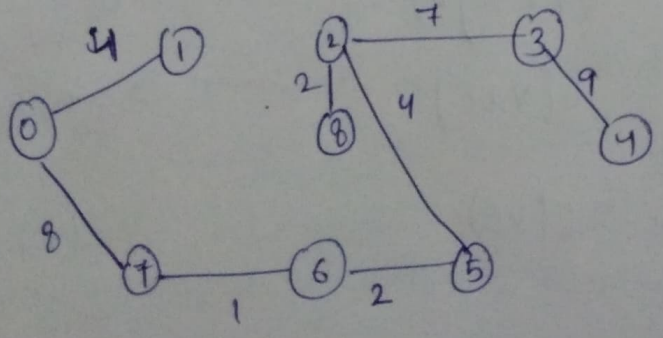
Qu-3. Apply Prims and kruskal algo on the graph (2) to compute MST and its weight.



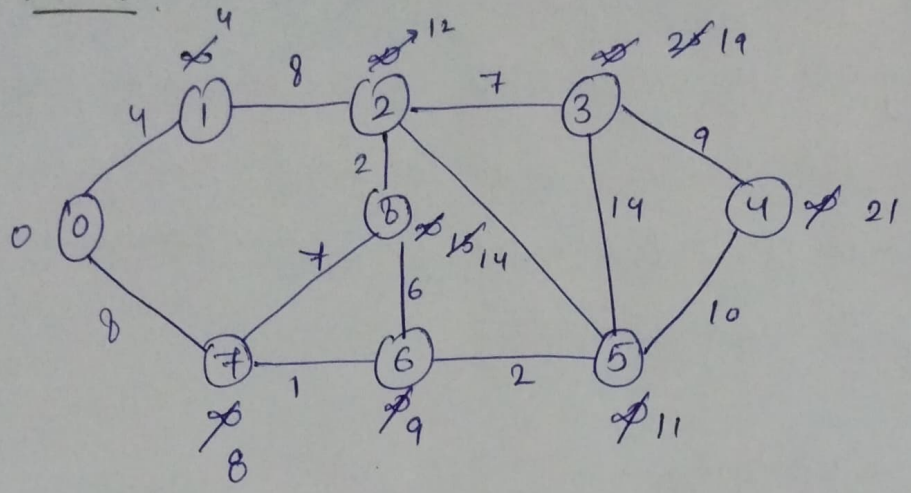
Soln.

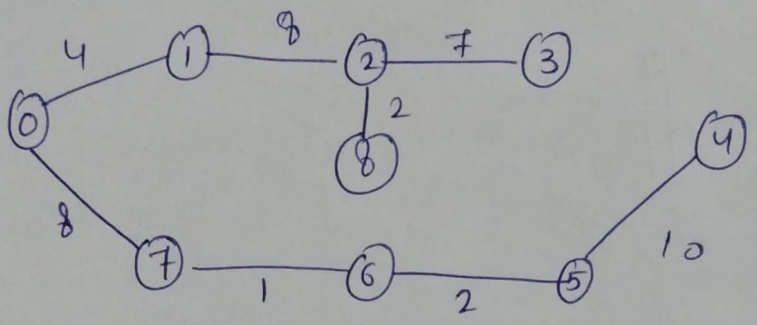
Kruskal

Path	weight
7 → 6	1
6 → 5	2
2 → 8	2
0 → 1	4
2 → 5	4
8 → 6	6
2 → 3	7
7 → 8	7
0 → 7	8
1 → 2	8
3 → 4	9
5 → 4	10
1 → 7	11
3 → 5	14



Prim's





MST

Que-4. Given a weighted graph. You are also given the sorted path from a source vertex 's' to a given distination vertex 't'. Does the shortest path remains same in the modified graph in the following Graph case.

- If the weight of every edge is ↑ed by 10 units.
- If the weight of every edge is multiplied by 10 units

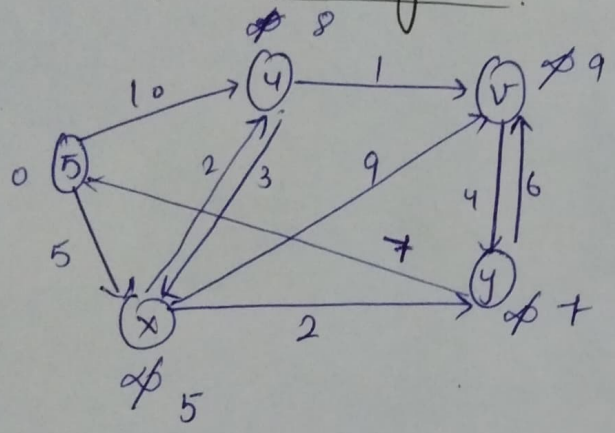
Ans- (1) The shortest path may change. The reason is that there may be different number of edges in different paths from 's' to 't'.

for example - Let, shortest path be of weight 15 and has 5 days. Let, there be another path with 2 edges and total weight is 25. The weight of the shortest path is increased by 5*10. and hence, becomes 15+50 (65), which the weight of other path is increased by 2*10, it becomes 25+50 (45), so shortest

has changed to other path when weight is 45. (4)

(2) If we multiply all the edges with 10, the shortest path does not change. The reason is that weighted of all paths from 's' to 't' is multiplied by some amount. the number of edges on a path does not matter.

Que-3- Dijkstra's Algorithm-



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

Billmann Ford Algo

1st →	0	10	∞	∞ 5	∞
2nd →	0	10	∞ 11	5	∞
3rd →	0	8	9	5	7
4th →	0	8	9	5	7