Tutorial - 6 Nikhil Singh I 20

Ques 1→ What do you mean by minimum spanning tree? What is the application of MST.

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.

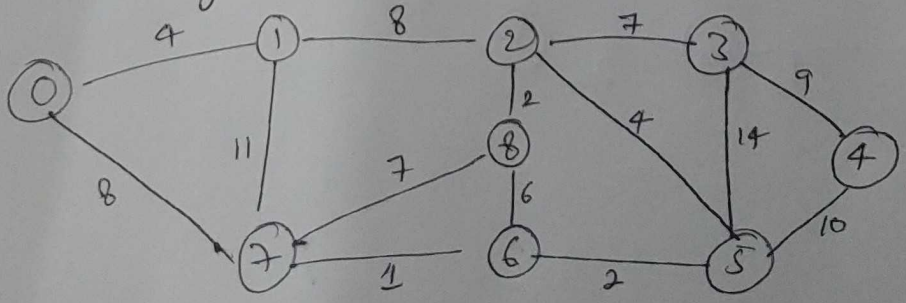
Application

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

Ques 2→ Please analyse the time and space complexity of Prim's, kruskal, Dijkstra's and Bellman Ford Algorithms

Algo	T.C	S.C
Prims	$O(V^2)$	$O(V+E)$
kruskal	$O(E \log V)$	$O(\log E)$
Dijkstra	$O(V+E)$	$O(V+E)$
Bellman	$O(VE)$	$O(V)$

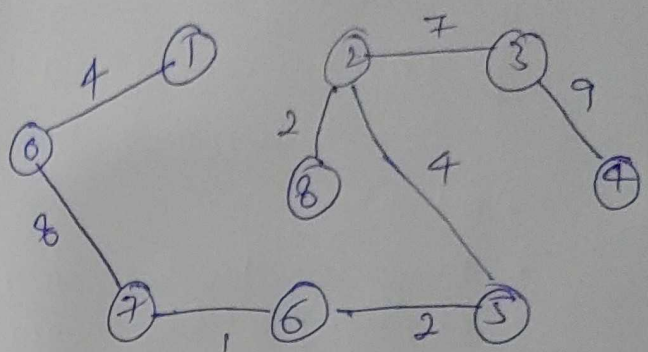
Ques 3→ Apply Prim's and Kruskal algo on the graph to complete MST and its weight.



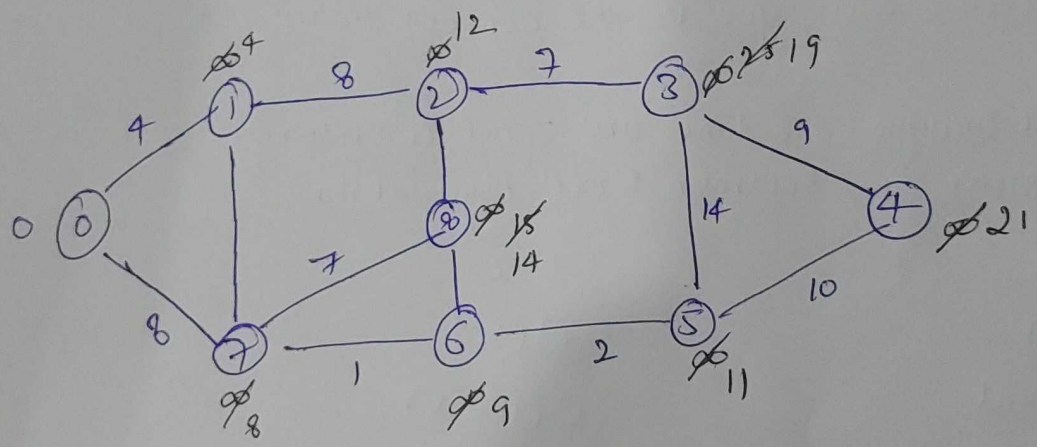
Kruskal's

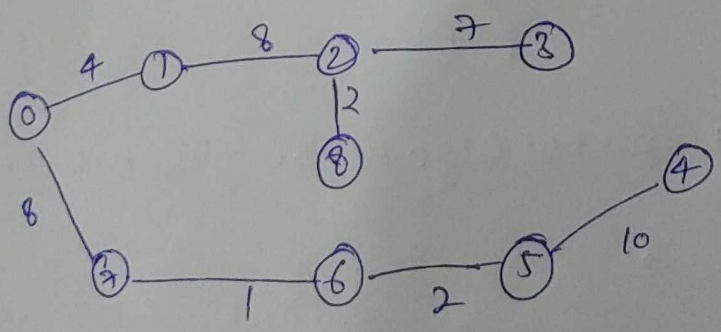
Path	weight
7 → 6	1
6 → 5	2

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





MST

Ques 4 → Given a weight graph. You are also given the shortest path from a source vertex 's' to a given destination vertex 't'. Does the shortest path remains same in the modified graph in the following case.

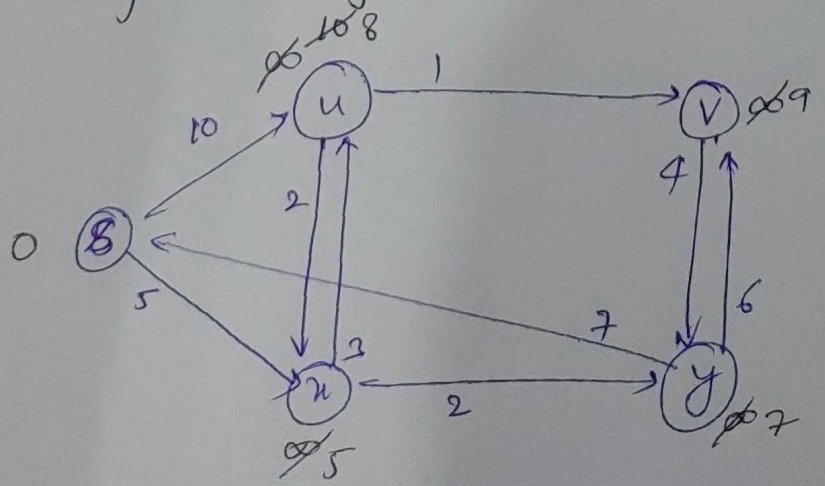
- If the weight of every edge is red by 10 units.
- If the weight of every edge is multiplied by 10 units.

Soln [i] 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 edges. 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 become 15+50 (65), while the weight of other path is increased by 2*10, it becomes 25+20 (45), so shortest has changed to other path whose weight is 45.

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

Ques 5 → Dijkstra's Algorithm.



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

Bellman Ford Algorithm