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Tutorial Sheet - 6

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Sol 1 - Minimum spanning tree is a subset of the edges of a connected edge - weighted undirected graph that connects all the vertices together without any cycles & with the minimum possible total edge weighted.

Application :-

i) Consider n stations are to be linked using a communication network and lying of ~~com~~ communication link between any two stations involves a cost.

The ideal ~~graph~~ solution would be to extract a subgraph termed as minimum cost spanning tree.

ii) Suppose you want to construct highways or ~~ro~~ railroads spanning several cities then we can use the concept of minimum spanning trees.

iii) Designing LAN.

iv) Laying pipelines connecting offshore drilling sites, refineries, & consumer markets.

v) Suppose you meant to apply a set of houses with:-

→ electric power.

→ Water.

→ telephone lines.

→ Sewage lines.

Sol2. - Time complexity of prim's algo: $O(|E| \log|V|)$

Space complexity of prim's algo: $O|V|$

Time complexity of Kruskal's algo: $O(|E| \log|E|)$

Space complexity of Kruskal's algo: $O(|V|)$

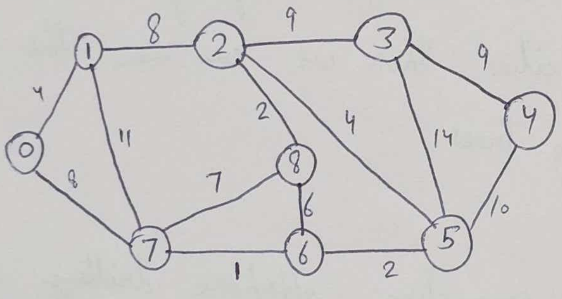
Time complexity of Dijstra's algo: $O(V^2)$

Space complexity of Dijkstra's algo: $O(V^2)$

Time complexity of Bellman ford's algo: $O(VE)$

Space complexity of Bellman ford's algo: $O(E)$.

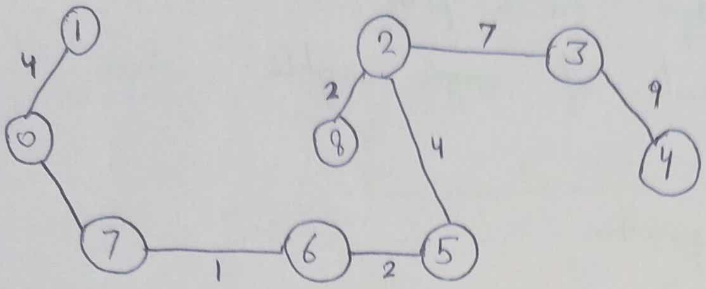
Sol 3 -



Kruskal's algo:

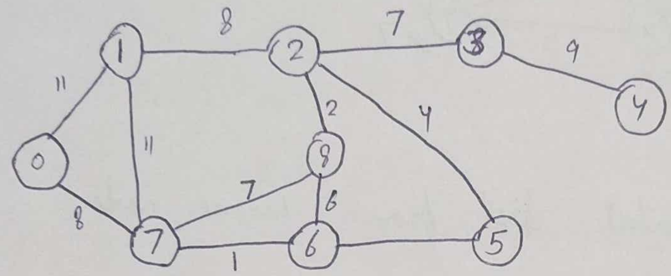
O	V	W	
6	7	1	✓
5	6	2	✓
2	8	2	✓
0	1	4	✓
2	5	4	✓
6	8	6	X
2	3	7	✓
7	8	7	X
0	7	8	✓
1	2	8	X

O	V	W	
4	3	9	✓
4	5	10	X
1	7	11	X
3	5	14	X



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

Prim's algorithm :-



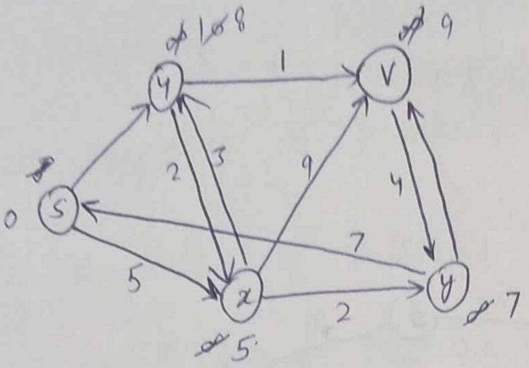
Weight = 4 + 8 + ' + 2 + 4 + 2 + 7 + 9 = 37.

Sol 4 = (i) The shortest path may change. The reason is there may be different number of ~~so~~ edges in different path from 's' to 't' for eg, let shortest path be of weight 15 and has edge 5 edges. Let there be another path with 2 edges and total weight 25. This weight of the shortest path is increased by 5×10 and ~~&~~ becomes 15 + 50 weight of the other path is increased by 2×10 & becomes 25 + 20. So, the shortest path changes to the other path with weight ~~at~~ as 45.

(ii) If we multiply all edges weight by 60, the ~~sorted~~ shortest path doesn't change. The reason is simple, weights of all path from 'S' to 't' get multiplied by same amount.

The number of edges on a path doesn't matter. It is like changing units of ~~weigh~~ weights.

Sol 5. Dijkstra Algorithm:



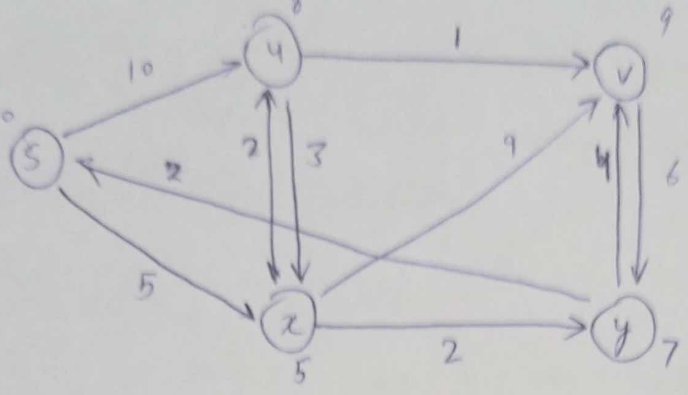
Node	Shortest dist from source node.
u	8
x	5
v	9
y	7

⇒ Bellman ford algo:

1st →	s 0	u ~~∞~~ 10	v ∞	x ~~∞~~ 5	y ∞
2nd →	s 0	u 10	v ~~∞~~ 11	x 5	y ∞
3rd →	s 0	u ~~10~~ 8	v ~~11~~ 9	x 5	y ~~∞~~ 7
4th →	0	8	9	x 5	y 7

graph doesn't have -ve cycle.

Final graph


8
9
0
u
v
s
x
y
10
1
2
3
9
4
6
2
5
2
5
7