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.

Applications -

(1) Consider the n stations are to be linked using a communication network & lying of communication network & by link b/w any two stations involves a cost.
The ideal solution would be to extract subgraph termed as minimum cost spanning tree.

(2) Suppose you want to construct highways or railroads spannin several cities. Then we can use the concept of minimum spanning tree

(3) Designing LAN

(4) Laying pipelines connecting off shore drilling sites, refineries, & consumer markets.

(5) Suppose you meant to apply a set of houses with -

- Electric Power.
- Water,
- Telephone lines
- Sewage ding

Sol 2) Time complexity of prim's algorithm $O(E | \log |V|)$
space complexity of prim's algo - $O(V)$

Time complexity of Kruckshal's algo - $O(|V| \log |E|)$
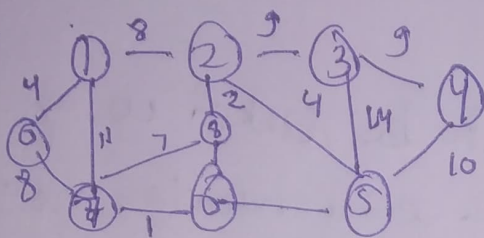Space complexity of Kruckshal's algo - $O(|V|)$

of Dijkstra's algo - $O(V^2)$

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

Time complexity of Bellman ford algo - $O(VE)$
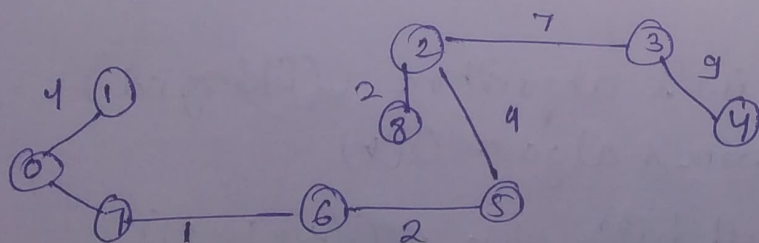
Space complexity of Bellman ford $O(E)$

Sol 3) -

Krutkal's algo -

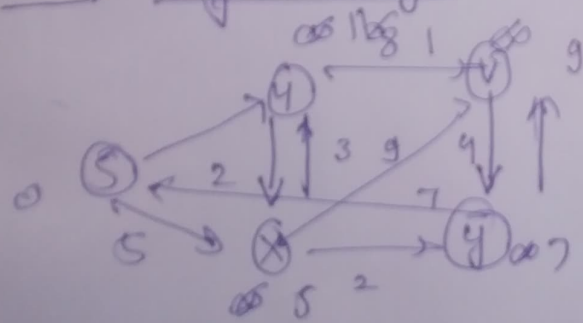| θ	V	W			$\oplus$	V	W	
6	7	1	✓		4	3	9	✓
5	6	2	✓		4	5	10	X
2	8	2	✓		1	7	11	X
0	1	4	✓		3	5	14	X
2	5	4	✓					
6	8	6	X					
2	3	7	✓					
			X					
7	8	7						
0	7	8	✓					
1	2	8	X					

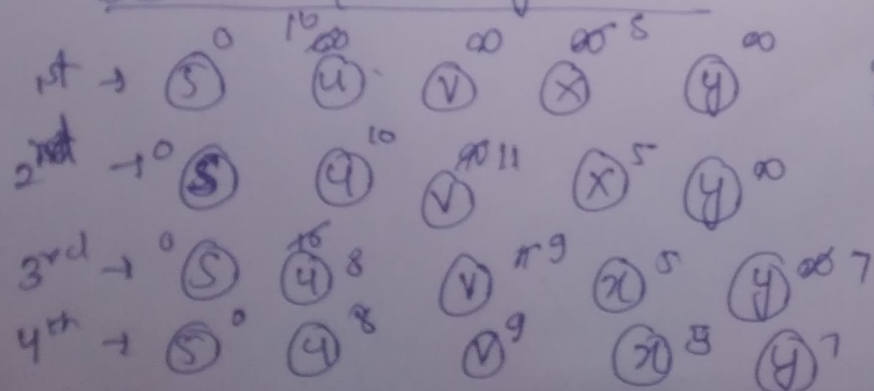weight = $1 + 2 + 2 + 4 + 4 + 4 + 7 + 8 + 9$

= 37

Sol 4) 9 (i) The shortest path may change the reason is there may be different no. of edges in different paths from 's' to 't' for eg - let shortest path be of weight is and has edge 5 edges. let there be another path with 2 edges and total weight as 25. The 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 as 45.

(ii) If we multiply all edges by 60, the shortest path doesn't change. The reason is simple, weights of all paths from 's' to 't' get multiplied by some amount the no. of edges on a path doesn't matter. It is like changing units by weights.

Sol 5) - Dijkstra Algo.

Bellman ford algorithm

1st → ⑤	④	Ⓥ	Ⓧ	Ⓨ	
0	10∞	∞	∞ 5	∞	graph doesn't have -ve cycle.
2nd →0 ⑤	④ 10	Ⓥ 90 11	Ⓧ 5	Ⓨ ∞	
3rd →0 ⑤	④ 10 8	Ⓥ 9	Ⓧ 5	Ⓨ ∞ 7	
4th →0 ⑤	④ 8	Ⓥ 9	Ⓧ 5	Ⓨ 7	

Final Graph :

0

S

10

y 3

1

v 9

2

3³

9

7

5

u

5

7

2

4

6

y 7