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Ans - 1

The cost of spanning tree is the sum of the weights of all the edges in the tree. There can be many spanning trees. Minimum spanning trees is the spanning trees where the cost is minimum among all the spanning trees. There also can be many minimum spanning trees.

Minimum spanning trees has direct applications in the design of networks. It is used in algorithms approximating the travelling sales man problem, multi-terminal minimum cut problem and minimum cost weight perfect matching.

Other Pratical Applications :-

1. Cluster Analysis
2. Handwriting recognition
3. Image segmentation

Ans - 2.

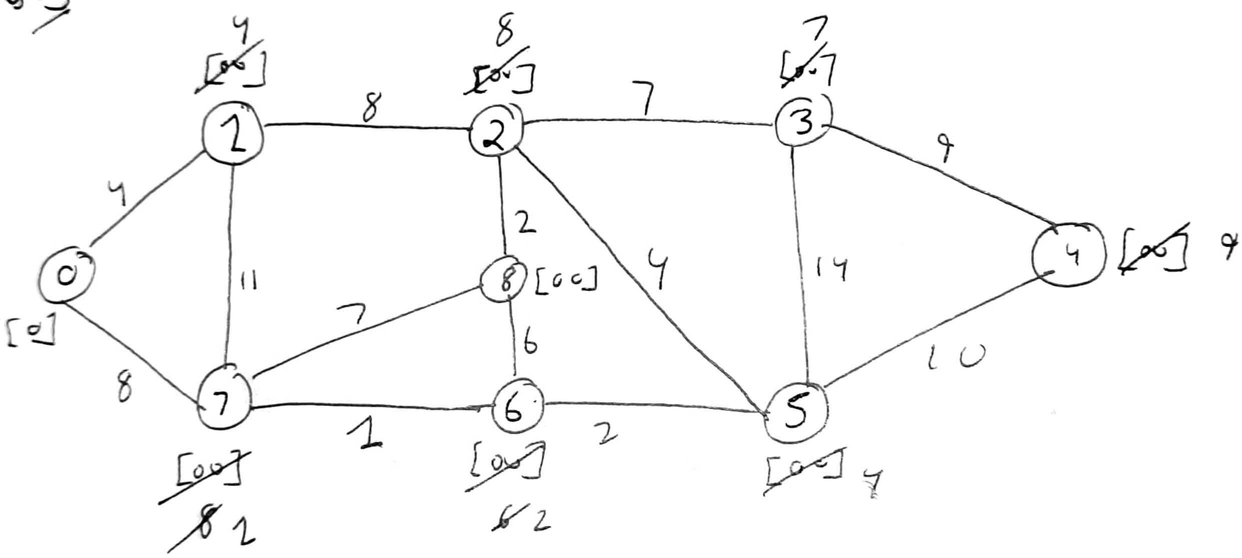
	Time complexity	Space complexity
1) Prism algo	$O(V^2)$ $O(E \log V)$ using Fibonacci Heap	$O(\|V\|)$

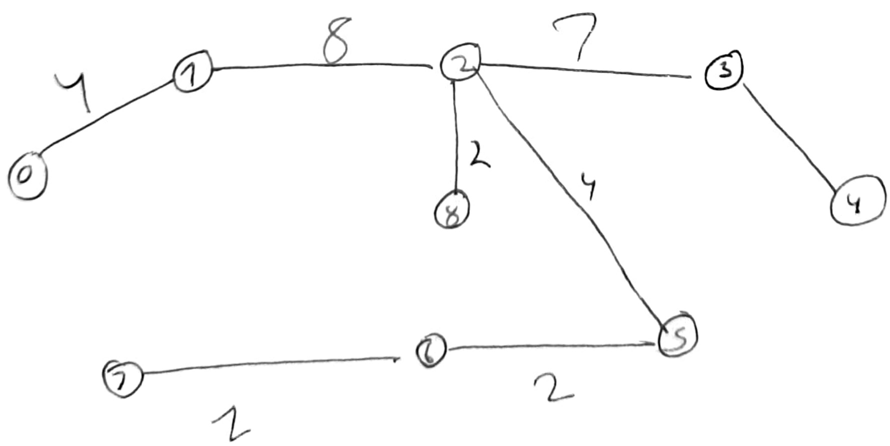
2. Kruskal algo. — $O(E \log E) = O(E \log V)$ — $O(|V|)$

3. Dijkstra.. — $O(E \log V)$ using priority queue. — $O(|V| + |E|)$

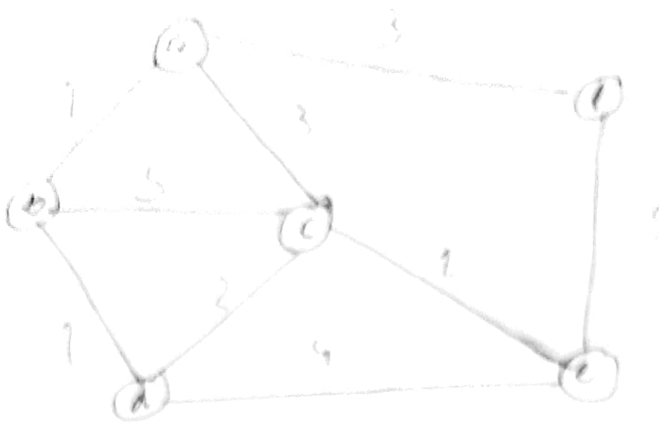
4. Bellman Ford.. — $O(VE)$ — $O(V)$

Ans-3

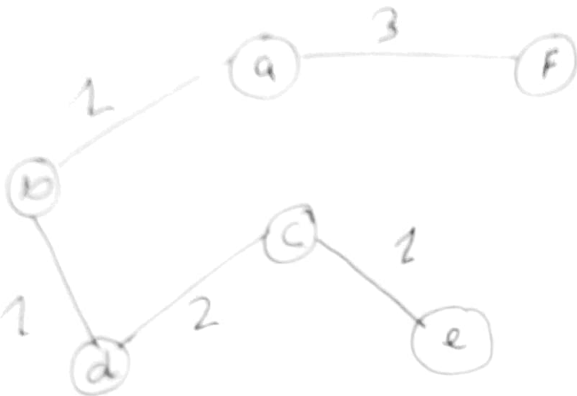




Min weight = 37



Kruskal



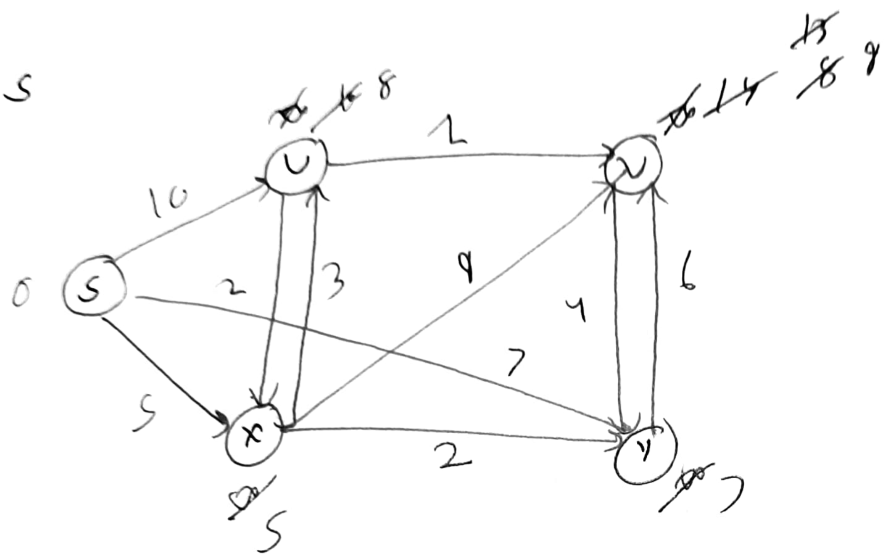
min weight = 8

Ans - 4

1. The shortest path may change the reason is, there may be different number of edges is different. For example, let shortest path s from s to f of weight 15 and has 5 edges. Let there be another path with 2 edges and total weight 25. The weight of shortest path is increased by 5 * 10 and becomes 15 + 10 - weight of the other path is increased by 2 * 10 and becomes 25 + 20. So the ~~lightest~~ shortest path changes to the other path with weight as 45.

ii) If we multiply all the edge weight by 10 shortest paths does not change. The number of edges and paths does not matter.

Ans- S



① Dijkstra Algorithm :-

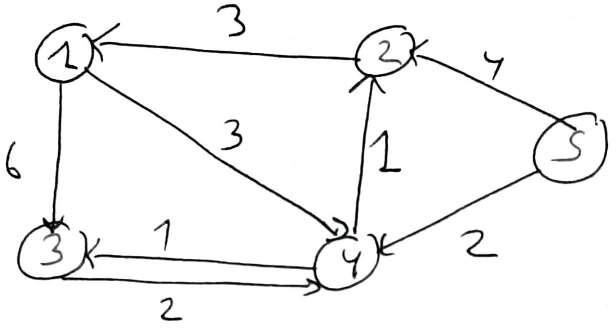
Node.	shortest dist. from source node 0
U	8
V	9
X	5
Y	7

② Bellman Agorithm :-

S	U	V	X	Y
0	~~∞~~	~~∞~~	~~∞~~	~~∞~~
	~~10~~	9	5	7
	8			

S	U	V	X	Y
0	8	9	5	7

Ans 6



$D =$

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

$D_1 =$

	1	2	3	4	5
1	0	∞	6	3	∞
2	3	0	9	6	∞
3	∞	∞	0	2	∞
4	∞	1	1	0	∞
5	∞	4	∞	2	0

$D_2 =$

	1	2	3	4	5
1	0	∞	6	3	∞
2	3	0	9	6	∞
3	∞	∞	0	2	∞
4	4	1	1	0	∞
5	7	4	13	2	∞

D_3

	1	2	3	4	5
1	0	∞	6	4	∞
2	3	0	9	6	∞
3	∞	∞	0	2	∞
4	4	1	1	0	∞
5	7	4	13	2	∞

D_4

	1	2	3	4	5
1	0	4	4	3	∞
2	3	0	7	6	∞
3	6	3	0	2	∞
4	4	1	1	0	∞
5	6	3	3	2	0

D_5

	1	2	3	4	5
1	0	4	4	3	∞
2	3	0	7	6	∞
3	6	3	0	2	∞
4	4	1	1	0	∞
5	6	3	3	2	0

Time complexity :- $O(V^3)$

Space complexity :- $O(V^2)$